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Breast Cancer Screening Disparities among Ethnically Diverse Women in California: A Latent Profile Analysis

A dissertation submitted in partial satisfaction of the requirements for the degree of Doctor of Philosophy

in

Clinical Psychology

by

Arianna Aldridge Gerry

Committee in charge:

University of California, San Diego

Professor Mark Myers
Professor Thomas Rutledge

San Diego State University

Professor Scott C. Roesch, Chair
Professor Vanessa Malcarne
Professor Linda Gallo

2011

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The Dissertation of Arianna Aldridge Gerry is approved, and is acceptable in quality and form for publication on microfilm and electronically:

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Chair

University of California, San Diego

San Diego State University

2011

DEDICATION

This dissertation is dedicated to my parents, Andrew and Sylvia Aldridge, whose faith, wisdom, support, and love have inspired my passion for discovery, creativity, and determination to realize my aspirations. Their foundation of love and support has fueled my efforts throughout the arduous process of research, writing, and defending my dissertation. I am forever grateful and blessed to have such incredible parents who have loved and supported me on every step of my journey.

In dedication to my husband, Jon Gerry, who has been a source of inspiration and support throughout my entire dissertation endeavor. He balanced my life when it could have become narrow in scope, fostered my creativity, and inspired me to persevere when the completion of my dissertation felt illusive. I am blessed to have such an amazing husband who lights up my life each day, and with whom I can share this pivotal point in my career.

In dedication to my mentor, Scott C. Roesch, whose guidance, support, insight, statistical expertise, and mentorship have been instrumental in all aspects of my graduate training. Dr. Roesch enabled me to formulate, develop, and hone my abilities as a researcher and clinical psychologist. He fostered a collaborative environment, challenged me to stretch my ideas and research perspectives, inspired confidence, and encouraged me to pursue my research interests. I cannot express my gratitude for the opportunities I have had as his mentee. He is truly the best mentor I could have ever hoped for to guide me through my graduate training and beyond.

TABLE OF CONTENTS

Signature Page……iii

Dedication……...iv

Table of Contents……....v

List of Tables……..…vi

Vita……....vii

Abstract…….....xviii

Introduction……..…1

Background & Significance…….6
Breast Cancer Survival & Correlates of Risk……..……...6
Modifiable Risk Factors & Health Behaviors.....……10
Screening for Breast Cancer…….14
Disparities in Screening Behavior……20

Methods……..37
Data Source & Sample……..36
Study Design…….39
Observed Variables for the LPA……...41
Dependent Variables…….53

Results……....54
Sample Frequencies & Descriptives…….54
Statistical Analyses…...……56
Ethnicity Moderator Analyses……. 65

Discussion……..76
LPA Class Interpretation……..76
Ethnicity and Class Interaction Interpretation……..86
Study Limitations……..97
Summary and Future Recommendations……100

References……....103

Tables……...…131

LIST OF TABLES

Table 1: Model fit Indexes for the 2-, 3-, & 4-Class Solutions……..131

Table 2a: Health Conditional Response Means and Probabilities……..132

Table 2b: Stress Conditional Response Means and Probabilities……...133

Table 2c: Demographic Conditional Response Means and Probabilities……...134

Table 3: Interactions of Health Classes x Ethnicity for Screening Outcomes……135

Table 4: Interactions of Stress Classes x Ethnicity for Screening Outcomes…….136

Table 5: Interactions of Demographic Classes x Ethnicity for Screening Outcomes….137

Table 6: Representation of Women by Ethnicity in Classes……...138

CURRICULUM VITA
ARIANNA ALDRIDGE GERRY, Ph.D.

AREAS OF CURRENT INTEREST

- Stress, Coping, and Adjustment with Chronic Illness
- Relationship of Stress, Sleep, Immune Functioning, and Breast Cancer
- Ethnic Disparities in Mental and Community Health
- Dissemination of Mental Health Interventions for Adults with Chronic Illness

EDUCATION

2011-2013 **NIH T32 Postdoctoral Research Training Fellowship**
Stanford University
Department of Psychiatry and Behavioral Sciences
Center on Stress and Health

2010-2011 **Clinical Psychology Internship (APA – accredited)**
Veterans Affairs Palo Alto Health Care System, Palo Alto, CA
Behavioral Medicine Track:
Rotations: Behavioral Medicine Clinic, Pain, MOVE Time, Co-Ed Intensive Treatment Unit, ACT Mini Rotation, Hematology/Oncology, Primary Care, Health Services Research & Development.

2011 **Ph.D. in Clinical Psychology**
University of California, San Diego & San Diego State University
UCSD/SDSU Joint Doctoral Program in Clinical Psychology.
Dissertation: "Breast cancer screening disparities among ethnically diverse women in California: A latent profile analysis."
Chair: Scott C. Roesch, Ph.D.

2010 **M.P.H.,** San Diego State University, Public Health and Behavior

2008 **M.S.,** San Diego State University, Clinical Psychology

2003 **B.S.,** Santa Clara University, Psychology
Minor: General Business
Degree Honors: Magna Cum Laude

GRANTS AWARDED

2007-2010 NRSA Pre-doctoral fellowship award (F31HD056623)
"Stress and coping in minority adolescents: An internet-based daily diary study." Funded by the National Institute of Child Health and Human Development.

HONORS & AWARDS

2008	Dorathe L. Frick Memorial Award "In recognition of significant contributions made to the Doctoral Training Facility and the Doctoral Program by a third year doctoral student." – UCSD/SDSU
2007-2010	UCSD Student Travel Scholarship Award
2007-2010	SDSU Student Travel Scholarship Award
2003	B.S. Magna Cum Laude – Santa Clara University (SCU)
2003	Wilheim Wundt Award: "Outstanding performance in scholarship, psychological research and service." – SCU
2003	National Dean's List
2000-2003	SCU Dean's List
2003	Valedictorian Nomination – SCU
1999-2003	4-year Academic Scholarship Award – SCU

RESEARCH EXPERIENCE

2011 **Psychology Intern/Research Associate**
Veterans Affairs Palo Alto Health Care System, Palo Alto, CA
Health Services Research & Development
Supervisor – Julie Weitlauf, Ph.D.

- Co-investigator on a study that examines trauma exposure (e.g., physical/verbal abuse) and psychosocial dysfunction (e.g., depression, social strain, sexual dissatisfaction) as barriers to cervical cancer screening. The study examines these relationships prospectively within the Women's Health Initiative data.

Supervisor – Michael Cucciare, Ph.D.

- Investigating the role of perceived consequences and social norms of alcohol/substance use as mediators of the relationship of coping, physical, and mental health as they relate to alcohol or substance use behavior.
- The study will also explore whether brief MI intervention within Primary Care settings changes perceptions and norms, ultimately modifying alcohol/substance use behavior.

2005-Present **Research Associate/Lab Manager**
SDSU Stress & Coping Lab, San Diego, CA
Committee Chair: Scott C. Roesch, Ph.D.

- Examination of daily stress, coping, and adjustment in ethnic minority adolescents, including health disparities.
- Involved in refining the daily diary website, measurement selection, implementation of the study, and supervising and training research assistants.
- Responsible for performing statistical analyses; Latent Profile Analysis (LPA) and Hierarchical Linear Modeling.
- ***Dissertation research***: Explores health, stress, and demographic variables associated with women's breast cancer screening behaviors among ethnically diverse women in California. Primary aims of the

study are to establish typologies of women, through LPA, to identify breast cancer screening profiles that may distinctly influence screening participation.

2007-2010 **Research Associate/Statistical Consultant**
UCSD Moores Cancer Center & Community Outreach, San Diego, CA
Supervisors: Vanessa Malcarne, Ph.D., & Georgia Sadler, Ph.D., MBA

- Validation of American Sign Language (ASL) and Spanish translated psychosocial and physical health measures (e.g., SF-12 Health Survey, Center for Epidemiological Studies Depression Scale, Multidimensional Health Locus of Control, & Barriers to Clinical Trial Participation).
- Statistical analyses included confirmatory factor analysis, structural equation modeling, multiple groups analysis, and multilevel modeling.

2008-2009 **Research Associate/Statistical Consultant**
UCSD Department of Psychiatry: Addictions Research, San Diego, CA
Supervisor: Mark Myers, Ph.D.

- Validation of a newly developed measure the Behavioral Undercontrol Questionnaire, assessing risky youth behavior (e.g., alcohol/substance abuse) in a sample of ethnically diverse sample of UCSD undergraduates.
- Statistical analyses included confirmatory factor analysis and multiple groups analysis.

2003-2005 **Clinical Research Assistant**
The Parkinson's Institute, Sunnyvale, CA
Supervisors: Caroline Tanner, M.D., Ph.D., and Kathleen Comyns, M.P.H.

- National Epidemiological twin and farmer research studies for Parkinson's Disease.
- Recruited and screened participants, gathered data through detailed interviewing protocols, and data management.
- Reviewed medical and neurological assessments of subjects, developed study protocols for and trained research assistants.
- Assisted with neurological exams, administered informed consent and cognitive exams, scored and interpreted cognitive exam findings.

2003-2005 **Volunteer Research Associate**
Stanford University: Mood and Anxiety Disorders Lab, Palo Alto, CA
Supervisor: Ian Gotlib, Ph.D.

- Research the etiology of Depression in daughters of depressed mothers. Collaborator in the coding of stressful life events, data management, and analysis.

2001-2004 **Research Associate/Lab Manager**
Santa Clara University: Health Psychology Lab, Santa Clara, CA
Supervisor: Thomas Plante, Ph.D.

- Managed and trained lab assistants, tested participants through study protocols, designed the participant database for two studies on SPSS, analyzed results for three of four studies.
- Major contributor to the writing, publication and conference presentation of papers.

2003 **Project Manager**
SCU School of Business: Marketing Research, Santa Clara, CA
Supervisor: Buford Barr, MBA

- Manager of the SCU Independent Marketing Research Group. Assessed a non-profit organization (PICO) and created a full marketing and communications (MARCOM) plan and strategy for this organization.
- Board of Directors adopted and integrated the plan into their company's public relations plan.

CLINICAL EXPERIENCE

2010-2011 **Psychology Intern**
Veterans Affairs Palo Alto Health Care System, Palo Alto, CA
Clinical Psychology Internship (APA – accredited)

Behavioral Medicine Clinic *(*9/2010-8/2011)
Supervisor – Judith Chapman, Ph.D.

- Provide comprehensive assessment and outpatient therapy to veterans experiencing medical or health problems (e.g., chronic pain, insomnia, cancer, diabetes, heart disease), in addition to treating veterans with Axis-I disorders.
- Provide mental health transplant evaluations for veterans seeking organ transplant.
- Mode of therapy: CBT, Acceptance & Commitment Therapy (ACT), MI.
- Co-led a CBT Chronic Pain Group.

Hematology/Oncology Clinic (3/2011-8/2011)
Supervisor – Veronica Reis, Ph.D.

- Involved in multidisciplinary team diagnostic assessment and intervention with veterans experiencing cancer and blood disorders. Mode of therapy: Brief CBT, ACT, Existential Therapy, and MI.

ACT Oncology Group (6/2011-8/2011)
Supervisor – Veronica Reis, Ph.D.

- Co-creating and ACT group protocol for oncology patients.
- Plan to lead an 8 week ACT group.

Primary Care Clinic (3/2011-8/2011)
Supervisor – James Mazzone, Ph.D.

- Involved in diagnostic assessment, brief intervention, and triage with veterans referred by primary care physicians/staff for mood,

alcohol/substance abuse, and PTSD. Involved in triage and referral to appropriate services within the VA and community.

Chronic Pain Clinic *(*9/2010-3/2011):
Supervisor – Judith Chapman, Ph.D.

- Involved in multidisciplinary team diagnostic assessment and brief intervention with veterans experiencing chronic pain. Mode of therapy: Brief CBT for chronic pain, ACT, and MI.

MOVE! Time Clinic *(*9/2010-3/2011)*:*
Supervisor – Holly Cacciapaglia, Ph.D.

- Involved in multidisciplinary team diagnostic assessment and treatment of veterans seeking weight reduction/management pre/post bariatric surgery. Mode of therapy: CBT and MI.

Co-Ed Intensive Treatment Unit *(*9/2010-3/2011)*:*
Supervisor – Kim Brodsky, Ph.D.

- Provide psychodiagnostic assessment and treatment to male and female veterans with serious mental illness in acute crisis.
- Co-Lead a Distress Tolerance Group and Relaxation Group.

ACT Mini Rotation *(*9/2010-3/2011)*:*
Supervisor – Robyn Walser, Ph.D.

- ACT training, supervision, and use of the ACT protocol with patients experiencing chronic pain, fatigue, recovery from alcohol/substance abuse, and serious mental illness.
- Co-developer of ACT protocol for Oncology Patients.

2009-2010 **Co-Supervisor**
SDSU Psychology Clinic, San Diego, CA
Supervisor: Linda Gallo, Ph.D.

- Provided weekly individual supervision to SDSU/UCSD clinical practicum students providing assessment and individual and group psychotherapeutic interventions.

2008-2009 **Clinical Practicum Trainee**
Rady Children's Hospital, San Diego, CA
Pediatric Hematology/Oncology Clinic:
Supervisor – Charles Farrow, Ph.D.

- Provided clinical treatment for children with cancer and blood diseases and their families using Cognitive Behavioral Therapy (CBT), Existential Therapy, Interpersonal Psychotherapy Therapy (IPT), Biofeedback, and Supportive Therapy.
- Performed psychological, neuropsychological, and personality assessment of inpatients and outpatients. Completed integrative and neuropsychological reports.

2007-2008 **Clinical Practicum Trainee**
VA San Diego Medical Center, San Diego, CA

Mental Health Tobacco Use Cessation Clinic:
Supervisor – Mark Myers, Ph.D.

- Provided CBT group therapy and psychoeducation for tobacco use cessation to inpatient and outpatient veterans with substance dependence and/or other Axis I disorders.

2007-2008 **Clinical Practicum Trainee**
VA San Diego Medical Center, San Diego, CA
Spinal Cord Injury (SCI) Unit:
Supervisor – Thomas Rutledge, Ph.D.

- Provided assessment and brief and short-term treatment of veterans with spinal cord injury, chronic pain, Multiple Sclerosis, and post-Polio Syndrome.
- Conducted structured intakes, cognitive capacity screens, and neuropsychological testing, and integrative report writing.
- Provided brief and short-term therapy including CBT, Motivational Interviewing (MI), and pain management.

2008 **Clinical Practicum Trainee**
VA San Diego Medical Center, San Diego, CA
Chronic Pain Group:
Supervisor – Thomas Rutledge, Ph.D.

- Provided CBT Chronic Pain group therapy for outpatients.

2006-2007 **Clinical Practicum Trainee**
SDSU Psychology Clinic, San Diego, CA
Supervisors: Vanessa Malcarne, Ph.D. and Alan Litrownik, Ph.D.
Rick Schulte, Ph.D. − CBT Group for Depression.

- Provided individual and group therapy and assessment for ethnically diverse adolescents and adults using CBT and IPT modalities.

TEACHING EXPERIENCE

Instructor
Psychology Department, University of San Diego, San Diego, CA
Fall 2009 Psychology 101: Introductory Psychology
Spring 2009 Psychology 357: Health Psychology

Teaching Assistant
Fall 2008 Psychology 775: Multivariate Statistics

Tutor
UCSD/SDSU JDP in Clinical Psychology, San Diego, CA
Fall 2007 Psychology 770 A: Experimental Design: Regression Statistics

Spring 2008 Psychology 770 B: Experimental Design: ANOVA Statistics

Guest Lecturer
Psychology Department, SDSU, San Diego, CA
Fall 2009 Psychology 407: Health Psychology

- "Stress, Coping, and Cancer."

Fall 2007 Psychology 407: Health Psychology
- "Stress, Coping, Pain & Adjustment in Spinal Cord Injury Patients."

PROFESSIONAL SERVICE

2010-2011 **Intern Seminar Committee Representative**
Palo Alto VA Health Care System – Psychology Intern Seminar Committee
- Liaison for my clinical psychology internship cohort in planning of weekly seminars as well as 2-day workshops.

2009-2011 **President** (2010-2011)/**President-Elect** (2009-2010)
American Psychological Association: Division 12, Section 10 Section on Graduate Student and Early Career Psychologists
- Lead the section to address the unique needs of its members entering the profession and facing early career challenges in clinical psychology.
- Represent the interests and concerns of Section 10 members and facilitate a forum for communication.
- Establish mentorship opportunities with established Division 12 psychologists.
- Host 3 hours of sessions at the APA conference − 2010 − devoted to Section 10 members (e.g., poster session, awards, and seminar).

2007-2009 **Chair & Board Member**
Western Psychological Association - WPA Student Council
- Led the student council to create an interactive forum for students attending the WPA conference. Motivational leadership to student officers and representatives to achieve the student council's goals.
- Liaison to the formal WPA Board. Addressed issues related to student communication, and hosted student conversation hours with invited conference speakers.

2007-2008 **SBM Program Planning Committee**
Society of Behavioral Medicine
- Participated on the planning committee for the SBM 29th Annual Conference, San Diego, CA.

2006-2008 **Student Search & Selection Committee –** *UCSD/SDSU JDP in Clinical Psychology*

2005-2007 **Director of Marketing**
Western Psychological Association - WPA Student Council

- Led the council in recruiting and retaining student membership, monitored membership. Facilitated communication between the representatives and student council.

REVIEWER EXPERIENCE

2009	*Health Psychology*: Peer Reviewer– 1 Manuscript
2008-2010	*Cognitive Therapy and Research*: Peer Reviewer– 2 Manuscripts
2006-2010	*Journal of Behavioral Medicine*: Peer Reviewer–10 Manuscripts

PROFESSIONAL MEMBERSHIPS

2003-2010	American Psychological Association: Graduate Student member, Divisions of Clinical Psychology (12), Section 10; Health Psychology (38)
2005-2010	Society of Behavioral Medicine: Student member
2005-2010	Western Psychological Association: Student Council member
2010	Phi Kappa Phi: Lifetime member
2003	Phi Beta Kappa: Lifetime member
2001-2005	Sigma Xi: Student member
2000-2003	Psi Chi: Lifetime member
1999-2003	National Society of Collegiate Scholars: Co-Founder – SCU Division

PROFESSIONAL PUBLICATIONS

Research Manuscripts:

Aldridge-Gerry, A.A., Roesch, S.C., Villodas, F., McCable, C., & Leung, Q. (2011). Daily stress and alcohol consumption: Modeling between-person and within-person ethnic variation in coping behavior. *Journal of Studies on Alcohol and Drugs, 72,* 125-134.

Roesch, S.C., **Aldridge, A.A.,** Stocking, S.N., Villodas, F., Leung, Q., Bartley, C.E., & Black, L.J. (in press). Multilevel factor analysis and structural equation modeling of daily diary coping data: Modeling trait and state variation. *Multivariate Behavioral Research.*

Doran, N., **Aldridge, A.A**., Roesch, S.C., Myers, M. (in press). Invariance Study of the Behavioral Undercontrol Questionnaire: Differences Across Gender and Ethnicity. *European Journal of Psychological Assessment.*

Athale, N., **Aldridge, A**., Malcarne, V. L., Nakaji, M., Samady, W., & Sadler, G. R. (2010). Validity of the Multidimensional Health Locus of Control Scales in American Sign Language. *Journal of Health Psychology*, *15*, 1064-1074.

Roesch, S.C., Duangado, K.M., Vaughn, A.A., **Aldridge, A.A**., & Villodas, F. (2010). Dispositional hope and the propensity to cope: A daily diary assessment of minority adolescents. *Cultural Diversity and Ethnic Minority Psychology, 16,* 191-198.

Roesch, S.C., Vaughn, A.A., **Aldridge, A.A**., & Villodas, F. (2009). Daily diaries and minority adolescents: Random coefficient regression modeling of attributional style, coping, and affect. *International Journal of Psychology, 44,* 393-400.

Roesch, S.C., **Aldridge, A.A**., Huff, T.L.P., Langner, K., Villodas, F., & Bradshaw, K. (2009).

On the Dimensionality of the Proactive Coping Inventory: 7, 5, 3 Factors? *Anxiety, Stress, and Coping, 22*, 327-340.

Roesch, S.C., **Aldridge, A.A**., Vickers, R.R., & Helving, L.K. (2009). Testing personality-coping diatheses for negative and positive affect: A longitudinal evaluation. *Anxiety, Stress, and Coping, 22*, 263-281.

Vaughn, A.V., Roesch, S.C., & **Aldridge, A.A.** (2009). Stress-related growth in racial/ethnic minority adolescents: Measurement structure and validity. *Educational and Psychological Measurement, 69,* 131-145.

Aldridge, A.A., & Roesch, S.C. (2008). Coping with daily stressors: Modeling intraethnic variation in Mexican-American adolescents. *Hispanic Journal of Behavioral Sciences, 30,* 340-356.

Aldridge, A.A., & Roesch, S.C. (2008). Developing coping typologies of minority adolescents: A latent profile analysis. *Journal of Adolescence, 31,* 499-517.

Aldridge, A.A., & Roesch, S.C. (2007). Coping and adjustment in children with cancer: A meta-analytic study. *Journal of Behavioral Medicine, 30*, 115-129.

Plante, T.G. & **Aldridge, A**. (2005). Psychological patterns among Roman Catholic clergy accused of sexual misconduct. *Pastoral Psychology, 54*, 73-80.

Plante, T.G., **Aldridge, A**., & Louie, C. (2005). Are successful applicants to the priesthood psychologically healthy? *Pastoral Psychology, 54*, 81-91.

Plante, T.G., **Aldridge, A**., Su, D., Bogden, R., Belo, M., & Khan, K. (2003). Does virtual reality enhance the management of stress when paired with exercise? An exploratory study. *International Journal of Stress Management, 10*, 203-216.

Plante, T.G., **Aldridge, A**., Bogden, R., & Hanelin, C. (2003). Might virtual reality promote the mood benefits of exercise? *Computers in Human Behavior, 19*, 495-509.

Manuscripts Under Review:

Aldridge, A.A. (under review). Do exercise interventions improve psychological & physical health of breast cancer patients and survivors? A review of reviews.

Roesch, S.C., Duangado, K.M., Vaughn, A.A., & **Aldridge, A.A**. (revise and resubmit; paper resubmitted). "I think I can, therefore I will": Hope and growth and the propensity to cope.

Roesch, S.C., & **Aldridge, A.A.** (under revision). Describing (or Evaluating) Between-Person and Within-Person Variation in Daily Diary Coping Behavior.

Wang, R., **Aldridge, A.A**., Malcarne, V., Roesch, S.C., Nakaji, M., Sadler, G.R. (under review). Interaction between MHLC and assimilation of cervical cancer information in deaf women.

Manuscripts in Preparation:

Aldridge, A.A., & Roesch, S.M. (in preparation). Testing the factorial validity of the Brief COPE and Coping Responses Inventory: Redundant and unique factors within and between measures.

Aldridge, A.A., Malcarne, V., Roesch, S.C., & Sadler, G.R. (in preparation). Validation of the English and Spanish versions of the Barriers to Clinical Trials Participation Scale (BCTP) in Hispanic women.

Champassak, S., **Aldridge, A.A.**, Malcarne, V., Roesch, S.C., Sadler, G.R. (in preparation). Validation of the English and Spanish translation of the POWE Fatalism Inventory in Hispanic women.

Godebu, E., **Aldridge, A.A**., Malcarne, V., Roesch, S.C., & Sadler, G.R. (in preparation). Validation of an American Sign Language Version of the SF-12 Health Survey.

Harn, L., **Aldridge, A.A.**, Ramezani, R., Malcarne, V., Roesch, S.C., & Sadler, G.R. (in preparation). Reliability and validity of an American Sign Language version of the CES-D.

PROFESSIONAL PRESENTATIONS

Aldridge, A.A., Roesch, S.C., & Villodas, F. (2010, May). *Daily stress and alcohol consumption: Modeling between-person and within-person ethnic variation in coping behavior.* Poster presented at the Association for Psychological Science, Boston, MA.

Aldridge, A.A., & Roesch, S.C. (2009, April). *Testing the factorial validity of the Brief COPE and Coping Responses Inventory: Redundant and unique factors within and between measures.* Poster presented at the Western Psychological Association, Portland, OR.

Aldridge, A.A. (2008, November). *Neurocognitive rehabilitation in pediatric oncology patients.* Presentation for Pediatric Neuropsychology Rounds at Rady Children's Hospital, San Diego, CA.

Malcarne, V.L., **Aldridge, A.A**., Roesch, S.C., Riley, N., & Sadler, G.R.S. (2008, October). *Translating and validating instruments for diverse communities: The Barriers to Clinical Trials Participation Scale.* Paper presented at the American Association for Cancer Education, Clearwater, FL.

