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Cervical Cancer Screening Disparities in an Ethnically Diverse Population of Women Residing in the United States in 1999: A Secondary Analysis of Data from the 1999 Behavioral Risk Factor Surveillance System

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Cervical Cancer Screening Disparities in an Ethnically Diverse Population of Women

Residing in the United States in 1999: A Secondary Analysis of Data from the 1999

Behavioral Risk Factor Surveillance System

by

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A dissertation submitted in partial fulfillment
of the requirements for the degree of
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Dedication

This dissertation is dedicated to my beloved children, Yeatie and Yannick. I thank you with all my heart for your steadfast belief in my ability to stay the course. Thank you for your constant encouragement throughout this long, long, journey. I would never have made it through without your prayers, and without your unwavering love for me.

Table of Contents

List of Tables

Cervical Cancer Screening Disparities in an Ethnically Diverse Population of Women Residing in the United States in 1999: A Secondary Analysis of Data from the 1999 Behavioral Risk Factor Surveillance System

Chodaesessie Wellesley-Cole Morgan

ABSTRACT

Black American women have the highest screening rates for cervical cancer among all the ethnic groups in the United States. Even though evidence from the literature suggests that the number of deaths from cervical cancer in the United States could be reduced by preventive screening, this particular minority population still suffers disproportionately higher mortality from the disease than the other minority and majority populations in the United States. This study was proposed to investigate cancer screening disparities among different subpopulations of women residing in the United States during 1999, and to recommend public health interventions that could potentially increase cervical cancer screening rates, thereby decreasing differential mortality rates for cervical cancer among these subpopulations.

The Preventive Health Model in conjunction with data from the 1999 Behavioral Risk Factor Surveillance System was used to identify the covariates of cervical cancer screening behavior in an ethnically diverse population of American women residing in the United States during the specified timeframe. Univariate, bivariate and multivariable logistic regression procedures were used to evaluate the association between each one of

the independent variables and the dependent variable (compliance with the 1999 cervical screening guidelines of the American Cancer Society).

One of the major findings of this study was that Black, White and Hispanic American women were more similar in their screening behavior than dissimilar. The study also showed that the disparity in cervical cancer screening behavior in this population is in age, rather than in ethnic origin. Black, White and Hispanic American women of child-bearing age (18-44 years) were more likely to be compliant with the 1999 cervical cancer screening guidelines of the American Cancer Society, than Black, White and Hispanic American women who were not of child-bearing age (45 to 64 years). Implications for public health intervention studies are discussed, and recommendations made for future research in this area of cervical cancer screening behavior.

CHAPTER ONE: INTRODUCTION

Statement of the Problem

Evidence from the literature suggests that the overall health status of the American nation has improved during the past 25 years. However, disparities in health status between minority and majority populations in the United States still exist (American Cancer Society, [ACS], 2004; DHSS. Race and health: Cancer management, 1999). The health status of individuals and the health status of the communities within which they live and work contribute to the health status of the nation as a whole. It is, therefore, imperative that greater attention be paid to health care of minority populations because as these populations increase in size, their contribution to the ill-health status or the well-being status of the entire nation will also increase (NIH Guide: Understanding and eliminating minority health disparities, 2000; Woodward & Kawachi, 2000). A number of socio-demographic, socio-cultural, and socio-economic variables have been associated with disparities in health between minority and majority populations in the United States. These variables include region of residence, ethnic origin, age, gender, poverty, health behavior, access to health care, geographical location and patient-primary care provider communication (ACS, 2004; DHSS. Race and health: Cancer management, 1999).

Cancer is one of the diseases of which some minority populations bear a disproportionate amount of the burden. Black Americans have one of the highest

1

proportions of the cancer burden among all the ethnic groups in the United States. Cancer is the second leading cause of death in the United States and disparities exist in both incidence and mortality rates between the minority and majority populations. The rates for cancer have been age-adjusted to the 2000 U.S. standard population The age-adjusted, incidence rates for all invasive cancers at all sites from 1997-2001 for Black Americans is 515.8 cases per 100,000; for Hispanic Americans the rate is 351.3 cases per 100,000; for White Americans the rate is 479.6 cases per 100,000; for American Indians/Alaska Natives the rate is 237.7 cases per 100,000, for Asians/Pacific Islanders the rate is 336.6 cases per 100,000, and for all ethnic groups the rate is 470.3 cases per 100,000. Since Black Americans, White Americans, American Indians/Alaska Natives or Asians/Pacific Islanders are groups not mutually exclusive of Hispanic Americans, the observed incidence rates for Hispanic Americans are underestimates of the true rates (Ries et al., 2004).

The age-adjusted mortality rates for all invasive cancers at all sites for Black Americans is 252.5 deaths per 100,000; for Hispanic Americans the rate is 136.5 deaths per 100,000; among White Americans the rate is 196.9 deaths per 100,000; for American Indians/Alaska Natives the rate is 134.9 deaths per 100,000, for Asians/Pacific Islanders the rate is 122.0 deaths per 100,000, and for all ethnic groups the rate is 199.8 deaths per 100,000. Since Black Americans, White Americans, American Indians/Alaska Natives or Asians/Pacific Islanders are groups not mutually exclusive of Hispanic Americans, the observed mortality rates for Hispanic Americans are underestimates of the true rates (Ries et al., 2004).

Cervical cancer in the second most highly incident cancer in women throughout the world (Bosch & de Sanjose, 2003; Gray & Walzer, 2004; Munoz et al., 2004; World Health Organization [WHO] 2002). It is also the second most common cause of cancer mortality in women worldwide (Adams, et al., 2001). Cervical cancer is an important public health problem because of the burden of the disease and the potential for prevention by means of screening (Gray & Walzer, 2004). In the United States, the probability of developing invasive cervical cancer is 0.16 (1 in 632) for women from birth to 39 years of age and 0.31 (1 in 322) for women age 40 to 59 years of age (National Cancer Institute [NCI] 2003). Cervical cancer is the second leading cause of cancer mortality, among women aged 20 to 39 years, and among women aged 40 to 59 years, it is the fifth leading cause of cancer mortality (Greenlee, Murry, Bolden & Wingo, 2000). The age-adjusted mortality rate for cervical cancer for women 20 to 54 years of age is 2.7 cases per 100,000, and the age-adjusted mortality rate for cervical cancer women 55 to 64 years of age is 5.7 cases per 100,000 (NCI, 2005).

Disparities exist in both the incidence and mortality rates for cervical cancer between the minority and majority populations. Hispanic American women have the highest age-adjusted incidence rates for cervical cancer with 16.2 cases per 100,000; followed by Black American women with 11.8 cases per 100,000; followed by Asians/Pacific Islanders with 9.5 cases per 100,000; followed by White American women with 8.9 cases pre 100,000 and American Indians/Alaska Natives with 6.0 cases per 100,000. The age-adjusted incidence rates for cervical cancer for all ethnic groups is 9.3 deaths per 100, 000 (Ries et al., 2004).

Black American women have the highest age-adjusted mortality rate for cervical cancer among all the ethnic groups with 5.6 cervical cancer deaths per 100,000. For Hispanic American women the rate is 3.6 cervical cancer deaths per 100,000; Asians/Pacific Islanders and American Indians/Alaska Natives followed with 2.8 cervical cancer deaths per 100, 000 and White American women with 2.6 cervical cancer deaths per 100,000. The age-adjusted mortality rates for cervical cancer for all ethnic groups is 2.9 deaths per 100, 000 (Ries et al., 2004).

Evidence from the literature suggests that the number of deaths from cervical cancer in the United States could be reduced by preventive screening, a public health intervention strategy (CDC, 1998-1999; DHHS. Race and health: Cancer management, 1999; Franco, Duarte-Franco, & Ferenczy, 2001; Holmquist, 2000; Klaes, et al. 2001; Koop, 1997; MMWR, 1997; Runowicz & Fields, 1999; Sasieni & Adams, 1999; Schiffman, Brinton, Devessa & Fraumeni, 1996). Data from the 1999 Behavioral Risk Factor Surveillance System show that Black American women have the highest prevalence of preventive cervical cancer screening behavior among all the ethnic groups in the United States (CDC/NCCDPHP. BRFSS: Prevalence data, 2002). Other evidence from the literature indicates that cervical cancer screening rates are higher among Black American women when compared to White American women (Makuc, Fried & Kleinman, 1989; Martin, Parker, Wingo & Heath, 1996). It is well documented in the breast cancer screening literature that primary care provider recommendation about obtaining screening mammograms is one of the strongest covariates of adherence to breast cancer screening guidelines (American Cancer Society [ACS], 2004; Lippert, Eaker, Vierkant & Remington, 1999; Mandelblatt & Yabroff, 2000; O'Malley, Earp,

Hawley, Schell, Mathews & Mitchell, 2001; Roetzheim, Fox, Leake & Houn, 1996).

However the relationship between adherence to cervical cancer screening guidelines and primary care provider recommendation about obtaining a smear test has not been well studied (Hiatt, Klabunde, Breen, Swan & Ballard-Barbash, 2002).

In summary, although evidence from the literature suggests that the overall health status of the American nation has improved during the past 25 years, disparities in health status between minority and majority populations in the United States still exist (ACS, 2004; DHSS. Race and health: Cancer management, 1999). Disparities exist in both the incidence and mortality rates for cervical cancer between the minority and majority populations. Even though Black American women have the highest screening rates among all the ethnic groups (CDC/NCCDPHP. BRFSS: Prevalence data, 2002); and evidence from the literature suggests that the number of deaths from cervical cancer in the United States can be reduced by preventive screening (CDC, 1998-1999; DHHS. Race and health: Cancer management, 1999; Franco, Duarte-Franco, & Ferenczy, 2001; Holmquist, 2000; Klaes, et al. 2001; Koop, 1997; MMWR, 1997; Runowicz & Fields, 1999; Sasieni & Adams, 1999; Schiffman, Brinton, Devessa & Fraumeni, 1996); this particular minority population still suffers disproportionately higher mortality from the disease than the other minority and majority populations in the United States (Ries et al., 2004).

Rationale for the Study

This study was proposed to investigate cancer screening disparities among different subpopulations of women residing in the United States during 1999, and recommend public health interventions that could potentially increase cervical cancer

5

screening rates, thereby decreasing differential mortality rates for cervical cancer among these subpopulations (CDC, 1998-1999; DHHS. Race and health: Cancer management, 1999; Franco, Duarte-Franco, & Ferenczy, 2001; Holmquist, 2000; Klaes, et al. 2001; Koop, 1997; MMWR, 1997; Runowicz & Fields, 1999; Sasieni & Adams, 1999; Schiffman, Brinton, Devessa & Fraumeni, 1996). The principal investigator intends to use an appropriate theoretical model or theory of health behavior to provide an evidence-based, scientific rationale (a) to guide the research on differences in cervical cancer screening behavior among the ethnically diverse groups of women residing in the United States, and (b) to guide the ensuing discussion on designing and developing appropriate interventions to increase cervical cancer screening in these groups (Glanz & Rimer, 1997; Race and health, 1999; Turnock, 1997).

The Preventive Health Model has not been used to explain preventive cervical cancer screening behavior in women. The Preventive Health Model in conjunction with data from the 1999 Behavioral Risk Factor Surveillance System will be used to identify the covariates of cervical cancer screening behavior in this ethnically diverse population of American women. The principal investigator is also interested in investigating the magnitude of the association between cervical cancer screening behavior and ethnic origin of the women in the United States, because evidence from the literature indicates that cervical cancer screening rates are higher among Black American women when compared to White American women (Makuc, Fried & Kleinman, 1989; Martin, Parker, Wingo & Heath, 1996).

One of the most powerful measures for reducing the mortality rates of cervical cancer, especially in minority populations, is by increasing cervical cancer screening

(CDC, 1998-1999; DHHS. Race and health: Cancer management, 1999; Franco, Duarte-Franco, & Ferenczy, 2001; Holmquist, 2000; Klaes, et al. 2001; Koop, 1997; MMWR, 1997; Runowicz & Fields, 1999; Sasieni & Adams, 1999; Schiffman, Brinton, Devessa & Fraumeni, 1996). Although the literature identifies physician recommendation as the most powerful predictor for breast cancer screening (Mandelblatt & Yabroff, 2000), little is known about the effect of physician recommendation on cervical cancer screening behavior, especially in minority populations (Champion & Menon, 1997; Hiatt, Klabunde, Breen, Swan & Ballard-Barbash, 2002).

It is critical, given the public health orientation of this study, to investigate whether membership of an ethnic group with its distinctive social and cultural traditions could have a moderating effect on the association between primary care provider advice about cervical cancer screening and compliance with the 1999 cervical cancer screening guidelines of the ACS. The effect of ethnic origin as a moderating variable in the association between primary care provider advice about cervical cancer screening and compliance with the 1999 cervical cancer screening guidelines of the ACS will also be investigated.

<p align="center">Purpose of the Study</p>

The primary purpose of the study is to use the Preventive Health Model in conjunction with data from the 1999 Behavioral Risk Factor Surveillance System to: (a) investigate the association of selected, significant, covariates of cervical cancer screening behavior with compliance with the 1999 cervical cancer screening guidelines of the ACS in an ethnically diverse population of American women, (b) investigate the magnitude of the association of ethnic origin and compliance with the 1999 cervical

<p align="center">7</p>

cancer screening guidelines of the ACS, (c) investigate the association between primary care provider advice about cervical cancer screening and compliance with the 1999 cervical cancer screening guidelines of the ACS in this population, and (d) investigate whether the association between primary care provider advice about cervical cancer screening and compliance with the 1999 cervical cancer screening guidelines of the ACS is moderated by ethnic origin. The secondary purpose of this study is to examine the utility of the Preventive Health Model as a theoretical model in (a) guiding the research into cervical cancer screening behavior in this ethnically diverse population of women, and (b) guiding the ensuing discussion on designing and developing appropriate intervention strategies for increasing cervical cancer screening in this population (Glanz & Rimer, 1997; Race and health, 1999; Turnock, 1997).

<div align="center">Theories and Theoretical Models of Health Behavior</div>

Even though many theories and theoretical models of health behavior appear to have similar explanatory or predictive powers, no single theory, or theoretical model can be used to explain all of the processes involved in complex, health behavioral change, such as cervical cancer screening (Jennings, 1997; Prochaska, Reading & Evers, 1997; Weinstein, 1993). The Health Belief Model (Rosenstock, Strecher & Becker, 1988), Social Cognitive Theory (Bandura 1986), the Theory of Reasoned Action (Fishbein & Ajzen, 1975; Ajzen & Fishbein, 1980), and the Transtheoretical Model (Prochaska, 1997) have all been used to try to explain why women do or do not obtain screening tests for cervical cancer (Rimer, 1996).

The ensuing discussion about the application of these theories and models will be in the context of cervical cancer screening behavior. The Health Belief Model

hypothesizes that cervical cancer screening behavior depends on a woman's need to avoid cervical cancer and her belief that having a cervical cancer test will help to detect early symptoms of the disease if it is present. The constructs of the model include a woman's perceptions about: (a) her own susceptibility to cervical cancer, (b) the severity of the consequences of leaving cervical cancer untreated, (c) the benefits of compliance with the recommended guidelines for screening for the disease, and (d) the barriers of adhering to the recommended screening guidelines (Janz & Becker, 1984). These constructs were originally proposed to explain an individual's readiness to engage in a particular health action, such as cervical cancer screening (Glanz & Rimer, 1997). Hochbaum (1958) proposed the construct of cues to action to explain how an individual's readiness to take part in a cervical cancer screening program, could be activated by personal factors and environmental influences. Rosenstock, Strecher and Becker (1988) added the construct of self-efficacy to the Health Belief Model to increase its explanatory power.

Bandura (1986) explained human behavior in terms of Social Cognitive Theory which posits that behavior, personal factors (including cognition), socio-cultural and socio-demographic factors all interact in a reciprocal manner to determine an individual's behavior. The constructs of this theory include the individual woman's capacity to: (a) think through the consequences of compliance with, or non-compliance with the cervical cancer screening guidelines, (b) learn more about cervical cancer screening by observing other women (vicarious learning), (c) have the confidence to comply with to the recommended screening guidelines, (d) have the confidence to overcome any barriers

presented, and comply with the recommended screening guidelines, and (e) regulate her own cervical cancer screening behavior.

The Theory of Reasoned Action posits that behavioral intention is the most important covariate of behavior. Therefore, in the context of cervical cancer screening behavior, a woman's intention to comply with recommended cervical cancer screening guidelines is the most important covariate as to whether she will or will not perform this behavior. The direct covariates of a woman's intention to comply with the recommended screening guidelines are: (a) her attitude towards compliance with the health behavior, (b) the subjective norm associated with cervical cancer screening behavior and, (c) her perceptions about her own self control compliance with the recommended screening guidelines (Ajzen, 1991).

The basic premise of Transtheoretical Model is that behavioral change is a process involving progress through five stages of change which are: (a) precontemplation (a woman in this stage of behavioral change has not even thought about screening for cervical cancer); (b) contemplation (a woman in this stage has thought about getting a cancer screening test); (c) preparation (a woman in this stage of behavioral change has made arrangements for obtaining a cervical cancer screening test); (d) action (in this stage of behavioral change a woman has been screened once for cervical cancer) and, (e) maintenance (in this final stage of behavioral change a woman is being screened regularly for cervical cancer) (Prochaska, et al., 1994; Rimer, 1996).

In summary, the Health Belief Model (Rosenstock, Strecher & Becker, 1988), Social Cognitive Theory (Bandura 1986), the Theory of Reasoned Action (Fishbein & Ajzen, 1975; Ajzen & Fishbein, 1980), and the Transtheoretical Model (Prochaska, 1997)

have all been used individually to try to predict and understand self-initiated health behavior such as cervical cancer screening (Rimer, 1996). Even though these theories and theoretical models of health behavior appear to have similar explanatory or predictive powers, none of them can be used individually to explain all of the processes involved in complex, health behavioral change, such as cervical cancer screening (Jennings, 1997; Prochaska, Reading & Evers, 1997; Weinstein, 1993).

<u>The Preventive Health Model and Constructs from the Health Belief Model, the Theory of Reasoned Action and Social Cognitive Theory</u>

The Preventive Health Model was developed specifically to explain and understand the covariates of preventive health behavior (Myers, Ross, Jepson, Wolf, Balshem, Millner, & Leventhal, 1994). It is a theoretical model which has been derived from constructs of the Health Belief Model, the Theory of Reasoned Action and Social Cognitive Theory that are thought to be important in explaining and understanding preventive health behavior, such as cancer screening (Carver & Scheier as cited in Myers, et al., 1994). This model has been used in studies to determine: (a) colorectal cancer screening behavior in men and women (Myers et al., 1994, Watts, Vernon, Myers & Tilley, 2003), and (b) prostate cancer screening behavior in African American men (Gwede, 2001; Myers, Wolf, Mckee, McGory, Burgh, Nelson, & Nelson 1996). In the context of cervical cancer screening behavior, the Preventive Health Model posits that a broad set of factors influence a woman's decision to be screened for cervical cancer (Myers et al., 1994).

The first set of variables may be described as the *background factors* which may include age, gender, ethnic origin, education, and past preventive screening behavior.

11

These background factors may be viewed as the socio-demographic context within which a woman makes decisions about her health care. The construct of background factors is derived from the Health Belief Model (Strecher & Rosenstock, 1997).