Sadler, G.R., Malcarne, V., **Aldridge, A**., Roesch, S.C. & Riley, N. (2008, October). *Translating and validating instruments for diverse communities: A call to action.* Paper presented at the Annual Convention of the American Association for Cancer Education, Clearwater, FL.

Aldridge, A.A., & Roesch, S.C. (2008, March). *Do exercise interventions improve psychological*

and physical health of breast cancer patients and survivors: A review of randomized control trials. Poster presented at the Society of Behavioral Medicine conference, San Diego, CA.

Godebu, E., **Aldridge, A.A**., Malcarne, V., Roesch, S.M., Sadler, G.R. (2007, October). *Structural validation of an American Sign Language version of the Short Form-12 (SF-12) health survey (version 2).* Paper presented at the American Association for Cancer Education conference, Birmingham, AL.

Aldridge, A.A., & Roesch, S.C. (2007, March). *Developing coping profiles of minority adolescents: A latent profile analysis.* Paper presentation at the Biannual Meeting of the Society for Research in Child Development, Boston, MA.

Aldridge, A.A., & Roesch, S.C. (2006, March). *Coping and adjustment in children with cancer: A meta-analytic review*. Poster presented at the Society of Behavioral Medicine conference, San Francisco, CA.

Aldridge, A.A., Roesch, S.C., & Vaughn, A.A. (2006, April). *Coping with daily stressors: Intraethnic variation in Latino adolescents*. Paper presented at the Western Psychological Association conference, Palm Springs, CA.

Roesch, S.C., **Aldridge, A.A**., & Vaughn, A.A., & Putnam, A. (2006, April). *Thriving, surviving, and going under: Latino adolescents coping with stressors*. Paper presented at the Western Psychological Association conference, Palm Springs, CA.

Plante, T.G., **Aldridge, A.,** Su, D., Bogden, R., Belo, M., & Khan, K. (2004). *Does virtual reality enhance the management of stress when paired with exercise?* Poster presentation at the American Psychological Association conference, Honolulu, HI.

Plante, T.G., **Aldridge, A.,** Su, D., Bogden, R., Belo, M., & Khan, K. (2003). *Does virtual reality enhance the management of stress when paired with exercise?* Paper presented at The Western Psychology Conference for Undergraduate Research, Santa Clara University, CA.

Plante, T.G., **Aldridge, A.,** Bogdan, R., Hanelin, C. (2002). *The influence of exercise and virtual reality on psychological functioning.* Paper presented at the American Academy of Health Behavior conference, Napa, CA.

Plante, T.G., **Aldridge, A**., Bogdan, R., Hanelin, C. (2002). *The influence of exercise and virtual reality on psychological functioning*. Paper presented at The Western Psychology Conference for Undergraduate Research, Santa Clara University, CA and The Sigma Xi Scientific Research Conference, Santa Clara, CA.

ABSTRACT OF THE DISSERTATION

Breast Cancer Screening Disparities Among Ethnically Diverse Women in California: A Latent Profile Analysis

by

Arianna Aldridge Gerry

Doctor of Philosophy in Clinical Psychology

University of California, San Diego, 2011
San Diego State University, 2011

Professor Scott, C. Roesch, Chair

Breast cancer is one of the most common cancers among women in the United States (U.S. CSWG, 2009). Health care, screening behaviors (e.g., mammography) and late-stage disease detection account for significant differences in breast cancer morbidity and mortality among ethnically diverse women (ACS, 2007). The current study sought to identify variables that best predict women's breast cancer screening behaviors and to develop screening typologies for women in a large multiethnic sample (N = 15,130) from the California Health Interview Survey 2005 (CHIS, 2006). The study examined whether ethnicity (Hispanic, African American, Asian, and non-Hispanic white) moderated the relationship between emergent typologies and screening outcomes.

Variables of interest addressed the following themes: health behaviors, women's health, cancer history, health insurance, health care utilization, mental health, as well as acculturation, racial discrimination, education, and socioeconomic status. Latent profile analysis (LPA: Lanza, Flaherty, & Collins, 2003) was employed to empirically derive and subsequently predict screening using each variable simultaneously to develop typologies of women. Post-hoc analyses using logistic regression were utilized to explain significant ethnicity by class interactions.

Results revealed three substantive risk domains, Health, Stress, and Demographic, were significantly related to breast cancer screening. LPA revealed two classes, deemed Healthy and Health Risk, emerged significant for the Health domain. Health Risk class women engaged in more mammography screening, relative to Healthy class counterparts across all ethnic groups (*ps* < .001). In the Stress domain Minimal, Mild, Moderate, and Severe Stress classes emerged. Women reported more breast cancer screening in the Minimal and Mild Stress classes, comparatively to their Moderate and Severe Stress class counterparts (*ps* < .001). This relationship was significant in follow-up analyses for non-Hispanic white women. Among the Demographic domain Minimal, Limited, Moderate, and Substantial Resource classes emerged. Women in the Minimal and Substantial Resource classes engaged in greater breast cancer screening (*ps* < .001) than Limited and Moderate Resource class women and this was replicated across ethnic groups. The current study portrays a rich constellation of variables that influence women's screening behaviors and underpins future targets of breast cancer prevention in typologies of ethnically diverse women within California.

INTRODUCTION

Breast cancer is one of the most common cancers among women in the United States, approximately accounting for one out of every four cancer diagnoses (American Cancer Society, 2007). It is the number one cause of cancer related death in Hispanic women and second in non-Hispanic white, African American, and Asian American/Pacific Islander (AA/PI) women (U.S. Cancer Statistics Working Group, 2009). In 2009, approximately 192,370 new cases of invasive cancer will be diagnosed with about 40,170 women expected to die from breast cancer (Horner, Ries, Krapcho, Neyman, Aminou, Howlader et al., 2008). Across the world, a 5-fold variation in incidence rates has suggested that women living in industrialized societies are at increased risk (Parkin, Bray, & Devesa, 2001) with rapid increases in incidence among developing nations and U.S. immigrant populations (Deapen, Liu, Perkins, Bernstein, & Ross; Kliewer & Smith, 1995; Parkin, Bray, & Devesa, 2001; Wu, Ziegler, Pike, Normura, West, Kolonel, et al., 1996; Ziegler, Hoover, & Pike, 1993). Overall, non-Hispanic white women have the highest incidence of breast cancer, followed by African American, AA/PI, and Hispanic women (Horner, et al., 2008).

Several disparities exist among ethnic minority women in contrast to non-Hispanic white women that range from time of diagnosis to survival from breast cancer. Breast cancer mortality rates reflect disparities as African American women are more likely to die of breast cancer, followed by non-Hispanic white women, Hispanic, and AAPI women (Horner, et al., 2008). For example, while non-Hispanic white women have a higher incidence of breast cancer (127.8 per 100,000) than African American women (117.7 per 100,000), after the age of 40; however, African American women are more

likely to die of breast cancer (33.0 vs. 23.9 per 100,000) (ACS, 2007; Horner, et al., 2008). Further, African American women were more likely to be diagnosed with larger tumors (e.g., 2.1-5.0 cm, and ≥5.0 cm). Larger tumor size has been associated with decreased survival (Michaelson, Silverstein, Wyatt, 2002) and later stage of cancer detection leads to worse prognosis (Fields, Buist, Doubeni, Enger, Fouayzi, Hart, et al., 2005). Moreover, breast cancer is the second leading cause of cancer related death in African American women (ACS, 2007; Fye, 2001; Jones & Chilton, 2002). Overall, both populations of women have a higher incidence and death rate than other ethnic groups.

While Hispanic women do have lower incidence and death rates from breast cancer than non-Hispanic white women (e.g., incidence of 88.3 vs. 127.8 per 100,000, respectively), this is the leading cause of cancer death (O'Brien, Cokkinides, Jemal, Cardinez, Murray, Samuels, et al., 2003). Mortality rate due to breast cancer for Hispanic women is 15.5 per 100,000 (ACS, 2007; Horner, et al., 2008). This may be due, in part, to the lack of participation, especially in Mexican-American women, in regular mammogram screening that could detect the cancer at an early stage (Gorin & Heck, 2005; Hedeen & White, 2001; National Women's Health Information Center, 2003). Thus, similar to African American women, Hispanic women are also not benefiting from early cancer detection via screening, and increasing their likelihood of mortality.

For AA/PI women the incidence (89.5 per 100,000) is slightly higher but mortality (12.5 per 100,000) is lower than Hispanic breast cancer rates (Horner, et al., 2008). Similar to Hispanic women, breast cancer is the most common form of cancer, but a second leading cause of death from cancer in AAPI women. Despite lower mortality rates relative to non-Hispanic white women, both incidence and mortality rates are

continuing to rise (Asian American Network for Cancer Awareness, Research & Training, 2002; ACS, 2006a). Increasing mortality rates in AAPI women has been linked with underutilization of screening (ACS, 2006; Kagawa-Singer & Pourat, 2000), as AAPI women have the lowest breast cancer screening and early detection of all ethnic groups (ACS, 2007; Deapen, Liu, Perkins, Bernstein, & Ross, 2002; Kagawa-Singer, 1996; Kagawa-Singer & Puorat, 2000; Maxwell, Bastani, & Warda, 1997; Tu, Taplin, Barlow, & Boyko, 1999). Acculturation to the U.S. has also been associated with an increase in breast cancer prevalence, with rates approaching those of non-Hispanic women in America the longer AAPI women reside in the U.S. (Deapen, Liu, Perkins, Bernstein, & Ross, 2002; Pineda, White, Kristal, & Taylor, 2001; Stanford, Herrinton, Schwartz, & Weiss, 1995; Ziegler, Hoover, Pie, Hildesheim, Nomura, West et al., 1993). These findings suggest that again there are many factors contributing to the ethnic disparities in the onset, detection, course, and treatment of breast cancer among the various major ethnic groups in the U.S.

While the disparities in detection of breast cancer and related health outcomes such as increased mortality suggest a host of potential causal factors, the incidence rates of breast cancer have decreased between the period of 2001 and 2004 by about 3.5% each year (ACS, 2007). This is likely due to early detection and improved treatment technologies, whereas during the span of 1987-2001 the incidence of breast cancer increased by 0.5%, probably due to delayed reproductive patterns of women that placed them at greater risk for developing breast cancer. More specifically, during 1992-2002, incidence rates did not change significantly among non-Hispanic whites, African Americans, and Hispanics/Latinos, but rather increased in AA/PIs (ACS, 2007).

Health care and screening behaviors as well as late-stage disease detection have been found to account for much of the difference in morbidity and mortality outcomes among women with breast cancer (ACS, 2007). Several variables have been reported to influence screening behaviors such as regular visits to a primary care physician or gynecologist (Barr, Franks, Lee, Herther, & Schachter, 2001), beliefs about screening (Smedley, Sitith, & Nelson, 2003), sociodemographic factors such as higher education and income, (Bobo, Shapiro, Schulman, & Wolters, 2004; Messina, Lane, Glanz, West, Taylor, Frishman et al., 2004), as well acculturation and perceived discrimination (Burgos, Schetzina, Dixon, & Mendoza, 2005; Crawley, Ahn, & Winkleby, 2008). While these factors have been examined in the literature, there has yet to be a study that examines several of these factors simultaneously, or that has attempted to create profiles of women that are related to their screening behaviors.

Present Study

The purpose of the current study was to develop screening typologies for women in a large sample of racially and ethnically diverse women surveyed as part of the California Health Interview Survey, 2005 (CHIS, 2006). Variables of interest include the following overarching themes: health behaviors (e.g., alcohol use), women's health (e.g., PAP smear), cancer history/prevention (e.g., family history), health insurance (e.g., usual source of care), health care utilization (e.g., ER visits in 12 months), mental health status (e.g., psychological distress), as well as sociodemographic factors such as race/ethnicity, acculturation (e.g., citizenship status), racial discrimination (e.g., frequency of being treated badly because of race), age, education, and socioeconomic status (SES). Rather than only evaluate how an individual factor relates to screening behavior, the current

study both empirically derives and subsequently predicts screening using each variable simultaneously to develop typologies of women who either avoid or engage in breast cancer screening behaviors. In turn, these typologies will hopefully provide useful information in determining specific combinations of barriers to screening that will better inform future researchers and community programs in their quest to eliminate screening disparities and improve the health of all women.

BACKGROUND AND SIGNIFICANCE

Breast Cancer Survival and Correlates of Risk

An integral factor in increasing survival of women with breast cancer is early detection via adequate health care and screening measures. For example, recent data from ACS (2007) reported that relative survival rates for women diagnosed with breast cancer are 89% after 5 years, 81% after 10 years, and 73% after 15 years. However, since rates are based on past treatment successes, recent trends in long-term survival will likely have increased with advances in screening and early detection, as well as improvements in treatment technology.

Survival from breast cancer is highly disparate among women from various ethnic minority groups. For example, African American women with breast cancer have a 77% chance of survival, whereas their non-Hispanic white counterparts have 90% likelihood (ACS, 2007). In contrast, AAPI women have been shown to have better survival than non-Hispanic white women (Li, Malone, & Daling, 2003) indicating disparities in breast cancer health outcomes are varied among ethnic minorities, and not just in relation to the non-Hispanic white population. This significant difference in survival rate among women of varying ethnicities is largely due to later stage at detection and worse stage-specific survival, indicating that poorer quality of treatment may be an underlying cause (ACS, 2007; Curtis, Quale, Haggstrom, & Smith-Bindman, 2007; Fields et al., 2005; Miller, Kolonel, Berstein, Young, Swanson, West, et al., 1996). In relation to the overall improvements in breast cancer survival rates, Hispanic women have benefited less, with slower increases in their survival rates (Clegg, Li, Hankey, Chu, & Edwards, 2002; Gilliland, Hunt, & Key, 1998; Jemal, Clegg, Ward, Ries, Wu, Jamison et al., 2004;

Stewart, King, Thompson, Friedman, & Wingo, 2004). This highlights the ever increasing health disparities among women of diverse racial and ethnic minority groups that could likely be eliminated with proper early breast cancer detection and treatment.

Socioeconomic Status

Another correlate shown to play a significant role in the detection and treatment of breast cancer is socioeconomic status. Those individuals with lower-SES have reduced 5-year survival rates relative to those women with higher-SES, regardless of disease stage (Baquet & Commiskey, 2000; Bradley, Given, & Roberts, 2001; Singh, Miller, Hankey, & Edwards, 2003). Similarly, reduced access to care and lack of health insurance has been associated with women diagnosed with more advanced stages of breast cancer (Halpern, Bian, Ward, Schrag, & Chen, 2007), and subsequently reduced chance of long-term survival. Further, the combination of low-SES, reduced access to quality health care, treatment disparities, and more aggressive tumors found among African Americans, place these women at greater mortality risk than non-Hispanic white and AAPI women (Bach, Schrag, Brawley, Galaznik, Yakren, & Begg, 2002; Carey, Perou, Livsay, Dressler, Cowan, Conway et al., 2006; Chlebowski, Chen, Anderson, Rohan, Aragaki, Lane et al., 2005; Curtis, Quale, Haggstrom, & Smith-Bindman, 2007; Newman, Griffith, Jatoi, Simon, Crowe, & Colditz, 2006; Shavers & Brown, 2002; Tammemagi, Nerenz, Neslund-Dudas, Feldkamp, & Nathanson, 2005). Furthermore, a report of the SEER U.S. data 2002 indicated the poorest 5 year survival rate was for African American women at all SES levels, and poorer survival rates for all Hispanic, AAPI, and non-Hispanic white women at lower SES levels (Mayer, 2003). In the lowest-SES bracket, survival rates were 80.1% in AAPI, 79.3% in non-Hispanic white, 76.9% in

Hispanic, and 68.3% in African American women (Mayer, 2003). This demonstrates that while race and ethnicity are factors, SES also plays a very important role in reducing survival rates for all women, as survival rate from breast cancer was 76.6% in women of the lowest SES group and 90.1% in the highest SES group (Mayer, 2003). This is not surprising as these women are more likely to have health insurance, greater access to improved health care and a usual source of care, as well we improved screening and treatment options.

In contrast to the relationship between SES and survival from breast cancer, the incidence in breast cancer is associated with higher SES and related professional and educational achievement (Zografos, Panou, & Panou, 2004). In a large cohort study with approximately 1.5 million Denmark women, researchers found that breast cancer risk was highest in academics (Relative Risk [RR] = 1.39) but lowest in women in agricultural professions (RR = 0.77), (Dano, Anderson, Ewertz, Petersen, & Lynge, 2003). In another study, women with higher education (e.g., > 13 years) were found to have a relative risk of 1.79 when compared to women with less education (e.g., < 9 years; Tavini, Gallus, La Vecchia, Montella, Dal Maso, & Franceschi, 1999). Similarly, in the U.S., prevalence of breast cancer is highest among women with higher SES. In contrast, once breast cancer develops, those women of lower SES are more likely to have a recurrence following treatment and ultimately die from the disease (Yabroff & Gordis, 2003). Treatment is often disparate among high-vs.-low SES women, with higher SES women often receiving breast conservation and endocrine therapy than women of low SES (Thomson, Hole, Twelves, Brewster, & Black, 2001). While higher SES and education are associated with increased incidence of breast cancer in women, other common risk factors such as

lifestyle and reproductive choices (e.g., delayed childbirth) may account for these differences as well (Heck & Pamuk, 1997).

Breast Cancer Risk Factors

Several variables play a role in the development of breast cancer with the three greatest risk factors female sex, increasing age, and family history, all of which are considered non-modifiable (ACS, 2007). However several modifiable variables exist with preventative strategies that include maintaining normal weight and avoiding obesity (BMI > 30), engaging in physical activity, and reduction of sedentary behavior as well as minimizing alcohol intake (Kushi, Byers, Doyle, Bandera, McCullough, Gansler et al., 2006). Additional risk factors include increased exposure to reproductive hormones as experienced by women with histories of early menarche (< 12 years), late menopause (>55 years), later age of first full-term pregnancy (>30 years), fewer pregnancies (Bernstein, 2002; Hulk & Moorman, 2001), use of oral contraceptives, reduced time spent breast feeding (CGHFBC: Collaborative Group on Hormonal Factors in Breast Cancer, 2002; Shantakumar, Terry, Teitelbaum, Britton, Millikan, Moorman et al., 2007) and use of combination hormone replacement therapy (HRT; Beral, 2003; Li, Malone, Porter, Weiss, Tang, Cushing-Haugen et al., 2003; Rossouw, Anderson, Prentice, LaCroix, Kooperberg, Stefanick et al., 2002) have been shown to place women at greater risk of developing breast cancer.

Family History of Cancer

Several studies have determined that women with a family history of breast cancer are at increased risk for developing cancer (ACS, 2007). Relative risk has been shown to increase significantly with the number of affected first degree (e.g., 1 relative =

RR of 1.80, 2 relatives = RR of 2.93, and 3 relatives = RR of 3.90; CGHFBC, 2001) and less so for affected second-degree relatives (RR = 1.5; Sattin, Rubin, Webster, Huezo, Wingo, Ory et al., 1985). Risk is also greater if the affected relative was less than 40 years old at diagnosis (Dite, Jenkins, Southey, Hocking, Giles, McCredie et al., 2003; Negri, Braga, Vecchia, Franceschi, & Parazzini, 1997). Women who have first-degree relatives diagnosed with ovarian cancer (e.g., more than 2 relatives) have also been shown to be at an increased risk for developing breast cancer (e.g., RR = 3.74 and 1.79 for women <50 years or ≥50 years old, respectively; Sutcliffe, Pharoah, Easton, & Ponder, 2000).

Women found to have mutations in the BRCA1 and BRCA2 genes are also at more risk for developing breast cancer (ACS, 2007; Ford, Easton, Stratton, Narod, Goldgar, Devilee et al., 1998). Specifically, the cumulative risk for carriers of the BRCA1 mutation and BRCA2 mutation are 65% and 45%, respectively, by the age of 70 years (Antoniou, Pharoah, Narod, Risch, Eyfjord, Hopper et al., 2003). These mutations also account for about 10% of women 40 years or younger who are diagnosed with breast cancer (de Sanjose, Leone, Berez et al., 2003; NCI, 2009) but exist in only about 1% in the general population (Ford, Easton, Stratton et al., 1998). However, technology to date is not capable of determining whether or not a person carrying these mutations will develop breast cancer (Lichtenstein, Holm, Verkasa et al., 2000).

Modifiable Risk Factors and Health Behaviors

Physical Activity

Research has shown that women who engage in physical activity are less likely to develop breast cancer (Bianchini, Kaaks, & Vainio, 2002; Dallal, Sullivan-Halley, Ross

et al, 2007; IARC: International Agency for Cancer Research, 2002; Lahmann, Friedenreich, Schuit, Salvini, Allen, Key et al., 2007; McTiernan, Kooperberg, White, Wilcox, Coates, Adams-Campbell et al., 2003). While regular physical activity has been found to reduce the risk of developing breast cancer in postmenopausal women (McTiernan et al, 2003) most studies have shown that engaging in vigorous exercise for 45-40 minutes at least 5 days per week is linked with greater risk reduction (The National Heart, Lung, and Blood Institute, 2005). The benefits of exercise on reducing the risk of breast cancer may be linked with changes in hormonal activity and improved energy balance due to engaging in physical activity (Friedenreich, 2001; IARC, 2002). In addition, physical activity may protect against the development of breast cancer as it has been linked with reduced lifetime exposure to sex steroid hormones, reduced insulin and insulin-like growth factors, as well as prevention of overweight and obesity (Bergstrom, Pisani, Tenet, Wolk, & Adami, 2001; Irwin, Yasui, Ulrich, Bowen, Rudolph, Schwartz et al., 2003; Key, Appleby, Reeves, Roddam, Dorgan, Longcope et al., 2003; McTiernan, Tworoger, Ulrich, Yasui, Irwin, Rajan et al., 2004; Muti, Quattrin, Grant, Krogh, Micheli, Schunemann et al., 2002). In a recent meta-analytic study examining the relationship of physical activity and breast cancer Monninkhof and colleagues (2007) found that postmenopausal women who engaged in physical activity had breast cancer risk reductions that ranged from 20%-80%. In their analysis of the higher quality studies, they found a 6% decrease in breast cancer risk for each additional hour of physical activity engaged in per week.

Alcohol Consumption

Several studies have shown that alcohol consumption increases a women's risk of developing breast cancer (Fentiman, 2001; Hamajima, Hirose, Tajima, Rohan, Calle, Heath et al., 2002; Terry, Zhang, Kabat, Britton, Teitelbaum, Neugut et al., 2006; Zhang, Lee, Manson, Cook, Willett, & Buring, 2007). Alcohol consumption per day has been linked with a relative risk of 1.07-1.10 for women consuming a typical drink per day (10-12 g/day) relative to women who did not drink (Colditz & Rosner, 2000; Ellison, Zhang, McLennan, & Rothman, 2001; Hamajima, et al., 2002; Key, Allen, Spencer, & Travis, 2003; Tjonneland, Thomsen, & Stripp, Christensen, Overvad, Mellemkael et al., 2003). Prior reviews have also identified that women who drink 2 alcoholic beverages day may increase their risk of developing breast cancer by 21% (Hamajima et al., 2002) likely due to the increase in estrogen and androgen levels in women who consume alcohol (Singletary & Gapstur, 2001).

Hormone Replacement Therapy

Several studies have shown increased risk of breast cancer for postmenopausal women who use combined hormone replacement therapy (HRT) that includes estrogen and progestin (Anderson, Chlebowski, Rossouw, Rodabough, McTiernan, Margolis et al., 2006; Chlebowski, Hendrix, Langer, Stefanick, Gass, Lane et al., 2003). Further, combined HRT also increases breast tissue density, which likely limits the effectiveness of mammograms and leads to detecting the cancer at a later stage in the disease process.

Summary of Breast Cancer Correlates

In sum, there are several stable and modifiable risk factors that in combination can increase a woman's likelihood for developing breast cancer in her lifetime. The most

studied risk factors have been discussed in the passage above and again include being female, increased age, and a family history of breast cancer. Further, hormonal factors such as early age at menarche or late menopause, reproductive behavior (e.g., age 30 or over at first full-term pregnancy, abortion) and increased breast density are also factors that have been examined and place a women at increased risk for developing breast cancer. Additional important and modifiable risk factors include being overweight or obese, especially following menopause, sedentary behavior and limited engagement in physically activity, consumption of alcohol, and use of HRT. There are several other environmental risk factors such as poor diet, exposure to toxins in the environment, and higher SES that have also been studied (ACS, 2007; Zografos, Panou, & Panou, 2004). Due to the large number of potential breast cancer risk factors, each has often been studied in isolation to determine how strongly correlated a factor is to the etiology of breast cancer. While accounting for the unique variance of each risk factor is important in determining if a woman is at risk for developing breast cancer, it is highly likely that significant colliniarity and interactions exist among these factors. There has been no study to date that has examined these factors simultaneously to account for the several potential interactive effects of these factors combined.