The second set of variables may be described as *representation factors.* This construct is also derived from the Health Belief Model and includes a woman's perceptions about: (a) her own susceptibility to cervical cancer, (b) the severity of the consequences of leaving cervical cancer untreated, (c) the benefits compliance with the recommended guidelines for screening for the disease, and (d) the barriers of compliance with the recommended screening guidelines, including the practical convenience of compliance with the screening guidelines (Janz & Becker, 1984; Strecher & Rosenstock, 1997).

Social influence factors form the third set of variables. These factors include a woman's relationship with her health care professional, and the social support for cervical cancer screening behavior provided by significant individuals in her life. This particular construct is derived from Social Cognitive Theory which posits that behavior, personal factors (including cognition), socio-cultural and socio-demographic factors all interact in a reciprocal manner to determine an individual's pattern of health behavior. (Baranowski, Perry & Parcel, 1997).

Program factors comprise the fourth set of factors in the model. A woman may be exposed to educational interventions, such as primary care provider advice or recommendations, the purpose of which is to motivate and reinforce cervical cancer screening behavior (Myers, et al., 1994). This construct is derived from both Social Cognitive Theory and the Health Belief Model and refers to the contacts made by the

12

health services system for the purpose of motivating and reinforcing a given preventive health behavior (Baranowski, Perry & Parcel, 1997; Strecher & Rosenstock, 1997).

According to the Theory of Reasoned Action (Fishbein & Ajzen, 1975; Ajzen & Fishbein, 1980), the combination of background, representation, social influence and program factors could influence a woman's intention towards having a cervical cancer screening test. The Preventive Health Model posits that background, psychological representation, social influence and program factors influence a woman's intention to participate in a cervical cancer screening program, and also influence a woman's behavior in obtaining a cervical cancer screening test (Myers, et al., 1994).

The Preventive Health Model has not been used to examine cervical cancer screening behavior in women. The investigator proposes to contribute to the body of knowledge by using the model to guide the research into compliance with the 1999 cervical cancer screening guidelines of the ACS in an ethnically diverse population of women residing in the United States. The Preventive Health Model is a theoretical model within which covariates associated with cervical cancer screening behavior can be studied, so that interventions can be focused on those that are most likely to reduce cervical cancer mortality rates, by increasing cervical cancer behavior, especially among the Black American women (Glanz & Rimer, 1997; Race and health, 1999; Turnock, 1997).

<u>Assumptions of the Study</u>

The principal investigator will use data previously collected by researchers for the 1999 Behavioral Risk Factor Surveillance System (BRFSS), a collaborative project of the Centers for Disease Control and Prevention (CDC), and the U.S. states and territories.

The BRFSS is an on-going data collection (survey) program designed to measure behavioral risk factors in the adult population 18 years of age and over, living in households with telephones (CDC/NCCDPHP. Overview: BRFSS 1999, 2002).

The research methods and data analysis techniques employed by the BRFSS researchers are explained briefly in Chapter 3. For the purpose of this study it is assumed that:

1. The telephone interviewers followed standardized procedures when reading the questions to the study participants over the telephone.

2. The questions were appropriate in design and content to elicit the required responses.

3. The questions were understood by the study participants, answered honestly, and to the best of their ability.

4. The managers checked the questionnaires for errors (CDC/NCDPHP/DASH Behavioral Risk factor Surveillance System Training Guide, 2000).

<u>Delimitations of the Study</u>

The following delimitations, under the control of researchers at the Centers for Disease Control and Prevention (CDC), were imposed upon the study participants. The study participants (a) must be 18 years or older, (b) must reside in households with telephones, (c) must be non-institutionalized civilians, (d) must be able to understand what is said to them over the telephone, and (e) must be understood over the telephone.

The delimitations under principal investigator control are that: (a) the study sample has been selected from the population interviewed by the CDC researchers, and (b) the study variables have been selected from those already chosen by the researchers at the CDC for inclusion in the 1999 BRFSS database.

14

<u>Limitations of the Study</u>

The limitations of the study are such that the results may not be generalizable to (a) adults who do not have telephones, (b) adults who have telephones but are institutionalized, (c) adults who are not civilians, (d) adults who cannot hear or understand what is being conveyed to them over the telephone, (e) adults who cannot be understood over the telephone.

<u>Definitions of Terms</u>

The terms defined below are specific to this particular study and will be expanded, where appropriate, within the context of the study.

<u>Acculturation</u>

"Process of cultural change in which members of a group or one group assimilate(s) various cultural patterns from a different group" (On-line Medical Dictionary, 2004).

<u>American Indian or Alaska Native</u>

"A person having origins in any of the original peoples of North and South America (including Central America), and who maintains tribal affiliation of community attachment" (Office of Management and Budget, [OMB], 1997).

<u>Asian American</u>

"A person having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent including, for example Cambodia, China, India, Japan, Korea, Malaysia, Laos, Pakistan, the Philippine Islands, Thailand and Vietnam" (OMB, 1997).

Ancestry

"A line of descent" (Webster's New American Dictionary, 1995).

Asymptomatic

"Showing or causing no symptoms of disease" (Dorland's Illustrated Medical

Dictionary, 2000).

Black American

"A person having origins in any of the original peoples of sub-Saharan Africa"

(OMB, 1997).

Cancer

"A general term for more than 100 diseases that are characterized by

uncontrolled, abnormal growth of cells. Cancer cells can spread locally or through the

bloodstream and lymphatic system to other parts of the body" (On-line Medical

Dictionary 1997-2004).

Cancer, *cervix*

"Cancer of the entrance to the womb (uterus)" (On-line Medical Dictionary 1997-

2004).

Carcinoma

"A malignant new growth that arises from epithelium, found in the skin, or more

commonly, the lining of body organs, for example: breast, prostate, lung, stomach or

bowel. Carcinomas tend to infiltrate into adjacent tissue and spread (metastasize) to

distant organs, for example: to bone, liver, lung or the brain" (On-line Medical Dictionary

1997-2004).

Concept (Construct)

1. "An abstract idea or notion"

2. "An explanatory variable or principle in a scientific system" (On-line Medical Dictionary 1997-2004).

Dependent Variable

"A dependent variable is a variable the value of which is dependent on the effect of other variable(s) – independent variable(s) – in the relationship under study. A manifestation or outcome whose variation we seek to explain or account for by the influence of independent variables" (Last, 1995).

Epidemiologist

"One who specializes in epidemiology" (Dorland's Illustrated Medical Dictionary, 2000).

Epidemiology

"The science concerned with the study of factors determining and influencing the frequency and distribution of disease, injury, and other health-related events and their causes in a defined human population for purposes of establishing programs to prevent and control their development and spread. Also the sum of knowledge gained in such a study" (Dorland's Illustrated Medical Dictionary, 2000).

Ethnic Group

"A social group characterized by a distinctive social and cultural tradition, maintained within the group from generation to generation, a common history and origin, and a sense of identification with the group. Members of the group have distinct features

in their way of life, shared experiences and often a common genetic heritage. These features may be reflected in their health and disease experience" (Last, 1995).

Gynecological

"Pertaining to gynecology" (Dorland's Illustrated Medical Dictionary, 2000).

Gynecologist

"A medical doctor who specializes in gynecology and diseases affecting the female reproductive system" (On-line Medical Dictionary, 2004).

Gynecology

"A branch of medicine dealing with the diagnosis and treatment of disorders affecting the female reproductive organs and genital tract" (On-line Medical Dictionary, 2004).

Health

"The state of being hale, sound, or whole, in body, mind, or soul; especially, the state of being free from physical disease or pain" (On-line Medical Dictionary 1997-2004).

Health Behavior

"Behaviors expressed by individuals to protect, maintain or promote their health status. For example, proper diet, and appropriate exercise are activities perceived to influence health status. Life style is closely associated with health behavior and factors influencing life style are socio-economic, educational and cultural" (On-line Medical Dictionary 1997-2004).

Health Problem

"A health problem is a situation or condition of the people (expressed in health outcome measures such mortality, morbidity, or disability) that is considered undesirable and is likely to exist in the future" (Turnock, 1997).

Health Problem Analysis

"Health problem analysis is a framework for analyzing health problems to identify their covariates and contributing factors so that interventions can be targeted rationally towards those factors most likely to reduce the level of the health problem" (Turnock, 1997).

Health Status Indicators

"The measurement of the health status for a given population using a variety of indices, including morbidity, mortality and available health resources" (On-line Medical Dictionary 1997-2004).

Hispanic American

"A person of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin" (OMB, 1997).

Incidence

"Incidence more generally refers to the number of new events, e.g., new cases of a disease in a defined population, within a specified period of time" (Last, 1995).

Human Papillomavirus

"A disease caused by the human papillomavirus characterized by a wart-like growth on the genitalia (for example penis or vulva). The infection is most commonly transmitted sexually" (On-line Medical Dictionary, 1997-2003).

Incidence Rate

"The incidence rate is the rate at which new events occur in a population. The numerator is the number of new events that occur in a defined period; the denominator i.e. the population at risk of experiencing the event during this period, sometimes expressed as person-time" (Last, 1995).

Independent Variable

"An independent variable is the characteristic being observed or measured that is hypothesized to influence an event or manifestation (the dependent variable) within the defined area of relationships under study; that is the independent variable is not influenced by the event or manifestation but may cause or contribute to variation of the event or manifestation" (Last, 1995).

Inequalities (Disparities) in Health

"Inequalities in health refer to the virtual universal phenomenon of variation in health indicators the incidence, prevalence, mortality, morbidity, survival, burden of disease and other adverse health conditions that exist among specific population groups in the United States etc" (Last, 1995).

Intervention Studies

"Epidemiological investigations designed t test hypothesized cause-effect relationships by modifying the supposed causal factor(s) in the study population" (On-line Medical Dictionary, 1997-2004).

Medicine

"A scientifically-based discipline dedicated to the prevention and treatment of disease and injury" (On-line Medical Dictionary, 1997-2004).

Minority Group

"A minority group is a group characterized by a sense of separate identity and awareness of status apart from a usually larger group of which it forms or is held to form a part as: (a) a body of nationals of a state forming a small, but appreciable part of the population of another usually neighboring state, (b) a group differing from the predominant section of a larger group in one or more characteristics (as in ethnic origin, language, culture, or religion) and as a result often subjected to differential treatment, especially discrimination, or (c) a group numerically smaller than other groups or a combination of other groups in a community but constituting the predominant element" (Webster's Third New International Dictionary, 1993).

Model

"A model is a formalized expression of a theory or the causal situation that is regarded as having generated the observed data" (Last, 1995).

Moderator Variable

"A factor that modifies the effect of a putative causal factor under study. For example immunization status is an effect modifier for the consequences of exposure to pathogenic organisms. Effect modification is detected by varying the selected effect measure for the under study across levels of another factor" (Last, 1995).

Morbidity

"Morbidity is any departure, subjective or objective, from a state of physiological or psychological well-being. The WHO Expert Committee on Health Statistics noted in its Sixth report (1959) that morbidity could be measured in terms of three units: (1) individuals who were ill; (2) the illnesses (periods or spells of illness) that these

individuals experienced; and (3) the duration (days, weeks, etc.) of these illnesses" (Last, 1995).

Mortality Rate

"The mortality rate is an estimate of the proportion of a population that dies during a specified period. The numerator is the number of individuals dying during the period; the denominator is the number in the population, usually estimated as the midyear population" (Last, 1995).

Nurse, registered

"A graduate nurse who has been legally authorized (registered) to practice after examination by a state board of nurse examiners or similar regulating authority, and who is legally entitled to use the designation RN" (Dorland's Illustrated Medical Dictionary, 2000).

Nurse-Practitioner, advanced, registered

"A registered nurse who is an expert in nursing practice and ensures ongoing development of expertise through clinical experience and continuing education" (Dorland's Illustrated Medical Dictionary, 2000).

Obstetric, obstetrical

"Pertaining to obstetrics" (Dorland's Illustrated Medical Dictionary, 2000).

Obstetrician

"One who practices obstetrics" (Dorland's Illustrated Medical Dictionary, 2000).

Obstetrics

"A branch of medicine that deals with management of pregnancy, labor and the puerium" (Dorland's Illustrated Medical Dictionary, 2000).

Pacific Islander

"A person having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific Islanders" (OMB, 1997).

Papanicolaou (Pap) Smear Test

"Microscopic examination of cells collected from the *uterine cervix*. The Pap test is used to detect cancer, changes in the *uterine cervix* that may lead to cancer, and non-cancerous conditions, such as infection or inflammation" (On-line Medical Dictionary, 1997-2004).

Predictive Value

"In screening and diagnostic tests, the probability that an individual with a positive test is a true positive (i.e., does have the disease) is referred to as the predictive value of a positive test. The predictive value of a negative test is the probability that an individual with a negative does *not* have the disease. The predictive value of a screening test is determined by the sensitivity and specificity of the test, and by the prevalence of the condition for which the test is used" (Last, 1995).

Prevalence

"Prevalence is the number of events, e.g., instances of a given disease or other condition, in a given population at a designated time. When used without qualification, the term usually refers to the situation at a specified point in time (point prevalence). Point prevalence is a number not a rate" (Last, 1995).

Prevalence "Rate" (Ratio)

"The prevalence ratio is a proportion not a rate and is the total number of all individuals who have an attribute or disease at a particular time (or during a particular

23

period) divided by the population at risk of having the attribute or disease at this point in time or midway through the period" (Last, 1995).

Preventive Health Services

"Services designed for promotion of health and prevention of disease" (On-line Medical Dictionary, 1997-2004).

Preventive Health Behavior

Preventive health behavior is any activity undertaken by an individual who believes himself/herself to be healthy, for the purpose of preventing or detecting illness in an asymptomatic state (Kasl & Cobb, 1966).

Public Health

"Public health is fulfilling society's interest in assuring conditions in which people can be healthy" (Institute of Medicine [IOM], 1988, p. 7).

Risk Factor

"A risk factor is an aspect of personal behavior or lifestyle, an environmental exposure, or an inborn or inherited characteristic, which on the basis of epidemiological evidence, is known to be associated with health-related condition(s) considered important to prevent "(Last, 1995).

Screening

"The U.S. Commission on Chronic Illness defined screening in 1951 as being the presumptive identification of unrecognized disease or defect by the application of tests, examinations or other procedures that can be applied rapidly. Screening tests sort out apparently well persons who probably have a disease from those who probably do not. A screening test is not intended to be diagnostic. Individuals with positive or suspicious

findings must be referred to their physicians for diagnosis and necessary treatment. Screening is an initial *preventive* examination only, and positive responders require a second *diagnostic* examination" (Last, 1995).

Sensitivity and Specificity (of a screening test)

1. "Sensitivity is the proportion of truly diseased individuals in the screened population who are identified as diseased by the screening test. Sensitivity is a measure of the probability that any given case will be identified by the test – the true positive rate" (Last, 1995).

2. "Specificity is the proportion of truly non-diseased individuals who are so identified by the screening test. It is a measure of the probability of correctly identifying a non-diseased individual with a screening test – the true negative rate" (Last, 1995).

Theory

"In science, an explanation for some phenomenon which is based on observation, experimentation, and reasoning, and has been confirmed over the course of many independent experiments. Theories are more certain than hypotheses, but less certain than laws" (On-line Medical Dictionary, 1997-2004).

Variable

"A variable is any quantity that varies. Any attribute, phenomenon, or event that can have different values" (Last, 1995)

White American

"A person having origins in any of the original peoples of Europe, the Middle East and North Africa" (OMB, 1997).

CHAPTER TWO: LITERATURE REVIEW

<u>Etiology of Cervical Cancer</u>

Although the overall incidence rates and mortality rates of the disease have declined in developed countries, cervical cancer (cancer of the entrance to the uterus) is still a major public health problem throughout the world (Masood, 1997; On-line Medical Dictionary, 1997-2004). Women in less affluent regions of the world have higher rates of incidence and mortality, and lower rates of survival from this disease than do women from more affluent areas. Incidence and mortality rates in the United States and Canada are among the lowest in the world and have declined during the last 50 years and evidence suggests that it is because of the increased availability of cervical cancer screening programs in these countries (Franco, Duarte-Franco & Ferenczy, 2001). It is, therefore, imperative to ensure the availability of cervical screening programs, particularly among women in lower socio-economic regions and groups, (Herrero, 1996).

The most likely causative agent of cervical cancer and its precursors is the human papillomavirus (HPV) (Cuzick, 2000; Hoffman & Cavanagh, 1996; Palefsky, 2003; Rohan, Burk, & Franco, 2003). In addition to being a common sexually transmitted infection (STI), several case-control and cohort studies have shown that specific types of HPV are the causal agent for most squamous epithelial cancers of the female and male genital tracts (Munoz, & Bosch, 1992). The genital HPVs are classified as high, intermediate or low risk depending on the frequency with which they are detected in

cancers. The high-risk HPV genotypes are 16, 18, 31, and 45; the intermediate-risk HPV

genotypes are 33, 35, 39, 45 51, 52, 56, 58, 59 and 68. HPV 6, 11, 26, 32, 40, 42, 43, 44,

53, 54, 55, 61, 66, 69, 73 and unnumbered types designated as Pap155, Pap291, CP4173,

C8304, IS039, CP141, and W13b (among immune competent individuals) are almost

never found in association with malignant tumors and are classified as low risk types

(Jacobsen, et al., 2000; Lorincz, et al., 1992; Poljak, Marin, Seme & Vince, 2002).

Results of several epidemiological studies indicate that there is a strong

association between HPV (types 16, 18, 31, 33, and 35) infection and invasive cervical

cancer (Munoz, Bosch, de Sanjose, & Shah, 1994; Munoz, et al., 1992, Munoz, et al.,

1993). A dose-response relationship has been reported between increasing estimated viral

load and risk of cervical cancer (Munoz, & Bosch, 1992). Although there is strong

evidence to support the etiological role of certain HPV genotypes in the development of

cervical cancer; evidence suggests that these HPV genotypes are necessary but not

sufficient causes of cervical cancer, and other factors must also be present for cancer to

progress to malignancy The other factors could be infectious agents, chemical co-

carcinogens and factors related to the host immune response (Kiviat, 1996; Schiffman,

1992; Schiffman & Castle, 2003).

<u>Development of the Papanicolaou Screening Test</u>

In 1940, Dr. George Papanicolaou developed a screening test for cancer of the

uterine cervix in women. Precancerous changes, invisible to the naked eye, were detected

in cellular debris from the cervix and fundus of the uterus, collected by the Papanicolaou

vaginal smear technique. The cellular debris was smeared on glass slides, stained and

then the cells examined for early detection of cancers of the uterus (Papanicolaou &

Traut, 1941). Studies had shown that the squamocolumnar junction of the cervix was the area in which cancer developed most frequently than in any other area. The spatula technique was developed to study malignant changes in squamous cells from this site before they were exfoliated. A small spatula was used to scrape the surface of the tissues at the squamocolumnar junction. The cells and secretions were then placed on a glass slide, stained and examined for any malignancies (Ayre, 1947). Therefore, in the late 1940s to early 1950s, the Papanicolaou smear evolved into a technique to screen for precancerous cervical conditions, which were then histologically confirmed and treated, with the intention of preventing progression to invasive cervical cancer (Hoffman & Cavanagh, 1996).

In April 1996, the Consensus Development Conference of Cancer of the Cervix, which was convened by the National Institutes of Health (NIH), concluded that failure to detect cervical disease in women could be due either to sampling error or to screening error (NIH, 1996). Although the panel concluded that the conventional cervicovaginal (Papanicolaou) smear test was the best available method for screening for cervical cancer, recommendations were made that new methods of collecting specimens and reading cervical cells were needed to reduce the number of false-negative results (NIH, 1996).