While determining the potential causes or risk factors of breast cancer in women is central to improving primary prevention programs and reducing incidence of breast cancer in women overall, several of the aforementioned variables are not modifiable or difficult to modify (ACS, 2007). Therefore, examining the factors that play a role in secondary prevention, such as screening for breast cancer, will be vital to improving the detection of the disease at an early and more treatable stage thereby improving survival.

Understanding screening behaviors and respective barriers to breast cancer screening will thus be central to improving the utility and efficacy of screening programs for all women. Hopefully, with improved understanding of the screening options available to women, the barriers that exist, as well as ways to eliminate these barriers, women will begin to engage in breast cancer screening and ultimately improve their survival and quality of life.

Screening for Breast Cancer

Screening and improved treatment of breast cancer have contributed to improved survival (ACS, 2007; Berry, Cronin, Plevritis, Fryback, Clarke, Zelen et al., 2005; Gotzsche & Nielsen, 2006), however treatment is fraught with debilitating or adverse effects on cardiovascular health, secondary cancers, physical mobility, energy level, cognition, sexuality, and psychosocial functioning (ACS, 2006b; Downie, Mar Fan, Houede-Tchen, & Tannock, 2006; Hassett, O'Malley, Pakes, Newhouse, & Earle, 2006; Partridge, Burstein & Winer, 2001). Financial costs of treatment are also considerable, for example the National Cancer Institute reported that in the U.S. $8.1 billion was spent in 2004 (NCI, 2007). Some studies have shown that women who have a positive family history of breast cancer are more likely to obtain recommended screening (Halbert, Kessler, Wileyto, Weathers, Stopfer, Domcheck et al., 2005; Petrisek, Campbell, & Laliberte, 2000) while other studies have demonstrated that women with a family history don't present with earlier stages of breast cancer or smaller tumors (Russo, Herd-Smith, Gestri, Bianch, Vezzosi, Del Turco et al., 2002) indicating screening was delayed. Prognosis improves significantly with appropriate screening measures (e.g., mammogram and clinical breast exams; Smith, Cokkinides, Von Eschenback, Levin, Cohen, Runowicz

et al., 2003) and has been shown true across racial and ethnic groups in the U.S. (e.g., Dignam, 2001).

Mammography

Studies have demonstrated that detecting breast cancer early through mammography significantly improves successful treatment, increases treatment options due to early detection and subsequently increases survival (Duffy, Tabar, & Chen, Holmqvist, Yen, Abdsalah et al., 2002; Humphrey, Helfand, Chan, & Woolf, 2002; Tabar, Yen, Vitak, Tony Chen, Smith, & Duffy 2003). Mammograms successfully detect approximately 80%-90% of breast cancers in women who have shown no symptoms of breast cancer and of all the women participating in screening only 5%-10% have abnormal or inconclusive results requiring further testing (ACS, 2007). A systematic review by Gotzsche and Nielsen (2006) revealed that for every 2000 women invited for mammography screening over a period of 10 years one woman will have her life prolonged. Thus, the American Cancer Society recommends that women over 40 years of age receive both annual mammograms and clinical breast exams. Similarly, for all women aged 40 and over, the targeted mammography screening rate was set at 70% by Healthy People 2010, with the targeted rate met in 2003, but in 2005 it dropped to 67% of women (DHHS: Department of Health and Human Services, 2000). Additional screening techniques are improved digital imaging mammograms as well as magnetic resonance imaging (MRI). Both screening techniques are very useful in detecting cancer in women with dense breast tissue; however, an increase in false positives also yields additional testing and biopsy to rule in or out the presence of disease (ACS, 2007).

While early detection through mammography screening can reduce mortality due to breast cancer in women there are also negative aspects that can emerge, as it can also lead to overdiagnosis and treatment that may even reduce or neutralize potential benefits (Vainio & Bianchini, 2002). For example, low-risk women who have their cancers identified at screening may undergo radiotherapy treatment, which has been shown to increase all-cause mortality due to the adverse cardiovascular effects (EBCTCG, 1995, 2000). In a recent Cochrane Review (Gotzsche & Nielsen 2006) that investigated seven randomized trials with over half a million women, health effects for women were examined for those who participated in mammographic screening and those who did not. General findings from this study revealed that screening likely reduces breast cancer mortality by approximately 20%; however, more evidence from higher quality randomized trials suggests relative risk reduction is about 15%, with absolute risk reduction 0.05%. In contrast, this meta-analytic study also revealed some negative health effects due to screening. Women who engaged in screening were more likely to be overdiagnosed and overtreated by about 30%, or incurred an absolute risk increase of 0.5%. Thus, findings demonstrated that of every 2000 women screened over 10 years, one will have prolonged life. However, unsuccessful treatment of identified breast cancer is also a factor, whereby 10 healthy women who would not have been diagnosed if they were not screened will not be successfully treated. In sum, Gotzche and Nielsen (2006) conclude that recommendations for women to undergo mammography screening have mixed implications for improving women's health.

Breast cancer screening recommendations from the U.S. Preventive Services Task Force (USPSTF) have been revised since 2005. Following their 2009 investigation, the

USPSTF advises against routine mammography screening in women under the age of 50 years. Derived from their exhaustive review of the harms and benefits of breast cancer screening, women aged 40-49 years more commonly experience false-positive results, overdiagnosis, and additional unnecessary screening. These women often are subject to increased radiation exposure over their lifetimes, pain during the procedure, increased invasive procedures such as breast biopsy, as well as psychological distress. When comparing age cohorts, the USPSTF (Nelson, Tyne, Bougatsos, Chan, & Hymphrey, 2009) estimated the number needed to screen and save one life is 1904 in women 40-49 years, while it is 1339 for women aged 50-59 years. Since they determined the risk for breast cancer increases steeply with age past 40 years, the risk reduction from screening is significantly greater for women between 50-59 years of age. While determining the potential harms of mammography screening are moderate for all age cohorts, the benefits of screening increase as women age, and considerably in women aged 60-69 years. Some reactions to the change in breast cancer screening recommendations have posited that high risk segments of the population, including the poor and uninsured, will become further underrepresented among breast cancer prevention services, including mammography (Hoerger, Ekwueme, Miller, Uzunangelov, Hall, Segel et al., 2011). However, it is too early to detect whether there has been a negative impact on these populations. To individualize their recommendations, the USPSTF encourages physicians to discuss the potential benefits and harms of screening, as well as limitations of mammography that apply to women of their age cohort. Ultimately, women should be carefully informed of both the risks and benefits of screening and potential treatment options as they age.

Breast Self-Exam

A meta-analysis utilizing data from two large population-based intervention studies (388,535 women) from Russia and Shanghai found that there was no statistically significant difference in breast cancer mortality between women in the breast self-examination intervention and those in the control group. On the whole, Kosters and Gotzsche (2003) found no beneficial effect of screening by breast self-exam and in contrast was linked to increased harm due to the increase in number of biopsies performed on benign lesions. These findings arguably demonstrate the importance for women to obtain proper screening from adequate measures such as mammography or MRI rather than relying on self-exam.

Repetitive Screening Behaviors

Several studies have revealed that factors influencing women to obtain a second screen often include higher education and income, younger age, and being married (Bobo, Shapiro, Schulman, & Wolters, 2004; Hitchcock, Steckevicz, & Thompson, 1995; Lechner, de Vries, & Offermans, 1997; Mayne & Earp, 2003; Messina, et al., 2004; Pakenham, Pruss, & Clutton, 2000; Rimer, Trock, Engstrom, Lerman, & King 1991). Ethnic minority women are also less likely to engage in repeat screening behaviors relative to non-Hispanic white women (Blanchard & Lurie, 2004), with several reasons including lack of insurance and regular source of health care, low income, little awareness of preventive care, and poor patient-provider communication (Ayanian, Kohler, Abe, & Epstein, 1993; Glanz, Croyle, Chollette, & Pinn, 2003). Within the U.S., living in a rural area is also negatively linked with rescreening behaviors in women, whereas women living in an urban region are more likely to utilize mammography

screening (Engelman, Ellerbeck, Perpich, Nazir, McCarter, & Ahluwalia, 2004). Family history of breast cancer has also been positively associated with women's likelihood of returning for additional screening (Achat, Close, & Taylor, 2005; Ahmed, Fort, Elzey, & Bailey, 2004; Bobo, Shapiro, Schulman, & Wolters, 2004; Lee & Vogel, 1995; Lerman, Rimer, Trock, Balshem, & Engstrom, 1990; Taylor, Taplin, Urban, White, & Peacock, 1995).

Not surprisingly, a woman's pattern of engaging in health behaviors, as well as availability of health care is also predictive of repeat screening behaviors. Women who have regular physicians and especially those who obtain care from a regular gynecologist are significantly more likely to participate in rescreening (Barr, Franks, Lee, Herther, & Schachter, 2001; Halabi, Skiner, Samsa, Strigo, Crawfor, & Rimer, 2000; Lee & Vogel, 1995; Pakenham, Pruss, & Clutton, 2000; Taylor, Taplin, Urban, White, & Peacock, 1995; Vernon, Laville, & Jackson, 1990; Zapka, Stoddard, Maul, & Costanza, 1991). Similarly, women who obtain clinical breast examinations more often obtain a mammography and are adherent to rescreening (Achat, Close, & Taylor, 2005; Halabi, Skinner, Samsa, Strigo, Crawford, & Rimer, 2000; Hitchcock, Steckevicz, Thompson., 1995; Zapka, Stoddard, Maul, & Costanza, 1991). In contrast, those women who engage in high risk behaviors, such as smoking in the past or present, are less likely to rescreen (Bulliard, Landtsheer, & Levi, 2004; Halabi et al., 2000; Messina et al., 2004; Rakowski, Meissner, Vernon, Breen, Rimer, & Clark, 2006).

Existing knowledge about mammography screening and belief in the benefits of screening, even if there is not evidence of disease, is also predictive of a woman's rescreening behavior (Achat et al., 2005; Halabi et al., 2000; Mayne & Earp, 2003).

Reflective of this finding, in one study by Ahmed and colleagues (2004), women who engaged in breast cancer rescreening reported they had adequate knowledge of breast cancer risk factors, held value in early detection, and trust in the screening process. Comparably, a recent Canadian study found that women who did not engage in rescreening were more apt to believe that mammograms were not effective at finding cancer and that their risk of developing breast cancer was below average (Edwards, Chiarelli, Stewart, Majpruz, Ritvo, & Mai, 2009). The study also found that nurses at screening centers can positively influence women's' knowledge and beliefs about the importance of screening, and subsequently increase compliance with biennial screening.

Disparities in Screening Behavior

Lower screening rates and later-stage disease detection among racial or ethnic minority individuals account for much of the morbidity and mortality disparities associated with breast cancer (ACS, 2007a). Studies have shown that Asian American and Hispanic/Latino individuals participate significantly less in breast cancer screening relative to their non-Hispanic white counterparts (Babey, Ponce, Etzioni, Spencer, Brown, & Chawla, 2003J; Winkleby, Kim, Urizar, Ahn, Jennings, & Snider, 2006). For example, in a 4-year longitudinal study of screening behavior in women over the age of 50, investigators found that only 19% of non-Hispanic whites, 14% of AAPI, 11% of African Americans, and 8% of Hispanics received all recommended mammography screenings (Blanchard, Colbert, Puri, Weissman, Moy, Kopans, 2004). ACS (2007) also reported that the percentage of women 40 and older who obtained a mammogram within the past two years was highest for non-Hispanic whites at 68.1%, followed by African Americans at 64.9%, Hispanics at 59.6% and AAPIs at 54.2%. However, when

measuring the percentage of women who obtained a mammogram within the past year, rates were considerably lower for non-Hispanic whites (52.9%), African Americans (49.9%), Hispanics (41.7%), and AAPI (37.9%). As evidenced by these statistics, ethnic minorities as a whole engage in less breast cancer screening than their non-Hispanic white counterparts, accounting for disparities in survival rates.

In general, acculturation has been hypothesized as a key mediator in the health-behaviors and outcomes of ethnic minority health. Acculturation has been described as a multidimensional and multidirectional process whereby immigrants and their descendants adopt behaviors, beliefs, and values of the host culture, in concert with adapting the behaviors, beliefs, and values belonging to their culture of origin (De La Rosa, 2002; Landrine & Klonoff, 2004). The "healthy immigrant effect" may describe an acculturation phenomenon of worsened health and health behaviors of individuals first to later generations (Flores & Brotanek, 2005). While acculturation and generation status is not synonymous, the latter has also been linked with variations in health-risk behaviors (Allen, Elliott, Morales, Diamant, Hambarsoomian, & Schuster, 2007), health care access and utilization (Burgos, Schetzina, Dixon, & Mendoza, 2005) and thus may be related to screening behaviors. Investigations examining the effect of immigration or citizenship also suggest that recent immigrants or non-citizens are less likely to be screened for breast cancer than those residing longer in the U.S., or who are citizens (De Alba, Hubbell, McMullin, Sweningson, & Saitz, 2005; Kandula, Wen, Jacobs, & Lauderdale, 2006; Wong, Gildengorin, Nguyen, & Mock, 2005).

From investigations concerning the issues of unequal treatment in health care, the Institute of Medicine identified that disparities in health-care are largely due to racial and

ethnic discrimination (Smedley, Sitith, & Nelson, 2003). In addition, the Institute described multiple levels that influence whether screening recommendations are accepted and adhered to by women. First, at the individual level, a woman's health beliefs, education, and cultural influences or barriers may play a role in her screening behavior. Second, at the provider level, failure to recommend screening and biases or discrimination may play a role. Third, at the health care system level, access to care and screening, costs of care, and unavailability of translators also influence screening and early detection of breast cancer in a woman.

The role of perceived discrimination, whether or not discrimination is actually involved, has been shown to have widespread effects on health-seeking behaviors. For example, individuals reporting perceived general (not specific to medical) discrimination are less likely to use preventative health services (e.g., flu shots, cholesterol testing; Blanchard et al., 2004; Trivedi & Ayanian, 2006) and are less apt to adhere to medication regimens especially if these individuals perceive unfair treatment in their health care setting (Casagrande, Gary, LaVeist, Gaskin, & Cooper, 2007; Van Houtven, Voils, Oddone et al., 2005). In a recent study by Crawley, Ahn, and Winkleby (2008) utilizing the California Health Interview Survey data with a sample of 8,051 women aged 40-75, they investigated the relationship between perceived medical discrimination and related cancer screening behaviors. Results showed that women who perceived medical discrimination were half as likely to obtain breast cancer mammography screening (Odds Ratio, [OR] 0.52; 95% CI, 0.51-0.54) than their counterparts not perceiving medical discrimination.

Mental health issues also play a role in whether a woman engages in screening behavior. For example, when mental health barriers exist poor health care decision making and reduced participation in cancer screening often result (McGarvey & Brenin, 2005). Specifically, individuals suffering from depression, phobias, anxiety and other psychological conditions are less likely to participate in screening and are less informed when it comes to making a decision about their health care (Pirraglia, Sanyal, Singer, & Ferris, 2004; Desai, Bruce, & Kasl, 1999). Studies have also suggested that mentally ill women are at increased risk for breast cancer (Carney, Allen, & Doebbeling, 2002; Cotterchio, Kreiger, Darlington, & Steingart, 2000; Desai, Bruce, & Kasl, 1999; Friedman, Moore, Webb, Puryear, 1999; Hallbreich, Shen, & Panaro, 1996; Owen, Jessie, & De Vries Robbe, 2002) which may be due to factors that include under-utilization of preventive care, less access to treatment, and risk factors that are common in both mental illness and cancer (Miller, Lasser, & Becker, 2007). Lasser and colleagues (2003) also found a low overall rate of mammography screening for women with mental illness, relative to screening behaviors of women in the community. In a qualitative study by Miller et al., (2007) they found that women reported fear of pain, a new diagnosis, and mistrust of the health care system as barriers to screening. These factors also exacerbated health system barriers of long wait times, transportation issues, and lack of follow-up for missed appointments. Further, providers expressed concern regarding "re-traumatizing" patients with histories of trauma during the screening process and reported enhancing communication with mental health providers would improve screening participation. Women in this study also agreed that support from their mental health provider in coordinating preventative or primary care was preferred.

Overall, findings from several studies indicate that several predictors play a role in screening behavior among women (Colbert, Kaine, & Bigby et al., 2004; Consedine, Magai, Conway, & Negut, 2004; Garbers & Chiasson, 2006; Martin & Degner, 2006). For example, worry about getting breast cancer has been positively associated with mammography screening behavior among women (Consedine, Magai, Conway, & Negut, 2004) as has the influence of physician recommendation (Bazargan, Bazargan, Calderon, Husaini & Baker, 2003; Colbert, Kaine, & Bigby et al., 2004; Garbers & Chiasson, 2006; Nekhlyudov, Ross-Degan, & Fletcher, 2003). Additional predictors of women's screening behaviors include media messages about breast cancer that often influence women's understanding of their risk of developing breast cancer and subsequently influence their screening and also frequency thereof (Covello & Peters, 2002; Haas, Kaplan, Des, Gildengoin, Perez-Stable, & Kerlikowske, 2005; Jones, Patterson, & Calvocoressi, 2003; Steele, Mebane, Viswanath, & Solomon, 2005). One study demonstrated that 81% of women ($N \approx 2{,}000$) surveyed utilized TV, newspapers, and magazines to obtain most of their health information. A significant majority of these women incorrectly believed that mammography actually reduces the chance of developing breast cancer (Covello & Peters, 2002). Thus, it is central to address the constellation of factors that combine to influence a woman's choice, knowledge about, and access to engage in breast cancer screening in order to improve screening rates among the diverse women within California and the greater U.S.

Screening Behavior Disparities in African-American Women

Significant disparities in screening behavior exist between African American and non-Hispanic white women, with higher African American mortality rates attributed to

these differences in screening for breast cancer (Fields et al., 2005; Husaini, Sherkat, & Bragg et al., 2001; Jacobellis & Cutter, 2002; Young, Walter, & Smitherman, 2002). For example, African American women have been less apt to practice self-exams, or obtain clinical breast exams and mammograms (Gotay, 1998; Williams, Brown, Hill, & Schwanz, 2001). Recent studies have demonstrated that there has been trend towards reduction in discrepant screening behaviors; however, there has been little research examining the several variables that influence African American screening practices as well as age of first mammogram (Bowie, Wells, Juon, Sydnor, & Rodriguez, 2008; Ghafoor, Jenal, Ward, Smith, & Thun, 2003; Newman, 2005). The National Health Interview Survey (NHIS) revealed that 39.69% of the 4,481 African American women in the study reported having their first mammogram before the age of 40 years (CDC; Centers for Disease Control, 2005). In contrast, about 20% of African American women over the age of 40 have reported not obtaining a mammogram in the prior 2 years (CDC, 2006).

In a recent study examining the predictors of mammography screening behavior and age of first mammography among African American women, about 77% of women (N = 213) reported having a mammogram, and about 40% reported having their first mammogram before the age of 40 (Bowie, Wells, Juon, Sydnor, & Rodriguez, 2008). The findings of this study revealed that African American women who screened before the age of 40 were more likely to be knowledgeable about screening guidelines, have received physician recommendations to screen, and have three or more female relatives who had been screened, relative to those women who never screened. In addition, women who screened at or after the age of 40 had stronger religious beliefs concerning

health than women who never had screened. Strikingly, no significant differences in predictors emerged between the two age groups (screening before or at/after age 40).

Other studies have shown that a woman's perception and experience of her body, as well as the health care provider's sincere and respectful understanding of the patient throughout the exam experience can influence screening behavior. A recent study (Lende and Lachiondo, 2009) addressed the relationship between screening behaviors and how African American women experience embodiment, or relate to their bodies, and the several meanings their bodies can have. The authors found that practitioners and women with embodied understandings, quality patient-provider relationship, and providers who utilized personal rather than objective biomedical considerations for screening and treatment increased women's decisions to engage in screening behaviors. In addition, health beliefs such as fatalism, or the belief that there is little one can do to alter his/her fate, and divine predestination (e.g., God's will) play a significant role in African American women's screening behavior (Jennings, 1996). Fatalistic beliefs have been found to be one of the strongest barriers to breast cancer screening even when accounting for other factors such as SES, age, and education (Powe, 1995).

Screening Behavior Disparities in Hispanic Women

While Hispanic women have lower incidence and mortality rates from breast cancer than non-Hispanic white women (O'Brien et al., 2003), that this is the leading cause of cancer death may be due, in part, to the lack of participation in regular mammogram screening that could detect early cancers (Gorin & Heck, 2005; Hedeen & White, 2001; NWHIC, 2003). Primary variables that have been shown to play a role in reduced screening behavior of Mexican American women include lack of health

insurance, lack of obtaining a usual source for health care, lower SES, institutional barriers, and lack of proficiency in English (Asamoa et al., 2004; Coughlin & Uhler, 2002; Fernandez-Esquer et al., 2003; Parchman & Byrd, 2001; Selvin & Brett, 2003). For example, studies have shown that Hispanic women and non-English speakers had their first mammography at a later age and were also less likely to adhere to additional exams than other groups (Blanchard et al., 2004; Colbert, Kaine, Bigby, Smith, Moore, Rafferty et al., 2004). In addition, having health insurance, a usual source of care, and citizenship were stronger indicators of screening behavior than English proficiency, in a large sample of Hispanic immigrants (Carrasquillo & Pati, 2004).

Acculturation has been shown to influence screening rates in Hispanic women, whereby women who are more acculturated to the U.S. are more likely to perform breast self-exams (Peragallo, Fox, & Alba, 2000), and obtain a clinical breast exam or mammogram (O'Malley, Kerner, Johnson, & Mandelblatt, 1999; Stein & Fox, 1990; Suarez & Pulley, 1995). Several studies have suggested that language is a proxy for cultural orientation and acculturation, and ultimately health beliefs that influence Mexican-American screening behaviors (Fernandez-Esquer, Espinoza, Ramirez, & McAlister, 2003; Gorin & Heck, 2005; McGarvey, Clavet, Johnson, Butler, Cook, & Pennino, 2003; McMullin, De Alba, Chavez, & Hubbell, 2005). In a review by Timmins (2002) that examined the role of language as a barrier to health care for Hispanics, the findings suggest that English proficiency is an indicator for lower quality and limited access to health care.

Lack of accurate knowledge about breast cancer may also result from limited English proficiency, and has also been shown to be a significant predictor of low

screening behavior (Schettino, Hernandez-Valero, Moguel, Hajek, & Jones, 2006). Furthermore, a recent study by Fernandez and Morales (2007) examined the effects of language proficiency, health insurance, and usual source of care in a sample of Hispanic women living on the border between the U.S. and Mexico. Differences in screening behavior were found due to SES and structural barriers to access of health care. Women in this study who preferred Spanish were also less likely to report age-appropriate cancer screening behaviors, have health insurance, and a usual health care provider, with use of the latter accounting for most of the variance in screening behavior (e.g., doubled the utilization of screening services).

Across studies examining Hispanic women's health beliefs, perceived barriers to screening included embarrassment, limited English proficiency, and the belief that cancer is fatal (Austin, Ahmad, McNally, & Stewart, 2002). Analogous to the predestination and fatalism beliefs observed in African American women discussed above, Hispanic women also hold beliefs in divine predestination or that getting breast cancer is "God's punishment" (7% of Latinos vs. 2% whites; Perez-Stable, Sabogal, Otero-Sabogal, Hiatt, & McPhee, 1992). Hispanic women also held more fatalistic beliefs (e.g., "getting a death sentence" = 46% vs. 26%) and beliefs about the inevitable (e.g., "very little one can to do prevent getting cancer" = 26% vs. 18%) than white women (Olsen & Frank-Stromborg, 1993). These fatalistic cultural value orientations have been found to underlie Hispanic women's reasons for not obtaining breast cancer screening (Flynn, 2006). Research has also shown that Hispanic women have low perceived susceptibility of developing breast cancer, even though they have high perceived severity beliefs about the disease (Fulton, Rakowski, & Jones, 1995). Therefore, these factors have likely have

a significant impact on Hispanic women's health behaviors that include screening for breast cancer.

Reflective of the embodiment experience for African American women, studies have shown that Hispanic women's cultural standards regarding their bodies also influence their screening behavior. In a study by Borrayo and Jenkins (2001) women of Mexican-decent believed that screening violated their cultural standards, since it ultimately asks them to engage in and participate in inappropriate behaviors. For example, women felt screening is "indecent" and embarrassing as it requires them to touch their own breast and also expose their breasts to a health care provider. As these are not acceptable or respectable female behaviors, Mexican-American women in this study reported that to avoid feeling indecent they resisted participating in screening. Thus, several important cultural variables and perceptions of breast cancer are highly influential in whether a Hispanic or Mexican-American woman will choose to participate in breast cancer screening.