The ThinPrep Papanicolaou test, a liquid-based cervical cytological preparation was approved by the United States Food and Drug Administration for use in 1996. The cervical cells are collected with a brush or similar collection instrument. The collection instrument is then rinsed in a vial of liquid preservative. The vial is sent to a laboratory where an automated thin-layer slide device prepares the slide for viewing (Carpenter &

Davey, 1999). The ThinPrep Papanicolaou test improves the quality of cervical cancer screening by improving the detection and management of patients with cervical abnormalities, and by reducing the number of false-negative results (Linder, 1998; Linder & Zahniser, 1998; Roberts, Gurley, Thurloe, Bowditch & Laverty, 1997).

Since its initial publication in 1989, the Bethesda System has been widely used by commercial and academic cytopathology laboratories in the United States for reporting cervical/vaginal cytological diagnoses (Kurman, Malkasian, Sedlis & Solomon, 1991; National Cancer Institute [NCI], 1989). The terminology for reporting the results of cervical cytology in the Bethesda System also included information on HPV as part of the cytological criteria (Rosetti, Gerli, Saab, & Drano, 2000). In 2001 the Bethesda System terminology for reporting the results of cervical cytology was updated to reflect the advances in the biological perspectives of cervical cancer and cervical cancer screening technology. In light of these advances, the panel from the Bethesda 2001 Workshop concluded that cervical cytology is primarily a screening test, and secondarily a diagnostic test (Solomon et al., 2002).

<u>Principles of Cancer Screening</u>

For screening to be implemented as public health policy, the disease has to be an important health problem (Miller, 1995). The main objective of screening for a disease is to reduce the mortality or burden of suffering from the disease in an individual, or in a population (Bjorge, Trope & Engeland, 1999; MacLean, 1996; Smith, 1999). However, several governing principles have to be taken into consideration before a screening program can be initiated within a given population:

1. The biology and natural history of the disease should be known.

2. The cancer should exist for a long time in an asymptomatic, preclinical phase.

3. The disease should have a high prevalence and incidence in the given population.

4. The disease should have serious clinical consequences measured in mortality, morbidity and costs.

5. The mortality rate from the disease in the population of the screened individuals should be significantly lower in comparison to the mortality rate from the disease in an equivalent population of unscreened individuals (Clark, 1995; Clark & Reintgen, 1996; Schifeling, Horton & Tafelski, 1997).

Cervical cancer is the second leading cause of cancer mortality, among women aged 20 to 39 years, and among women aged 40 to 59 years, it is the fifth leading cause of cancer mortality in the United States (Greenlee, Murry, Bolden & Wingo, 2000), therefore, it is a disease of significant public health importance. According to the governing principles of cancer screening (Clark & Reintgen, 1996) cervical cancer is amenable to screening for the following reasons.

1. The biology and natural history of the disease is known (Ayre, 1947).

2. The cancer exists in a slow-growing preclinical phase for a long period of time (Vilos, 1998).

3. Hispanic American women have the highest age-adjusted incidence rates for cervical cancer with 16.2 cases per 100,000; followed by Black American women with 11.8 cases per 100,000. The age-adjusted incidence rates for

cervical cancer for all ethnic groups is 9.3 deaths per 100, 000 (Ries et al., 2004).

4. Black American women have the highest age-adjusted mortality rate for cervical cancer among all the ethnic groups with 5.6 cervical cancer deaths per 100,000. For Hispanic American women the rate is 3.6 cervical cancer deaths per 100,000 The age-adjusted mortality rates for cervical cancer for all ethnic groups is 2.9 deaths per 100, 000 (Ries et al., 2004). Helms and Melnikow (1999) reported that cost estimates for a preventive Papnicolaou smear test ranged from $23.79 to $123.48. Treatment for curable invasive cervical cancer was estimated at $12,893. For incurable invasive cervical cancer treatment cost was estimated at $128,927.

5. Evidence from the literature suggests that the number of deaths from cervical cancer in the United States could be reduced by preventive screening (CDC, 1998-1999; DHHS. Race and health: Cancer management, 1999; Franco, Duarte-Franco, & Ferenczy, 2001; Holmquist, 2000; Klaes, et al. 2001; Koop, 1997; MMWR, 1997; Runowicz & Fields, 1999; Sasieni & Adams, 1999; Schiffman, Brinton, Devessa & Fraumeni, 1996).

There are many benefits to screening such as a reduction in the mortality and morbidity rates of cervical cancer, and savings in the overall cost of health care (Clark & Reintgen, 1996). However, there are also potentially harmful side effects associated with the invasive screening test which should be taken into consideration. These side effects include the inconvenience, anxiety and discomfort associated with screening test and, the expense incurred in terms of time and finances. There are also potential side effects

31

related to the screening test results. A false-positive test result could cause anxiety and incur unnecessary, expensive diagnostic evaluations such as a *diagnostic* screening and/or colposcopy. A false-negative result may lead to a false sense of security, with ensuing clinical symptoms of cervical cancer being dismissed because of the previous negative result. The consequences of these actions could prove to be a fatal (Clark & Reintgen, 1996).

<u>Effectiveness and Cost-Effectiveness of Cervical Cancer Screening</u>

For a screening program to be judged effective, the cervical cancer mortality rate for the screened population should be significantly lower than for the unscreened population, and the stage distribution of detected cancers in the screened population should be shifted towards lower stage cancers compared to higher stage cancers detected in the unscreened population (Clark & Reintgen, 1996). Staging is the process of describing the spread of cancer from the site of origin, and is essential in determining the choice of therapy and assessing prognosis. If cancer cells are present only in the layer of cells in which they have developed, and have not spread, the stage is *in situ*. If the cancer cells have spread beyond the original layer of tissue, the cancer is referred to as being invasive (ACS, 2004).

As the use of the Papanicolaou cytological screening has become more prevalent throughout the United States, and other countries such as the United Kingdom and India, there has been a shift towards diagnosis of earlier clinical stages in patients with cervical cancer (Camilleri-Ferrante & Day, 1997; Chao, Becker, Jordan, Darling, Gilliland & Key, 1996; Gibson, Spiegelhalter, Jayant, Rao, Nene & Dale, 1994; Shingleton, et al., 1996). In countries such as the United States and others that have implemented

32

widespread screening programs, there has also been a reduction in the mortality from, invasive cervical cancer (Franco, Duarte-Franco, & Ferenczy, 2001; Holmquist, 2000; Klaes, et al. 2001; MMWR, 1997; Runowicz, & Fields, 1999; Sasieni & Adams, 1999).

Cost-effectiveness analysis defines outcomes in natural units, such as cancers detected, survival rates, years of life gained, or tumor response to treatment. To be cost-effective the cost of a screening program (screening costs, diagnostic evaluations, treatment cost of detected cancers, and value of lives lost to cancer deaths) should be less than the costs incurred by the unscreened population (diagnostic evaluations, treatment cost of detected cancer and value of years lost to cancer deaths) (Clark & Reintgen, 1996). Evidence for the effectiveness of Papanicolaou cytological screening has been shown by epidemiological studies indicating that the risk of invasive cervical cancer is greater among women who have not been screened or who have been screened on an irregular basis, and that the risk increases with time since the last normal smear, or with lower frequency of screening. Surveillance statistics from different regions also indicate that the rates of cervical cancer incidence and mortality have decreased following the introduction of screening in the Scandinavian countries, Canada, and in the United States, with reductions in the incidence and mortality rates being proportional to the coverage of the screening programs (Franco, Duarte-Franco & Ferenczy, 2001). Although no prospective, randomized, controlled trial of screening for cervical cancer has been done, the data from observational trials in many countries throughout the world documenting the decreasing mortality rate for cervical cancer is evidence that screening for this tumor is both effective and cost-effective (Adami, Ponten, Sparen, Bergstrom, Gustafsson & Friberg, 1994; Bocciolone, La Vecchia, Levi, Lucchini & Franceschi, 1993; Gompel,

1998; Helms & Melnikow, 1999; Hristova & Hakama, 1997; Ku, 1999; Mandelblatt, 1997; Sato, Matunaga, Tsuji, Yajima & Sasaki, 1999; Smith, Mettlin, Davis & Eyre, 2000; Suba, Nguyen, Nguyen & Raab, 2001; Shingleton, Patrick, Johnston & Smith, 1995).

<u>Cervical Cancer Screening Guidelines of the American Cancer Society</u>

<u>from 1999 to 2005</u>

The American Cancer Society (ACS) screening guidelines for early detection of cancer in asymptomatic people are assessed each year in the event that novel scientific evidence indicates a change, clarification or re-formulation of any of the existing screening guidelines. The guidelines are evaluated every five years whether or not there is new scientific evidence to imply that any change be made to the recommendations (ACS 2003; ACS 2004). From 1999 to 2002 the ACS recommended that "all women who are or have been sexually active or who are 18 and older should have an annual Papanicolaou test to check for changes in the *uterine cervix* and pelvic examination to check for changes in the uterus and ovaries. After three or more consecutive satisfactory examinations with satisfactory normal findings, the Papanicolaou test may be performed less frequently…" (ACS, 1999, p. 31; ACS, 2000, p. 34; ACS, 2001, p. 35; ACS, 2002, p. 19).

Since 2003, new cervical cancer screening guidelines, based on recent advances in cervical cancer research, have been developed. The ACS recommends that "cervical cancer screening should begin approximately three years after a woman starts to have vaginal intercourse, but no later than 21 years of age. Screening should be done every year with conventional Papanicolaou smear tests or every two years using the liquid-

34

based tests. At or after 30 years of age, women who have had three consecutive, normal results may elect to be screened every two to three years. Physicians may suggest that a woman screen more often if she has certain risk factors, such as HIV infection or a compromised immune system. Women who are 70 years of age and older, who have had three consecutive normal Papanicolaou tests in the last 10 years may chose to stop cervical cancer screening. Screening women who have had a total hysterectomy (with removal of the cervix) is not necessary unless the surgery was undertaken as a treatment for cervical cancer" (ACS, 2003, p. 48; ACS, 2004, p. 56).

In 2005 the ACS recommendations for cervical cancer screening suggest that "cervical cancer screening should begin approximately three years after a woman starts to have vaginal intercourse, but no later than 21 years of age. Screening should be done every year with conventional Papanicolaou smear tests or every two years using the liquid-based tests. At or after 30 years of age, women who have had three consecutive, normal results may elect to be screened every two to three years. Alternatively, cervical cancer screening with HPV DNA testing and or liquid-based cytology could be performed every three years. Physicians may suggest that a woman screen more often if she has certain risk factors, such as HIV infection or a compromised immune system. Women who are 70 years of age and older, who have had three consecutive normal Papanicolaou tests in the last 10 years may chose to stop cervical cancer screening. Screening women who have had a total hysterectomy (with removal of the cervix) is not necessary unless the surgery was undertaken as a treatment for cervical cancer" (ACS, 2005, p. 60).

35

Studies of Covariates of Cervical Cancer Screening Behavior: 1990 to 2005

A search of the literature database at the National Library of Medicine (MEDLINE) and manual searches from 1990 to 2005 were executed on the topic of covariates of cervical cancer screening behavior. The principal investigator was interested in finding out which variables were significant in determining cervical cancer screening behavior in the studies. In the context of cervical cancer screening behavior, the Preventive Health Model posits that a broad set of factors (variables) influence a woman's decision to be screened for cervical cancer (Myers et al., 1994). These variables, extracted from a survey of the relevant literature, will then be used to build the theoretical constructs of the Preventive Health Model for this study. The results from these selected studies are summarized in the following section of the literature review.

Hayward, Shapiro, Freeman and Corey (1988) evaluated the national trends in the provision of cancer screening preventive care from the 1986 Access to Care Survey, a large telephone survey of the U.S. population. The researchers had two main study objectives: (a) to determine the proportion of American women who were currently receiving recommended cervical and breast cancer screening, and (b) to determine which groups were at greatest risk of not receiving these preventive measures.

The study sample consisted of 4,659 women aged 20 years or older: 1,867 women aged 20 to 39 years, 721 women aged 40 to 49 years, 1,040 women aged 50 to 64 years, and 1,031 women aged 65 years or older. The sample was weighted, using methods similar to those used in the National Health Interview Study so that the findings were representative of the U.S. population (National Center for Health Statistics [NCHS], 1985). All interviewers were trained by a single field coordinator. Households were

36

selected by the Waksberg screening procedure for random digit dialing (a procedure designed to eliminate the bulk of nonworking and no household telephone numbers while retaining equal selection probabilities for households) (Waksberg, 1978). The study participants were asked whether they had received the following screening procedures during the previous year: Papanicolaou smear (for women aged 20 years or older), breast examination performed by a physician (for women aged 20 years or older), and mammogram (for women aged 40 years or older) (Hayward et al. 1988).

The researchers reported that the overall response rate for households and individuals selected for interviews was 76%. The response rate of respondents who answered questions about preventive care ranged from 95.9% for Papanicolaou smears to 96.3% for mammograms. The Chi-square test of homogeneity was used to analyze the bivariate associations between each of the screening modalities and the nine independent variables: age, race/ethnicity, income, employment status, health insurance status, self-reported health status, rural versus urban residence, education of respondent, and site of usual medical care. Logistic regression analysis showed age, health insurance status, income, education, employment status and race/ethnicity to be related significantly to the receipt of Papanicolaou cervical smears (Hayward et al. 1988).

The researchers found that: (a) older women were at a higher risk of not receiving Papanicolaou smear tests than younger women, (b) uninsured women were less likely to have had Papanicolaou smears than women with insurance, (c) women with less education were less likely to have been screened regularly for cervical cancer than women who were better educated, (d) poorer women (income, ≤150% of the federal poverty level) were less likely to have been screened regularly for cervical cancer than

37

had women with income >150% of the federal poverty level, (e) Women who were not in the work force (e.g. housewives) were less likely to have received Papanicolaou smears than those who were employed and unemployed, and (f) Black women were more likely to have had Papanicolaou smears than were White and Hispanic women (Hayward et al. 1988).

Calle, Flanders, Thun and Martin, (1993) used data from the 1987 National Health Interview Survey Cancer Control Supplement to identify demographic variables associated with underuse of mammography or Papanicolaou smear screening. The characteristics were then examined together to produce profiles of women who underuse the cancer screening services available to them and who would be most likely to benefit from intervention programs.

Calle, et al. (1993) analyzed the responses of 12,252 women to questions about Papanicolaou smear screening. The women were 18 years and older and had not reported any history of cancer, except non-melanoma skin cancer. The analysis of mammography use was restricted to 6,353 women aged 40 and older without a history of cancer. Two measures of underuse of both Papanicolaou smear screening and mammography were employed, these were, never having been screened and not having been screened in the past year. The researchers examined eight demographic variables as potential covariates of underuse of screening. These variables were: age (18 to 39, 40 to 64, 65+ for Papanicolaou smear; 40 to 49, 50 to 64, 65+ for mammography); race/ethnicity (White, Black, Hispanic, other); formal education (fewer than 12 years, 12 years, more than 12 years); marital status (married, widowed, divorced, never married); type of urban area (central city, other metropolitan statistical area, non-metropolitan statistical area); region

(Northeast, Midwest, South, West); employment (in the labor force, not in the labor force) and income (below poverty level, poverty level to 200% of poverty level, 200% to 300% of poverty level, >300% of poverty level). The income variable was constructed based on the reported household income and family size, and using the 1987 poverty income guidelines (DHHS as cited in Calle, Flanders, Thun & Martin, 1993) to identify those people living below the poverty level, which was defined as a household income of about $11,000 for a family of four.

The researchers found that when all the demographic variables were included in the multivariate model, five variables remained significantly associated with underuse of Papanicolaou smear screening. These variables were: (a) other race, and (b) never-married marital status were the strongest independent covariates of never having had a Papanicolaou smear; (c) Hispanic ethnicity, (d) age 65 years or older, and (e) education of fewer than 12 years were also strong independent covariates of underuse of Papanicolaou smear screening (Calle, Flanders, Thun & Martin, 1993).

Katz and Hofer (1994) compared the association of income and education with breast and cervical cancer screening in Ontario, Canada, and the United States. The study sample was representative of all civilian, noninstitutionalized women aged 18 years and older living in Ontario and the United States. The researchers used the 1990 Ontario Health Survey (OHS) and the 1990 U.S. National Health Interview Survey (NHIS) Health Prevention Supplement Sample Person File, population-based surveys that collected detailed information on health care use, health status, health behavior, and demographics from a sample of the civilian, noninstitutionalized population. The dependent variables were: (a) a Papanicolaou test within 2 years of having being

39

surveyed; (b) a clinical breast examination within 1 year of having being surveyed, and (c) a screening mammography within 1 year of having being surveyed. Katz and Hofer (1994) selected a two-year interval recommendation for the frequency of screening Papanicolaou tests because it was the most comparable interval across the surveys.

The independent variables were family income and education. Family income was divided into six categories, the lowest being less than $15,200 and the highest being greater than $45,600. Education was categorized as some high school, high school graduate, some college, and college graduate. The researchers found that in both countries, women with higher incomes and higher educational levels were more likely to have received Papanicolaou screening tests (Katz & Hofer, 1994).

Hubbell, Chavez, Mishra and Valdez (1996) studied whether beliefs about cervical cancer influenced the use of Papanicolaou smears among Latinas and Anglo women in Orange County, California. The researchers designed a survey instrument using questions from the National Health Interview Survey, the Behavioral Risk Factor Surveillance Survey and an earlier ethnographic survey of the Orange County Latinas and Anglo women. Trained bilingual female interviewers conducted the survey from September 1992 to March 1993, using the computer-assisted telephone interview (CATI) system. Approximately 94% of Latino and 99% of Anglo households in Orange County have telephones (U.S. Bureau of Census as cited in Hubbell, Chavez, Mishra & Valdez, 1996). The survey used a cross-sectional sample of random-digit telephone numbers that included both listed and unlisted numbers, thereby minimizing potential bias by excluding households with unlisted numbers.

Hubbell, et al. (1996) used the Chi-square test to analyze the categorical data and logistic regression analysis to evaluate the covariates of Papanicolaou smear use. The predictor variables for both Latinas and Anglo women included: age (<40 years; ≥40 years), marital status (married; not married), household income (<$25,000; ≥$25,000), insurance status (no health status; any type of health status), education (≤to high school; >high school), and employment status (employed; not employed and not in the workforce). Acculturation, and country of birth (born outside the United States; born in the United States) were added to the list of predictors for the Latina sample.

The researchers reported that the variables associated with Papanicolaou smear use among Latinas within three years of having being surveyed were (a) health insurance status, (b) marital status, and (c) acculturation level. Women with health insurance were more likely than those without insurance to have had cervical cancer screening. Latinas who were married were more likely to have had Papanicolaou smear screening and those who were more highly acculturated to living in the United States were more likely to have had a Papanicolaou smear screening test (Hubbell, et al., 1996).

Fontaine, Faith, Allison and Cheskin (1998) examined the relationship between body mass index [BMI] (calculated as weight in kilograms divided by the square of height in meters), and the use of preventive health care services in a nationally representative sample of women. The data sources used were the 1992 National Health Interview Survey (NHIS), Cancer Control and Health Insurance supplements, conducted by the National Center for Health Statistics. The study participants consisted of 6,981 women aged 18 years old and older residing in the United States who reported socio-demographic information and the use of preventive health care services.