Screening Behavior Disparities in Asian American/Pacific Islander Women

Asian American women are less likely to undergo regular breast cancer screening than non-Hispanic whites, thus a likely contributor to their increased mortality and morbidity due to delayed detection and treatment (Durvasula, Regan, Ureno, & Howell, 2006; Greenlee, Murray, Bolden, & Wingo, 2000; Goodman, 1991; Parker, Davis, Wingo, Ries, & Heath, 1998; Tu, Taplin, Barlow, & Boyko, 1999; Wismer, Moskowitz, Chen, Kang, Novotny, Min, 1998). ACS (2006a) has found that AAPI women in the U.S. have the lowest mammography screening rates compared to women from other racial/ethnic groups. For example, only 53.5% of Asian American women aged 40 years

or older had received a mammogram within the past two years, the lowest screening rate of all U.S. racial and ethnic groups (National Center for Health Statistics, 2003). AAPI women are also less likely to participate in a second mammography screening (Blanchard et al., 2004), indicating a decline in possible early detection and treatment of breast cancer in these women.

Additional studies have found barriers to screening often include structural problems such as lack of time, health care scheduling problems, and location, in addition to discomfort explained as experiencing pain, feeling embarrassed or uncomfortable, and financial issues such as the cost of a mammogram or lack of insurance (Wu, Hsieh, & West, 2008). In contrast, other studies have shown that acculturation and a reduction in modesty are linked with increased participation in clinical breast exam (Tang, Solomon, & McCracken, 2000), whereas belief that cancer is contagious and lack of knowledge that most cancers are curable if diagnosed early (Wong-Kim, Sun, DeMattos, 2003) are linked with reduced screening behaviors. In a study by Regan and Durvasula (2008), they found that younger Asian American women were less likely to engage in screening behaviors (e.g., clinical breast exam), and that more experience with sexual intercourse was associated with participating in screening; however, acculturation was not a significant predictor of screening in this study. Further, the more these women perceived barriers to screening, such as embarrassment or fears about pain and discomfort and the less they perceived support, their screening behaviors were reduced.

The role of acculturation in whether or not Asian American women obtain screening has included English language proficiency (Lee, Lee, & Stewart, 1996) and length of residency in the U.S. (Juon, Choi & Kim, 2000; Yu, Hong, & Seeto, 2003), as

well as level of education (Yu, Kim, Chen, & Brintnall, 2001). A recent study among Chinese immigrant women showed that a short residency in the U.S. and low income predicted lack of engagement in breast self exam, despite awareness of self exam (Wong-Kim & Wang, 2006). In a larger national study with AAPI women (*n* = 1695), Leong-Wu and Fernandez (2006) found that Asian women who were foreign born and lived in the U.S. less than 5 years and between 5-10 years were less likely to obtain a mammography. Similarly, younger women (aged 40-49 vs. aged 50-64 years) were half as likely to participate in screening. Not surprisingly, they also found that having insurance was positively associated with mammography screening (OR 1.59; CI 1.02-2.48).

Studies have also examined language proficiency, a marker for acculturation, and increased knowledge of breast cancer to enhanced screening behavior in AAPI women. A recent study that examined the effectiveness of a culturally and linguistically focused cancer education program designed for AAPI women, demonstrated that with increased knowledge and awareness about breast cancer subsequent screening practices increased, as did access to screening among these women in California (Sadler, Hung, Beerman, Chen, Chow, & Chan, 2009). Other studies have also demonstrated that AAPI women, specifically Filipino, proficient in English, and better skills in navigating the medical system were more likely than recent immigrants to adhere to cancer-screening guidelines in the U.S. (Maxwell, Bastani, & Warda, 2000). Thus, again highlighting that there are several factors that influence a woman's screening behavior, with significant differences that can emerge even within ethnic minority group members.

Present Study

As evidenced by the aforementioned disparities in screening behaviors among ethnically diverse women, and the importance of screening for the early detection and treatment of breast cancer, the current study sought to identify variables that best predict women's breast cancer screening behaviors. More importantly, the current study aims to establish typologies comprised of several of the aforementioned variables that influence screening behavior. For the current study these independent variables or correlates include the following: (1) alcohol use, (2) cigarette smoking use, (3) general health, (4) pregnancy and births, (5) PAP smear test, (6) breast cancer history, (7-8) family history of breast cancer (i.e., 1st and 2nd degree relatives), (9) usual source of care, (10) health insurance coverage over the past 12 months, (11) visits to a medical doctor in the past year, (12) communication with a doctor, (13) emergency room visits in past year, (14) and psychological distress. Demographic and sociodemographic variables will also be assessed in the current study and include the following: (1) Age, (2) race/ethnicity (3) educational attainment, (4) employment status, (5) annual household income, (6) residence (i.e., urban vs. rural) and (7) citizenship status, (8) percent life in the U.S., (9) perceived racial/ethnic discrimination, and (10) perceived health care discrimination. The dependent variables of the study include women's breast cancer screening behavior of either (1) obtaining a clinical breast exam in the past year, (2) ever having a mammogram, (3) mammogram in the past 2 years, and (4) mammogram over 2 years ago.

The primary purpose of the current study is to establish typologies of women participating or not participating in breast cancer screening in order to create screening

profile structures based on combinations of individual variables or factors that have been identified to influence this behavior. Second, examining the identified classes or profiles in an ethnically diverse sample will hopefully elucidate patterns of variables that may have disparate influences on screening participation. Third, once classes or typologies were identified, the predictive ability of each class with respect to women's engagement in clinical breast exam and/or mammographic screening was explored. Before examining the emergent profile structures, a priori hypotheses were established to examine the association between these identified factors and barriers to screening behavior. Hypotheses regarding the correlational relationships between these factors and screening are outlined below before discussing the rational for determining typologies that predict screening.

Primary hypotheses of the current study are grounded in the current literature as discussed in the aforementioned passages. These hypotheses are related to the specific variables that will comprise emergent profiles and will inform the exploratory interpretation of these profiles. First hypothesis: Those women who engage in positive health behaviors will engage in more breast cancer screening behavior(s) (e.g., clinical breast exam and/or mammography) than women who do not engage in positive health behaviors. Specifically, those women who abstain from drinking alcohol, women who do not binge drink, or use tobacco will be more apt to participate in screening. Second hypothesis: Those women who rate their physical and mental health as good over the past month will be more likely to engage in screening behaviors than those women who feel their health is poor. Third hypothesis: Women who have had a full term pregnancy and given birth to a child will be more apt to participate in screening. Fourth hypothesis:

Women who have ever obtained a PAP smear, especially those who obtained a more recent PAP smear (e.g., a year ago or less) and those women reporting their doctors have recommended they receive a PAP smear will be more likely to participate in screening. Fifth hypothesis: Women reporting a family history of cancer, and specifically those women reporting family history of breast cancer will participate in screening more than their counterparts without a history of cancer or breast cancer. Sixth hypothesis: Those women reporting a usual source of care, health coverage over the past year, and women who obtain regular visits to their medical provider and less emergency medical visits will engage in screening behaviors. Seventh hypothesis: Women reporting good communication with their doctors will be more apt to follow provider recommendations and obtain screening. Eighth hypothesis: Women reporting more mental health problems (e.g., symptoms of depression) will be less likely to participate in screening than women reporting no mental health problems.

Hypotheses also include those factors and/or barriers to screening related to the demographic and sociodemographic data. First hypothesis: Women who are older in age will have participated in more screening behaviors than younger women. Second hypothesis: Ethnic minority women will have participated less in screening behavior than non-Hispanic white women. Specifically, following the recent trends as outlined by ACS (2007) non-Hispanic white women will obtain the most screening, followed by African American, Hispanic, and AAPI women. Third hypothesis: Women who are more acculturated to the U.S. will be more likely to obtain breast cancer screening. In particular, those who are foreign born, not U.S. citizens, recent immigrants, and less proficient in English or whose primary language is not English will be less likely to have

participated in screening. Fourth hypothesis: Those women who reported experiencing racial/ethnic discrimination will be less likely to engage in screening behavior than women reporting no racial/ethnic discrimination experiences. Fifth hypothesis: Women with higher educational attainment (e.g., some college or completed college), employed, and those of higher-SES, such as having a higher household income and above the federal poverty level, will engage in more breast cancer screening behaviors than women with less education, unemployed, or of lower SES.

Latent profile analysis (LPA; Lanza, Flaherty, & Collins, 2003) and related hypotheses to determine profiles of women who engage or do not engage in screening behaviors is a central aim of the current study; however, the analyses are more exploratory in nature as predicting the number of classes that will emerge is difficult to determine a priori. In general, the hypothesis regarding the profile structure of variables to determine engagement in screening assumes that more than two distinct profiles will emerge from this group of ethnically diverse women. Since LPA is exploratory, it is likely that profiles will emerge roughly as having at least one typology with predominately well-established barriers to screening that predict women do not participate in screening. In contrast, the typology consisting of well-established positive behaviors and factors, congruent with the current literature, will identify women who engage in breast cancer screening. This simplified explanation of potential emergent typologies will likely become more complex as the 23 variables identified will produce unique and rich typologies that predict women's screening behaviors. These typologies will provide a deeper understanding of the combination of variables that more strongly influence a woman's screening choices and ultimate behaviors, above and beyond

examining variables in isolation. To better understand why LPA offers a unique and more informative perspective regarding the combination of factors that play a role in women's screening, a rationale for use in the current study is provided below.

The current study will employ latent profile analysis (LPA; an extension of latent class analysis; Lanza, Flaherty, & Collins, 2003) to examine the aforementioned variables simultaneously to determine typologies of women that predict subsequent breast cancer screening behavior. Utilizing statistical methods such as LPA will allow researchers to identify taxonomies of people rather than a taxonomy of variables as is customary in research using exploratory or confirmatory factor analysis. These latter methods do not account for the complexity of variables that influence a woman's screening behavior. In LPA, a person-centered categorical latent variable is derived whereby individuals are assigned to one mutually exclusive profile (or class) based on their responses to observed variables of interest (e.g., screening mediators). These classes, then, are substantively characterized by interpreting responses within each class (i.e., conditional response means). Identifying a latent structure of screening predictors will reveal profiles of individuals who employ similar patterns of behavior (within class homogeneity) but differ from other patterns of predictive behaviors (between class heterogeneity). LPA, therefore, is a decidedly useful tool to distinguish variations of behaviors and risk factors, which ultimately will reveal their degree of effect on screening behavior within each profile.

METHODS

Data Source and Sample

The data used for the current study was obtained from women completing the CHIS 2005 (CHIS, 2006). The CHIS is a population-based random digit dialing survey of California's population that has been collected every other year since 2001 (CHIS, 2007). It is the largest health survey conducted in any state and one of the largest in the U.S. and includes assessment of breast cancer screening practices and related health variables. It is also very unique in that it is one of the only surveys that address racial/ethnic health care discrimination and cancer screening (Crawley, Ahn, & Winkleby, 2008). In general, "CHIS collects extensive information for all age groups on health status, health conditions, health-related behaviors, health insurance coverage, access to health care services, and other health and health related issues" (CHIS, 2007).

Sample Design and Inclusion Criteria

The CHIS sample is representative of noninstitutionalized individuals living in California households and was obtained using a multi-stage sample (CHIS, 2007). Sample selection was via telephone random-digit dialing (RRD) sampling combined with Korean and Vietnamese surname list samples, and one adult respondent over the age of 18 was selected at random to participate in the study. List-assisted RDD sampling was employed and yields an unclustered sample with good operational features (Tucker, Lepkowski, and Piekarski, 2002). Geographic stratification representative of all California counties included 41 single-county strata with three strata that combined two or more counties yielding a total of 44 geographic strata. Households sampled included residential houses, apartments, and mobile homes, and randomly generated telephone

numbers were from listed, unlisted, and nonresidential by using the White Pages (residential) and Yellow Pages (business). Households with no landline telephone because of cell phone use or due to language limitations were generally excluded in the telephone surveys. The telephone interview surveys were conducted in English, Spanish, Chinese (Mandarin and Cantonese dialects) Vietnamese and Korean, which are primarily representative of the languages spoken in California based on the 2000 Census. Interviews in all languages were conducted using Westat's computer-assisted telephone interview (CATI) system. For the adult sample, over 10% of the interviews were conducted in a language other than English.

The screener completion rate was 49.8%, with the household response rate for the CHIS 2005 at 29.5%. Adult extended interview completion rate for 2005 was 54.0%, with the overall response rate 26.9% for adults. This response rate is reflective of similar scientific telephone survey responses in California with an overall response rate 29.2% for the California Behavioral Risk Factor Surveillance System (BRFSS) Survey. In addition, California survey response rates are generally lower than national response rates to telephone surveys, with both declining on average (CHIS, 2007a). For more information on CHIS 2005 methodology see http://www.chis.ucla.edu/methodology.html.

The data included for use in the current study was obtained from the CHIS 2005 public use files that can be found at http://www.chis.ucla.edu/get-data.html. The study included data from only adult women aged 40 to 75 since this age group is targeted for breast cancer screening as recommended by the American Cancer Society (ACS, 2007). Women in the current study varied by ethnicity and included: African-American, AA/PI,

and those reporting ethnicity as Hispanic/Latina, with inclusion of non-Hispanic white women used as a comparison group

Study Design

Statistical Analysis

The current study will first examine the sample characteristics of women's responses to the variables under examination in SPSS (15.0). Second, LPA (Lanza, Flaherty, & Collins, 2003) will be employed to obtain typologies of health behavior within this diverse sample of adult women, and then relate these typologies to the specific screening outcomes aforementioned. LPA was used to investigate the plausibility of 1-, 2-, 3-, 4 and potentially higher class solutions. Classes will be added iteratively to determine the best model fit for the data, according to both statistical and interpretive perspectives. The purpose of this analysis is to derive latent classes that describe different categorical types of participants based on the response pattern associated with continuously-measured observed variables in the data set. LPA assumes a simple parametric model and uses the observed data to estimate parameter values for the model. This model-based approach is preferable to more subjective grouping techniques such as cluster analysis (Vermut & Magidson, 2002).

Overall, LPA optimally uses the *categorical* latent variables or latent class variables to find these homogeneous groups of individuals, who can then be appropriately classified according to typologies. On the contrary, factor analysis uses *continuous* latent variables or factors to examine underlying dimensions by explaining the correlations among observed variables (Muthen, 2006). This flexibility of the independence of the items within a class can affect class formation and consequently each individual's

probability of class membership can be estimated so the person may be classified into the most appropriate class. LPA also allows for the probability of an individual's membership in a health behavior profile to be estimated in the same model as the estimation of that profile (Hill, Degnan, Calkins, & Keane, 2006). The flexibility of LPA accounts for the likelihood that there is uncertainty in class membership and allows for both prediction of the probability of membership in a particular group while simultaneously estimating the classes. Therefore, unlike traditional methods such as factor or cluster analysis, individuals are not forced into groups, which likely may lead to classification errors (Hill, Degnan, Calkins, & Keane, 2006). Thus, employing LPA to examine health behavior classes or typologies of people will maximize the understanding of how women in the current study engage in breast cancer screening behaviors.

Model parameters are estimated using the maximum likelihood (ML) criterion. Model fit was evaluated using the Lo-Mendell-Rubin Adjusted Likelihood Ratio Test (LMRT) likelihood ratio, which is a statistical indicator of the number of classes that best fit the data (Lo, Mendell, & Rubin, 2001). The LMRT statistically compares the fit of a target model (e.g., a 2-class model) to a model that specifies one fewer class (e.g., a 1-class model). P-values less than .05 indicate that the "higher class" solution fits better (e.g., 2-class better than 1-class). P-values greater than .05 indicate that the "lower class" solution fits better. Both the Akaike Information Criterion (AIC; Akaike, 1974) and the sample size-adjusted Bayesian Information Criterion (BIC; Schwarz, 1978) were also examined to ascertain the most optimal class solution. Optimal model fit is generally defined by lower AIC and BIC values (i.e., closer to 0).

Observed Variables for the LPA

The following observed variables or correlates were assessed within the following domains: Health behaviors, women's health, cancer history and prevention, health insurance, health care utilization and access, and mental health. In addition, demographic and sociodemographic variables within the domains: age, education, SES and employment, acculturation, and racial discrimination, will also be included in the analyses. Second, the emergent classes will be examined in SPSS (15.0) to determine the relationship with women's breast cancer screening. Ethnicity/race will serve as a moderator and examined as an interaction term with the LPA classes to predict screening behavior. Finally, post-hoc analyses using logistic regression will be utilized to explain potentially significant interactions.

Health Behaviors:

1). Alcohol binge use was assessed by the following constructed item: "Considering all types of alcoholic beverages, during the past 30 days about how many times did you have 4 or more drinks on an occasion?" with the number of times recorded or the option to refuse or give the response. The item for binge drinking was then constructed into a binary variable in the CHIS dataset by identifying women who responded to drinking 4 or more alcoholic beverages on one occasion, with the items coded "yes" = 1 for 4+ drinks and "no" = 2 for less than 4 drinks.

2). Current smoking was assessed by using the constructed binary variable of the following items: (a) "Altogether, have you smoked at least 100 or more cigarettes in your entire lifetime?" With response options "yes, no, refused or don't know."

(b) “Do you now smoke cigarettes every day, some days, or not at all?” with response options “every day, some days, not at all, refused or don’t know.” The CHIS constructed variable of current smoker was derived from combining these two items and coded “current smoker = 1” and “not current smoker = 2.”

Health & Women’s Health:

1) General health related quality of life was assessed with a continuous variable that combined the items: (a) “Now, I am going to ask about your health over the past 30 days. Thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?” with response options including the number of days or “none, refused, or don’t know.” (b) “Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?” with response options including the number of days or “none, refused, or don’t know.” The constructed CHIS variable that assessed health related quality of life identified the total number of unhealthy days from the above items, with the minimum unhealthy days = 0 and the maximum unhealthy days = 30.

2) Pregnancy and births were assessed by the following item: (a) “Have you ever given birth to a live infant?” with response options “yes =1, no=2, refused, don’t know.”

3) Pap smear test screening was measured by the following items: (a) Have you ever had a Pap smear test to check for cervical cancer?” with four response options of “yes =1, no=2, refused, don’t know.”

Cancer History and Prevention:

1) Cancer history was measured by the CHIS constructed variable of the following items: (a) "Has the doctor ever told you that you had a cancer of any kind?" with four response options of "yes, no, refused, don't know." If the response type was indicated for breast cancer the constructed variable was coded positive for breast cancer: b) "Have you ever had an operation to remove a lump from your breast" and c) "Did the lump turn out to be cancer" included response options "yes, no, refused, don't know." If these items were positively coded for breast cancer the constructed CHIS variable was coded 1 = "yes" and 2 = "no" for women responding to the diagnosis of breast cancer by a physician.

2) Family history of cancer was assessed by using the CHIS constructed variable from several source variables that identify the number of 1st degree female relatives ever diagnosed with breast cancer. The items include: (a) "The next questions ask about your family history of cancer. By family we mean only your relatives, including half brothers and sisters.." (b) "Has your father or mother, or have any of your (brothers, sisters, sons, or daughters) ever had cancer of any kind?" with four response options of "yes, no, refused, don't know." (c) "Have any of your female relatives been diagnosed with cancer of the breast, ovary, uterus, colon, or rectum?" with response options "yes, no, refused or don't know;" d) Which female relatives have been diagnosed…was it your…" with the following options "grandmother, aunt(s), mother, sister(s), daughter(s), refused, don't know." d) How many of your sisters had cancer of the breast, ovary, uterus, colon, or rectum?" with response for "number of sisters, refused or don't know."

e) “Thinking about the (youngest/next youngest) of your sisters who had cancer, did she have cancer of the breast, ovary, uterus, colon, or rectum?” with response options “breast, ovarian, uterine or endometrial, colon or rectal, female problems, none of these cancer types, refused, or don’t know.” f) “How many of your daughters had cancer of the breast, ovary, uterus, colon, or rectum?” with response option for “number of daughters, refused, or don’t know.” g) “Thinking about the (youngest/next youngest) of your daughters who had cancer, did she have cancer of the breast, ovary, uterus, colon, or rectum?” with response options “breast, ovarian, uterine or endometrial, colon or rectal, female problems, none of these cancer types, refused, or don’t know.” h) “Did your mother have cancer of the breast, ovary, uterus, colon, or rectum?” with response options “breast, ovarian, uterine or endometrial, colon or rectal, female problems, none of these cancer types, refused, or don’t know.” The CHIS constructed variable identifies the total number of 1st degree female relatives who were ever diagnosed with breast cancer from the woman’s response to the above items.

3) Family history of breast cancer was also assessed by using the CHIS constructed variable derived from several source variables that identify the number of 2nd degree female relatives ever diagnosed with breast cancer. The items mirror the aforementioned 1st degree female relative items. The CHIS constructed variable identifies the total number of 2nd degree female relatives, including the following: “mother’s mother, father’s mother, both grandmothers, aunts on mother’s side, aunts on father’s side, both sides, number of aunts total,”

who were ever diagnosed with breast cancer, as reported by the woman respondent.

Health Insurance:

1) Usual source of care CHIS constructed variable was measured by the following: (a) "Is there a place that you usually go to when you are sick or need advice about your health?" with the following response options "yes, no, doctor/my doctor, Kaiser, more than one place, refused, or don't know." b) What kind of place do you go to most often – (a medical/Is your doctor in a private) doctor's office, a clinic or hospital clinic, an emergency room, or some other place?" with response options "doctor's office/ Kaiser/other HMO, clinic/health center/hospital clinic, emergency room, some other place (specify), no one place, refused, don't know." The CHIS constructed variable is coded "1 = yes" if the woman responded positively to having a usual source of care from any of the above places, and "2 = no" if the woman responded "use of emergency room or no usual source of care" to these items.

2) Coverage over past 12 months was assessed by CHIS constructed variable derived from the following items: (a) "Thinking about your current health insurance, did you have this same insurance for all 12 of the past 12 months?" with four response options of "yes, no, refused, don't know." (b) "During the past 12 months, was there any time when you had no health insurance at all?" with four response options of "yes, no, refused, don't know." This item was followed by "For how many months during the past 12 months did you have no health insurance at all?" with the response recording the number of months or with the

options of "refused or don't know." (c) "Were you covered by health insurance at any time during the past 12 months?" with response options "yes, no, refused, don't know." d) "For how many months out of the last 12 months did you have health insurance?" with the number of months, "refused, or don't know" available for response. The constructed variable of "any insurance in the last 12 months" derived from the above items was coded "1 = Currently uninsured," "2 = Uninsured any months during the past 12 months" and "3 = Insured all months during the past 12 months."

Health Care Utilization and Access to Care:

1) Visits to the medical doctor was assessed by the items: (a) "During the past 12 months, how many times have you seen a medical doctor?" with the number of times recorded or "refused or don't know" as response options. Response range for number of visits was zero to 365 days in a year.

2) Communication with doctor was assessed by the following item: (a) "The last time you saw a doctor, did you have a hard time understanding the doctor?" with four response options of "yes, no, refused, don't know." The communication variable was coded "1 = Yes" and "2 = No."

3) Emergency room visits were assessed by the CHIS constructed item derived from the following items: a) "During the past 12 months, did you visit a hospital emergency room for your own health?" with four response options of "yes, no, refused, don't know." b) "During the past 12 months, have you had a visit to a hospital emergency room or urgent care clinic because of your asthma?" with response options "yes, no, refused, or don't know." c) "During the past 12

months, have you had to visit a hospital emergency room or urgent care clinic because of your asthma?" with response options the same as above. The CHIS constructed variable for ER visits in the last year was coded "1 = Yes" and "2 = No."

Mental Health:

1) Mental health status was measured by the CHIS constructed variable comprised of the following items: (a) "About how often during the past 30 days did you feel nervous – Would you say all of the time, most of the time, some of the time, a little of the time, or none of the time?" with additional response options "refused or don't know." (b) "During the past 30 days, about how often did you feel hopeless –all of the time, most of the time, some of the time, a little of the time, or none of the time?" with additional response options "refused or don't know." (c) "During the past 30 days, about how often did you feel restless or fidgety?" with response options again "all of the time, most of the time, some of the time, a little of the time, or none of the time?" with additional response options "refused or don't know." (d) How often did you feel so depressed that nothing could cheer you up?" with response options "all of the time, most of the time, some of the time, a little of the time, or none of the time?" with additional response options "refused or don't know." (e) "During the past 30 days, about how often did you feel that everything was an effort?" with response options "all of the time, most of the time, some of the time, a little of the time, none of the time, refused or don't know?" (f) "During the past 30 days, about how often did

you feel worthless?" with response options "all of the time, most of the time, some of the time, a little of the time, none of the time, refused, or don't know."

The CHIS constructed variable for serious psychological distress was derived from responses to these questions that comprise the Kessler 6-Item Psychological Distress Scale (K6; Kessler, Andrews, Colpe, Hiripi, Mtroczek, Normand, et al., 2002). The items on this scale are reverse coded to indicate cases with greater frequency of symptoms receive higher scores and are ranked as follows: 1 (All the time) = 4 pts., 2 (Most of the time) = 3 pts., 3 (Some of the time) = 2 pts., 4 (A little of the time) = 1 pts., 5 (not at all) = 0 pts. The scale scores range from a minimum of zero to a maximum of 24, with the later indicating the most serious psychological distress. Current studies with the K6 have also supported the score of 13 and above as a reliable indicator of psychological distress (Kessler et al., 2002; Swartz, 2007).

Acculturation:

1) Acculturation was assessed with two CHIS constructed variables, one set of items assessed citizenship, while the other set of items assessed percentage of life lived in the U.S. The first CHIS constructed variable was derived from the following items: a) "Country of birth was assessed by the following items: (a) "In what country were you born?" with response options available for several major countries and the option for "other." b) "The next questions are about citizenship and immigration. Are you a citizen of the United States?" with response options that include "yes, no, application pending, refused, or don't know." c) "Are you a permanent resident with a green card? Your answers are confidential and will not

be reported to Immigration Services." with response options including "yes, no, application pending, refused, don't know." The CHIS constructed variable of citizenship status, comprised of the above items, is coded "1 = U.S. Born," "2 = Naturalized," "3 = Non-Citizen." The current study re-coded this variable 1 = U.S. born and naturalized, and 2 = non-citizen.

2) The second CHIS constructed variable for acculturation measured percent life in the U.S. and was derived from the item: a) "About how many years have you lived in the United States?" with "number of years" or "year first came to the U.S." available as response options, in addition to "refused, or don't know." The CHIS constructed variable is computed by measuring the percentage of the respondent's life spent in the U.S. and provides categorical responses that include: "1 = 0-20% of life in U.S.," "2 = 21-40% of life in U.S.," "3 = 41-60% of life in U.S.," "4 = of life in U.S.," "5 = 81% or more of life in U.S."

Racial/Ethnic Discrimination

1) The first variable to assess racial/ethnic discrimination is the item: "Thinking about your race or ethnicity, how often have you felt treated badly or unfairly because of your race or ethnicity? Would you say…" with response options "never, rarely, sometimes, often, or all the time?" with "refused or don't know" also options. The item was coded on a scale of 1 – 5 with "1 = never," "2 = rarely," "3 = sometimes," "4 = often," "5 = all the time."

2) The second variable assessed discrimination related to receiving medical care: "Was there ever a time when you would have gotten better medical care if you

had belonged to a different race or ethnic group?" with four response options of "yes, no, refused, don't know." The item was coded "1 = Yes," and "2 = No."

Demographic Information:

1) Age was assessed with the following items" (a) "What is your date of birth?" with options for month listed, range of days, and years (1898-1985) also provided. (b) "What is your age, please?" with years of age reported or "refuse or don't know" as response options. Age was then coded on a continuous scale based on the woman's response, with the minimum age 40 yrs and maximum up to 75 years included in the current study based on screening recommendations (ACS, 2006).

2) Ethnicity/Race was assessed with the CHIS constructed variable comprised of the following items: (a) "Are you Latino or Hispanic?" with four response options of "yes, no, refused, don't know." (b) Also, please tell me which one or more of the following you would use to describe yourself. Would you describe yourself as Native Hawaiian, Other Pacific Islander, American Indian, Alaska Native, Asian, Black, African American, or White?" with the following similar response options "white, black or African American, Asian, American Indian or Alaska Native, Other Pacific Islander, Native Hawaiian, other, refused, or don't know." While there were several other items that assessed distinctions regarding race and ethnicity, the constructed CHIS variable used in the current study assessed the overarching race/ethnic variable that was coded: "Hispanic = 1," "White, Non-Hispanic (NH) = 2," "African American Only, NH = 3," "American Indian/Alaskan Native Only, NH = 4," "Asian Only, NH = 5," "Native

Hawaiian/Pacific Islander, NH = 6," and "Two or More Races, NH = 7." The current study recoded this variable to include the Hispanic = 1, White = 2, African American = 3, and Asian = 4, since preliminary analyses concluded that there were not enough participants to run LPAs with more refined race/ethnic categories. Ethnicity was used as a moderator variable in the LPAs.

Sociodemographic Information:

1) Employment status was assessed by the constructed CHIS variable that comprised the following items: (a) "Which of the following were you doing last week?" with the response options "working at a job or business, with a job or business but not at work, looking for work or, not working at a job or business?" and "refused or don't know" as options as well. (b) "What is the main reason you did not work last week?" with the response options "taking care of house or family, on planned vacation, couldn't find a job, going to school/student, retired, disabled, unable to work temporarily, on layoff or strike, on family or maternity leave, off season, other, refused, don't know." (c) "This is about the work you do. How many hours per week do you usually work at all jobs or businesses?" with response options to describe the number of hours, "refused, or don't know." The CHIS constructed variable for employment measured five categories of employment that include: "1 = full time employment" (21+ hrs/wk), "2 = part-time employment" (0-20 hrs/wk), "3 = employed, not at work," "4 = unemployed, looking for work," and "5 = unemployed, not looking for work." The current study recoded this variable into the following variable 1 = employed, 2 = working from home, 3 = unemployed.

2) Annual household income was assessed by the item: (a) "What is your best estimate of your household's total annual income from all sources before taxes in 2004?" with free response option for the amount as well as "refused or don't know."

3) Rural and urban community dwelling was assessed using the CHIS variable that assessed the following categories based on zipcode of the participant: (a) "1 = urban," (b) "2 = 2nd city," (c) "3 = suburban," and (d) "4 = town and rural." Urban was classified as "dense neighborhoods that represent the central cities of most major metropolitan areas (more than 4,150 persons/square mile." Second city was associated with "moderate-density neighborhoods in population centers (more than 1,000 and fewer than 4,150 persons/sq mi)." Suburban was classified as "moderate-density neighborhoods not surrounded by urban or second city population centers (estimated to be more than 1,000 persons/sq mi and not in an urban or 2nd city population center)." Town or rural was classified as "isolated small towns or less-developed areas on exurban frontier (estimated to be more than 210 but fewer than 950 persons/sq mi)," in addition to "small villages and rural hamlets surrounded by productive farmland or wide-open spaces (estimated to be 210 or fewer persons/sq mi)." The current study re-coded this variable to reflect residence with 1 = urban and 2 = rural.

3) Educational attainment item: (a) "What is the highest grade of education you have completed and received credit for?" with response options including "no formal education, grade school (1st grade to 8th grade), high school (9th to 12th grade), 4-year college or university (1st year-freshman to 4th/5th year

senior/BA/BS), graduate or professional school (1st year grad/prof school to Phd), 2-year junior or community college (1st year or 2nd year AA/AS) for "grade school." The current study re-coded this variable to reflect 1 = high school education, 2 = some college, and 3 = graduated from college.

Dependent Variables

Women's Health:

Breast cancer and mammography screening was assessed by the following items: (a) "In the past 12 months, has a doctor examined your breasts for lumps?" with responses including "yes, no, refused, and don't know." (b) "Have you ever had a mammogram?" with responses including "yes, no, refused, and don't know." (c) The CHIS constructed variable that identifies women who have "Had a mammogram within the past 2 years," "Had a mammogram over 2 years ago," or "Never had a mammogram." Response options included "yes, no, and never."

RESULTS

Sample Frequencies & Descriptives

The overall sample (N = 15,130) was 72.0% non-Hispanic white, 14.6% Hispanic, 8.7% Asian, and 4.7% African American. The average age of the sample was 52.08 years old (SD = 9.29). The total sample frequencies and descriptives are reported according to health, stress, and sociodemographics.

Health

For the health domain 9% of women reported "binge drinking" (4+ drinks), and 13% of women were "current smokers." 72.8% of women reported "ever having a pap smear," and 80.8% of women reported "ever giving birth to a live infant." On average, women reported experiencing 9.89 (SD = 11.38) unhealthy days in the past year. Only 4.5% of women reported ever being told they had breast cancer. 9.3% of women reported they had 1 first degree relative with breast cancer, and 11.7% of women reported they had 1 second degree relative and 2.4% of women reported have 2 second degree relatives diagnosed with breast cancer. Most women (94.3%) reported having a "usual source of care other than the ER" and 88.7% of women reported being insured, while 18.8% of women reported visiting the ER within the past year. On average, women reported seeing an M.D. 5.42 times (SD = 10.17) in the past 12 months and only 2.9% of women reported having a "hard time understanding the doctor" during their last visit.

Stress

On average, women reported minimal psychological distress (M = 3.41, SD = 4.09, min = 0.0 to max = 24.0). Women reported being treated badly because of race or

ethnicity as “never” (63.7%), “rarely” (21.4%), sometimes (12.2%), often (2.0%), all the time (0.6%), with a small number of women not reporting (0.1%). However, 3.7% of women reported that they would have received better medical care if they were of a different race or ethnicity. The majority of women reported being U.S. born citizens and naturalized citizens (92.8%), with 7.2% reporting they were non-citizens. For percent life in the U.S.; 80.8% of women reported living in the U.S. for 81% or more of their lives, 4.5% reported living in the U.S. for 61-81% of their lives, 7.2% of women reported living in the U.S. between 41-60% of their lives, 4.9% of women reported spending 21-40% of their lives in the U.S., 2.6% of women reported spending 0-20% of their lives in the U.S.

Socioeconomic Status

For educational attainment 39.3% of women reported graduating from college or above, with 26.9% reporting attaining some college, 30.8% reporting attaining a high school education or below, and 3% not reporting. For working status, 59.2% of women were employed, with only 0.7% working from home, and 40.1% reporting unemployment. 80.5% of women reported living in an urban environment, whereas 19.5% of women reported living in a rural environment. Average household annual income was $70,308.74 (SD = %61,410.74).

Outcome variables

The majority of women (76.6% and 92.4%) reported having a doctor perform a breast exam to check for lumps within the past 12 months, and ever having a mammogram, respectively. 80.4% of women reported having a mammogram within the past 2 years, 12.0% over 2 years ago, and 7.6% of women reported never having a mammogram.

Statistical Analyses

Latent profile analysis (LPA; Lanza et al., 2003) was employed to obtain typologies of ethnically diverse women that indicate subsequent breast cancer screening behaviors. LPA first utilizes all observations that are associated with the dependent variables and performs maximum likelihood estimation (Little & Rubin, 1987). LPA also allows for the probability of an individual's membership in a breast cancer screening profile to be estimated in the same model as the estimation of that profile (Hill, Degnan, Calkins, & Keane, 2006). The flexibility of LPA accounts for the likelihood that there is uncertainty in class membership by allowing both prediction of the probability of membership in a particular group while simultaneously estimating the coping classes. Consequently, each individual's probability of class membership can be estimated so the person may be classified into the most appropriate class (Hill, Degnan, Calkins, & Keane, 2006). Although the points of the distribution are occupied by individuals in different latent classes, it is up to the analysis interpretations, in light of possible covariates and substantive theory, to decide if these classes can be seen as substantively different categories or simply representative of a single, non-normal distribution (Muthen, 2006). As a result of the flexibility and maximal information accounted for within this analysis, LPA was utilized to derive the optimal number of breast cancer screening classes or risk typologies within this ethnically diverse sample of women.

LPA was used to investigate the plausibility of 1-, 2-, 3-, and 4-class solutions among three substantive risk typologies. Initial analyses included all 23 variables, however, the data yielded no theoretically meaningful or substantive classes. Therefore, to improve the theoretical implications of the study, the 23 variables were substantively

allocated to three risk domains that included: a) Health Domain, comprised of Health Behaviors (i.e., female binge drinking, current smoker), Health and Women's Health (i.e., number of unhealthy days, ever given birth to a live infant, ever had a Pap smear), Cancer History and Prevention (i.e., ever told you have breast cancer, number of 1st degree female relatives with breast cancer, number of 2nd degree female relatives with breast cancer), Health Insurance (i.e., usual source of health care other than ER, any insurance in the last 12 months), and Health Care Utilization (i.e., number of times you saw an M.D. in the past 12 months, hard time understanding doctor at the last visit, ER visits within the last year); b) Stress Domain, comprised of Mental Health (i.e., serious psychological distress), Acculturation (i.e., citizenship status, percent life in the U.S.), Racial Discrimination (i.e., frequency of being treated badly b/c of race, would have received better medical care if a different race/ethnicity); and c) Demographic Domain, comprised of Age, Race/Ethnicity, Sociodemographics (i.e., annual household income, residence, working status) and Education. Classes were added iteratively to determine the best model fit for the data according to both statistical and interpretive perspectives. The purpose of this analysis was to derive latent classes that describe different categorical types of participants based on the response pattern associated with continuously-measured observed variables in the data set.

LPA assumes a simple parametric model and uses the observed data to estimate parameter values for the model (Mplus, Version 4). Model fit was evaluated using the Lo-Mendell-Rubin Adjusted Likelihood Ratio Test (LMRT) that is a statistical indicator of the number of classes that best fit the data (Lo, Mendell, & Rubin, 2001). The LMRT statistically compares the fit of a target model (e.g., a 2-class model) to a model that

specifies one fewer class (e.g., a 1-class model). P-values less than .05 indicate that the "higher class" solution fits better (e.g., 2-class better than 1-class). P-values greater than .05 indicate that the "lower class" solution fits better. Both the Akaike Information Criterion (AIC; Akaike, 1974) and the sample size-adjusted Bayesian Information Criterion (BIC; Schwarz, 1978) were also examined to ascertain the most optimal class solution. Optimal model fit is defined by lower AIC and BIC values (i.e., closer to 0). Table 1 contains the AIC, BIC, and LMRT values for the latent profile analyses conducted among the three risk domains.

Health Domain

For the Health domain, LPA revealed that the 2-class solution was the best fitting solution as evidenced by the LMRT and LRT adjusted non-significant values ($p = 0.0762$). The 2-class model was retained and no further testing of higher classes was completed due to the non-significant LMRT value. In this 2-class solution, Class 1 was composed of 13,640 (90.2%) women, and Class 2 was composed of 1,490 (9.8%) of the women.

To substantively interpret each class the conditional response means, conditional response probabilities and the overall sample means for each domain were evaluated (see Table 2a-2c). For the Health domain and subclass *health behaviors* women in Class 1 were less likely (8.9%) to binge drink than Class 2 (9.8%); however women in Class 1 were more likely to be current smokers (13.2%), than women in Class 2 (11.8%). For the subclass *women's health*, women in Class 1 reported fewer days of poor health than women in Class 2. More women reported giving birth to a live infant in Class 1 (81.1%) than women in Class 2 (78.3%), and fewer women obtained a PAP smear in Class 1

(96.8%) than women in Class 2 (98.3%). For the subclass *cancer history and prevention*, fewer women reported having been diagnosed with breast cancer in Class 1 (4.1%) than women in Class 2 (7.2%). Women in Class 1 reported no 1st degree female relatives diagnosed with breast cancer, while the average number of female relatives diagnosed with breast cancer in Class 2 was about one. Similarly, in Class 2 women reported a slightly higher average of 2nd degree female relatives diagnosed with breast cancer than in Class 1, with both class averages less than one. For subclass of *health insurance*, fewer women in Class 1 (94.1%) reported having a usual source of health care other than the ER than women in Class 2 (95.4%); however, more women in Class 1 (11.7%) reported having any insurance than women in Class 2 (8.6%). For subclass *healthcare utilization* it appeared that women in Class 1 (3.1%) had a harder time understanding their doctor during the last visit than women in Class 2 (2.2%). Women in Class 1 had on average 1 fewer visit to their M.D. in the past year than women in Class 2, and women in Class 2 also had more ER visits (20.6%) than women in Class 1 (18.5%). Overall, based on the pattern of responses of women in Class 1 vs. Class 2 it appears that women in Class 2 have higher risk for poor health related to their health behaviors, overall health and cancer risk, in addition to utilizing health care more frequently. Therefore, Class 2 hereafter will be referred to as the Health Risk class while Class 1 will be referred to as the Healthy class.

Stress Domain

For the Stress domain, a 2-class solution was considered better than the 1-class solution as evidenced by significant LMRT and LRT adjusted values. The 3-class solution was considered better than the 2-class solution, due lower AIC and BIC values,

and significant LMRT and LRT adjusted values. The 4-class solution was also considered better than the 3-class solution due to lower AIC and BIC values and no further testing was completed due to the non-significant LMRT and LRT adjusted values. For this 4-class solution Class 1 was composed of 9,648 (63.8%) women, Class 2 was composed of 396 (2.6%) women, Class 3 was composed of 3,235 (21.4%) women, and Class 4 was composed of 1,851 (12.2%) of women.

Conditional response means and probabilities for the Stress domain revealed 4 Classes of women. For the subclass of *mental health* women in Class 2 reported on average more serious psychological distress, followed by women in Class 4, Class 3, and finally Class 1, with women reporting the least amount of psychological distress. The *acculturation* subclass demonstrated that women in Class 4 were the least acculturated (8.9% noncitizens), followed by Class 1 (7.6% noncitizens), Class 2 (5.8% noncitizens), and Class 3 (5.3% noncitizens). All classes of women reported living 61-80% of their lives in the U.S., with women in Class 3 living in the U.S. on average longer than Class1, Class 2, and Class 4, respectively. For the subclass of *racial discrimination* women in Class 2 reported being treated badly because of race/ethnicity "often," while Class 4 reported "sometimes," Class 3 "rarely," and Class 1 with women reporting "never" being treated badly due to race/ethnicity. Similarly, regarding medical care discrimination, more women in Class 2 (24.2%) reported they would have received better medical care if they were a different race/ethnicity, followed by women in Class 4 (11.1%), Class 3 (3.5%), and Class 1 (2.0%). Overall, reflective of women's pattern of responses to mental health, acculturative, and racial discrimination stressors it appears Class 2 experienced the highest levels of stress, followed by Class 4, Class 3, and finally Class 1.

Thus, Class 2 will hereafter be referred to as the Severe Stress class, Class 4 the Moderate Stress class, Class 3 the Mild Stress class, and Class 1 the Minimal Stress class.

Demographic Domain

For the Demographic domain, a 2-class solution was considered better than the 1-class solution as evidenced by significant LMRT and LRT adjusted values. The 3-class solution was considered better than the 2-class solution, due lower AIC and BIC values, and significant LMRT and LRT adjusted values. The 4-class solution was also considered better than the 3-class solution due to lower AIC and BIC values and significant LMRT and LRT adjusted values. A 5-class solution was examined, however, did not yield a measurable outcome, thus the 4-class solution was retained for the Demographic domain. For this 4-class solution Class 1 was composed of 4,827 (31.9%) women, Class 2 was composed of 1,075 (7.1%) women, Class 3 was composed of 2,978 (19.7%) women, and Class 4 was composed of 6,250 (41.3%) women.

Conditional response means and probabilities for the Demographics domain revealed 4 Classes of women as well. For the subclass of *age*, women in Class 3 on average were the oldest, followed by Class 4, Class 2, and finally Class 1 as the youngest. For *education*, it appeared that Class 4 followed by Class 2 both had the highest levels of education reporting "some college," while Class 1 and Class 3 reported a high school education at least. For *SES and employment* subclass women in Class 2 reported the highest annual household income ($234,020), followed by Class 4 ($76,430), Class 1 ($47,440) and Class 3 ($31,560). For residence, it appeared that more women in Class 3 (26.3%) and Class 1 (21.5%) lived in rural locations than women in Class 4 (16.4%) and Class 2 (11.4%), respectively. Finally, it appeared that the most women who were

unemployed were in Class 3 (90.9%), followed by women in Class 2 (30.3%), women in Class 4 (30.0%), and Class 1 (24.0%) with the least unemployment. Overall, related to the pattern of demographics for Classes, Class 2 will hereafter be referred to as the Substantial Resource group, Class 4 the Moderate Resource group, Class 1 the Limited Resource group, and Class 3 the Minimal Resource group.

Multinomial regression models for the class predictors of Health, Stress, and Demographic domains of the screening outcome variables were examined. For the Health domain, women in the Health Risk class were more likely to report "yes" relative to "no" for obtaining a breast exam in the past year [*b* = .256 (SE = .068); OR = 1.29, 95% CI (1.13-1.48), *p<.001*], than women in the Healthy class. In addition, women in the Health Risk class were more likely to report ever having a mammogram [*b* = .784 (SE = .139); OR = 2.19, 95% CI (1.67-2.87), *p<.001*], than women in the Healthy class. Last, women in the Health Risk class were more likely to report obtaining a mammogram within the past 2 years [*b* = .807 (SE = .139); OR = 2.24, 95% CI (1.71-2.94), *p<.001*] and over two years ago [*b* = .617 (SE = .159); OR = 1.85, 95% CI (1.36-2.53), *p<.001*], relative to women in the healthy class.

Multinomial regression models for the four classes of the Stress domain were examined next. Women in the Severe Stress class and Moderate Stress class were less likely to obtain a breast exam in the past year [*b* = -.293 (SE = .114); OR = 0.75, 95% CI (0.60-0.93), *p = .010*] and [*b* = -.129 (SE = .059); OR = 0.88, 95% CI (0.78-0.99), *p = .029*] respectively, relative to women in the Minimal Stress class. No significant relationship between women in Mild Stress class and women in the Minimal Stress class for obtaining a breast exam in the past year [*b* = -.052 (SE = .048); OR = 0.95, 95% CI

(0.87-1.04), p = .283], was observed. Similarly, women in the Severe Stress class were less likely to obtain a breast exam in the past year [*b* = -.242 (SE = .119); OR = 0.79, 95% CI (0.62-0.99), *p = .042*] relative to women in the Mild Stress class. Furthermore, women in the Severe and Moderate Stress classes were less likely to report ever having a mammogram [*b* = -.354 (SE = .175); OR = 0.70, 95% CI (0.50-0.99), *p = .043*] and [*b* = -.411 (SE = .087); OR = 0.66, 95% CI (0.56-0.79), *p <.001*] respectively, relative to women in the Minimal Stress class. However, no significant relationship emerged for women in the Mild Stress relative to the Minimal Stress classes [*b* = -.143 (SE = .076); OR = 0.87, 95% CI (0.75-1.01), p = .062]. Only women in the Moderate Stress class reported they were significantly less likely to obtain a mammogram [*b* = -.268 (SE = .101); OR = 0.77, 95% CI (0.63-0.93), *p = .008*], comparatively to women in the Mild Stress class. No significant relationship emerged for women in the Severe Stress class compared to the Mild Stress class of women [b = -211 (SE = .183); OR = 0.81, 95% CI (0.57-1.16), p = .247]. For the last outcome variable assessing women's mammogram activity in the past 2 years, women in all Stress classes were significantly less likely to have a mammogram within the past two years relative to the Minimal Stress class including; the Mild Stress class [*b* = -.161 (SE = .077); OR = 0.85, 95% CI (0.73-0.99), *p = .037*], Moderate Stress class [*b* = -.435 (SE = .088); OR = 0.65, 95% CI (0.55-0.77), *p <.001*], and the Severe Stress class [*b* = -.396 (SE = .177); OR = 0.67, 95% CI (0.48-0.95), *p = .025*]. In addition, compared to the Mild Stress class, women in Moderate Stress class reported they were significantly less likely to obtain a mammogram in the past two years [*b* = -.274 (SE = .102); OR = 0.76, 95% CI (0.62-0.93), *p = .007*]. Finally, women in the Moderate Stress class reported they were also significantly less

likely to obtain a mammogram over two years ago [*b* = -.257 (SE = .109); OR = 0.77, 95% CI (0.62-0.96), *p = .018*], in relation to women in the Minimal Stress class.

Multinomial regression models for the four classes of the Demographic domain were examined next. Women in the Minimal Resource class [b = -.760 (SE = .094); OR = 0.47, 95% CI (0.39-0.56), p <.001], Limited Resource class [b = -.746 (SE = .091); OR = 0.47, 95% CI (0.40-0.57), p<.001], and the Moderate Resource class [*b* = -.272 (SE = .090); OR = 0.76, 95% CI (0.64-10.91), *p =.003*] were significantly less likely to obtain breast exams in the past year than women in the Substantial Resource class. Women in the Minimal Resource class [*b* = -.487 (SE = .052), OR = 0.61, 95% CI (0.56-0.68), *p <.001*] and Limited Resource class [*b* = -.473 (SE = .045); OR = 0.62, 95% CI (0.57-0.68), *p <.001*] were significantly less apt to obtain a breast exam in the past 12 months, relative to women in the Moderate Resource class. Women in the Minimal Resource class [*b* = .515 (SE = .109); OR = 1.67, 95% CI (1.35-2.07), *p <.001*] and the Substantial Resource class [*b* = .324 (SE = .155); OR = 1.38, 95% CI (1.02-1.87), *p = .037*] were more likely to ever have a mammogram, in relation to women in the Moderate Resource class. However, women in the Limited Resource class [b = -.768 (SE = .068); OR = 0.46, 95% CI (0.41-0.53), p <.001] were less prone to report ever having a mammogram in contrast to the Moderate Resource class. Further, women in the Minimal Resource class [*b* = 1.283 (SE = .105); OR = 3.61, 95% CI (2.93-4.43), *p <.001*], the Moderate Resource class [*b* = .768 (SE = .068); OR = 2.16, 95% CI (1.89-2.46), *p <.001*], and the Substantial Resource class [*b* = 1.091 (SE = .153); OR = 2.98, 95% CI (2.21-4.02), *p<.001*] were more likely to ever have a mammogram, in relation to the Limited Resource class.