The independent variables in the study were: age, race (nonwhite or white), family income, education (years completed), smoking status (nonsmoker-former smoker or current smoker), and health insurance status (not covered or unknown or covered by private insurance, Medicare, or both). The dependent variables were the number of physician visits in the 12 months before completing the survey, and the interval since the most recent mammography, clinical breast examination, gynecological examination, or Papanicolaou smear test. The intervals were defined as : (a) within the past year, (b) 1 to 3 years ago, (c) more than 3 years ago, (d) unknown specific interval ($\leq$ 3 years versus >3 years), (e) not ascertained or do not know, or (f) unknown or refused.

Multiple linear regression analysis was used to examine the relationship between the BMI and the number of physician visits in the 12 months before completing the survey. Logistic regression analyses were used to examine whether BMI was related to delaying each of the four preventive health care procedures. The researchers found that after controlling for age, race, income, education smoking status and health insurance status, the BMI increased in direct association with increased frequency of physician visits. However, compared with women of average relative body weight (BMI of 25), obese and severely obese women were significantly more likely to delay clinical breast examinations, gynecological examinations and Papanicolaou smear testing, suggesting that body weight may play a role in delaying these forms of preventive health care.

Rakowski, Clark and Ehrich (1999) investigated the association of smoking status with breast and cervical cancer screening across the 1990-1994 National Health Interview Surveys (NHIS). The data were from the Health Promotion and Cancer Control Supplements to the 1990-1994 NHIS. The population of women studied were 42 to 75

42

years of age. Associations were examined between smoking status (never, former, <1 pack/day, ≥1 pack/day) and three screening indicators: (a) ever had a screening mammography, (b) had mammogram in the past 2 years, and (c) had the Papanicolaou test in the past 3 years. Data analyses were conducted by bivariate and multiple logistic regression. The researchers found that women who smoked ≥1 pack of cigarettes per day were significantly less likely to have had a Papanicolaou smear, or a screening mammography compared to women who had never smoked.

Simoes, Newschaffer, Hagdrup, Ali-Abarghoui, Tao, Mack & Brownson (1999) combined data from two probability samples, 967 women from the 1994 Missouri Behavioral Risk Factor Surveillance System (BRFSS) and 816 women from the 1994 Missouri Enhanced Survey (ES) to investigate the predictors of: (a) routine cervical cancer screening, and (b) compliance with a recommended cervical cancer screening schedule. The researchers analyzed data on two groups of women: women aged 50 and older, and those younger than 50 years of age. The independent variables were:
(a) race/ethnicity (White or African American), (b) educational attainment (less than high school, or high school graduate and higher), (c) health insurance (covered or not covered), (d) financial barriers to medical care in the previous year (had financial barriers, did not have financial barriers), (e) clinical breast examination (never had screening, not had screening within past five years, had screening within past five years), (f) screening mammography (never had screening, not had screening within past five years, had screening within past five years), (g) weight (overweight: BMI >27.3 kg/m^2, non-overweight: BMI ≤27.3 kg/m^2, (h) smoking status (ever smoked or never smoked), and (i) physical activity during previous month (active or inactive).

Simoes, et al. (1999) used logistic regression modeling to generate prevalence odds ratios to identify predictors of non-compliance to cervical cancer screening guidelines. The researchers showed that women who were younger than 50 years of age, and had had a mammogram or a clinical breast examination during the previous five years were more likely to comply with the compliance with the 1999 cervical cancer screening guidelines of the ACS schedule. The odds of non-compliance with compliance with the 1999 cervical cancer screening guidelines of the ACS: (a) increased with age, and (b) was higher among White women, smokers, women without health coverage, women without a high school education, and among women who had experienced financial barriers to seeking medical care.

Jennings-Dozier and Lawrence (2000) investigated whether specific socio-demographic variables, such as age, income, marital status and number of persons living at home, were associated with annual Pap testing adherence in a sample of minority women form the Philadelphia metropolitan area. A convenience sample of 204 Black and Hispanic American women was recruited from nonprofit agencies in the Philadelphia metropolitan area. The inclusion criteria for the study included women who: (a) could read and comprehend English and/or Spanish, (b) did not have a medical history of cervical cancer, (c) had not had a hysterectomy, and (d) had lived on the mainland of the United States for at least one year. Women were considered to be adherent to Pap testing if they reported having had a Papanicolaou test within the 14 months preceding enrollment into the study. Women who had never had a Papanicolaou smear, or who had not obtained a cervical cancer screening test within the last 14 months preceding their enrollment into the study were classified as being non-adherent.

The researchers used the Demographic Assessment Survey (DAS) to collect data
on the following variables :age (≤40 years and >40 years), ethnicity (Hispanic or Black)
educational level (never attended school to completed graduate/professional school),
family income ($5,000 to $50,000), and their history of cervical cancer screening (ever
had a Papanicolaou test or last time obtained a Papanicolaou screening test) and level of
acculturation (for Hispanics). To measure the level of acculturation in the Hispanic
population of women, the study participants were asked whether they were born on the
mainland United States and whether they spoke English at home (Jennings-Dozier &
Lawrence 2000).

The researchers reported that the Black American women who were adherent to
annual Papanicolaou testing were younger, earned a higher income, had insurance, were
unmarried and were more likely to be high school graduates than Black American women
who were not adherent to annual Papanicolaou testing. A similar result was reported for
the Hispanic American women in the study. Those who were adherent to annual
Papanicolaou testing were younger, earned a higher income, had insurance, were married
and were at least high school graduates when compared to Hispanic women who were not
adherent to compliance with the 1999 cervical cancer screening guidelines of the ACS
(Jennings-Dozier & Lawrence 2000).

Amonkar and Madhavan (2000) determined compliance rates for breast and
cervical cancer screening behavior recommendations for women residing in the
Appalachian states and identified covariates of these compliance rates by using BRFSS
from data from 1995 to 1997. Compliance with other preventive services, having
insurance coverage, residing in urban areas, better self-reported health, and higher

45

education were associated with increased odds of compliance with annual screening recommendations. Obesity and smoking were associated with decreased odds of compliance.

Coughlin, Thompson, Seeff, Richards and Stallings (2002) compared the cancer screening patterns of adult (≥ 18 years of age) Black American and White American women and men living in nonmetropolitan counties of the southern Black Belt region of the United States, to those of individuals living in non- Black Belt southern counties and other regions of the United States. The Black Belt region is an area which includes practically contiguous counties in the states of Virginia, North and South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Texas, Arkansas and Tennessee, with high concentrations of Black Americans. These are predominantly rural areas in which the population is economically dependent on agriculture (Lyson & Falk, 2000). The authors analyzed data from the state-based Behavioral Risk Factor Surveillance System (BRFSS) to find out whether there were disparities in the cancer screening rates of Black American and White American women and men in nonmetropolitan counties of the southern Black Belt region of the United States, to those of individuals living in non-Black Belt southern counties and other regions of the United States. The screening tests were use of the Papanicolaou test, mammography, test for fecal occult blood test (FOBT), and flexible sigmoidoscopy or colonoscopy.

The researchers found that Black American and White American men in the Black Belt counties were significantly less likely to have: had a colonoscopy, sigmoidoscopy or fecal occult blood screening test than those living in non-Black Belt southern counties or elsewhere in the United States. Black American and White

46

American women in the Black Belt counties were significantly less likely to have: (a) had a recent (within the past 2 years) mammogram than were Black American and White American women living elsewhere in the United States, and (b) had a colonoscopy, sigmoidoscopy or fecal occult blood screening test than those living in non-Black Belt southern counties or elsewhere in the United States. This pattern of regional differences in screening behavior was not found among the women who had had a recent (within the past 3 years) Papanicolaou test (Coughlin, Thompson, Seeff, Richards & Stallings, 2002).

Hiatt, Klabunde, Breen, Swan and Ballard-Barbash (2002) reviewed 65 papers, published between 1980 and 2001, that had used NHIS data to determine whether the investigators had assessed one or more covariates of screening use to identify factors that could help to explain screening practices or to reveal differences in screening behavior among different subpopulations. Forty-eight studies examined covariates of screening use, but only 10 of these studies used a theory or theoretical model. The researchers believe that it is important to use a theory or theoretical model because they guide the design of the research question, and the ensuing data analysis and interpretation of the results. Women with: (a) higher levels of education and income, (b) a usual source of health care and (c) insurance coverage were more likely to be screened for cervical cancer. Younger women were more likely to be screened for cervical cancer than older women. These variables were strongly and consistently associated with screening behavior across the studies reviewed.

These findings are consistent with the results in the studies reviewed by the principal investigator in which: (a) educational level, (b) income level, (c) regular source of care, (d) health insurance coverage, (e) age, (f) employment status, (g) ethnic origin,

47

(h) marital status, (i) BMI , (j) smoking status, and (k) past screening behavior, (l) region of residence, and (m) primary care provider advice about screening, were all found to be significantly associated with cancer screening behavior.

<u>Physician Recommendation and Adherence to Cancer Screening Guidelines</u>

One of the objectives of this study is to investigate the association between primary care provider advice about cervical cancer screening and compliance with the 1999 cervical cancer screening guidelines of the ACS in an ethnically diverse population of women residing in the United States. Therefore a search of the literature database at the National Library of Medicine (MEDLINE) and manual searches from 1996 to 2005 were performed relevant to the topic of physician recommendation and adherence to cancer screening guidelines. The results from these selected studies are summarized in the following section of the literature review.

Roetzheim, Fox, Leake and Houn (1996) conducted a study to determine whether selected risk factors influenced the breast cancer screening rates of women Medicare-insured women, aged 65 years and older. The researchers used data from the NCI Medicare Supplement that had been collected for the NCI in 1991 and 1993 to evaluate the impact of the 1991 benefit on mammography utilization. Self-reported rates of screening mammography and clinical breast examinations were compared for women with benign breast disease, women with a family history of breast cancer and women without these risk factors. The sample consisted of 5,376 non-Hispanic White, Medicare-insured women surveyed at five National Cancer Institute Breast Cancer Consortium sites in 1991 and 1993. These sites were in Long Island, New York; Los Angeles, California; eastern North Carolina; eastern Massachusetts and Philadelphia, Pennsylvania. It was

reported that the women with a family history of breast cancer and benign breast disease were more likely to have had screening mammography than those women lacking these risk factors. Women with a positive family history, or personal history were more likely than those without these risk factors, to have reported having had a clinical breast examination. The researchers concluded that these results were due to the more frequent provision of clinical breast examinations by the physicians and physician recommendations for screening mammography examinations.

Champion and Menon (1997) studied the variables associated with breast cancer screening behaviors of mammography utilization and breast self-examination in a convenience sample of low income African American women living in a large Midwestern, metropolitan area. Data were collected as part of an ongoing intervention trial to increase breast cancer screening in low income African American women. Four hundred and thirty women were enrolled into the longitudinal study from three multisite service centers in the metropolitan area. Eligibility for the study included being: (a) 45 to 64 years of age, (b) African American, and (c) having a combined income of ≤150% of poverty ($21,666 annually for a family of four). Variables studied included health insurance, source of health care, cost of having a mammography, perceived risk of having a mammography, perceived benefits, perceived barriers and physician recommendation. Variables that were significantly associated with breast self examination included: (a) perceived risk, (b) perceived benefits, (c) perceived barriers and (d) having a regular physician. Variables that significantly predicted mammography utilization included: (a) perceived barriers, (b) having a regular physician, (c) and recommendation by a health care professional to have a mammography.

Ruchlin (1997) identified and assessed the differences in breast and cervical cancer screening patterns among women who were 55-64, 65-74, 75-84, and over 84 years of age. The data was obtained from a nationally representative sample of 28,584,574 women who were interviewed for the 1990 Health Promotion and Disease Prevention Supplement to the National Health Interview Survey. The dependent variables were screening behavior : (a) having knowledge of breast self-examination, (b) ever having had a mammography, and (c) having had a Papanicolaou smear within the last three years. The independent variables were age, educational level, area of residence, health status and health belief measures. The researcher found that women 64 years and older were less likely to have had any of the screening tests than women 55-64 years of age. White women were more likely to know how to examine their own breasts and were more likely to have ever had a screening mammography than were non-White women. Having attended college and living in a central city of a metropolitan area were also significantly associated with all three screening measures. Finally, Ruchlin (1997) found that over a third of the women in the sample had not had a mammography because the procedure had not been recommended to them by their physician.

Stoddard et al. (1998) studied the characteristics of 11, 292 women 50 to 80 of age, who had not been adherent to the National Cancer Institute (NCI) recommendation that they obtain a screening mammography every one or two years. Data were from baseline surveys of women collected at the five study sites of the NCI Breast Cancer Screening Consortium. The Consortium includes the Fred Hutchinson Cancer Research Center, the State University of New York at Stony Brook, the RAND Corporation, the University of Massachusetts, and the Duke Comprehensive Cancer Center. The five sites

share a primary goal of identifying effective means of increasing utilization of screening mammography by women aged 50 years and above who have not been adherent to the NCI screening recommendations. Non adherent women were defined as those who had not had a screening mammography during the past 24 months, or those who had not been screened for 24 months prior to the most recent mammography.

The women were enrolled from different subpopulations of the United States. The subpopulations were defined by different criteria including geographic region, HMO membership, church membership, or non-urban residence. The study results indicated that the primary predictors of regular mammography adoption included physician recommendation for a mammography, and a recent clinical breast examination (Stoddard et al., 1998).

O'Malley, Earp, Hawley, Schell, Matthews and Mitchell (2001) investigated the association between physician recommendation for mammography and race/ethnicity, and socio-economic status in a population of women who lived in 10 counties across rural, eastern North Carolina. Data for this study was collected from the 1993 to 1994 base survey of 2000 women 50 years and older, which included 2 cohorts of Black women and 2 similar cohorts of White women. The primary outcome was self-report of physician recommendation for mammography in the past 2 years. The researchers concluded that physician recommendation was a strongly associated with mammography use.

Taylor et al. (2002) conducted a study to examine Papanicolaou testing barriers and facilitators among Chinese American women in Seattle, Washington. Four hundred and thirty-two women aged 20 to 79 years of age completed a questionnaire. The main

outcome measures of the community-based study were that the women had had: (a) at least one previous Papanicolaou smear test and, (b) a Papanicolaou smear test within two years of the interview for the survey.

The researchers reported that women with a history of at least one Papanicolaou smear test: (a) were married, (b) believed that a Papanicolaou smear test is necessary for sexually inactive women, (c) lacked concern about cancer being discovered, (d) were embarrassed by having the test, (e) had received a physician or family recommendation for cervical cancer screening, (f) had obtained family planning services in North America and (g) had a regular primary care provider. Women who had a Papanicolaou smear test within two years of the interview for the survey: (a) believed that a Papanicolaou smear test is necessary for sexually inactive women, (c) were not embarrassed by having the test, (d) had received a physician recommendation for cervical cancer screening, (e) had received obstetric services in North America and (f) had a regular primary care provider (Taylor et al., 2002).

It is well documented in breast cancer screening literature that physician recommendation about obtaining a mammogram is a strong covariate of adherence to breast cancer screening guidelines (ACS, 2004; Lippert, Eaker, Vierkant & Remington, 1999; O'Malley, Earp, Hawley, Schell, Mathews & Mitchell, 2001; Roetzheim, Fox, Leake & Houn, 1996). Mandelblatt and Yabroff (2000) reviewed breast and cervical cancer screening guidelines for women 65 years and older. The researchers reported that older women, especially older minority women, remain underrepresented in screening programs and are the most likely to die from breast or cervical cancer. Physician recommendation has been found to be one of the strongest predictors of screening across

all age, socio-economic and ethnic origins, and one of the most important reasons women report for not being screened is that their physicians did not recommended the procedure to them.

Evidence from the literature suggests that the number of deaths from cervical cancer in the United States can be reduced by preventive screening (DHHS. Race and health: Cancer management, 1999; CDC, 1998-1999; Franco, Duarte-Franco, & Ferenczy, 2001; Holmquist, 2000; Klaes, et al. 2001; Koop, 1997; MMWR, 1997; Runowicz & Fields, 1999; Sasieni & Adams, 1999; Schiffman, Brinton, Devessa & Fraumeni, 1996). Although evidence from the literature indicates that physician recommendation is strongly associated with adherence to breast cancer screening guidelines, little attention has been paid to physician recommendation as a major covariate of cervical cancer screening (Hiatt, Klabunde, Breen, Swan & Ballard-Barbash, 2002; Champion & Menon, 1997). The principal investigator, therefore, proposes to contribute further to the body of knowledge by investigating the association between adherence to cervical cancer screening guidelines and primary care provider advice about obtaining a Papanicolaou smear test.

<u>Ethnic Group and Cancer Screening Behavior</u>

Last (1995) defines an ethnic group as a "social group characterized by a distinctive social and cultural tradition, maintained within the group from generation to generation, a common history and origin, and a sense of identification with the group. Members of the group have distinct features in their way of life, shared experiences and often a common genetic heritage. These features may be reflected in their health and disease experience." Ethnic origin is used in this study in place of the terms race and/or

ethnicity used by other researchers. This term [ethnic origin] as used by the principal investigator also encompasses the distinctive socio-cultural traditions maintained within each group.

Health professionals have learned that interventions to promote health must be culturally relevant to the population in question (DHHS, 1998). For example, minority populations may have different perspectives on what constitutes cancer or the relative importance of screening for cervical cancer. Increasing demographic diversity makes it imperative for researchers to develop a more diverse approach to the design of intervention programs (Fielding, 1999).

It has been hypothesized that the method of grouping data into broad ethnic group categories could mask underlying differences among the different cultural groups (Potosky, Breen, Graubard & Parsons, 1998). For example, a study of cancer screening in a multi-ethnic community of Blacks and Hispanics found that rates of mammography and Papanicolaou smear tests differed among Colombian, Dominican, Ecuadorian, Puerto Rican, Caribbean, Haitian and United States-born Black women (O'Malley, Mandelblatt, Gold, Cagney & Kerner, 1997). Hiatt and Pasick (1996) hypothesized that variations in screening rates among members of the same ethnically-defined group could be partly explained by differences in language and level of acculturation within the group. The researchers reported that the hypothesis was supported by the observation that significantly lower rates of screening mammography are and clinical breast examination are reported, in the United States, among non-English speakers compared to English speakers. When language was evaluated within ethnically defined groups, rates of screening for English-speaking Hispanic and Chinese women were closer to those of

White American women. Within Hispanic populations, lower levels of acculturation and speaking Spanish were associated with lower rates of cancer screening, and older Hispanic women where less likely to speak English, more likely to speak Spanish and were less acculturated than younger Hispanic women (Hiatt & Pasick, 1996; O'Malley, Kerner, Johnson & Mandelblatt, 1999; Stein, Fox & Murata, 1991).

Kagawa-Singer (1997) reported that among Chinese American women, especially among unmarried women, restrictions on gynecological examinations by male physicians and breast self-examinations (because touching one's own body intimately may be taboo) could be individual barriers that prevent women from participating in cancer screening programs. Barriers such as insufficient of information in the various Chinese languages, few female physicians and the absence of educational campaigns tailored to the needs of the Chinese American women also contribute to the underscreening of this subpopulation (Mo, 1992).

Perez-Stable, Sabogal, Otero-Sabogal, Hiatt and McPhee (1992) collected information regarding the knowledge about and attitudes toward cancer in a sample of adult health plan members, self-identified as either Latino or Anglo. The researchers found that compared to Anglos, Latinos were more likely to believe that: (a) having cancer is like receiving a death sentence, (b) cancer is God's punishment, (c) it is uncomfortable to touch someone with cancer, and (d) there is very little one can do to prevent cancer. The researchers concluded that the data collected would be invaluable in developing tailored, culturally-appropriate cancer control interventions for Latinos.

Lee (2000) enrolled 102 Korean American from Queens, New York into a study to investigate their general knowledge about cervical cancer screening. The Health Belief

Model was used as theoretical model to guide the study. The concept of perceived barriers to preventive health actions is a key component of the Health Belief Model. Lee (2000) enrolled the women into focus groups ranging in size from 9 to 17 women, and asked them about: (a) their knowledge about the cause, early detection and prevention of cervical cancer, and (b) about the barriers that prevented the women from screening for cervical cancer using the Papanicolaou test. The women in the focus groups expressed a number of perceived barriers that they felt prevented them from having the Papanicolaou test. These barriers were grouped into structural and psychosociocultural barriers by the researcher.

The structural barriers were factors that affected the study population's access to health services. The most frequently mentioned structural barriers were cost and lack of insurance, lack of time and language difficulties. Women stated that because of these barriers, both they and some of their friends would return to Korea for the tests and treatment of cancer or other medical conditions. The psychosocio-cultural barriers included perceptions, social customs, and culturally induced beliefs and attitudes related to the women's backgrounds and socialization. Fear and embarrassment were found to be important psychosociocultural barriers for the Korean American women, many of whom attributed these barriers to their upbringing (Lee, 2000).

Kelaher, Gillespie, Allotey, Manderson, Potts, Sheldrake and Young (1999) used the Transtheoretical Model of Behavioral Change (TTM) to study participation in cervical cancer screening programs by different language and cultural groups in Queensland, Australia. The model used by the researchers consisted of six stages: (a) *precontemplation* (no past history of screening, no intention to be screened),

(b) *contemplation* (no past history of screening, intention to be screened), (c) *action* (intention to continue screening after initial screening), (d) *maintenance* (intention to continue regular screening), (e) *relapse* (no intention to be screened again after initial screening), and (f) *relapse risk* (no intention to be screened again after regular screening). Focus groups and structured interviews were used to classify the sample in terms of the TTM. The study sample consisted of Australian South Sea Islanders, Chinese, German, Greek and Muslim women. Kelaher, et al. (1999), stated that cervical cancer screening promotion for women of diverse cultures and ethnicities in Australia tended to focus on women in the precontemplation and contemplation stages. However, since most of the women in the study sample were in the action and maintenance stages, the researchers concluded that representing cervical cancer screening promotion in terms of the Transtheoretical Model could considerably improve the effectiveness of interventions for women of diverse cultures and ethnicities because different stages of change need different points of intervention (Kelaher, et al. 1999; Rimer, 1996).

Evidence from the literature suggests that the number of deaths from cervical cancer in the United States can be reduced by preventive screening (CDC, 1998-1999; DHHS. Race and health: Cancer management, 1999; Franco, Duarte-Franco, & Ferenczy, 2001; Holmquist, 2000; Klaes, et al. 2001; Koop, 1997; MMWR, 1997; Runowicz & Fields, 1999; Sasieni & Adams, 1999; Schiffman, Brinton, Devessa & Fraumeni, 1996), little attention has been paid to physician recommendation as a major predictor of cervical cancer screening (Hiatt, Klabunde, Breen, Swan & Ballard-Barbash, 2002; Champion & Menon, 1997). The socio-cultural traditions or customs are reflected in the preventive health behavior of the ethnically diverse group of women highlighted in the

review of the literature. These traditions may put the women at a high risk of being underscreened (Potosky, Breen, Graubard & Parsons, 1998).

One of the most powerful measures for reducing the mortality rates of cervical cancer, especially in minority populations, is by increasing cervical cancer screening (CDC, 1998-1999; DHHS. Race and health: Cancer management, 1999; Franco, Duarte-Franco, & Ferenczy, 2001; Holmquist, 2000; Klaes, et al. 2001; Koop, 1997; MMWR, 1997; Runowicz & Fields, 1999; Sasieni & Adams, 1999; Schiffman, Brinton, Devessa & Fraumeni, 1996). Although the literature identifies physician recommendation as the most powerful predictor for breast cancer screening (Mandelblatt & Yabroff, 2000), little is known about the effect of physician recommendation on cervical cancer screening, especially in minority populations. In order to develop effective programs to increase cervical cancer screening, it is important to examine whether population-specific factors such as ethnic origin should be a focus for future intervention programs. The effect of ethnic origin as a moderating variable in the association between primary care provider advice about cervical cancer screening and compliance with the 1999 cervical cancer screening guidelines of the ACS will also be investigated. It is critical, given the public health orientation of this study, to investigate whether membership of an ethnic group with its distinctive social and cultural traditions could have a moderating effect on the association between primary care provider advice about cervical cancer screening and compliance with the 1999 cervical cancer screening guidelines of the ACS . The insights gained from this study will be added to the body of knowledge and used to design more effective, tailored, interventions to enable the women to adhere to the cancer screening

guidelines of the American Cancer Society, thereby reducing the mortality rates of cervical cancer, especially in the minority populations.

<div align="center">The Preventive Health Model</div>

The Preventive Health Model was developed specifically to understand and determine the covariates of preventive health behavior (Myers, Ross, Jepson, Wolf, Balshem, Millner, & Leventhal, 1994). It is a theoretical model which has been derived from constructs of the Health Belief Model, the Theory of Reasoned Action and Social Cognitive Theory that are thought to be important in predicting preventive health behavior, such as cancer screening (Carver & Scheier as cited in Myers, et al., 1994). This model has been used in studies to predict: (a) colorectal cancer screening behavior in men and women (Myers et al., 1994, Watts, Vernon, Myers & Tilley, 2003), and (b) prostate cancer screening behavior in African American men (Gwede, 2001; Myers, Wolf, Mckee, McGory, Burgh, Nelson, & Nelson 1996).

The Preventive Health Model posits that a broad set of factors influence an individual's decision to be screened for cervical cancer (Myers et al., 1994). The first set of factors described as the *background factors* which may include age, gender, ethnic origin, education, and past preventive screening behavior. These background factors may be described as the socio-demographic context within which an individual makes decisions about his or her health care. The background factors construct is derived from the Health Belief Model (Strecher & Rosenstock, 1997).

The second set of factors are described as *representation factors.* The representation factors construct is also derived from the Health Belief Model and includes an individual's perceptions about: (a) his or her own susceptibility to a particular disease,

(b) the severity of the consequences of leaving the disease untreated, (c) the benefits of adhering to the recommended guidelines for engaging in behavior to prevent the disease, and (d) the barriers of adhering to the recommended preventive behavior, including the practical convenience of adhering to said behavior (Janz & Becker, 1984; Strecher & Rosenstock, 1997).

Social influence factors form the third set of factors. These factors include an individual's relationship with his or her health care professional, and the social support for engaging in preventive health behavior provided by significant individuals in his or her life. This social influence factors construct is derived from Social Cognitive Theory which posits that behavior, personal factors (including cognition), socio-cultural and socio-demographic factors all interact in a reciprocal manner to determine an individual's pattern of health behavior. (Baranowski, Perry & Parcel, 1997).

Program factors comprise the fourth set of factors in the model. An individual may be exposed to educational interventions, such as primary care provider advice or recommendations, the purpose of which is to motivate and reinforce a particular preventive health behavior (Myers, et al., 1994). The program factors construct is derived from both Social Cognitive Theory and the Health Belief Model and refers to the contacts made by the health services system for the purpose of motivating and reinforcing the given preventive health behavior (Baranowski, Perry & Parcel, 1997; Strecher & Rosenstock, 1997).

According to the Theory of Reasoned Action (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), the combination of background, representation, social influence and program factors could influence an individual's intention towards engaging in preventive

60

health behavior. The Preventive Health Model posits that background, psychological representation, social influence and program factors influence an individual's intention to engage in preventive health behavior, and also influence an individual to engage in preventive health behavior (Myers, et al., 1994).

Myers, et al. (1994) used the Preventive Health Model to identify factors associated with prospective adherence to colorectal cancer screening. The sampling frame for the study consisted of 12,800 adult men and women (50 to 74 years of age) who were members of HMO PA or HMO NJ, two prepaid health care plans of U.S. Healthcare, an independent practice association health maintenance organization. As HMO members, subjects in the sampling frame were eligible for free colorectal cancer screening through a central screening office. The HMO members were mailed fecal occult blood screening kits on an annual basis. The kit included three tests and a postage-paid return envelope. Individuals who did not return completed fecal occult blood tests to a central laboratory by mail within 15 days received a reminder letter to do the test. Individuals who adhered to the testing received their results by mail. Their primary care physicians also were notified of the test results by mail. None of the individuals included in the study had received prior fecal occult blood test mailings in the screening program. The outcome behavior, adherence to screening, was characterized by completion and return of the fecal occult blood tests within 90 days of the date on which the tests were mailed.

The researchers found that variables from each of the four domains of the Preventive Health Model were found to be significantly associated with adherence to fecal occult blood testing.

1. The background variables were: (a) gender (female), (b) age (being older) and (c) past fecal occult blood testing;

2. the psychological representation factors were: (a) worry about having an abnormal screening test result; (b) self-efficacy related to screening, (c) perceptions about the severity and curability of colorectal cancer, and (d) the salience and coherence of fecal occult blood screening;

3. the social influence factors were: (a) rapport between physician and patient, and (b) powerful others locus of control; and

4. the program factors included exposure to health education interventions (Myers, et al. 1994).

Myers, et al. (1996) presented the results of a telephone survey conducted among African American men who had been selected from the patient population of a community-based primary care physician practice in Philadelphia. Researchers identified a total of 2,355 African American men from the population who were 40 to 70 years of age and had complete addresses and telephone numbers in the central computer database of the practice. A random sample of two hundred and fifty-two men was selected from this population. Two hundred and eighteen men were eligible to take part in the study, and 154 completed the survey. Factors measured in the telephone survey were elicited from the Preventive Health Model. The dependent variable was intention to undergo an annual prostate cancer screening examination.

A number of the Preventive Health Model factors were found to be significantly associated with screening intention.

1. The background factors were: (a) age, and (b) having had a screening examination in the past year before the interview;

2. the psychological representation factors were: (a) belief in the salience of prostate cancer screening, (b) belief in the efficacy of screening, and (c) belief in the residual value of screening;

3. the social influence factors were: (a) perceived support from the health care professional, (b) receptivity to health care professional advice about screening, and (c) the influence of family members and friends on screening intention.

The researchers did not collect any data on program factors, so this component of the Preventive Health Model was not included in the theoretical framework of the study (Myers, et al. 1996).

Gwede (2001) studied factors that influence regular prostate cancer screening behavior among African American men. The researcher sought to determine the barriers and motivating factors for screening among African American men 40 years and older in Hillsborough County, Florida. The key constructs of the Preventive Health Model used in this study were background factors, psychological representation factors and social influence factors.

Gwede (2001) found the following statistically significant associations with one or other or both of the screening modalities (prostate-specific antigen blood test, or the digital rectal examination). Age was significantly associated with both the ACS screening guidelines (use of both tests) and the relaxed ACS screening guidelines (use of at least one of the tests). Younger men (40-49 years of age) were less likely to be screened regularly for prostate cancer than older men (65 years of age and over). Men who

received regular medical care (saw a doctor at least once a year for any medical condition, or annual physical examination) were more likely to been screened for prostate cancer compared to those who had not received regular medical care. Men who were more knowledgeable about prostate cancer screening guidelines were more likely to have been screened regularly than those with less knowledge on the topic. Finally, men who received recommendations from their physicians to undergo prostate cancer screening examinations were more likely to have been screened regularly compared to those who had not received recommendations from their physicians.

Gwede (2001) found that the results of his study were consistent with the results reported by Myers, et al. (1994) and Myers, et al. (1996). Gwede (2001) found that: (a) background factors (such as age and regular medical care); (b) psychological representation factors (importance and benefits of screening); and (c) social influence factors (receptivity to the recommendation of the physician for prostate cancer screening) were significantly and positively associated with prostate cancer screening behavior.

Watts, Vernon, Myers and Tilley (2003) reported that there is little information in the literature about whether the predictors of intention to be screened for colorectal cancer in cross-sectional studies also predict intention over time, or change in intention over time. The researchers studied the predictors of intention to screen for colorectal cancer in a population of white, male automotive workers. They hypothesized that if intentions to screen for colorectal cancer change over time, then it is imperative to know which predictors contribute to the behavior. The authors argued further, that since there is a low participation rate in colorectal cancer screening, behavioral interventions need to be developed to encourage participation in these screening programs. Information gained

from such cross-sectional studies could then be used in intervention programs to:

(a) reinforce an individual's strong intention in following colorectal screening advice, or

(b) strengthen an individual's weak intention in getting screened for colon cancer.

Watts, Vernon, Myers and Tilley (2003) conducted a cross-sectional study among white, male, automotive workers taking part in The Next Step Trial, a worksite health promotion trial to encourage colorectal cancer screening and modification in diet (Tilley et al., 1999a; Tilley et al., 1999b). The study sample consisted of 2,556 men, enrolled from 28 different worksites, who had (a) responded to baseline (1993) and follow-up surveys (1994 and 1995) from the Next Step Trial, (b) did not have colorectal cancer at baseline, and (c) did not develop the disease during the study period. The dependent variables were: (a) intention to be screened for colorectal cancer, and (b) change in intention to be screened for colorectal cancer. The independent variables were represented by the constructs of the Preventive Health Model which included the background, representation, social influence and program factors. The researchers found that a number of the Preventive Health Model factors were significantly associated with colorectal cancer screening intention.

1. The background factors were: (a) having a family history of polyps or colorectal cancer, and (b) having had a screening examination during the previous 2 years before the interview;

2. the psychological representation factors were: (a) belief in the salience of colorectal cancer screening, (b) lack of concern about screening-related discomfort, (c) perceived susceptibility to colorectal polyps and cancer, and (d) lack of fear and worry bout being diagnosed with colorectal cancer;

65

3. the social influence factors were: (a) receptivity to family member support for colorectal cancer screening, and (b) support for colorectal cancer screening among family members.

Watts, Vernon, Myers and Tilley (2003) found that the results of their study were consistent with the results reported by Myers, et al. (1994) for colorectal cancer screening; Myers, et al. (1996) and Gwede (2001) for prostate cancer screening; Orbell (1996) for cervical cancer; and Savage and Clark (1996) for breast cancer screening. The researchers did not include physician recommendation as a predictor variable because the Next Step Trial was delivered through the medical departments at each of the 28 worksites, not directly through the plant physicians. However, they advised that since physician recommendation is such an important predictor variable in intention to undergo other cancer screening behavior (Gwede, 2001; Myers et al., 1994; Myers et al., 1996; Orbell, 1996; Savage & Clark, 1996), it should be included as a predictor variable in future studies of intention to undergo colorectal cancer screening

Even though many theories and theoretical models of health behavior appear to have similar explanatory or predictive powers, no single theory, or theoretical model can be used to explain all of the processes involved in complex, health behavioral change, such as cervical cancer screening (Jennings, 1997; Prochaska, Reading & Evers, 1997; Weinstein, 1993). The Health Belief Model (Rosenstock, Strecher & Becker, 1988), Social Cognitive Theory (Bandura 1986), the Theory of Reasoned Action (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), and the Transtheoretical Model (Prochaska, 1997) have all been used to try to explain why women do or do not obtain screening tests for cervical cancer (Rimer, 1996).

The Preventive Health Model has been selected as the most appropriate

theoretical model for investigating self-initiated compliance with the 1999 cervical cancer

screening guidelines of the ACS in an ethnically diverse population of American women.

The constructs of the Preventive Health Model will be operationalized by the

theoretically and conceptually appropriate variables chosen from the pertinent literature,

and matched with relevant variables from the 1999 Behavioral Risk Factor Surveillance

System data set. This theoretical model will be used to guide the formation of the

research questions, methodology, analyses, and subsequent interpretation of the results of

the study.

<u>Overview of the Behavioral Risk Factor Surveillance System</u>

During the early 1980s, scientific research showed that personal health behavior

played a major role in chronic disease morbidity and mortality. During this time

telephone surveys emerged as a reliable, valid and acceptable method of collecting

information on health behavior. The Behavioral Risk Factor Surveillance System

(BRFSS) a collaborative project of the Centers for Disease Control and Prevention

(CDC), and the U.S. states and territories was initiated in 1984, with 15 states collecting

surveillance data on risk behavior through monthly telephone interviews. By 1990, 50

states, the District of Columbia, Puerto Rico, Guam and the Virgin Islands were

participating in the BRFSS. The surveys were developed and administered to monitor the

state-level prevalence of the major behavioral risk factors in the non-institutionalized

adult population 18 years of age and over in the United States (CDC/NCCDPHP.

Overview: BRFSS 1999; 2002). The basic philosophy of the BRFSS was then, and

continues to be, to collect data on self-reported health behavior, rather than on self-

reported attitudes and knowledge, because this type of data can be used for planning, implementing, managing and evaluating health promotion and disease prevention programs. Factors assessed by the BRFSS include tobacco use, general health status, health coverage, and the use of cancer screening services (CDC/NCCDPHP. About the BRFSS, 2002).

The intention of this investigation is to study the association among the covariates of compliance with the 1999 cervical cancer screening guidelines of the ACS (cervical cancer screening behavior) and to explore the relationship between primary care provider advice about cervical cancer screening and compliance with the 1999 cervical cancer screening guidelines of the ACS in an ethnically diverse population of American women. The BRFSS data set has been selected for this purpose because it contains questions pertaining to (self-reported) health behavior rather than to (self-reported) knowledge, attitudes, and perceptions of, or intentions to perform health behavior. Moreover this data set contains survey questions specific to preventive screening behavior, including cervical cancer screening behavior (CDC/NCCDPHP. About the BRFSS, 2002; Coughlin, Uhler, Hall & Briss, 2004).

Reliability and Validity of the Self-Reported Data from the 1999 BRFSS

Stein, Lederman and Shea (1994) studied the reliability of the Behavioral Risk Factor Surveillance System questionnaire using a random sample of White adults (n = 122) and a separate sample of Black and Hispanic adults (n = 200) in Massachusetts. The questionnaire was administered twice, 21 to 44 days apart, by telephone there was a 65% response rate for second administration of the questionnaire. Individual level reliability (Kappa for categorical variables, correlation for continuous variables) for demographic

characteristics was > 0.8 for White respondents and >0.6 for Black and Hispanic

respondents. Reliability coefficients for behavioral risk factors were >0.7. The

researchers concluded that the data supported the use of the Behavioral Risk Factor

Surveillance System questionnaire for surveillance and research.

Stein, Lederman and Shea (1996) also assessed the reproducibility of responses to

the women's health module of the 1992 Behavioral Risk Factor Surveillance System. The

module included questions about breast and cervical cancer screening, clinical breast

examinations, hysterectomy, and pregnancy status. A random sample of women in

Massachusetts (n = 91, response rate for the repeat interview = 70.0%) and a separate

random sample of minority women in the state (n = 179; response rate for the repeat

interview = 69.4%) were interviewed twice, by telephone, 21 to 94 days apart. Based on

Kappa statistics, concordance exceeded 85% for almost all variables examined, but

tended to be lower for nonwhite respondents. The researchers concluded that the

women's health module of the BRFSS questionnaire yielded highly consistent group

mean estimates of prevalence when administered repeatedly to the same individuals.