For the last outcome variable assessing mammography screening over the past 2 years, women in the Minimal Resource class [*b* = .502 (SE = .110); OR = 1.65, 95% CI (1.32-2.05), *p <.001*] and Substantial Resource class [*b* = .340 (SE = .156); OR = 1.41, 95% CI (1.04-1.91), *p = .029*] were more likely to have a mammogram within the past two years, relative to the Moderate Resource class; however, women in the Limited Resource class [*b* = -.822 (SE = .069); OR = 0.44, 95% CI (0.38-0.50), *p <.001*] were less apt to have a mammogram in the last two years relative to their Moderate counterparts. In contrast to the Limited resource class, the Minimal Resource class [*b* = 1.324 (SE = .106); OR = 3.76, 95% CI (3.05-4.62), *p <.001*] and Substantial Resource class [*b* = 1.162 (SE = .153); OR = 3.20, 95% CI (2.37-4.32), *p <.001*] were more apt to obtain a mammogram in the past 2 years. The Limited Resource class [*b* = -.424 (SE = .085); OR = 0.65, 95% CI (0.55-0.77), *p <.001*] was less likely to have a mammogram over 2 years, while the Minimal Resource class [*b* = .611 (SE = .125); OR = 1.84, 95% CI (1.44-2.36), *p <.001*] was more likely than their Moderate Resource counterparts. Finally, the Limited Resource class [*b* = -1.035 (SE = .121); OR = 0.36, 95% CI (0.28-0.45), *p<.001*] was less likely to have a mammogram over 2 years ago than the Minimal Resource class.

Ethnicity Moderator Analyses

Following main effect analyses, interaction models testing whether ethnicity moderated the class – breast cancer screening behavior relationship, controlling for all statistically significant covariates, were examined. Statistical information for the Ethnicity x Class interaction terms, including the *logits* and *p*-values, are reported in Tables 3-5. The post hoc analyses for these significant interactions are reported below.

Further, the percentage break down of women among each class by ethnicity is reported in Table 6.

Health Domain Post Hoc Analyses

For the Health Domain, significant interactions were found for Hispanics (vs. non-Hispanic whites) for the Healthy class in all outcomes but not the Health Risk class (*p*s > .05). Upon further examination of the interactions, the simple slope relating the Hispanic Healthy class to breast exam in the past year was not statistically significant, relative to the Hispanic Health Risk class. However, the simple slope relating the Hispanic Healthy class to ever having a mammogram was statistically significant and negative [*b* = -1.204 (SE = .461), OR = 0.30, 95% CI (0.12-0.74), *p* = *.009*). Hispanic women in the Health Risk class (relative to the Healthy class) were more likely to report ever having a mammogram. The simple slopes for the Hispanic Healthy class was statistically significant and negative for Hispanic women reporting a mammogram within the past two years [*b* = -1.270 (SE = .462), OR = 0.28, 95% CI (0.11-0.70), p = *.006*], but not for mammography over two years (*p*s > .05). Hispanic women in the Health Risk class were more likely to report a mammogram within the past two years relative to their Healthy class counterparts.

Only one significant interaction emerged for African Americans (vs. non-Hispanic whites) for the Healthy class and mammogram over two years ago. However, the simple slope for the African American Healthy class was not statistically significant for mammogram over two years ago (*p*s > .05).

Several interactions among Health class and Asians (vs. non-Hispanic whites) emerged for each breast cancer screening outcome. Of the five significant interactions,

the simple slope for the Asian Healthy class was statistically significant and negative for mammogram obtained within the past two years [*b* = -16.359 (SE = .385), OR = $7.86^{\wedge-8}$, 95% CI ($3.70^{\wedge-8}$ – $1.67^{\wedge-7}$ $p < .001$], indicating Asian women in the Health Risk class women were more apt to report having a mammogram in the past two years. The simple slope for the Asian Health Risk class that was statistically significant and positive [*b* = 19.359 (SE = .385), $2.56^{\wedge8}$, 95% CI ($1.20^{\wedge8}$– $5.43^{\wedge8}$, $p < .001$], suggesting Asian women in the Health Risk class are more likely to have a mammogram in the past two years relative to their Healthy counterparts.

For non-Hispanic white (vs. Hispanic) x Health class, seven significant interactions emerged for all three breast cancer screening outcomes. For the non-Hispanic white Healthy class statistically significant and negative simple slopes emerged for women reporting ever having a mammogram [*b* = -.522 (SE = .155), OR = 0.59, 95% CI (0.44-0.80), $p < .001$], mammogram in the past 2 years [*b* = -.540 (SE = .155), OR = 0.58, 95% CI (0.43-0.79), $p < .001$], and mammogram over 2 years ago [*b* = -.388 (SE = .177), OR = 0.68, 95% CI (0.48-0.96), $p = .028$]. Thus, non-Hispanic white women in the Health Risk class were more likely to engage in breast cancer screening behaviors than women in the Healthy class. Further, a statistically significant and positive simple slope was found for breast exam in the past year [*b* = .220 (SE = .077), OR = 1.25, 95% CI (1.07-1.45), $p = .004$], for non-Hispanic white women in the Health Risk class indicating they are more apt to obtain breast exam relative to their Healthy counterparts.

Stress Domain Post Hoc Analyses

For the Stress Domain, significant interactions were found for Hispanics (vs. non-Hispanic white) for all the stress classes with the exception of the Severe Stress class (*p*s

< .05). Further examination of these interactions revealed none of the simple slopes for the Hispanic Minimal Stress class emerged significant (*p*s < .05). Similarly, for the Hispanic Mild Stress and the Hispanic Moderate Stress classes, neither of the simple slopes emerged significant (*p*s < .05) for any of the screening outcomes. For African Americans, no significant interactions (*p*s < .05) with any of the stress classes emerged for the breast cancer screening outcomes. However, several significant interactions for Asian (vs. non-Hispanic white) x all the stress classes emerged. Follow-up of these interactions revealed no significant simple slopes for the Asian Minimal Stress, Mild Stress, and Moderate Stress classes and the screening outcomes (*p*s < .05). For the Asian Severe Stress class, no significant simple slope emerged for ever having a breast exam (*p*s < .05).

In contrast, several statistically significant interactions emerged for the non-Hispanic white (vs. Hispanic) x Stress classes for each of the outcome variables, with the exception of the Severe Stress class (*p*s < .05). The simple slopes for the non-Hispanic white Minimal Stress relative to the non-Hispanic white Severe stress class emerged significant and positive for having a doctor preform breast exam in the past year [*b* = .449 (SE = .189), OR = 1.57, 95% CI (1.08-2.27), *p=.017*], and for mammogram within the past 2 years [*b* = .648 (SE = .299), OR = 1.91, 95% CI (1.06-3.43*), p=.030*]. This suggests that non-Hispanic white women in the Minimal Stress class (relative to the Severe Stress class) are more likely to have a breast exam in the last year and mammogram in the past two years. For the non-Hispanic white Minimal Stress vs. non-Hispanic white Moderate Stress class all simple slopes emerged significant and positive for having a doctor preform breast exam in the past year [*b* = .285 (SE = .085), OR =

1.33, 95% CI (1.13-1.57), $p < .001$], for mammogram ever[b = .632 (SE = .128), OR = 1.88, 95% CI (1.46-2.42), $p<.001$], for having a mammogram within the past 2 years [b = .681 (SE = .130), OR = 1.98, 95% CI (1.53-2.55), $p<.001$], and for having a mammogram over 2 years ago [b = .333 (SE = .158), OR = 1.40, 95% CI (1.02-1.90), $p=.035$]. Non-Hispanic white women in the Minimal Stress class are more apt to engage in all breast cancer screening behaviors than their Moderate Stress class counterparts. For the non-Hispanic white Mild Stress, relative to the non-Hispanic white Moderate Stress class, the simple slopes for women reporting mammogram ever [b = .582 (SE = .149), OR = 1.79, 95% CI (1.34-2.40), $p<.001$], mammogram in the past 2 years [b = .606 (SE = .151), OR = 1.83, 95% CI (1.37-2.46), $p<.001$], and mammogram over two years ago [b = .443 (SE = .181), OR = 1.56, 95% CI (1.09-2.22), $p=.014$] emerged positive and significant. Thus, non-Hispanic white women in the Mild Stress class report engaging in more breast cancer screening in relation to the Moderate Stress class.

Demographic Domain Post Hoc Analyses

For the Demographic Domain, significant interactions were found for Hispanics (vs. non-Hispanic white) for all the Demographic classes with the exception of the Substantial Resource class (ps < .05). For the Hispanic Minimal Resource class relative to the Hispanic Substantial Resource class, simple slopes emerged significant and positive for ever having a mammogram [b = 1.363 (SE = .475), OR = 3.91, 95% CI (1.54-9.90), $p=.004$], having a mammogram within the past 2 years [b = 1.356 (SE = .478), OR = 3.88, 95% CI (1.52-9.90), $p=.005$], and over two years ago [b = 1.415 (SE = .649), OR = 4.12, 95% CI (1.15-14.70), $p=.029$]. Hispanic women in the Minimal Resource class (in relation to the Substantial Resource class) engage in more

mammogram screening. For the Hispanic Minimal Resource class relative to the Hispanic Moderate Resource class, simple slopes emerged significant and positive for ever having a mammogram [*b* = .793 (SE = .308), OR = 2.21, 95% CI (1.21-4.04), *p=.010*], having a mammogram within the past 2 years [*b* = .794 (SE = .309), OR = 2.21, 95% CI (1.21-4.05), *p=.010*], and over two years ago [*b* = .783 (SE = .365), OR = 2.19, 95% CI (1.07-4.48), *p=.032*]. Again, Hispanic women in the Minimal Resource class are more apt to engage in mammogram screening than their Moderate Resource counterparts.

For the Hispanic Limited Resource class relative to the Hispanic Moderate Resource class, simple slopes emerged significant and negative for obtaining a breast exam within the last year [*b* = -.537 (SE = .142), OR = 0.58, 95% CI (0.44-0.77), *p<.001*], for ever having a mammogram [*b* = -.817 (SE = .199), OR = 0.44, 95% CI (0.30-0.65), *p<.001*], for obtaining a mammogram within the past 2 years [*b* = -.855 (SE = .200), OR = 0.43, 95% CI (0.29-0.63), *p<.001*], and over two years ago [*b* = -.561 (SE = .256), OR = 0.57, 95% CI (0.35-0.94), *p=.029*]. Hispanic women in the Moderate Resource class engage in more breast cancer screening than their Limited Resource counterparts. For the Hispanic Limited Resource class relative to the Hispanic Minimal Resource class, simple slopes emerged significant and negative for ever having a mammogram [*b* = -1.609 (SE = .259), OR = 0.20, 95% CI (0.12-0.33), *p<.001*], for obtaining a mammogram within the past 2 years [*b* = -1.648 (SE = .259), OR = 0.19, 95% CI (0.12-0.32), *p<.001*], and over two years ago [*b* = -1.344 (SE = .300), OR = 0.26, 95% CI (0.15-0.47), *p<.001*]. Thus, Hispanic women in the Minimal Resource class are more likely to engage in mammogram screening than women in the Limited Resource class.

Last, the simple slope for Hispanic Moderate Resource class in comparison to the Hispanic Minimal Resource class emerged significant and positive for breast exam in the past 12 months [*b* = .418 (SE = .167), OR = 1.52, 95% CI (1.10-2.11), *p=.012*]. Here, Hispanic women in the Moderate Resource class are more apt to obtain a breast exam in the last year than Minimal Resource class counterparts.

For the African American (vs. non-Hispanic white) x Demographic classes, significant interactions emerged for the screening outcomes of mammogram ever, mammogram within the last 2 years and mammogram over 2 years ago. For the African American Minimal Resource class relative to the African American Moderate Resource class, significant and positive simple slopes emerged for ever having a mammogram [*b* = 1.423 (SE = .630), OR = 4.15, 95% CI (1.21-14.26), *p=.024*], mammogram within the past two years [*b* = 1.401 (SE = .631), OR = 4.06, 95% CI (1.18-13.98), *p=.026*], and over two years ago [*b* = 1.623 (SE = .706), OR = 5.07, 95% CI (1.27-20.22), *p=.022*]. Thus, African American women in the Minimal Resource class engage in more mammogram screening than women in Moderate Resource class.

For the African American Limited Resource class relative to the African American Minimal Resource class, significant and negative simple slopes emerged for ever having a mammogram [*b* = -1.819 (SE = .613), OR = 0.16, 95% CI (0.49-0.54), *p=.003*], mammogram within the past 2 years [*b* = -1.852 (SE = .615), OR = 0.16, 95% CI (0.05-0.52), *p=.003*], and mammogram over 2 years ago [*b* = -1.582 (SE = .676), OR = 0.21, 95% CI (0.06-0.77), *p=.019*]. Subsequently, African American women in the Minimal Resource class are more likely to engage in mammogram screening than Limited Resource class counterparts.

For the Asian (vs. non-Hispanic white) x Demographic class interactions, all were significant with the exception of the Substantial Resource class (*p*s < .05) for the three breast cancer screening outcomes. The simple slope for Asian Minimal Resource class relative to the Asian Substantial Resource class emerged negative and significant for breast exam [*b* = -.545 (SE = .279), OR = 0.58, 95% CI (0.34-1.00), *p=.051*]. This suggests that Asian women in the Substantial Resource class are more apt to have a breast exam in the past year in relation to the Minimal Resource class.

The Asian Limited Resource class relative to the Asian Substantial Resource class revealed significant and negative simple slopes for breast exam in the past 12 months [*b* = -.735 (SE = .260), OR = 0.48, 95% CI (0.29-0.80), *p<.005*], ever having a mammogram [*b* = -.816 (SE = .373), OR = 0.44, 95% CI (0.21-0.92), *p=.029*], mammogram within the past 2 years [*b* = -.783 (SE = .378), OR = 0.46, 95% CI (0.22-0.96), *p=.039*], and mammogram over 2 years ago [*b* = -.949 (SE = .442), OR = 0.39, 95% CI (0.16-0.92), *p=.032*]. Findings indicate that Asian women in Substantial Resource class (vs. the Limited Resource class) engage in more breast cancer screening. Further, women in the Asian Limited Resource class relative to the Minimal Resource class emerged significant and negative simple slopes for ever having a mammogram [*b* = -.749 (SE = .269), OR = 0.47, 95% CI (0.28-0.80), *p=.005*], and mammogram within the past 2 years [*b* = -.784 (SE = .273), OR = 0.46, 95% CI (0.28-0.78), *p=.004*]. In contrast, Asian women in the Minimal Resource class are more apt to ever have a mammogram, or have one in the past 2 years than their Limited Resource class counterparts. Women in the Asian Limited Resource class relative to the Moderate Resource class emerged significant and negative simple slopes for breast exam in the last year [*b* = -.532 (SE =

.138), OR = 0.59, 95% CI (0.45-0.77), *p<.001*], ever having a mammogram [*b* = -.474 (SE = .179), OR = 0.62, 95% CI (0.44-0.88), *p=.008*], and mammogram within the past 2 years [*b* = -.524 (SE = .181), OR = 0.59, 95% CI (0.42-0.85), *p=.004*]. Asian women in the Moderate Resource class engage in more breast cancer screening behaviors overall relative to women in the Limited Resource class.

For the Asian Moderate Resource class relative to the Asian Minimal Resource class, the simple slope emerged significant and positive for breast exam in the past year [*b* = .342 (SE = .172), OR = 1.41, 95% CI (1.01-1.97), *p=.046*]. Finally, it appears that Asian women in the Moderate Resource class are more likely to obtain a breast exam in the past year relative to their Minimal Resource class counterparts.

Last, several significant interactions for the non-Hispanic white (vs. Hispanic) x Demographic class emerged for breast cancer screening outcomes. The simple slope for the non-Hispanic white Minimal Resource class relative to non-Hispanic white Substantial Resource class emerged significant and negative for breast exam in the last year [*b* = -.879 (SE = .107), OR = 0.42, 95% CI (0.34-.51*), p<.001*]. This suggests non-Hispanic white women in the Substantial Resource class are more apt to have a breast exam than women in the Minimal Resource class. The simple slope for the non-Hispanic white Minimal Resource class vs. non-Hispanic white Moderate Resource class also emerged significant and negative for breast exam in the last year [*b* = -.559 (SE = .060), OR = 0.57, 95% CI (0.51-0.64), *p<.001*], indicating women in the Moderate Resource class obtained more breast exams (vs. Minimal Resource class). However, significant and positive simple slopes emerged for mammogram ever [*b* = .449 (SE = .135), OR = 1.57, 95% CI (1.20-2.04), *p=.001*], mammogram in the last 2 years [*b* = .431 (SE = .136), OR

= 1.54, 95% CI (1.18-2.01), *p=.001*], and for mammogram over 2 years ago [*b* = .575 (SE = .152), OR = 1.78, 95% CI (1.32-2.40), *p<.001*]. Thus, non-Hispanic white women in the Minimal Resource class are more likely than the Moderate Resource class to engage in mammography. Similarly, the simple slopes for the non-Hispanic white Minimal Resource class relative to the non-Hispanic white Limited Resource class emerged significant and positive for mammogram ever [*b* = 1.18 (SE = .134), OR = 3.24, 95% CI (2.49-4.21), *p<.001*], mammogram in the last 2 years [*b* = 1.222 (SE = .135), OR = 3.39, 95% CI (2.61-4.41), *p=.001*], and for mammogram over 2 years ago [*b* = . .905 (SE = .152), OR = 2.47, 95% CI (1.83-3.33), *p<.001*]. This finding suggests that non-Hispanic white women in the Minimal Resource class are more likely to engage in mammogram screening behaviors than their Limited Resource counterparts.

Next, simple slopes for the non-Hispanic white Limited Resource class relative to the non-Hispanic white Substantial Resource class emerged significant and negative for breast exam in the last year [*b* = -.814 (SE = .105), OR = 0.44, 95% CI (0.36-0.54), *p<.001*], mammogram ever [*b* = -1.120 (SE = .190), OR = 0.33, 95% CI (0.23-0.47), *p<.001*], mammogram in the last 2 years [*b* = -1.213 (SE = .191), OR = 0.30, 95% CI (0.21-0.43), *p<.001*], and for mammogram over 2 years ago [*b* = -.463 (SE = .224), OR = 0.63, 95% CI (0.41-0.98), *p=.039*]. Thus, non-Hispanic white women in the Substantial Resource class engage in more breast cancer screening overall, relative to Limited Resource class counterparts. The simple slopes for the non-Hispanic white Limited Resource class relative to the non-Hispanic white Moderate Resource class emerged significant and negative for breast exam in the last year [*b* = -.495 (SE = .056), OR = 0.61, 95% CI (0.55-0.68), *p<.001*], mammogram ever [*b* = -.726 (SE = .089), OR

= 0.48, 95% CI (0.48-0.41), $p<.001$], and for mammogram in the last 2 years [b = -.790 (SE = .089), OR = 0.45, 95% CI (0.38-0.54), $p<.001$]. Consequently, non-Hispanic white women in the Moderate Resource class are more likely to engage in breast exam and mammogram cancer screening than Limited Resource class counterparts.

Finally, the simple slopes for the non-Hispanic white Moderate Resource class relative to the non-Hispanic white Substantial Resource class emerged significant and negative for breast exam in the last year [b = -.319 (SE = .103), OR = 0.727, 95% CI (0.59-0.89), $p=.002$], mammogram ever [b = -.394 (SE = .191), OR = 0.67, 95% CI (0.46-0.98), $p=.039$], and for mammogram in the last 2 years [b = -.423 (SE = .191), OR = 0.66, 95% CI (0.45-0.95), $p=.027$]. This indicates that non-Hispanic white women in the Substantial Resource class obtain more breast exam and mammogram screening in relation to women in the Moderate Resource class.

DISCUSSION

The primary goal of the current study was to identify distinct typologies of women who engage in breast cancer screening behaviors. Second, study aims sought to identify ethnic differences among emergent typologies, as they relate to screening outcomes in this sample of ethnically diverse women in California. Overall, the study revealed three substantive risk domains, including Health, Stress, and Demographic domains that significantly predicted breast cancer screening behavior. LPA revealed that two typologies or classes emerged significant in the Health domain; the first deemed the Healthy class and the other the Health Risk class. Four classes emerged among the Stress and Demographic domains. In the Stress domain Minimal, Mild, Moderate, and Severe Stress classes emerged. Among the Demographic domain Minimal, Limited, Moderate, and Substantial Resource classes emerged. Further, significant interactions among ethnicity and the substantive risk domains of Health, Stress, and Demographics emerged, with several relationships predictive of women's screening behaviors.

LPA Class Interpretation

Health Domain Interpretation

Overall, women in the Healthy class (90.2% of women) engaged in healthier behaviors, had reduced cancer history and familial risk, more access to health care, insurance, were healthier, and utilized medical care and the ER less frequently than the Health Risk class (9.8% of women). Findings indicated that women in the Health Risk class reported participating in significantly more breast cancer screening behaviors than women in the Healthy class. Specifically, the Health Risk class engaged in all screening

outcomes examined, breast exam, mammogram ever, and mammogram in the past two years, as well as over two years ago, significantly more than the Healthy class.

Possible explanations include that there were relatively small differences in the patterns of women's responses among conditional response means and probabilities related to the different breast cancer screening health behavior variables. Of note, however, it appeared that the variables including family history of breast cancer, Pap smear screening, and diagnosis of breast cancer might have played a role in the increased breast cancer screening within the Health Risk group. This is consistent with the literature that suggest although women might be at higher risk of breast cancer, those women with a positive family history of breast cancer are more likely to obtain recommended mammography screening (Halbert et al., 2005; Isaacs, Peshkin, Schwartz, Demarco, Main, Lerman, 2002; McCaul, Branstetter, Schroeder, & Glasgow, 1996; Petrisek, Campbell, & Laliberte, 2000; Rees, Fry, & Cull, 2002). For example, a recent study demonstrated that both non-Hispanic white and Hispanic women were more likely to obtain mammogram screening if they had first-degree relatives diagnosed with breast cancer (Borrayo, Hines, Byers, Risendal, Slattery, Sweeney et al., 2009). Similarly, family history of breast cancer also has been linked to increased likelihood of a women obtaining additional mammography screening (Achat, Close, & Taylor, 2005; Ahmed, Fort, Elzey, & Bailey, 2004; Bobo, Shapiro, Schulman, & Wolters, 2004; Lee & Vogel, 1995; Lerman, Rimer, Trock, Balshem, & Engstrom, 1990; Taylor, Taplin, Urban, non-Hispanic white , & Peacock, 1995). Annual PAP smear screening has also been shown to positively influence mammogram screening among ethnic minority women (Giuliano, Papenfuss, de Zapien, Tilousi, & Nuvayestewa, 1998; Gomez, Tan, Keegan, & Clarke,

2004). Thus, since 98.3% of women in the Health Risk class engaged in cervical cancer screening behavior (vs. 96.8% in the Healthy class), it is likely that these women had an increased opportunity for mammogram screening despite their overall health risk.

Finally, it is likely that women already diagnosed with breast cancer, who are at an increased risk for reporting poor health, have likely had significantly more mammograms than women who have not reported ever being diagnosed with breast cancer. Studies suggest that breast cancer survivors are at increased risk for a second breast cancer, several years after initial diagnosis (Clarke, Collins, Darby, Davies, Elphinstone, Evans et al., 2005; Early Breast Cancer Trialists' Collaborative Group, 2005). Therefore, surveillance mammography and breast exams are recommended starting 1 year after initial diagnosis and 6-months following the completion of radiation therapy (Khatcheressian, Wolff, Smith, Grunfeld, Muss, Vogel et al., 2006), and have been shown to reduce breast cancer morbidity and increase survival (Lash, Fox, Buist, Wei, Frost, Geiger et al., 2007; Grunfeld, Noorani, McGhan, Paszat, Coyle, Walraven et al., 2002; Rojas, Telaro, Russo, Moschetti, Coe, Fossati et al., 2005; Schootman, Jeffee, Lian, Aft, & Gillanders, 2008). As a result, it is likely that women in the Health Risk class who reported having a higher prevalence of breast cancer also had an increase in breast cancer surveillance screening following their diagnosis.