<u>Limitations and Strengths of the 1999 BRFSS Data Set</u>

Although 95% of households in the United States have telephones, coverage

ranges from 87%-98% across states and varies for subgroups as well. For example, in the

South, minorities and individuals in lower socio-economic groups characteristically have

lower telephone coverage. Post-stratification weights were used which partially corrected

for any bias caused by non-telephone coverage. The weights also adjusted for differences

in probability of selection, nonresponse and non-telephone coverage (CDC/NCCDPHP.

Overview: BRFSS 1999, 2001). The absence of a telephone at home for a significant

proportion of potential respondents could make the study population less representative than the general population, thereby limiting the generalizability of the survey results (Marin, Vanoss & Perez-Stable, 1990).

The BRFSS has a number of unique strengths that will be discussed in this section. Nationwide, survey items from the surveillance system have remained relatively constant from year to year. Another strength of the BRFSS is the relative ease with which data can be compared across the states. Although the surveillance system is flexible and allows for additional questions from the states, the standard core questions enable health professionals not only to make comparisons between states, but also to track health trends over time and derive national-level conclusions from the observations. For example, by tracking trends over time, state-based data from the BRFSS have revealed a national epidemic of obesity (CDC/NCCDPHP. BRFSS: Tracking major health risks in America, 2001; CDC/NCCDPHP. BRFSS: Tracking public health trends, 2000).

<u>Public Health Significance of the Study</u>

Healthy People 2000: National Health Promotion and Disease Prevention Objectives was published in 1990 and identified health improvement goals to be reached by the year 2000. These documents established national health objectives and have served as a basis for the development of state and community health plans (Healthy People 2000, 1990). The *Healthy People 2000* initiative had three goals, to: (a) increase the span of healthy life, (b) reduce health disparities, and (c) achieve access to preventive services. One of the priority areas in *Healthy People 2000* was to increase the proportion of women aged 18 and older who had ever received a Papanicolaou smear test, and those

who had received the test within the preceeding 1 to 3 years. *Healthy People 2000* was the precursor to *Healthy People 2010.* (Healthy People 2000, 1990)

Healthy People 2010, is a document containing a set of health objectives designed for the nation to reach during the first decade of the 21st century (Healthy People 2010, 2000). The two major goals of this health initiative are: (a) to help individuals of all ages to improve the quality of their lives, and (b) to eliminate disparities in health among different sectors of the population. The vision for *Healthy People 2010* is *Healthy People in Healthy Communities* (U.S. Department of Health and Human Services [USDHHS], 2000). Therefore, in the context of the current national emphasis on health disparities research, this proposed study is a particularly appropriate opportunity to contribute new research on screening-related health behavior to the body of literature, and to current national dialogue on the subject. Researchers at the National Institutes of Health are also initiating investigations into health disparities to understand why some groups have disproportionately higher rates of disease than others (NCMHD, What we do, n.d.).).

The Preventive Health Model has not been used to predict preventive cervical cancer screening behavior in women. The Preventive Health Model in conjunction with data from the 1999 Behavioral Risk Factor Surveillance System will be used to identify the covariates of cervical cancer screening behavior in a diverse population of American women. The effect of ethnic origin as a moderating variable in the association between primary care provider advice about cervical cancer screening and compliance with the 1999 cervical cancer screening guidelines of the ACS will also be investigated.

The results of this study will enable public health researchers to develop and design intervention programs that could be tailored to the specified population segments

71

in the study (Glanz & Rimer, 1997; DHSS. Race and health: cancer management, 1999).

The objective of the interventions is to increase cervical screening to more optimal levels

among the diverse groups of women in the nation, thereby, not only reducing the

differences in mortality rate, but also reducing the overall mortality rate from cervical

cancer in the nation.

CHAPTER THREE: RESEARCH METHODS

Purpose of the Study

The purpose of the study was to use the Preventive Health Model in conjunction with data for the 1999 Behavioral Risk Factor Surveillance System to: (a) investigate the association of selected, significant, covariates of cervical cancer screening behavior with compliance with the 1999 cervical cancer screening guidelines of the ACS in this ethnically diverse population of American women, (b) investigate the magnitude of the association of ethnic origin and compliance with the 1999 cervical cancer screening guidelines of the ACS , (c) investigate the association between primary care provider advice about cervical cancer screening and compliance with the 1999 cervical cancer screening guidelines of the ACS in this population, and (d) investigate whether the association between primary care provider advice about cervical cancer screening and compliance with the 1999 cervical cancer screening guidelines of the ACS is moderated by ethnic origin.

Research Questions

The research questions posed were as follows:

1. Is there an association between each of the selected covariates of cervical cancer screening behavior and compliance with the 1999 cervical cancer screening guidelines of the ACS as recommended in an ethnically diverse population of American women?

73

2. Is there a difference in the magnitude of the association between ethnic origin and compliance with the 1999 cervical cancer screening guidelines of the ACS?

3. Is there an association between primary care provider advice about cervical cancer screening and compliance with the 1999 cervical cancer screening guidelines of the ACS?

4. Is the association between primary care provider advice about cervical cancer screening and compliance with the 1999 cervical cancer screening guidelines of the ACS moderated by ethnic origin?

Null Hypotheses

The study (null) hypotheses were as follows:

1. There is no association between each of the selected predictors of cervical cancer screening behavior, and compliance with the 1999 cervical cancer screening guidelines of the ACS in this ethnically diverse population of American women.

2. There is no difference in the magnitude of the association between ethnic origin and compliance with the 1999 cervical cancer screening guidelines of the ACS.

3. There is no association between primary care provider advice about cervical cancer screening and compliance with the 1999 cervical cancer screening guidelines of the ACS.

4. Ethnic origin does not moderate the association between primary care provider advice about cervical cancer screening and compliance with the 1999 cervical cancer screening guidelines of the ACS.

<center>Study Design</center>

The study design was a cross-sectional or prevalence study in which the status of the exposure (primary care provider advice about cervical cancer screening) and the attribute of interest (compliance with the 1999 cervical cancer screening guidelines of the ACS) were simultaneously assessed among individuals in the defined study sample.

<center>Selection of the Study Sample</center>

The BRFSS is a cross-sectional surveillance system involving 52 reporting areas, with natural variation over the sample sites. The BRFSS data were collected from a random sample of adults (one per household) through a telephone survey (CDC/NCCDPHP, Overview: BRFSS 1999, 2001). A total of 159,989 individuals were interviewed for the 1999 Behavioral Risk Factor Surveillance System, 94,679 of these individuals were women from 18 years to 65 years and older (CDC/NCCDPHP. 1999 BRFSS Codebook, 2002). The BRFSS sample consisted of 74,888 (79%) White, 8237 (9%) Black, and 5,687 (6%) Hispanic, 2234 (2%)Asian or Pacific Islander and 1450 (1.5%) American Indian or Alaska Native women. The Black and White Hispanic women were combined into a single Hispanic American group because there were not enough data on the Black Hispanic women for analysis.

In 1999, the ACS guidelines for cervical cancer screening suggested that "all women who are or who have been sexually active, or who are 18 and older should have an annual Pap test and pelvic examination. After three or more consecutive satisfactory examinations with normal findings, the Pap test may be performed less frequently as per physician recommendation (ACS, 1999, p. 31).

<center>75</center>

The ACS guidelines for cervical cancer screening updated in 2002 (Saslow, Runowicz, Solomon et al., 2002) recommended that "cervical cancer screening should begin approximately three years after a woman starts to have vaginal intercourse, but no later than 21 years of age. Screening should be done every year with conventional Papanicolaou smear tests or every two years using the liquid-based tests. At or after 30 years of age, women who have had three consecutive, normal results may elect to be screened every two to three years. Physicians may suggest that a women screen more often if she has certain risk factors, such as HIV infection or a compromised immune system. Women who are 70 years of age and older, who have had three consecutive normal Papanicolaou tests in the last 10 years may chose to stop cervical cancer screening. Screening women who have had a total hysterectomy with removal of the cervix is not necessary unless the surgery was undertaken as a treatment for cervical cancer" (ACS, 2003, p. 48; ACS, 2004, p. 56).

For the purpose of this study, the 1999 ACS cervical cancer screening guidelines were applied to the population of Black (non-Hispanic), White (non-Hispanic), Hispanic, Asian or Pacific Islander and American Indian or Alaska Native women aged 18 to 65 years and over who reported that they had received a preventive Papanicolaou smear test some time during their lifetime, selected from the 1999 BRFSS data set. Women who had never had a preventive Papanicolaou smear, who had had a diagnostic Papanicolaou smear or were being, or had been treated for an abnormal Papanicolaou smear were excluded from the study. The study population consisted of 66,360 (82%) White, 7,236 (9%) Black, 4,774 (6%) Hispanic, 1,817 (2%) Asian or Pacific Islander and 1,117 (1.4%)

American Indian, or Alaska Native women, a total of 81,304 observations, with one record per individual.

Selection of Variables

A panel of experts was selected by the principal investigator to provide advice about the selection of the variables, conceptual, theoretical and practical relevance of the variables in reference to the Preventive Health Model and the 1999 BRFSS data set, and final formulation of the research question. Members of the panel were required to have expertise in at least one of the areas identified as being crucial to this research process. These areas of expertise included: (a) cancer epidemiology, (b) principles of cancer screening, (c) cancer prevention research, (d) cancer screening practice, (e) measurement and theory, (f) applied theory, (g) statistical methods and research design, and (h) knowledge of secondary data analysis of public health data sets using SAS. The members of the panel were considered to be experts in their field by their peers, were members of their respective professional organizations, and had published articles within their areas of expertise. A list of the members of the expert panel, and their areas of expertise may be found in appendix A.

Members of the expert panel recommended that: (a) additional references be added to the original literature review to strengthen the argument for selecting the variables from the 1999 BRFSS database to be studied, (b) because of the importance of primary care provider recommendation in cancer screening, this variable, or proxy measure for this variable, should be used as the major independent variable in the study, (c) a more detailed explanation of how the Preventive Health Model is derived from components of the Health Belief Model, the Theory of Reasoned Action and Social

77

Cognitive Theory be written, and (d) variables selected from the 1999 BRFSS data set to operationalize the constructs of the Preventive Health Model be of conceptual, theoretical and practical value to the principal investigator in the context of this study.

The covariates of cervical cancer screening were examined from the studies in the literature review of chapter 2. The covariates were consistent across the studies. None of the authors had used all of these predictors in a single study. All of these variables were examined to find out how well they explained cervical cancer screening behavior when they were all controlled for in the same study.

Two hundred and eighty-four variables in the 1999 BRFSS data set were examined to find those of conceptual, theoretical and practical importance that matched the cervical cancer screening covariates from studies in the literature review. After this process, the selected variables were assessed by members of the panel of experts to see whether they could be used to operationalize the constructs of the Preventive Health Model, because variables specify how a construct is to be measured in a specific situation (Glanz, Lewis & Rimer, 1997).

<u>Operationalization of the Constructs of the Preventive Health Model</u>

Constructs of the Preventive Health Model and descriptions of the variables selected from the 1999 BRFSS are shown in Table 1. The following paragraphs contain brief discussions about the theoretical, conceptual and practical relevance of these variables as empirical counterparts of the model constructs.

This construct was operationalized by three types of variables; socio-demographic, past screening behavior and health profile variables. These diverse variables may influence a woman's cervical cancer screening behavior.

Socio-demographic variables. The socio-demographic variables were age, ethnic origin, marital status, educational level, employment status, income level, region of

Table 1

Operationalization of the Constructs of the Preventive Health Model

Constructs of the PHM	Variables from 1999 BRFSS	References
Background Factors Construct		
1. Socio-demographic variables		
Age	Child-bearing age	Hiatt, et al., 2002
Ethnic origin*	Ethnic origin	NCI, 2004
Marital status	Marital status	Hubbell, et al., 1996
Education level	Education level	Hiatt, et al., 2002
Employment status	Employment status	Hayward, et al., 1988
Income level	Income level	Hayward, et al., 1988
Region of residence	State FIPS codes	Coughlin, et al., 2002
Insurance coverage	Health coverage	Hiatt, et al., 2002
2. Past screening behavior variables		
Mammography	Had mammogram	Simoes, et al., 1999
Breast exam	Had breast exam	Simoes, et al., 1999
3. Health profile variables		
Tobacco use	Smoking status	Simoes, et al., 1999
Obesity (BMI)	Body Mass Index	Simoes, et al., 1999
Hysterectomy	Had hysterectomy	Smith, et al., 2003
Representation Factor Construct		
Practical convenience	Convenience of medical facility location	Strecher, et al., 1997
Social Influence Factor Construct		
Rapport with primary care provider	Satisfaction with primary care provider	Baranowski, et al., 1997
Program Factor Construct		
Screening advice	Cervical cancer screening advice	Baranowski, et al., 1997

*Moderating variable

79

residence, and insurance coverage. Age and socio-economic status are highly associated with screening behavior. For example, older individuals are less likely to be screened for cervical cancer than younger individuals. Women with higher levels of education and income are more likely to be screened for cervical cancer. A number of researchers found that there were no significant regional differences found among Black American and White American women in the use of the Papanicolaou smear test, (Coughlin, Thompson, Seeff, Richards & Stallings, 2002; Hiatt, Klabunde, Breen, Swan & Ballad-Bar bush, 2002).

Members of the expert panel advised that region of residence be included in the Preventive Health Model for greater explanatory power. There are strong and consistent associations between cervical cancer screening and having insurance coverage. Women who have insurance are more likely to have received Papanicolaou smears (Hiatt, Klabunde, Breen, Swan & Ballard-Barbash, 2002).

Ethnic origin was used in this study in place of the terms race and/or ethnicity used by other researchers. This variable was chosen to remain in model as a component of the background factors construct because, although cervical cancer screening rates are higher among Black American women than among White American women (Makuc, Fried & Kleinman, 1989; Martin, Parker, Wingo & Heath, 1996), Black American women have the highest age-adjusted mortality rate for cervical cancer among all the ethnic groups with 5.6 cervical cancer deaths per 100,000. For Hispanic American women the rate is 3.6 cervical cancer deaths per 100,000; Asians/Pacific Islanders and American Indians/Alaska Natives followed with 2.8 cervical cancer deaths per 100, 000 and White American women with 2.6 cervical cancer deaths per 100,000. The age-

adjusted mortality rates for cervical cancer for all ethnic groups is 2.9 deaths per 100, 000 (Ries et al., 2004).

Marital status and employment status are strong covariates of cervical cancer screening behavior and were kept in the model (Hayward et al,. 1988; Hubbell, Chavez, Mishra & Valdez, 1996).

Past screening behavior variables. Simoes, et al. (1999) found that women who had had a mammogram or a clinical breast examination were more likely to have had a Papanicolaou smear test than those women who had not. These variables will also be included in the model.

Health profile variables. Health profile variables are a component of the background factors construct. These variables are tobacco use, and obesity measured as body mass index [BMI] calculated as weight in kilograms divided by the square of height in meters. Health profile variables and their associations with cervical cancer screening are not as well understood as their associations with breast cancer. Simoes, et al. (1999) found that women who smoke cigarettes and are obese are more likely to be non-compliant with the 1999 cervical cancer screening guidelines of the ACS.

Although there is a dearth of literature about the relationship between cervical cancer screening behavior and whether or not a woman has had a hysterectomy, members of the expert panelist advised that this variable be included in the Preventive Health Model for greater explanatory power. Primary care providers and the American Cancer Society suggest that women who have had a total hysterectomy, with removal of the cervix may not need to continue with cervical cancer screening (Smith, Cokkinides, & Eyre, 2003).

81

Representation, Social Influence and Program Factors Constructs

Each one of the following constructs was operationalized by a single variable from the 1999 BRFSS data set. To arrive at a judgment about whether or not to be screened for cervical cancer, individuals consider a number of options including practical convenience and personal benefit (Strecher & Rosenstock, 1997). One of the considerations would be the whether or not the health care facility is in a convenient location for the individual. This variable was used to measure the representation factor of practical convenience.

Social influence factors form the third set of factors. These factors include the individual's relationship or rapport with primary care providers. This construct was used measured by individual's satisfaction with the care received from her primary care provider (Baranowski, Perry & Parcel, 1997).

Program factors comprise the fourth set of factors in the Preventive Health Model. This concept is derived from Social Cognitive Theory and the Health Belief Model and refers to the contacts made by primary care providers for motivating and reinforcing a given preventive health behavior, such as cervical cancer screening (Baranowski, Perry & Parcel, 1997; Strecher & Rosenstock, 1997). In breast cancer screening literature it is well documented that primary care provider recommendation about obtaining a mammogram is strongly associated with adherence to breast cancer screening guidelines (Lippert, Eaker, Vierkant & Remington, 1999; O'Malley, Earp, Hawley, Schell, Mathews & Mitchell, 2001; Roetzheim, Fox, Leake & Houn, 1996).

The principal investigator was interested in whether primary care provider advice about cervical cancer screening could also be a covariate of adherence to cervical cancer

screening guidelines. The 1999 BRFSS does not contain a direct question on receiving

advice or a recommendation from a woman's primary care provider about cervical cancer

screening. However, the question: "During the past year, have you received advice from

your doctor or primary care provider about your sexual practices and sexually transmitted

diseases?" is in the data set. After consultation the doctoral committee and panel of

experts concurred that the question from the 1999 BRFSS data set could be used as a

proxy measure for primary care provider advice about cervical cancer screening. This

variable was used to measure the program factor of screening advice.

<div align="center">Summary of the Proposed Study</div>

According to the Theory of Reasoned Action (Fishbein & Ajzen, 1975; Ajzen &

Fishbein, 1980), the combination of background, representation, social influence and

program factors is likely to influence an individual's intention to engage in preventive

behavior, and intention is a precursor to taking preventive action. The Preventive Health

Model posits that background, psychological representation, social influence and

program factors are associated with the act of taking preventive action. In this study the

principal investigator used the Preventive Health Model to study the covariates of

cervical cancer screening behavior in the ethnically diverse population of women selected

for this study.

The dichotomous dependent or outcome variable was compliance with the 1999

cervical cancer screening guidelines of the ACS . Black (non-Hispanic), White (non-

Hispanic), Hispanic, Asian or Pacific Islander and American Indian or Alaska Native

women aged 18 to 65 years and over who reported having had a routine Papanicolaou

smear test within a year of being interviewed for the 1999 BRFSS were classified as

being adherent to the annual cervical screening recommendations of the American

Cancer Society. Women who had not had a routine Papanicolaou smear test within a year

of being interviewed for the survey were classified as not being adherent to the

compliance with the 1999 cervical cancer screening guidelines of the ACS

recommendations of the American Cancer Society. The focal independent variable was

primary care provider advice about cervical cancer screening. The moderating variable

was ethnic origin. The Preventive Health Model was used as a theoretical and

explanatory framework for examining the association between cervical cancer screening

behavior and primary care provider advice about cervical cancer screening, while

controlling for background, representation and social influence factors.