Additionally, women in the Healthy class who report better health might believe they are not at-risk or are less concerned about their risk of developing breast cancer risk. In a recent study that examined breast and cervical cancer screening behaviors among Asian American and Latina women utilizing the CHIS 2001-2005 datasets, strikingly those women who reported greater health concerns and worse health status engaged in

more recent mammogram and Pap smear screening behaviors than healthy counterparts (Lee, Ju, Vang, & Lundquist, 2010). Similarly, in a focus group study with Mexican American women, Borrayo and Jenkins (2001a) found that women did not perceive a need for mammogram screening when they were feeling healthy. Thus, it might be that women in the Healthy class feel mammogram screening is not necessary as long as their perceived health is good. In sum, despite the pattern of unhealthy behaviors, worse health, and increased risk for developing breast cancer reported by women in the Health Risk class, it is likely that the variables discussed contributed to the current study findings that demonstrated women with higher Health Risk patterns engage in more breast cancer screening.

Stress Domain Interpretation

Among the classes in the Stress domain, women in the four classes responded differentially to variables in the mental health, acculturation, and racial discrimination categories and yielded classes of women that ranged from Minimal to Severe Stress. There were relatively few women in the Severe Stress class (2.6% of women), relative to Moderate (12.2%), Mild (21.4%), and Minimal (63.8%) Stress classes, respectively. For women who obtained a breast exam from a doctor in the past year, those in the Severe and Moderate Stress classes were less likely than women in the Minimal Stress class to obtain an exam. This finding is consistent with other studies that suggest women experiencing high degrees of life stress, including the constellations of stress examined in this study (e.g., psychological distress, acculturation, racial discrimination), are less prone to engage in preventative measures than women who experience or appraise their stressors with less severity. Similarly, women reporting Severe and Moderate Stress

were less apt to report ever having a mammogram than women with Minimal Stress. Women reporting Moderate Stress were also significantly less apt to report ever having a mammogram than women reporting Mild Stress. When examining more recent mammogram use, women in the Mild, Moderate, and Severe Stress classes reported significantly less mammogram screening behavior within the past 2 years than the Minimal Stress class. The only other significant relationship that emerged for mammogram obtained in the last 2 years demonstrated that the Mild Stress group engaged in more screening that the Moderate Stress class. Finally, women in the Moderate Stress class were significantly less apt to report having a mammogram over two years ago than women in the Minimal Stress class. Overall, it appears women experiencing less stress were more prone to engage in breast cancer screening than women reporting greater and more complex stress.

The study findings are unique in that patterns of psychosocial stressors uniquely vary among women. Examining the constellation of stressors that women report takes into account that most women do not experience stressful events in isolation. The four classes of stress that emerged across multiple domains demonstrated that greater complexity of stress experienced by women significantly reduces mammography screening behavior. In particular, women experiencing Severe stress reported higher perceived racial discrimination, provider discrimination, and more psychological distress. Thus, it is not surprising that these women were less likely to engage in breast exam and mammogram screening. These findings reflect other studies that show perceived discrimination reduces the likelihood that women will seek preventative health services (Blanchard et al., 2004; Trivedi & Ayanian, 2006) and mammogram screening (Crawley,

Ahn, & Winkleby, 2008). Similarly, women experiencing depression or suffering with mental illness are less likely to engage in mammography screening (Lasser, Zeytinoglu, Miller, Becker, Hermann, & Bor, 2003).

In contrast, acculturation was higher in the Severe Stress class with 5.8% (SE = .012) non-citizens, relative to 7.6% of women in the Minimal and 8.9% in the Moderate Stress classes non-citizens. Women in the Severe Stress class did not live in the U.S. as long as women in the Minimal and Mild Stress classes; however, these differences were quite small with all women in the study living in the U.S. for more than 61% of their lives. Reflective of the study findings it appears that women who were comparatively more acculturated in the Severe Stress class are less apt to engage in breast exam or mammogram screening behaviors. Literature on acculturation has revealed that variable relationships emerge with women's health screening behaviors. For example, several studies have shown that recent immigrants or non-citizens are less likely to be screened for breast cancer than those residing longer in the U.S. or who are citizens (De Alba, Hubbell, McMullin, Sweningson, & Saitz, 2005; Kandula, Wen, Jacobs, & Lauderdale, 2006; Wong, Gildengorin, Nguyen, & Mock, 2005). However, other studies have shown a "healthy immigrant effect" whereby acculturation worsened health and health behaviors of individuals from first to later generations (Flores & Brotanek, 2005). While acculturation and generation status is not synonymous, the latter has also been linked with variations in health-risk behaviors (Allen, Elliott, Morales, Diamant, Hambarsoomian, & Schuster, 2007), health care access and utilization (Burgos, Schetzina, Dixon, & Mendoza, 2005), and therefore related to screening behaviors. Thus, while women in the Severe Stress class appeared to be more acculturated than their

counterparts, having more complex stressors across several domains is indicative of poor breast cancer screening. Potentially, mental health and racial discrimination stressors are more predictive of women's screening behaviors, above acculturation status, and thus prospective intervention points to improve mammography screening.

Demographic Domain Interpretation

Among the classes in the demographic domain, women in the four classes were characterized differentially among variables in the age, education, and SES/education categories that yielded classes of women ranging from those with Minimal to Substantial resources. The sample breakdown revealed 7.1% of women were in the Substantial resource class, 41.3% in Moderate, 31.9% in Limited, and 19.7% in Minimal Resource classes. For the outcome variable of breast exam in the past year, not surprisingly, women in the Substantial Resource class engaged in more screening behavior than women in the Moderate, Limited, and Minimal Resource classes. Similarly, women in the Moderate resource class engaged in significantly more breast exam behavior in the past year than women in the Limited and Minimal Resource classes. These findings reflect several studies that have shown older women with low-income (Bowie, Wells, Juon, Syndor, & Rodriguez, 2008; Chen, 2009; Lee, Ju, Vang, & Lundquist, 2010; Welch, Miller, & James, 2008; Wu & Ronis, 2009), less education (Blanchard et al., 2004; Moy, Park, Feibelmann, Chiang, & Weissmann, 2006), who are unemployed (Bowie, Wells, Juon, Syndor, & Rodriguez, 2008; Lim, 2010) and live in rural settings (Avis-Williams, Khoury, Lisovicz, Graham-Kresge, 2009; Elkin, Ishill, Snow, Panageas, Bach, Liberman et al., 2010; Huang, Dignan, Han, Johnson, 2009), are less apt to engage in breast cancer screening.

For the outcome variable of women reporting a mammogram ever, some of the findings were less intuitive. For example, women in the Moderate Resource class were less apt to report having a mammogram ever than women in the Minimal and Substantial Resource classes. This suggests a non-linear or quadratic relationship in that women with the lowest and the highest resources engaged in more breast cancer screening behaviors than women with moderate resources. Women in the Substantial Resource class are on average 51 years old, with college-level education, average annual household income of $234,020, 68.8% are employed, and 88.6% are living in an urban setting. In contrast, women in the Minimal resource class are about 66 years old, have a high school education, average annual household income of $31,560, 8.6% are employed, and 73.3% are living in an urban setting. Potential explanations for the Minimal Resource class screening behaviors might include age effects, since several studies have shown older women are more likely to obtain mammogram screening (Adams, Breen, & Joski, 2006; Lee, Ju, Vang, & Lundquist, 2010; Mandelblatt, Gold, O'Malley, Taylor, Cagney, Hopkins et al., 1999). Other studies have also demonstrated that employment can be a barrier for some women to engage in preventative breast cancer screening behaviors. For example, studies with Chinese and Israeli women have shown that working and caring for family reduces women's concern about potential future health problems (Ashing, Padilla, Tejero, & Kagawa-Singer, 2003; Kadmon, Woloski-Wruble, Yongqin, Wan-Min, & DeKeyser, 2004). Similarly, for Hispanic women, transportation costs and taking time off of work also reduce likelihood of mammogram screening (Mack, Pavao, Tabnak, Knutson, & Kimerling, 2009; Tejeda, Thompson, Coronado, Heagerty, & Martin, 2009). A national study of women's breast cancer screening behaviors has also shown that

commuter intensity of more than 60 minutes each way to work, reduced the likelihood mammography use of women in California (Mobley, Kuo, Driscoll, Clayton, & Anselin, 2008). Thus, for women in the Minimal Resource class, older age and not having the constraints of work might offset the other sociodemographic barriers to mammogram screening in this sample of women.

A similar pattern of findings emerged when examining the three classes in relation to the Limited Resource class. Here, women in the Limited Resource class also reported they were less likely to ever have a mammogram than women with fewer resources than themselves (i.e., Minimal Resource class), and women with the most resources (i.e., Substantial Resource class). More consistent with the current literature, women in the Limited Resource class were less apt to report ever having a mammogram than women in the Moderate Resource class. Thus, again there appears to be a quadratic relationship between screening behavior and demographic resources, where women at the low and high ends of the resource spectrum actually engage in more screening ever, than their counterparts that fall in the middle resource range.

For the outcome variable of women reporting mammogram within the past two years, women in the Moderate Resource class engaged in less recent mammogram screening than women in the Minimal and Substantial Resource classes. Reflective of this pattern, women in the Limited Resource class also engaged in less mammogram screening in the past two years than women in classes at the lowest and highest ends of the resource spectrum. Last, and again more congruent with the literature, women in the Limited Resource class engaged in less mammogram screening in the past two years than women in the Moderate Resource class. Again, it is likely that age and employment

status might be driving the relationship between screening behaviors for women with the least resources whereas finances, education, and urban residence play a larger role in screening behavior as women gain more of these resources.

Finally, for the last outcome variable of women reporting mammogram screening over 2 years ago, fewer significant relationships emerged. Women in in the Minimal Resource class engaged in more breast cancer screening than women in both the Limited and Moderate Resource classes. This again reflects a non-linear relationship between resources and screening behavior, where women in the lowest resource group engage in more preventive breast cancer behaviors than women who are not as marginal, or as the literature suggests, high risk women with less access breast cancer to screening and prevention. It might be that women in this Minimal Resource class have the opportunity for free breast cancer screening services, for which the Limited and Moderate Resource class would not qualify. In a study with homeless women in San Francisco, CA, about 51% (N = 105) of a randomly sampled women among two homeless shelters reported they had recent clinical breast exams, and 47% reported current mammograms (Long, Tulsky, Chambers, Alpers, Robertson, Moss et al., 1998). Further, these homeless women had positive attitudes about cancer screening, had discussions with providers about screening, and had more medical visits all factors indicative of current mammogram screening. While this study sampled women several years before the current study, this underpins the concept that women who have access to free medical services, and utilize those services frequently, have a higher likelihood of obtaining breast exam and mammogram. Last, more consistent with the literature, the Moderate Resource class engaged in more mammogram screening over 2 years ago than women in

the Limited Resource class. Overall, the findings in the Demographic domain suggest that a constellation of resources should be accounted for when identifying women's likelihood of breast cancer screening. Taking into account resource complexity might improve intervention programs to target younger, working women, with moderate or limited resources, who are more likely to live in rural communities, and have a high school education or above.

Ethnicity and Class Interaction Interpretation

The second purpose of the study sought to examine how ethnicity might moderate the relationship between Health, Stress, and Demographic emergent classes and breast cancer screening outcomes. Ethnic differences in class membership within each of the risk domains, and breast cancer screening behaviors, provide a unique glimpse into specific risk patterns of the four ethnic groups that are representative of women in California.

Health Domain Post Hoc Interpretation

Within the Health Domain, post hoc analyses revealed significant simple slopes for Hispanic, Asian, and non-Hispanic white women. Across all three ethnic groups, women in the Health Risk class were more likely to report breast cancer screening behaviors relative to their Healthy counterparts. Specifically, Hispanic women in the Health Risk class were more apt to report having a mammogram ever or in the past two years relative to their Healthy counterparts. Similar to the aforementioned rational about the Health Risk class, a recent study with Hispanic women reporting a history of breast cancer in first-degree female relatives are more likely to be adherent to mammogram screening (Borrayo, Hines, Byers, Risendal, Slattery, Sweeney, et al., 2009). Similarly,

when Hispanic women reported good to excellent communication with providers, and also identified satisfaction with their health care relationship they were more likely to engage in mammogram screening regardless of health insurance availability (Sheppard, Wang, Yi, Harrison, Feng, Huerta et al., 2008). This reflects the Health Risk class who also reported better communication with a provider, but fewer women with insurance over the last 12 months. In addition, breast cancer survivorship might also be playing a role, where a similar study using CHIS 2001 and 2003 data, demonstrated Hispanic breast cancer survivors reported better or equivalent mammogram screening rates than non-Hispanic white women (Breslau, Jeffery, Davis, Moser, McNeel, Hawley, 2010). Further, in a focus group of Mexican American women (Borrayo & Jenkins, 2001a), they did not believe breast cancer screening is necessary when they felt healthy.

Asian women in the Health Risk class were also more likely to obtain a mammogram in the past two years relative to Asian women in the Healthy class. A recent study with Asian women who reported increased health problems found these women engaged in more breast cancer screening (Lee, Ju, Vang, & Lundquist, 2010). This finding is consistent with studies showing Asian immigrant women are less likely to seek healthcare and engage in cancer screening when there is an absence of symptoms or pain, and perceived health is good (Ashing, Padilla, Tejero, & Kagawa-Singer, 2004; Denberg, Wong, & Beattie, 2005). In another recent study with Asian-American women, insurance was not related to breast cancer screening, and women believed that annual or repeat mammograms were unnecessary when they felt healthy, had no breast symptoms, or family history of breast cancer (Wu & Ronis, 2009).

Finally, non-Hispanic white women in the Health Risk class were more likely to report breast exam in the past year, ever having a mammogram, and having a mammogram in the past two years, or over two years ago than non-Hispanic white Healthy class women. Reflective of the aforementioned discussion, it is likely that the pattern of health responses in the Health Risk class, such as familial risk (Halbert et al., 2005; Isaacs, Peshkin, Schwartz, Demarco, Main, Lerman, 2002), greater prevalence of breast cancer and survivorship (Khatcheressian, Wolff, Smith, Grunfeld, Muss, Vogel et al., 2006), and worse perceived health status (Lee, Ju, Vang, & Lundquist, 2010), might explain the increased screening behaviors for non-Hispanic white women as well. In sum, these patterns of findings in the Healthy and Health Risk classes emerged the same across Hispanic, Asian, and non-Hispanic white women. Results suggest that women who perceive themselves as healthier, use medical care less, and believe they are at less risk for developing breast cancer are less likely to engage in mammogram screening, ultimately placing these women at higher risk for developing breast cancer and treatment delay.

Stress Domain Post Hoc Interpretation

Related to the Stress Domain, post hoc analyses emerged non-significant for Hispanic, African American, and Asian women in all Stress classes ($ps < .05$). This was striking in that several interactions emerged significant for Hispanic and Asian women Stress classes (vs. non-Hispanic white women) for breast cancer screening. Thus, while there might be a practical difference among the various classes of ethnic women in the study, due to the smaller sample size of each group, there might not be enough power to detect a statistically significant effect. For non-Hispanic white women in the four Stress

classes, findings revealed several significant simple slopes related to breast cancer screening. Not surprising, non-Hispanic white women in the Minimal Stress class were more likely to obtain a breast exam within the year and mammogram within the past two years relative to the Severe Stress class. Similarly, these women were also more likely to engage in all breast cancer screening behaviors than women in the Moderate Stress class. The last simple slope relationship to emerge significant revealed that non-Hispanic white women in the Mild Stress class engaged more mammogram screening behaviors overall in relation to Moderate Stress class counterparts. Overall, these findings are consistent with the literature that suggests women undergoing significant psychosocial stressors are less likely to engage in preventative health behaviors and breast cancer screening (Lasser, Zeytinoglu, Miller, Becker, Hermann, & Bor, 2003; Miller, Lasser, & Becker, 2007). Interestingly, the stress variable categories that comprised most of the Stress domain included acculturation and racial discrimination, with only one variable accounting for mental health or psychological distress. Therefore, it may be that non-Hispanic white women in the Severe Stress class are endorsing higher levels of psychological distress. This is consistent with the increased prevalence of depression among non-Hispanic white women. For example, the National Institute of Mental Health found that non-Hispanic white women are 40% more likely to experience depression in their lifetime, than non-Hispanic blacks (Kessler, Berglund, Demler, Jin, Koretz, Merikangas, et al., 2003). It may also be that some of these women are less acculturated and endorsed perceived discrimination. On the whole, the most likely explanation for the follow-up findings related to Stress resonates with the literature on psychosocial distress as a barrier to breast cancer screening. Further examination of these Stress variables with larger samples of

ethnic minority women will likely inform which constellation of stressors influence breast cancer screening among diverse groups of women. Thus far, it appears for non-Hispanic white women, increased psychosocial stress across a constellation of variables reduces likelihood of breast cancer screening.

Demographic Domain Post Hoc Interpretation

Last, for the Demographic Domain, post hoc analyses revealed significant simple slopes for Hispanic, African American, Asian, and non-Hispanic white women. Related to Hispanic women, those in the Moderate Resource class engaged in more breast exam and mammogram screening than women in the Limited Resource class. Hispanic women in the Moderate Resource class obtained more breast exams in the past year relative to their Minimal Resource counterparts. This finding reflects recent studies with Hispanic women that have shown both SES and structural barriers to access health care are limiting factors in women's breast and cervical cancer screening behaviors (Fernandez and Morales, 2007). In contrast, the Minimal Resource class actually engaged in more mammogram screening behavior ever, in the past two years, and over two years ago, relative to the Substantial Resource Class, Moderate Resource, and Limited Resource classes. Similar findings emerged for the African American women in the current study. Specifically, African American women in the Minimal Resource group reported more mammograms ever, within two years, and over the past two years relative to both their Moderate Resource and Limited Resource counterparts.

While these findings are counter to the extant literature on sociodemographic status and ethnic minority groups of women, possible explanations could include the effect of age and employment status. First, women in the Minimal Resource class were

on average older than the rest of the Resource classes, and the literature suggests that older women are more likely to obtain mammogram screening (Adams, Breen, & Joski, 2006; Lee, Ju, Vang, & Lundquist, 2010; Mandelblatt, et al., 1999) and also likely to have more opportunities for screening. Additional interpretations could relate to women in the employment and residence status, since studies have revealed for Hispanic women, transportation cost and taking time off of work influence reduce likelihood of mammogram screening (Mack, Pavao, Tabnak, & Kimerling, 2009). Factors of unemployment might lend more time to visit a health care professional, whereas difficulty for women with moderate resources to engage in mammogram screening might be related to less time for scheduling or attending a visit. Moreover, having to pay a deductible or insurance copayment might be barriers for women in the Limited and Moderate Resource classes to obtain mammogram screening. Several studies have revealed even a small copayment or deductible is enough of a barrier to reduce breast cancer screening in women with insurance and who do not qualify for free government funded medical care (Spadea, Bellini, Knust, Stirbu, & Costa, 2010; Trivedi, Rakowski, & Ayanian, 2008). Further, the average education of the sample was high school or greater, indicating that education effects might not be relevant here, since it is typically women with less than a high school education who are less likely to have had mammography screening (ACS, 2007), and less apt to receive physician referral for breast or cervical screening (O'Malley, Earp, Hawley, Schell, Matthews, & Mitchell, 2001).

The findings for Asian women among various Demographic Domains emerged significant and in the direction of breast cancer screening that is more consistent with the

current literature. First, Asian women in the Substantial Resource class engaged in more breast exam screening than women in the Minimal Resource class. Second, Asian women in the Substantial Resource class engaged in more breast exam and mammogram screening than women in the Limited Resource class, also consistent with literature that suggests women with more available resources engage in breast cancer and health screening behaviors. Third, women in the Moderate Resource class are more likely to engage in breast exam and mammogram screening ever, in the past two years, and over two years ago relative to women in the Limited Resource class. These women also engaged in more breast exam screening in the past year relative to their Minimal Resource counterparts. In contrast to the trend in Asian women who engage in more breast cancer screening as their resources increase, there was one relationship that emerged similar to those of the Hispanic and African American ethnic groups. Here, Asian women in the Minimal Resource class engaged in more mammograms ever, and in the past two years relative to their Limited Resource counterparts.

It is striking that the relationship between resources and breast cancer screening emerged with more linearity than for those of Hispanic or African American women. It might be that age has less of an influence on Asian women relative to the other patterns of variables. In Asian women, education plays a significant role in screening behavior. For example, several studies have revealed that Asian women who are less educated are less apt to know about breast cancer screening and engage in screening than those with higher education (Ashing-Giwa, Padilla, Tejero, Kraemer, Wright, Coscarelli et al., 2005; Blanchard et al., 2004; Juon, Kim, Shankar, & Han, 2004; Lee-Lin, Menon, Pett, Nail, Lee, & Mooney, 2007; Lee, Ju, Vang, & Lundquist, 2010; Moy, Park, Feiblmann,

Chiang, & Weissmann, 2006). Further, in this sample the relationship of employment might be different for Asian women than the other ethnic groups. A recent study revealed Asian American women were less likely to have a mammogram if they were unemployed, where this finding did not emerge for Latina women in the study (Lim, 2010). Further, it might be for Asian women that residence has played a role, in that those women with lower resources have a higher composition of women living in rural rather than urban residence. One recent study found that if a women lives about 15 miles away from a mammography facility she is significantly less likely to obtain mammogram than a woman living only 5 miles away (Huang, Dignan, Han, & Johnson, 2009). In addition, other studies have also demonstrated travel distance may serve as a better indicator of access and utilization of health care services (Celaya, Rees, Gibson, Riddle, & Greenberg, 2006; Schuurman, Fiedler, Grzybowski, & Grund, 2006; Maheswaran, Pearson, Jordan, & Black, 2006; Punglia, Weeks, Neville, & Earle, 2006), and mammogram screening (Avis-Williams, Khoury, Lisovicz, Graham-Kresge, 2009; Elkin, Ishill, Snow, Panageas, Bach, Liberman et al., 2010; Huang, Dignan, Han, Johnson, 2009).

The final ethnic group examined within the current study included non-Hispanic white women and findings related to resource class and breast cancer emerged with variable directionality. First, non-Hispanic white women in the Substantial Resource class were more likely to have breast exams than women in the Minimal Resource class. Similarly, these women also engaged in both breast exam and all mammogram screening outcomes significantly more than women in the Limited Resource class. Non-Hispanic white women within the Substantial Resource class also engaged in more breast exam,

recent mammogram within the past 2 years, and mammogram ever than their Moderate Resource counterparts. For non-Hispanic white women in the Moderate Resource class they engaged in more breast exam screening than women in the Minimal Resource class. Similarly, these women also engaged in more breast exam, mammogram ever, and within the last two years relative to their Limited Resource counterparts. Finally, for non-Hispanic white women in the Minimal Resource class, findings reflected those of the other ethnic groups of women in that these women engaged in more mammogram screening behavior for all outcomes relative to both the Moderate Resource and Limited Resource classes. Thus, non-Hispanic white women's patterns of responding reflect other ethnic minority groups in that the relationship between resources and mammogram screening mirrors a non-linear quadratic relationship. It appears that despite the ethnic contribution to breast cancer screening differences, resource availability plays a unique relationship within this sample of women. That women at low and high ends of the resource spectrum engage in more breast cancer screening is an interesting finding. Consistent with the aforementioned studies, it might be that women with the lowest resources qualify for free medical resources, and have more time to engage in screening than their limited and moderate resource counterparts who are working, have their medical insurance tied to employment, and potentially high screening deductibles or co-pays.

In part, this pattern of findings observed in the CHIS 2005 sample of women might relate to initiatives targeting low-income, uninsured women, such as the National Breast and Cervical Cancer Early Detection Program (NBCCEDP: CDC, 2010; Eheman, Benard, Blackman, et al. 2006). Since the program's inception in 1991, more than 9.2

million breast and cervical cancer screening examinations have been performed, with 1,121,786 women receiving an NBCCEDP funded mammogram between years 2004-2009. Strikingly, only 14.3% of eligible women (e.g., income at or below 200% of Federal poverty level, medical insurance that does not cover mammogram, high insurance deductible/co-payment, not getting services though Medi-Cal or government insurance program) aged 40-64 years have utilized breast cancer screening. Thus, while the gap is closing there are still a significant number of eligible women who are not seeking or obtaining mammography services. In 2009, the NBCCEDP screened 324,912 women with mammography and found 4,635 breast cancers, while in 2005 392,295 women were screened (CDC, 2010). Further, from 2004-2009 the NBCCEDP's aggregate data by ethnicity and age revealed that of women screened 42.5% were non-Hispanic white, 30.4% Hispanic, 15.4% African-American, and 5.9% Asian/Pacific Islander. In addition, older women utilized the service more, with 72.5% of women between the ages of 50-64, and 23.2% between 40-49 years. In part, the age effects of increased mammogram screening in older women reflect the findings of the CHIS 2005 sample of women who are in the Minimal Resource class, and a potential explanation for why these women might have engaged in more screening behaviors than their Moderate and Limited Resource and sometimes Substantial resource counterparts.

Specific to California, is the Every Woman Counts cancer detection program (California Department of Public Health, 2010), that has likely had a significant impact on California's low-income and uninsured women. For example, recent data suggests that 56% of screening aged women obtained mammograms within 2005-2006 relative to only 39% of women in 1987 (ACS, 2008). Consistent with the current study's unique findings

related to resources and screening behavior, poor women have actually been shown to have the largest increase in mammography use (ACS, 2008). This reflects the findings observed in the Minimal Resource class of women, despite ethnic group, who frequently reported greater mammography screenings than women in the Limited and Moderate Resource classes. The frequency of significance here occurred more among the various breast cancer screening behaviors for Hispanic women, than any other ethnic group. In addition, it was striking that for Hispanic women, the Minimal Resource class often engaged in more breast cancer screening than their Substantial resource counterparts. It is heartening to observe a reduction in the gap of breast cancer screening behaviors with women who are the most resource poor; however, it is striking to see that women with limited and moderate resources may become high risk populations for developing undetected breast cancers related to lack in screening. Thus while one gap might be closing in the most resource poor, another gap is forming in breast cancer screening and detection among Californian women with moderate and limited resources who are not eligible for free services, and targets of current intervention and prevention programs.

Additional trends, following the current CHIS 2005 study, have shown that in 2006, African American women were actually most likely to have been recently screened (68%), followed by non-Hispanic white (62%), Hispanic (59%), and Asian women (55%) in California (ACS, 2008). However, related to a 2 year interval of mammography screening, 81% of non-Hispanic white women were screened relative to 79% of African American, 78% of Hispanic, and 65% of Asian women. These findings underpin decreasing breast cancer mortality within California between 1998 and 2005, which has significantly been declining by 28% in non-Hispanic white, 14% in Hispanic, and 10% in

African American women, with mortality trends declining for Asian/Pacific Islander women but not significantly (ACS, 2008).

Study Limitations

While there are several unique findings of the current study, there are several limitations to the study, thus results should be interpreted carefully. First, CHIS 2005 is a cross-sectional population based survey that used telephone random-digit dialing (RDD) of households with land lines. Unfortunately, the study did not include cell phone contact since cell phone use has been increasing, and has been shown to be especially useful in reaching lower SES individuals (Blumberg, Luke, Davidson, Davern, Yu, Soderberg, 2009; Kempf & Remington, 2007). Therefore, there may be systematic differences in the CHIS 2005 sample from residents living in California as a whole, and thus generalizability may be limited. However, the 26.9% response rate of the CHIS 2005 study is comparable to other similar scientific telephone survey responses in California, like the 29.2% overall response rate of the California Behavioral Risk Factor Surveillance System (BRFSS) Survey. The CHIS 2005 data were also weighted to minimize the source of telephone bias (CHIS, 2007). A second limitation of the CHIS 2005 study is that it utilized women's self-report. Some studies have indicated that participants that self-report are more likely to over-report use of breast and cervical cancer screening and under-report the time that has elapsed since they last engaged in screening (Kagawa-Singer, Pourat, Breen et al., 2007; McPhee, Nuguyen, Shema, Nguyen, Somkin, Vo et al., 2002). Third, the current investigation utilizes secondary data analysis, and is thus limited in the variables available for examination. Specifically, the dependent variables of breast exam in the past 12 months, mammogram ever, and

mammography use in the past two years, or over two years ago does not assess for repeated screening behavior among women, which provide a clearer picture of screening adherence. While the CHIS 2005 includes several important variables related to mammography screening, future improvements would include variables that assess specific cultural influences such as knowledge, fatalistic beliefs, and perceptions about breast cancer prevention and screening, perceived breast cancer risk (Fulton, Rakowski, & Jones, 1995; Ho, Yamal, Atkinson, Basen-Engguist, Tortolero-Luna, & Follen, 2005; Juon, Kim, Shankar, & Han, 2004; Moy, Park, Feibelmann, Chiang, & Weissman, 2006; Olsen & Frank-Stromborg, 1993), as well as concerns of modesty or embarrassment that are related to mammography and breast exam (Austin, Ahmad, McNally, & Stewart, 2002; Borrayo & Jenkins, 2001; Lee, 1998; Maxwell, Bastani, & Warda, 1997; Moy, Park, Feibelmann, Chiang, & Weissman, 2006). Despite these study limitations, the CHIS study is the largest health survey conducted in any state and one of the largest in the U.S. and includes assessment of breast cancer screening practices and related health variables. It is also very unique in that it is one of the only surveys that address racial/ethnic health care discrimination and cancer screening (Crawley, Ahn, & Winkleby, 2008; CHIS, 2007). In addition it is the first population-based survey that targeted limited English-proficient individuals, especially diverse Asian cohorts (e.g., Mandarin and Cantonese dialects, Vietnamese, and Korean; CHIS, 2007; Kagawa-Singer, Pourat, Breen, Coughlin, McLean, McNeel et al., 2007; Lim, 2010). It is also one of the most racially and ethnically diverse samples of women available (Breslau, Jeffery, Davis, Moser, McNeel, & Hawley, 2010).

Limitations related specifically to the current study and analyses also apply when interpreting the results. First, related to sample size limitations, it was not possible to examine American Indian/Alaska Native (AI/AN) women within the current study. This is a sorely underrepresented group of women that experience significant disparities in health care, mammogram screening, and breast cancer mortality (Satter, rios Burrows, Gatchell, Taualii, & Welch, 2003; Zuckermannn, Haley, Roubideaux, & Lille-Blanton, 2004), with some of the worst survival rates (Wampler, Lash, Sillman, & Herren, 2005; Wilson, Adams-Cameron, Burhansstipanov, Roubidoux, Cobb, Lynch et al., 2007). Therefore, bridging this gap within breast cancer prevention and intervention research for AI/AN would inform points of intervention to improve breast cancer screening and reduce breast cancer mortality. A second limitation of the current study is that the sample sizes among all ethnic groups varied widely, with non-Hispanic white women outnumbering all other racial/ethnic groups. However, the CHIS study oversampled Asian women since this population of women has been hard to reach within California (CHIS, 2007), and through their efforts gained a fairly representative sample of ethnically diverse women in the state. Third, one could argue that a 1 class solution might have fit the Health domain better, based on the LMRT, and small differences between the conditional response means and probabilities of the two classes. However, the substantive findings provided unique information regarding the pattern of women's responses and predisposing factors that may weigh more heavily on women's screening behavior than other risk factors. In addition, while the domains were created based on theory in how each variable relates to the overarching constructs of Health, Stress, and Demographics, it might be informative to identify profiles of women according to a

combination of overlapping domains. For the current sample, however, this was not possible given the complexity of the data and unequal representation among the ethnic group composition. Fourth, related to the current ethnic breakdown, the simple effects following the interactions of Ethnicity x Class with screening outcomes mostly emerged non-significant for African American women, followed by Hispanic, and Asian women respectively. Interestingly, African American women represented a smaller proportion of the overall sample size and thus the power to detect small simple effects might not have been enough to yield findings uniquely related to this group of women. Further studies should investigate the relationship among the current Health, Stress, and Demographic classes and screening behavior of African American women, as this group of women had the highest percentage of women in the Moderate and Severe Stress classes, as well as the Limited and Minimal Resource classes.

Summary and Future Recommendations

To summarize, the current study found unique classes of women among Health, Stress, and Demographic domains related to breast cancer screening behaviors in Californian women in the CHIS 2005 study. The study also examined these complex profiles of women among a large multiethnic sample that is unique in its generalizability to the diverse composition of California. Of note, it was striking that those women in the Health Risk class engaged in more breast cancer screening, in particular mammography screening. Further, these women engaged in more screening than Healthy class counterparts across all ethnic groups. These findings warrant further investigation of the specific variables in women's constellation of health factors as well as health beliefs that predict screening. Regarding women in the Stress domain, within the four classes that

emerged from the Minimal Stress class to Severe Stress class, women in the former engaged in more breast exam and mammogram screening than those women experiencing increased levels of stress. Related to the ethnic group interactions among the Stress classes, the only relationships to emerge significant were for non-Hispanic white women. These women also reported more breast cancer screening as their stress levels approached Minimal Stress, relative to their higher Stress class counterparts. Descriptively, African American women experienced the highest rate of being in the Severe and Moderate stress classes relative to all other ethnic groups. Related to the Demographic domain, it was striking that women in the Minimal and Substantial Resource classes engaged in greater breast cancer screening than women within the Limited and Moderate Resource class. This finding held across the diverse ethnic groups of women in the current study. While ethnicity moderated the relationship between class and breast cancer screening behavior, it appeared for the most part that Hispanic, African American, Asian, and non-Hispanic white women all responded similarly if they were in the same class. For instance, women in the Hispanic Health Risk class had similar screening behaviors as non-Hispanic whites in the Health Risk class. Both of these classes of women engaged in more screening than their healthy counterparts. This is notable and suggests similar variables are important risk factors for poor breast cancer screening despite ethnicity.

The current study adds a unique contribution to the literature on breast cancer screening prevention and portrays a rich constellation of variables that influence women's screening behaviors. The pattern of findings that emerged is unique and no study to date has utilized LPA to investigate the complexity of women's breast cancer

screening behavior through this means in such a large sample of women. Further, the ethnic diversity of the CHIS 2005 sample yields information regarding women's screening that is generalizable to a broad spectrum of women residing in California. It also highlights points of future intervention for women who may not be current targets of prevention and outreach programs. Perhaps, it is otherwise healthy, high breast cancer-risk women, with limited to moderate resources, who are experiencing moderate to severe stress that are the least likely to utilize breast cancer screening services. Future studies should consider this pattern of factors and their influence on screening behaviors. While there are specific variables within the emergent classes of women that appeared to have more influence on screening behavior than others, it is still necessary to account for the complexity of health, stress, and demographic factors that influence women's screening. Optimally, this study portrays a rich constellation of factors most salient to women's screening behaviors and underpins future targets of breast cancer prevention in typologies of ethnically diverse women within California.

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TABLES

Table 1

Model Fit Indexes for the 2-, 3-, and 4-Class Solutions

Fit Index	2-Class	3-Class	4-Class
Health Domain			
AIC:	312337.834		
BIC:	312574.192		
LMRT:	23902.705, p=.062		
LRT Adjusted	21652.919, p=.076		
Stress Domain			
AIC:	155852.538	145506.579	130251.443
BIC:	155959.280	145659.067	130449.678
LMRT:	22261.382, p*	10357.959, p*	21953.885, p=.076
LRT Adjusted	21882.443, p*	10181.643, p*	21580.180, p=.078
Demographic Domain			
AIC:	275891.838	270430.605	268358.587
BIC:	276013.829	270605.967	268587.320
LMRT:	7351.530, p*	5475.233, p*	2086.018, p*
LRT Adjusted	7244.006, p*	5395.152, p*	2055.508, p*

Note: AIC = Akaike Information Criterion, BIC = sample size-adjusted Bayesian Information Criterion, LMRT = Lo-Mendell-Rubin Test.
p* = $p < 0.00001$

Table 2a

Health Conditional Response Means and Probabilities

	Class 1: *(n = 13,640)*			*Class 2:* *(n = 1,490)*		
Health Items	*M*	*Yes*	*No*	*M*	*Yes*	*No*
Health Behaviors						
V1	---	.089	.911	---	.098	.902
V2	---	.132	.868	---	.118	.882
Women's Health						
V3	8.591	---	---	8.709	---	---
V4	---	.811	.189	---	.783	.217
V5	---	.968	.032	---	.983	.017
Cancer History & Prevention						
V6	---	.041	.959	---	.072	.928
V7	0.000	---	---	1.059	---	---
V8	0.227	---	---	0.434	---	---
Health Insurance						
V9	---	.941	.059	---	.954	.046
V10	---	.117	.883	---	.086	.914
Health Care Utilization						
V11	5.317	---	---	6.083	---	---
V12	---	.031	.969	---	.022	.978
V13	---	.185	.815	---	.206	.794

Note: VARIABLES: V1 = Female binge drinking (4+ drinks*)*; V2 = Current smoker; V3 = Number of unhealthy days, *min=0 to max=30*; V4 = Ever given birth to a live infant*;* V5 = Ever had a PAP smear*;* V6 = Ever told you have breast cancer; V7 = Number of 1st degree female relatives known to have breast cancer, *min=0 to max=4*; V8 = Number of 2nd degree female relatives known to have breast cancer, *min=0 to max=6*; V9 = Usual source of health care other than ER; V10 = Any insurance in the last 12 months, *1=uninsured, 2=insured*; V11 = Number of times you saw an M.D. in the past 12 months*, min=0 to max=365*; V12 = Hard time understanding doctor at the last visit; V13 = ER visits within the last year; Class 1 = Healthy class; Class 2 = Health Risk class.

Table 2b

Stress Conditional Response Means and Probabilities

	Class 1:			*Class 2:*			*Class 3:*			*Class 4:*		
	(n = 9,648)			*(n = 396)*			*(n = 3,235)*			*(n = 1,851)*		
Stress Items	*M*	*Yes*	*No*	*M*	*Yes*	*No*	*M*	*Yes*	*No*	*M*	*Yes*	*No*
Mental Health												
V14	2.913	---	---	6.333	---	---	3.692	---	---	4.848	---	---
Acculturation												
V15	---	.924[1]	.076 [2]	---	.942[1]	.058[2]	---	.947[1]	.053[2]	---	.911[1]	.089[2]
V16	4.588	---	---	4.505	---	---	4.628	---	---	4.318	---	---
Racial Discrimination												
V17	1.000	---	---	4.220	---	---	2.000	---	---	3.000	---	---
V18	---	.020	.980	---	.242	.758	---	.035	.965	---	111	.889

Note: VARIABLES: V14 = Serious psychological distress, *min=0 to max=24*, x ≥ 13 is significantly distressed; V15 = Citizenship status*, 1=U.S. born & naturalized, 2=Non-citizen*; V16 = Percent life in the U.S., *1=0-20%, 2=21-40%, 3=41-60%, 4=61-80%, 5=81%+*; V17 = Frequency of being treated badly b/c of race, *1=Never, 2=Rarely, 3=Sometimes, 4=Often, 5=All the time*; V18 = Would have received better medical care if a different race/ethnicity; Class 1 = Minimal Stress class; Class 2 = Severe Stress class; Class 3 = Mild Stress class; Class 4 = Moderate Stress class.

Table 2c

Demographic Conditional Response Means and Probabilities

	Class 1:			*Class 2:*			*Class 3:*			*Class 4:*		
	(n = 4,827)			*(n = 1,075)*			*(n = 2,978)*			*(n = 6,250)*		
Demographic Items	*M*	*Yes*	*No*	*M*	*Yes*	*No*	*M*	*Yes*	*No*	*M*	*Yes*	*No*
Age												
V19	50.582	---	---	51.445	---	---	65.509	---	---	54.938	---	---
Education												
V20	1.387	---	---	2.713	---	---	1.335	---	---	2.801	---	---
SES and Employment												
V21[1]	4.744	---	---	23.402	---	---	3.156	---	---	7.643	---	---
V22[12]	---	.785[1]	.215[2]	---	.886[1]	.114[2]	---	.737[1]	.263[2]	---	.836[1]	.164[2]
V23[123]	---	.751[1]	.008[2] .240[3]	---	.688[1]	.009[2] .303[3]	---	.086[1]	.005[2] .909[3]	---	.694[1]	.006[2] .300[3]

Note: VARIABLES: V19 = Age, *min=40 to max=75*; V20= Education, *1=High school, 2=Some college, 3=Graduated from college*; V21 = [1]Annual household income x $10,000, *min=$0 to max=$300,000*; V22 = Residence, *1=Urban, 2=Rural*; V23 = Working status*, 1=Employed, 2=Work from home, 3=Unemployed*; Class 1 = Limited Resource class; Class 2 = Substantial Resource class; Class 3 = Minimal Resource class; Class 4 = Moderate Resource class.

Table 3

Interactions of Health Classes x Ethnicity for Screening Outcomes

	Hispanic[a] (n = 2,216)	Black[a] (n = 700)	Asian[a] (n = 1,323)	White[b] (n = 10,891)
Outcome	*Logit (SE) p-value*	*Logit (SE) p-value*	*Logit (SE) p-value*	*Logit (SE) p-value*
Breast Exam – Yes[1]				
Healthy	-.180 (.055) *p=.001*	.109 (.102) p=.282	-.476 (.065) *p<.001*	.019 (.047) p=.678
Health Risk	.190 (.225) p=.398	.326 (.307) p =.288	-.219 (.270) p=.418	.282 (.076) *p<.001*
Mamm. Ever – Yes[1]				
Healthy	-.791 (.078) *p<.001*	-.287 (.154) p=.062	-.958 (.090) *p<.001*	.357 (.072) *p<.001*
Health Risk	.681 (.458) p=.136	.107 (.465) p=.818	--- --- ---	.776 (.152) *p<.001*
Mamm. 2 yrs[2]				
Healthy	-.731 (.101) *p<.001*	-.267 (.155) p=.084	-1.002 (.091) *p<.001*	.352 (.073) *p<.001*
Health Risk	.743 (.458) p=.105	.085 (.467) p=.856	19.153 (.377) *p <.001*	.797 (.152) *p<.001*
Mamm. Over 2 yrs[2]				
Healthy	-.731 (.101) *p<.001*	-.440 (.196) *p=.025*	-.697 (.116) *p<.001*	.392 (.090) *p<.001*
Health Risk	.137 (.559) p=.806	.243 (.549) p=.659	--- --- ---	.624 (.174) *p<.001*

Note: [1] = The response "No" serves as the reference group ; [2] Never had a mammogram serves as the reference group; [a]Reference group is non-Hispanic white ; [b]Reference group is Hispanic; Healthy class = Class 1; Health Risk class = Class 2.

Table 4

Interactions of Stress Classes x Ethnicity for Screening Outcomes

	Hispanic[a] (n = 2,216)	Black[a] (n = 700)	Asian[a] (n = 1,323)	White[b] (n = 10,891)
Outcome	*Logit (SE) p-value*	*Logit (SE) p-value*	*Logit (SE) p-value*	*Logit(SE) p-value*
Breast Exam – Yes[1]				
Minimal	-.162 (.070) *p=.020*	.313 (.236) p=.185	-.512 (.091) *p<.001*	.174 (.040) *p<.001*
Mild	-.127 (.106) p=.881	.077 (.182) p=.671	-.343 (.115) *p=.003*	.058 (.055) p=.299
Moderate	-.030 (.114) p=.790	.227 (.150) p=.131	-.291 (.124) *p=.019*	-.198 (.083) p=*.017*
Severe	-.234 (.223) p<.295	.084 (.232) p=.716	-.735 (.294) *p=.012*	-.354 (.188) p=.060
Mamm. Ever – Yes[1]				
Minimal	-.651 (.095) *p<.001*	-.053 (.348) p=.880	-.752 (.127) *p<.001*	.563 (.065) *p<.001*
Mild	-.561 (.146) *p<.001*	-.226 (.264) p=.391	-.783 (.150) *p<.001*	.287 (.097) *p=.003*
Moderate	-.395 (.156) *p=.011*	.066 (.234) p=.778	-.562 (.172) *p<.001*	-.339 (.123) *p=.006*
Severe	-.401 (.321) p=.211	-.085 (.349) p=.808	-.328 (.473) p=.488	-.255 (.293) p=.385
Mamm 2 yrs[2]				
Minimal	-.661 (.095) *p<.001*	-.035 (.349) p=.920	-.779 (.128) *p<.001*	.588 (.065) *p<.001*
Mild	-.489 (.147) *p=.001*	-.254 (.266) p=.339	-.829 (.152) *p<.001*	.271 (.097) *p=.005*
Moderate	-.391 (.157) *p=.013*	.102 (.235) p=.663	-.607 (.174) *p<.001*	-.378 (.124) *p=.002*
Severe	-.485 (.325) p=.136	-.040 (.351) p=.910	-.390 (.478) p=.415	-.313 (.296) p=.290
Mamm. Over 2 yrs[2]				
Minimal	-.584 (.125) *p<.001*	-.181 (.436) p=.677	-.588 (.167) *p<.001*	.395 (.079) *p<.001*
Mild	-.722 (.204) *p<.001*	-.057 (.323) p=.860	-.522 (.196) *p=.008*	.389 (.114) *p=.001*
Moderate	-.424 (.205) *p=.039*	-.222 (.300) p=.460	-.302 (.218) p=.166	-.110 (.152) p=.470
Severe	.033 (.385) p=.931	-.459 (.473) p=331	.011 (.571) p=.985	.067 (.352) p=.849

Note: [1] = The response "No" serves as the reference group ; [2] "Never had a mammogram" serves as the reference group; [a]Reference group is non-Hispanic white ; [b]Reference group is Hispanic; Minimal Stress class = Class 1; Severe Stress class = Class 2; Mild Stress class = Class 3; = Moderate Stress class = Class 4.

Table 5

Interactions of Demographic Classes x Ethnicity for Screening Outcomes

	Hispanic[a] (n = 2,216)	Black[a] (n = 700)	Asian[a] (n = 1,323)	White[b] (n = 10,891)
Outcome	*Logit (SE) p-value*	*Logit (SE) p-value*	*Logit (SE) p-value*	*Logit(SE) p-value*
Breast Exam – Yes[1]				
Substantial	.176 (.338) p=.603	.199 (.500) p=.691	.008 (.239) p=.973	.656 (.098) *p<.001*
Moderate	.318 (.129) *p=.014*	.307 (.166) p=.064	-.192 (.092) *p=.036*	.441 (.044) *p<.001*
Limited	-.268 (.066) *p<.001*	.149 (.151) p=.324	-.773 (.107) *p<.001*	-.266 (.048) *p<.001*
Minimal	-.116 (.109) p=.285	-.002 (.194) p=.991	-.550 (.148) *p<.001*	-.313 (.052) *p<.001*
Mamm. Ever – Yes[1]				
Substantial	-.597 (.406) p=.142	.677 (1.021) p=.507	-.199 (.351) p=.572	.835 (.183) *p<.001*
Moderate	-.056 (.187) p=.765	-.054 (.241) p=.822	-.570 (.125) *p<.001*	.534 (.074) *p<.001*
Limited	-1.027 (.084) *p<.001*	-.605 (.194) *p=.002*	-1.198 (.136) *p<.001*	-.487 (.072) *p<.001*
Minimal	.791 (.249) *p=.001*	1.423 (.584) *p=.015*	-.240 (.237) p=.311	.957 (.123) *p<.001*
Mamm. 2 yrs[2]				
Substantial	-.571 (.409) p=.163	.682 (1.024) p=.505	-.297 (.355) p=.403	.886 (.183) *p<.001*
Moderate	-.036 (.188) p=.848	-.007 (.242) p=.977	-.584 (.126) *p<.001*	.565 (.074) *p<.001*
Limited	-1.049 (.085) *p<.001*	-.617 (.195) *p=.002*	-1.266 (.139) *p<.001*	-.543 (.073) *p<.001*
Minimal	.812 (.250) *p=.001*	1.448 (.585) *p=.013*	-.269 (.239) p=.261	.959 (.124) *p<.001*
Mamm. Over 2 yrs[2]				
Substantial	-.793 (.587) p=.176	.642 (1.155) p=.579	.290 (.406) p=.475	.413 (.215) p=.055
Moderate	-.199 (.237) p=.401	-.443 (.170) p=.170	-.482 (.164) *p=.003*	.316 (.089) *p<.001*
Limited	-.886 (.114) *p<.001*	-.528 (.036) *p=.036*	-.823 (.182) *p<.001*	-.149 (.088) p=.092
Minimal	.640 (.283) *p=.024*	1.235 (.630) *p=.050*	-.067 (.293) p=.819	.937 (.138) *p<.001*

Note: [1] = The response "No" serves as the reference group ; [2] "Never had a mammogram" serves as the reference group; [a]Reference group is non-Hispanic white ; [b]Reference group is Hispanic; Limited Resource class = Class 1; Substantial Resource class = Class 2; Minimal Resource class = Class 3; Moderate Resource class = Class 4.

Table 6

Representation of Women by Ethnicity in Health, Stress, and Demographic Classes

	Class Composition by Percentage			
	Hispanic (n = 2,216)	Black (n = 700)	Asian (n = 1,323)	White (n = 10,891)
Class Domains				
Health				
Healthy	94.4%	89.7%	94.8%	88.8%
Health risk	5.6%	10.3%	5.2%	11.2%
Stress				
Minimal Stress	53.2%	17.7%	43.3%	71.4%
Mild Stress	21.8%	25.6%	28.4%	20.2%
Moderate Stress	20.4%	41.0%	24.6%	7.2%
Severe Stress	4.6%	25.6%	3.7%	1.2%
Demographics				
Substantial	2.4%	3.6%	7.5%	8.2%
Moderate	18.6%	35.0%	47.8%	45.6%
Limited	58.1%	39.9%	29.1%	26.4%
Minimal	20.9%	21.6%	15.6%	19.8%