<u>Data Management</u>

A second review of the literature was performed on studies of covariates of

cervical cancer screening behavior to identify the reported magnitude and range of the

odds ratios, significant at a conventional alpha level of 0.05, for each of the variables in

the proposed study. The odds ratios in the studies ranged from 1.3 to 13.7. The women in

the 1999 BRFSS identified their ethnic origins as (a) White, (b) Black, (c) Hispanic or

Spanish, (d) Asian or Pacific Islander, (e) American Indian or Alaska Native, or (f)

"other." A series of power analyses were performed and it was determined that with a

conventional alpha level of 0.05 and a beta level of 0.20: (a) odds ratios ≥ 1.1 in the entire

sample and in the White American women sub sample, (b) odds ratios ≥ 1.2 in the Black

American women and Hispanic American women sub samples, (d) odds ratios ≥ 1.5 in the

Asian or Pacific Islander women sub sample, (e) odds ratios ≥ 1.6 in the American Indian

or Alaska Native women sub sample, (f) odds ratios ≥ 1.4 in a combined sample of Asian

84

or Pacific Islander and American Indian or Alaska Native women, would be detected with 95% certainty in the proposed study. Following the series of power analyses, a decision was made to remove the Asian or Pacific Islander and American Indian or Alaska Native women from the study because of the lack of power to detect odds ratios of at least 1.3, in either sub sample, or both samples combined.

The software package used for data management and the statistical analyses was the Statistical Analysis System, SAS$^®$ version 9.1 (SAS Institute Inc., 2002-2003). The data was analyzed using logistic regression. The justification for this type of analysis is that the dependent variable is dichotomous, and this fact has to be accounted for in the analysis (Hatcher & Stepanski, 1994; Munro, 1997). An identification number was created for each of the observations and used to check for duplicate records in the BRFSS data set. Observations which had data missing on any of the variables were deleted. This strategy, complete case analysis, is known to yield valid inferences for logistic regression models (Allison, 1999). The frequency procedure in SAS$^®$ was used to produce frequency distributions for the variables in the BRFSS data set which had been used to operationalize the Preventive Health Model, as explained earlier in Chapter 3. Univariate procedures were used to explore and understand the distributional properties of the data set. The procedure produced descriptive statistics including the mean, median, standard deviation, percentiles, kurtosis, skewness and the extremes table. (Hatcher & Stepanski, 1997).

Bivariate analyses were used to investigate the relationships among the variables. These procedures provided both a test of statistical significance and a measure of the association. The Pearson product-moment correlation coefficient was used to test the null

hypothesis that the correlation between two interval-level variables was zero in the chosen population. The Pearson correlation also assessed the strength of the relationship between two variables, irrespective of the statistical significance of the relationship. The Pearson correlation ranged from -1.0 to +1.0, with the larger absolute values indicating stronger relationships or associations between the variables (Hatcher & Stepanski, 1997). Pearson correlation coefficients of ±0.5 (moderate correlation) to ±0.9 (strong correlation) were reported.

The Chi-square test of homogeneity was used to measure the bivariate associations between the dependent variable (compliance with the 1999 cervical cancer screening guidelines of the ACS) and each of the independent variables in the study sample. The Chi-square tested the null hypothesis that in this study population the dependent and independent variables were unrelated. The larger the value of the Chi-square, the stronger was the association between the two variables in the sample being examined. The cross tabulation of the Chi-square test for differences in proportions showed the frequencies, total sample size, missing data, the p-value of the Chi-square for each of the bivariate associations and whether or not this value was significant at the conventional alpha level set at 0.05.

<u>Logistic Regression Models</u>

The data were analyzed using the logistic regression procedure. All the models were developed to: (a) determine unadjusted odds ratios, and (b) refined to determine adjusted odds ratios. The variables were added to the logistic model according to their order in the Preventive Health Model (Myers et al. 1994; Myers et al. 1996). In the first step of the analysis, the focal independent variable (primary care provider advice about

cervical cancer screening) was regressed on the dependent variable (compliance with the 1999 cervical cancer screening guidelines of the ACS). In the next step the socio-demographic variables operationalizing the background factors construct, were added *en bloc* to the regression model. The stepwise selection process in the logistic procedure was used to determine which independent variables, statistically significant at the conventional alpha level of 0.05, would be removed from the model. The difference in the Chi-square values of the -2 Log Likelihood for the overall model compared with the nested model (with fewer independent variables) was compared. The Chi-square difference was used to make the final decision about which variables would be retained or removed from the model. The health profile variables, past screening behavior variables, representation and social influence variables were added separately to each model, and the steps repeated until all the variables were entered into a resultant full model. This procedure resulted in the final, best-fitting model, without any interaction terms, containing all the variables of statistical and practical significance.

An interaction effect is said to exist when the effect of an independent variable on a dependent variable differs depending on the value of a third variable, referred to as an effect modifier or a moderator variable (Jaccard, 2001). In this study the focal independent variable was primary care provider advice about cervical cancer screening, the dependent variable was compliance with the 1999 cervical cancer screening guidelines of the ACS, and the moderator variable was ethnic origin. The values of the moderator variable were Black American women, White American women and Hispanic American women. The principal investigator was interested in whether or not ethnic origin moderated the relationship between primary care provider advice about cervical

87

cancer screening and compliance with the 1999 cervical cancer screening guidelines of the ACS . In order to evaluate the effect of the moderator variable on the relationship of interest, interaction terms were defined.

Annual cervical cancer screening is a dichotomous variable scored 1 if the woman had received a Papanicolaou smear test within one year of being surveyed for the BRFSS, and 0 if the if the woman had not received a Papanicolaou smear test within one year of being surveyed for the BRFSS. The focal predictor variable, primary care provider advice about cervical cancer screening scored 1 if such advice was given and 0 if cervical cancer screening advice was not given. Ethnic origin was the moderator variable and since it had three levels these was represented by two dummy variables. Primary care provider did not give advice about cervical cancer screening is the reference for cervical cancer screening advice, and White American women was the reference group for ethnic origin. Product term analysis was used to analyze the interaction among these variables. All the dummy variables for cervical cancer screening were multiplied by all the variables of ethnic origin. This process yielded two product terms or interaction terms which were added to the model with all the background, representation and social influence factors. This constituted the full and final model with interaction terms.

The logististic procedure in SAS® was used to estimate a binary logit model via maximum likelihood. The Likelihood Ratio Chi-square and the Score Statistic tested the hypothesis that all of the explanatory variables have coefficients of zero. These two statistics along with the Akaike's information criterion (AIC) and the Schwarz criterion (SC) were used to compare the relative fit of the data to the various models. In general,

the lower values of these statistics corresponded to the more desirable models (Allison, 1999).

The Wald Chi-square statistic was used to test the null hypothesis that each individual coefficient is equal to zero. This statistic was examined to find out whether any or all of the two 2-way interactions were statistically significant. If at least one of the interactions was found to be significant, the interaction effect will be tested by using logistic regression to determine whether the interaction terms significantly improve model fit better than when there were no interaction terms included in the model. A model Chi-square was estimated for the each of the models. The Chi-square for the model without the interaction terms was subtracted from the Chi-square for the model with the interaction terms. The difference in the Chi-square value is distributed as a Chi-square with degrees of freedom equal to the difference in the degrees of freedom between the two models. A statistically significant Chi-square difference would imply that the interaction effect was significant (Jaccard, 2001).

The next step was to examine the logistic coefficients for the non-product terms in the interaction model. The main effect for a variable that is also in a 2-way interaction has to be interpreted as the effect of that variable when the other variable in the product term is zero (Allison, 1999). The dummy variable was part of the product term in the equation therefore the logistic coefficient was conditioned on the moderator variable being zero. These points were taken into consideration when the effects of variables in the product terms were interpreted (Jaccard, 2001). The next step was to examine the logistic coefficients for the product terms. Primary care provider advice about cervical cancer screening was a dichotomous variable (scored 1 = advice given, 0 = advice not

given). The odds ratio comparing the women given advice about cervical cancer screening by their primary care provider with women not given advice about cervical cancer screening by their primary care provider was calculated for each of the ethnic origins (i. e. each level of the moderating variable). If the odds ratios were identical in value (except for sampling error) then there was no interaction effect. Different values of the odds ratios would indicate that the effect of primary care provider advice about cervical cancer screening varied depending on the ethnic origin of the women. The results were then evaluated for statistical significance by calculating the p-value and the confidence interval around the point estimate.

None of the interaction effects was found to be statistically significant, therefore the final step in the analysis was to interpret the meaning of the odds ratios in the main effects model, the model without the interaction terms. The results were evaluated for statistical significance by calculating the confidence interval around the point estimate and by calculating the p-value (Allison, 1999).

<center>Regression Diagnostics</center>

These following diagnostic tests were performed on the full and final logistic regression model developed during the model building stage of the analysis. The tolerance statistic was used to assess multicollinearity. High values of the tolerance statistic were correlated with low multicollinearity. Several statistics produced by the logistic procedure was used to measure the influence of each observation. Influence statistics indicated how much some feature of the model changes if a particular observation was deleted from the model fit (Allison, 1999). The hat matrix diagonal identified cases, or observations which influenced the logistic regression model more

<center>90</center>

than others. The leverage statistic values were between 0.0 (no influence on the model) and 1.0 (completely determined the model). Influence statistics measured the effect that deleting an observation would have on each of the regression coefficients. The DFBETA statistic indicated cases or observations which were poorly fitted by the model. The statistic measured the change in the logit coefficients if a case was dropped from the model. The cutoff criterion for observations with poor fit was where the DFBETA >1.0. The C and the CBAR statistics are analogs of the Cook's D in ordinary least squares (OLS) regression, and are a third measure of influence on an individual observation. These statistics are standardized measures of the approximate change in all regression coefficients which would occur if an individual observation was deleted from the model. The Pearson (RESCHI) and deviance (RESDEV) residuals are standardized residuals used to identify observations that were not well explained by the model. The cutoff criterion for observations with poor fit was where the RESCHI >2.0, and RESDEV >3.0 (Allison, 1999).

These procedures were used to evaluate the study null hypotheses that: (a) there is no association among the selected covariates of cervical cancer screening behavior, and compliance with the 1999 cervical cancer screening guidelines of the ACS in an ethnically diverse population of American women, (b) there is no difference in the magnitude of the association between ethnic origin and compliance with the 1999 cervical cancer screening guidelines of the ACS, (c) there is no association between primary care provider advice about cervical cancer screening behavior and compliance with the 1999 cervical cancer screening guidelines of the ACS, and (d) ethnic origin does

not moderate the association between primary care provider advice about cervical cancer

screening and compliance with the 1999 cervical cancer screening guidelines of the ACS.

CHAPTER FOUR: RESULTS

Description of the Study Sample

The results of the data analysis to answer the research questions for this study are presented in this chapter. The study population selected from the 1999 BRFSS data set consisted of: (a) Black (non-Hispanic), White (non-Hispanic) and Hispanic (Black and White) American women 18 to 65 years and over (b) who reported that they had received a preventive Papanicolaou smear, and (c) resided in the United States. Women in the data set (a) who had never had a preventive Papanicolaou smear, (b) who had had a diagnostic Papanicolaou smear or were being treated for an abnormal Papanicolaou smear, (c) had been treated for an abnormal Papanicolaou smear, or (d) resided in Puerto Rico were excluded from the study. The women responded to questions posed to them by researchers from the Centers for Disease Control and Prevention (CDC, 1999).

The data were analyzed to see if there were any significant differences among the women who answered all of the questions asked by the researchers, and those who refused to answer some of the questions posed. From the frequency analyses, it was found that White American women (11.5%) were the most likely to refuse to answer questions, followed by Black American women (3.0%), and then Hispanic women (0.5%). From the logistic regression analyses, it was found that Black American women (OR=1.7, 1.4-1.9) were more likely to have answered the questions than White American women. Black American, White American, and Hispanic American women

93

(OR=0.7, 0.5-0.9) who had an annual household income of less than \$25, 000 were also significantly more likely to have answered than women in the study sample with higher annual incomes. The questions to which the response was either "don't know/not sure" or "refused" were then deleted from the data set. The study population consisted of 52,878 (84.7%) White, 5,742 (9.2%) Black, and 3,795 (6.1%) Hispanic American women, a total of 62,415 observations, with one record per individual.

The focal independent variable in this study was *cervical cancer screening advice*. The question "During the past year, have you received advice from your primary care provider about your sexual practices and sexually transmitted diseases?" was included in one of the optional modules in the 1999 BRFSS questionnaire. This question is a proxy for the question "Has your primary care provider ever advised you about cervical cancer screening?" Given that the question was not from the core section of the BRFSS questionnaire, the researchers from the CDC were not mandated to ask this question of women in all the 1999 BRFSS reporting regions of the United States. These optional CDC modules are sets of questions on specific topics that states can elect to use on their own questionnaires (CDC, 1999).

This question was only asked of women living in the states of Louisiana, Missouri, South Carolina, Texas, Virginia and Wyoming who were 18 to 64 years of age. The study sample, therefore, consisted of: (a) Black (non-Hispanic), White (non-Hispanic) and Hispanic (Black and White) American women, 18 to 64 years of age who (b) reported that they had received a preventive Papanicolaou smear test, and (c) resided in the states of Louisiana, Missouri, South Carolina, Texas, Virginia and Wyoming. The

study sample consisted 4,302 (79.8%) White, 873 (16.2%) Black, and 217 (4.0%)

Hispanic American women, a total of 5,392 observations, with one record per individual.

To assess for differences between the women in the study sample and those in the

study population, all the women who had been asked about whether or not they had been

advised by their primary health provider about cervical cancer screening were coded 1.

There were 5,392 women in the study sample who were from the study population of

62,415 women. All the women who had not been asked about whether or not they had

been advised by their primary health provider about cervical cancer screening, and who

originally had missing data for this variable were coded 0. Therefore 57,023 women out

of 62,415 remained in the population of interest. To assess for selection bias in the study

sample, the association between the focal independent variable, *cervical cancer screening*

advice and the dependent variable, *last Pap smear* for subjects in the study population

and in the study sample were measured using the Chi-square test of homogeneity.

Significant differences were found between the women in the study population

and those in the study sample ($\chi^2 = 26.0468$, p=<.0001). The women in the study sample

were younger (18 to 64 years of age) than those in the study population (18 to 99 years of

age). The ethnic origin of the women in the study sample was significantly different from

those in the study population. Black American women comprised 16.2% of the study

sample compared to 9.2% of the women in the study population. Hispanic American

women comprised 4.0% of the study sample, and 6.1% of the study population. White

American women comprised 79.8% of the study sample and 84.7% of the study

population. The region of residence differed significantly between the women from the

study sample and the women from the study population. There were not any women from

the Northeast included in the study sample, whereas they accounted for 16.0% of the study population. Fifty-seven percent of the women in the study sample resided in the South, compared to 36.7% of the women in the study population. A summary of questions selected from the BRFSS questionnaire, the corresponding variables hypothesized to be associated with compliance to the 1999 cervical cancer screening guidelines of the ACS, and the response categories are displayed in Table 2. Details pertaining to the response categories are discussed later in the chapter.

<p style="text-align:center;">Constructs of the Preventive Health Model</p>

The Preventive Health Model posits that a broad set of factors influence an individual's decision to be screened for cervical cancer (Myers et al., 1994). The following elements make up the constructs of the model.

Background Factors Construct

This construct of the Preventive Health Model consisted of three different types of variables; socio-demographic, past screening behavior and health profile variables. These diverse variables may influence a woman's cervical cancer screening behavior.

Socio-demographic variables. Socio-demographic variables included age, ethnic origin, marital status, educational level, employment status, income level, region of residence, and insurance coverage.

Ethnic origin was the moderator variable and because it consisted of three levels: (a) Black, non-Hispanic, (b) White, non-Hispanic, and (c) Hispanic (Black or White) it was represented by two dummy variables with the White, non-Hispanic American women as the referent group.

Table 2

Variables Associated with Compliance with the 1999 Cervical Cancer Screening Guidelines of the ACS in the Study Sample

Questions from the 1999 BRFSS Survey Questionnaire	Variables from 1999 BRFSS	Response Categories
What is your age?	Child-bearing age	18-44 years/45-64 years *
What is your race/are you of Spanish or Hispanic origin?	Ethnic origin Black Hispanic White	 Black, non-Hispanic Hispanic, (Black or White) White, non-Hispanic*
Are you married?	Marital status	Yes/No*
What is the highest grade or year of school you completed?	Education level	Some college education Less than college education*
Are you employed?	Employment status	Yes/No*
Is your annual household income from all sources more than $25,000?	Income level	Yes/No*
Census Bureau Regions: Region 1, Region 2, Region 3, Region 4	State FIPS codes	Northeast, Midwest, South*, West
Do you have any kind of health care coverage?	Have health coverage	Yes/No*
Have you ever had a mammogram?	Had mammogram	Yes/No*
Have you ever had a clinical breast exam?	Had breast exam	Yes/No*
Do you smoke cigarettes, every day, some days, or not at all?	Smoking status	Yes*/No
BMI more than 27.3 kg/m^2	Body Mass Index	Yes*/No
Have you had a hysterectomy?	Had hysterectomy	Yes*/No

*Referent group

Table 2 continued

Variables Associated with Compliance with the 1999 Cervical Cancer Screening Guidelines of the ACS In the Study Sample

Questions from the 1999 BRFSS Survey Questionnaire	Variables from 1999 BRFSS	Response Categories
How would you rate the convenience of your medical facility location?**	Convenience of medical facility location	Good/Poor*
How would you rate satisfaction with your primary care provider?**	Satisfaction with primary care provider	Good/Poor*
Has your primary care provider ever advised you about cervical cancer screening?	Cervical cancer screening advice	Yes/No*
How long since your last Pap smear?	Last Pap smear	Within 1 year/Over 1 year*

* Referent group
** Questions asked in Virginia

Dummy variables also were created for marital status (married versus not married), education level (have some college education versus have no college education) and income level (annual income of $25,000 or more versus annual income of less than $25,000). The age variable was defined as being of childbearing age (18 to 44 years of age) or over childbearing age (45 to 64 years of age).The insurance coverage variable was described to the respondents as having (or not having) "any kind of health care coverage, including health insurance, prepaid plans such as HMOs or government plans such as Medicare" (CDC, 1999, p.5). The region of residence variable was constructed from the United States census bureau regions with federal information processing standards (FIPS) codes (Table 3). The "FIPS codes are a standardized set of numeric or alphabetic codes issued by the National Institute of Standards and Technology (NIST) to ensure uniform identification of geographic entities through all federal government agencies" (U.S. Census Bureau, 2003).

Table 3

Census Bureau Regions of the United States with State FIPS Codes

Region 1: Northeast	
Connecticut (09)	New Jersey (34)
Maine (23)	New York (36)
Massachusetts (25)	Pennsylvania (42)
New Hampshire (33)	
Rhode Island (44)	
Vermont (50)	

Region 2: Midwest	
Indiana (18)	Iowa (19)
Illinois (17)	Kansas (20)
Michigan (26)	Minnesota (27)
Ohio (39)	Missouri (29)
Wisconsin (55)	Nebraska (31)
	North Dakota (38)
	South Dakota (46)

Region 3: South		
Delaware (10)	Alabama (01)	Arkansas (05)
District of Columbia (11)	Kentucky (21)	Louisiana (22)
Florida (12)	Mississippi (28)	Oklahoma (40)
Georgia (13)	Tennessee (47)	Texas (48)
Maryland (24)		
North Carolina (37)		
South Carolina (45)		
Virginia (51)		
West Virginia (54)		

Region 4: West	
Arizona (04)	Alaska (02)
Colorado (08)	California (06)
Idaho (16)	Hawaii (15)
New Mexico (35)	Oregon (41)
Montana (30)	Washington (53)
Utah (49)	
Nevada (32)	
Wyoming (56)	

Modified from U.S. Census Bureau, Geography Division, 2003

Past screening behavior variables. Simoes, et al. (1999) found that women who had had a mammogram (had a mammogram versus not had a mammogram) or a clinical (i.e. physical) breast examination (had a physical breast exam versus not had a physical breast exam) at some time during their lives, were more likely to have had a Papanicolaou smear test than those women who had not. These variables were also included in the model.

Health profile variables. Health profile variables were a component of the background factors construct. These variables were tobacco use status, and obesity measured as body mass index [BMI] calculated as weight in kilograms divided by the square of height in meters, and whether or not a woman has had a hysterectomy. Health profile variables and their associations with cervical cancer screening are not as well understood as their associations with breast cancer. Simoes, et al. (1999) found that women who are obese, and smoke tobacco, are more likely to be non-compliant with cervical cancer screening guidelines. Obesity was measured as not obese (BMI < 27.3 kg/m^2) and obese (BMI ≥ 27.3 kg/m^2). Women in the 1999 BRFSS were asked "Do you smoke cigarettes every day, some days or not at all?" Tobacco use status was measured as smoke and do not smoke. Although there is a dearth of literature about the relationship between cervical cancer screening behavior and whether or not a woman has had a hysterectomy (not had hysterectomy versus had hysterectomy) the variable was included in the Preventive Health Model to see if greater explanatory power could be gained.

Representation, Social Influence and Program Factors Constructs

Each one of these constructs of the PHM was operationalized by a single variable from the 1999 BRFSS data set. To arrive at a judgment about whether or not to be screened for cervical cancer, individuals consider a number of options including practical convenience and personal benefit (Strecher & Rosenstock, 1997). One of the considerations was whether or not a health care facility is conveniently located. This variable was used to measure the representation factor construct of practical convenience of medical facility (good versus poor) in terms of adequacy of location.

Social influence factors formed another set of factors. In this study there is a single social influence factor which is the woman's relationship or rapport with her primary care provider. The social influence factor construct was measured by the woman's satisfaction (good versus poor) with the care received from her primary care provider (Baranowski, Perry & Parcel, 1997).

Program factors comprised an additional set of factors in the Preventive Health Model. This concept, derived from Social Cognitive Theory and the Health Belief Model, referred to the contacts made by primary care providers for motivating and reinforcing a given preventive health behavior, such as cervical cancer screening (Baranowski, Perry & Parcel, 1997; Strecher & Rosenstock, 1997). In the breast cancer screening literature it is well documented that primary care provider recommendation about obtaining a mammogram is strongly associated with compliance to breast cancer screening guidelines (Lippert, Eaker, Vierkant & Remington, 1999; O'Malley, Earp, Hawley, Schell, Mathews & Mitchell, 2001; Roetzheim, Fox, Leake & Houn, 1996). A single variable, advice

about cervical cancer screening received from a primary care provider (yes versus no) was used to measure the program factor construct of the PHM in this study.

Data Analyses

Frequency Analyses

Frequency procedures were used to obtain descriptive statistics on the characteristics of women in the study sample. The characteristics of this sample, presented in terms of the constructs of the Preventive Health Model, are summarized in Table 4. The questions "Thinking of the distance or time you travel to get to the place you usually go to [*medical facility*] how would you rate the convenience of that place?" and "How would you rate your satisfaction with the overall health care provided by your primary care provider?" were asked of women in Virginia (CDC, 2002). A total of 1,081 women in Virginia answered the question about the practical convenience of the location of their medical facility. The women (97.3%) rated the convince of the location as being "very good" and 2.7% of the women rated the convenience as being "poor." A total of 1,198 Virginian women answered the question on rapport with their primary care provider. The women (96.9%) rated rapport with their primary care providers as being "very good" and 3.1% of the women rated rapport as being "poor." Given that the questions were only asked of women in one of the six reporting sites in the study sample, these variables were not included in further analysis of the data set.

There were statistically significant differences in the sources of health care coverage among the women in the study sample. The major sources of health coverage for the Black American women were through their employers (76.5%), through someone else's employer (9.5%) and through Medicaid or Medical Assistance (7.6%).

102

Table 4

Descriptive Statistics of the Study Sample

Constructs of the PHM	# Black Women (16.2%) Number (%)	# Hispanic Women (4.0%) Number (%)	# White Women (79.8%) Number (%)	# Study Sample (100.0%) Number (%)
Age				
18 - 44 years	595 (11.0%)	156 (2.9%)	2616 (48.5%)	3367 (62.4%)
45 – 64 years	278 (5.2%)	61 (1.1%)	1686 (31.3%)	2025 (37.6%)
Ethnic origin				
Black	873 (16.2%)			873 (16.2%)
Hispanic		217 (4.0%)		217 (4.0%)
White			4302 (79.8%)	4302 (79.8%)
Marital status				
Married	268 (5.0%)	124 (2.3%)	2698 (50.0%)	3090 (57.3%)
Not married	605 (11.2%)	93 (1.7%)	1604 (30.0%)	2302 (42.7%)
Educational level				
Some college education	412 (7.6%)	119 (2.2%)	2598 (48.2%)	3129 (58.0%)
No college education	461 (8.6%)	98 (1.8%)	1704 (31.6%)	2263 (41.9%)
Employment status				
Employed	649 (12.0%)	148 (2.7%)	3140 (58.2%)	3937 (73.0%)
Unemployed	224 (4.2%)	69 (1.3%)	1162 (21.6%)	1455 (27.0%)
Income level (annual)				
At least $25,000	375 (7.0%)	128 (2.4%)	3042 (56.4%)	3545 (65.8%)
Less than $25,000	498 (9.2%)	89 (1.7%)	1260 (23.4%)	1847 (34.3%)
Insurance Coverage				
Yes	667 (12.4%)	166 (3.1%)	3694 (68.5%)	4527 (84.0%)
No	206 (3.9%)	51 (1.0%)	608 (11.3%)	865 (16.0%)
Region of residence				
Midwest	86 (1.6%)	25 (0.7%)	1347 (25.0%)	1458 (27.0%)
South	785 (14.6%)	146 (2.7%)	2144 (39.8%)	3075 (57.0%)
West	2 (0.04%)	46 (0.9%)	811 (15.0%)	859 (15.9%)
Mammography				
Had mammogram	512 (9.5%)	106 (2.0%)	2443 (45.3%)	3061 (56.8%)
Not had mammogram	361 (6.7%)	111 (2.1%)	1859 (34.5%)	2331 (43.2%)
Breast exam				
Had breast exam	744 (13.8%)	196 (3.6%)	4020 (74.6%)	4960 (92.0%)
Not had breast exam	129 (2.4%)	21 (0.4%)	282 (5.2%)	432 (8.0%)

Percentages may not equal 100% because of rounding.

Table 4 continued

Descriptive Statistics of the Study Sample

Constructs of the PHM	# Black Women (9.2%) Number (%)	# Hispanic Women (6.1%) Number (%)	# White Women (84.7%) Number (%)	# Study Sample (100.0%) Number (%)
Tobacco use				
Smoke	173 (3.2%)	40 (0.7%)	1161 (21.5%)	1374 (25.5%)
Do not smoke	700 (13.0%)	177 (3.9%)	3141 (58.3%)	4018 (74.5%)
Obesity (BMI)				
Obese	450 (8.4%)	75 (1.4%)	1355 (25.1%)	1880 (34.9%)
Not obese	423 (7.8%)	142 (2.6%)	2947 (54.7%)	3512 (65.1%)
Hysterectomy				
Had hysterectomy	174 (3.2%)	31 (0.6%)	900 (16.7%)	1105 (20.5%)
Not had hysterectomy	699 (13.0%)	186 (3.5%)	3402 (63.1%)	4287 (79.5%)
*Practical convenience**				
Very good	222 (20.5%)	34 (3.2%)	796 (74.0%)	1052 (97.3%)
Poor	3 (0.3%)	2 (0.2%)	24 (2.2%)	29 (2.7%)
*Rapport with primary care provider**				
Very good	236 (19.7%)	40 (3.3%)	886 (74.0%)	1162 (96.9%)
Poor	13 (1.1%)	0 (0.0%)	23 (1.9%)	36 (3.0%)
Screening advice				
Yes	403 (7.5%)	82 (1.5%)	1426 (26.5%)	1911 (35.4%)
No	470 (8.7%)	135 (2.5%)	2876 (53.3%)	3481 (64.6%)
Compliance with the 1999 cervical cancer screening guidelines of the ACS guidelines				
Yes	698 (13.0%)	165 (3.1%)	3602 (56.8%)	3925 (72.8%)
No	175 (3.3%)	52 (1.0%)	1240 (23.00%)	1467 (27.2%)

Percentages may not equal 100% because of rounding.

The major sources of health coverage for Hispanic and White American women were virtually identical. Hispanic women were covered through their employers (52.8%), provided through someone else's employer (20.9%) or through indemnity plans (10.4%). The major sources of health coverage for White American women were through their

employers (55.7%), through someone else's employer (27.4%) or through indemnity

plans (9.6%). The different sources of health care coverage are summarized in Table 5.

Table 5

Sources of Health Care Coverage for the Study Sample

Health Care Coverage	Black Women Number (%)	Hispanic Women Number (%)	White Women Number (%)
Health care coverage provided by employer	443 (76.5%)	86 (52.8%)	1983 (55.7%)
Health care coverage provided by someone else's employer	55 (9.5%)	34 (20.9%)	978 (27.4%)
Indemnity plan	17 (2.9%)	17 (10.4%)	342 (9.6%)
Medicare	0 (0.0%)	0 (0.0%)	5 (0.1%)
Medicaid or Medical Assistance	44 (7.6%)	15 (9.2%)	108 (3.0%)
CHAMPUS, VA	15 (2.6%)	9 (5.5%)	102 (2.9%)
Indian Health Service	0 (0.0%)	1 (0.6%)	1 (0.03%)
Some other source	5 (0.9%)	1 (0.6%)	39 (1.1%)
Total	581 (100%)	163 (100%)	3558 (100%)

Percentages may not equal 100% because of rounding.

Univariate Analyses

The data were screened using the univariate procedure in SAS® to review the

quality of the data before conducting more sophisticated analyses. The univariate

procedure produced a number of descriptive statistics including skewness, kurtosis, and a

table of extreme observations for identifying outliers in the data set. This feature of SAS®

also produced a significance test for the null hypothesis that the data came from a

normally distributed population. It is important to test for normality of the data because

extremely non-normal data may lead to erroneous conclusions in inferential statistical

analyses. If the assumption of normality is violated, the likelihood of making a Type I or

alpha error (i.e. rejecting the null hypothesis when it is true) increases. A Type II or beta

105

error results when one fails to reject the null hypothesis when it is false. The second problem with extremely non-normal data is that they may cause bias in the correlation coefficients. Logistic regression does not need the dependent variable to be normally distributed, neither does it assume a linear relationship between the dependent and independent variables (Tabachnick & Fidell, 1996). Therefore, these restrictions do not apply to the analysis of this data set.

The univariate procedure produced a number of descriptive statistics of use in screening the quantitative variables. Selected values for the skewness and kurtosis statistics are displayed in Table 6.

Table 6

Summary of Selected Descriptive Univariate Statistics Skewness and Kurtosis for Variables in the Study Sample

Variable Name	Skewness	Kurtosis
Had breast exam	-3.1	7.6
Hispanic ethnic origin	4.7	19.9

The skewness statistic characterized the degree of asymmetry of the variable distribution around its mean. The variable *had breast exam* exhibited negative skewness indicating that the distribution had an asymmetrical tail that extended towards the lower values in the distribution. The variable *Hispanic ethnic origin* exhibited positive skewness that indicated that the distributions had asymmetrical tails extending towards the higher values in the distribution. Normal distributions produce a skewness statistic of about zero, with values of 2.0 standard errors of skewness.

106

Kurtosis characterized the relative peakedness or flatness of the distributions compared to the normal distribution. Mesokurtic (normal) distributions produce a kurtosis statistic of about zero. Positive kurtosis is indicated by a relatively peaked, or leptokurtic distribution, and negative kurtosis is indicated by a relatively flat, or platykurtic distribution. The variables in Table 6 displayed leptokurtic distributions. The other variables in the data set had values of the standard errors of the skewness statistic ranging from -1.5 to + 1.8, and values of the standard errors of the kurtosis statistic ranging from -1.9 to + 1.7. The table for extreme observations was examined to identify any observations that had contributed outliers to the data set. No such observations were found.

Bivariate Analyses

The correlation procedure further facilitated decisions on which variables were redundant in the model building process, and could, therefore, be removed from the analyses. This procedure was used to assess the strength of association between each of the variables in the study sample. The Pearson correlation coefficient ranges from no correlation (0.0) to perfect correlation (± 1.0). The associations of variables with a Pearson correlation of ± 0.3 and higher were reported. The results of the correlation analyses are summarized in Table 7.

The strength of the correlations varied from the absolute value of 0.3 (weak) to the absolute value of 0.6 (moderate). The negative value of the coefficient between *had hysterectomy * had mammogram* meant that if a women had had a mammogram, she was less likely to have had a hysterectomy. The negative value of the coefficient between *child-bearing age * had mammogram* meant that the younger the woman in the study

sample, the less likely she was to have had a mammogram. There were no strongly
correlated variables (absolute values of ± 0.7 to ± 0.9). Therefore, variables were not
dropped from the model at this point in the analyses.

Table 7

Summary of the Correlation Analyses: Assessment of the Strength of Association between each of the Variables in the Study Sample

Variable Names	Pearson Coefficient	Strength of Correlations	P-value
Employment status * Education level	0.3	weak correlation	<.0001
Had hysterectomy * Had mammogram	-0.3	weak correlation	<.0001
Income level * Have health coverage	0.3	weak correlation	<.0001
Education level * Had mammogram	0.4	moderate correlation	<.0001
Marital status * Income level	0.4	moderate correlation	<.0001
Child-bearing age * Had mammogram	-0.5	moderate correlation	<.0001
Child-bearing age * Had hysterectomy	0.4	moderate correlation	<.0001
Child-bearing age * Cervical cancer screening advice	0.3	weak correlation	<.0001

The Chi-square test of homogeneity was used to measure the bivariate
associations between the dependent variable (compliance with the 1999 cervical cancer
screening guidelines of the ACS) and each of the independent variables. The Chi-square
tested the null hypothesis that the dependent and independent variables were unrelated.
The larger the value of the Chi-square, the stronger was the association between the two
variables under examination in the sample. The cross tabulation of the Chi-square test for
differences in proportions showed the frequencies, total sample size, missing data, the p-
value of the Chi-square for each of the bivariate associations and whether or not this
value was statistically significant at the conventional alpha level of 0.05 (Hatcher &
Stepanski, 1994). The results for the Chi-square analyses are reported in Table 8. The

108

bivariate associations between *marital status* and *last Pap smear* (p = 0.2844) and

Hispanic ethnic origin (p = 0.2731) were not statistically significant.

Table 8

Chi-Square Analyses: Measurement of the Bivariate Associations between each Independent Variable and the Dependent Variable in the Study Sample

Cross Tabulations	Chi-Square Value	P-value
Education level * Last Pap smear	42.6	<.0001
Employment status * Last Pap smear	5.2	0.0223
Had mammogram * Last Pap smear	4.1	0.0427
Had hysterectomy * Last Pap smear	65.0	<.0001
Have health coverage * Last Pap smear	113.3	<.0001
Income level * Last Pap smear	30.0	<.0001
Marital status * Last Pap smear	1.1	0.2844
Cervical cancer screening advice * Last Pap smear	118.2	<.0001
Had breast exam * Last Pap smear	90.7	<.0001
Smoking status * Last Pap smear	36.6	<.0001
Child-bearing age * Last Pap smear	88.7	<.0001
Black ethnic origin * Last Pap smear	30.0	<.0001
Hispanic ethnic origin* Last Pap smear	1.2	0.2731
White ethnic origin * Last Pap smear	28.1	<.0001
Body Mass Index * Last Pap smear	33.8	<.0001
State FIPS codes * Last Pap smear	71.4	<.0001

Logistic Regression Analyses

After using the PHM as a guide for selecting the preliminary variables from the

1999 BRFSS, the data were analyzed using stepwise, binomial logistic regression

featuring nested models. The justification for using this type of analysis is the fact that

the dependent variable (compliance with the 1999 cervical cancer screening guidelines of

the ACS) is a categorical variable and this feature had to be accounted for in the analysis.

Logistic modeling was used to find the best model to explain the association between the

focal independent variable, *cervical cancer screening advice*, and compliance with the

1999 cervical cancer screening guidelines of the ACS, while simultaneously controlling

for confounding of the association by the other independent variables.

The first step in this procedure was to construct models of the unadjusted odds

ratio estimates for each of the independent variables to see which of the variables was an

independent determinant of compliance with the 1999 cervical cancer screening

guidelines of the ACS. Each independent variable was regressed on the dependent

variable. The results of this procedure are summarized in Table 9.

Table 9

Models of Unadjusted Odds Ratio Estimates for Covariates of Compliance with the 1999 Cervical Cancer Screening Guidelines of the ACS

Variable	β estimate	Unadjusted OR	95% CI	P-value
Child-bearing age	0.58	1.79	1.59 – 2.02	<.0001
Black ethnic origin	0.47	1.60	1.34 – 1.91	<.0001
Hispanic ethnic origin	0.18	1.19	0.87 – 1.64	0.2737
White ethnic origin	-0.43	0.65	0.55 – 0.76	<.0001
Marital status	-0.07	0.94	0.83 – 1.06	0.2844
Education level	0.40	1.49	1.32 – 1.69	<.0001
Employment status	0.16	1.17	1.02 – 1.33	0.0224
Income level	0.32	1.40	1.24 – 1.59	<.0001
State FIPS codes	-0.00	1.00	0.99 - 1.00	0.3065
Have health coverage	0.81	2.24	1.93 – 2.61	<.0001
Had mammogram	0.12	1.13	1.00 – 1.28	0.0428
Had breast exam	0.94	2.57	2.10 – 3.13	<.0001
Smoking status	0.41	1.50	1.32 – 1.72	<.0001
Body Mass Index	0.37	1.44	1.27 – 1.63	<.0001
Had hysterectomy	0.58	1.78	1.54 – 2.04	<.0001
Cervical cancer screening advice	0.75	2.11	1.84 - 2.41	<.0001

The variables *Hispanic ethnic origin, marital status, employment status* and *state

FIPS codes* were not statistically significant determinants of compliance. *White ethnic

origin* had a statistically significant inverse association with screening compliance. That

is, White American women were, independent of any other covariates, less likely to

comply with the 1999 cervical cancer screening guidelines of the ACS. All the other variables were independent determinants of cervical cancer screening compliance. All of the variables were retained for modeling the adjusted odds ratio for cervical cancer screening compliance with logistic regression procedures. The PHM was used to guide the construction of the regression models.

The next step in the analyses was to build the best fitting model for the variables. The focal independent variable, *cervical cancer screening advice,* was regressed on the dependent variable *last Pap smear*. The results are reported in Table 9. *Last Pap smear* was retained as a variable in the model.

In the next step, all of the socio-demographic variables were added *en bloc* to the regression model in the order outlined by the PHM. The iterative stepwise procedure in SAS® was used to guide the selection of the best variables to include in the regression model for the background factors construct of the PHM. The residual Chi-square test was used to assess the overall logistic model by comparing the difference in the Likelihood Ratio Chi-square between the overall model and the nested model. In general, if the p-value of the Chi-square at the alpha level of 0.05 was statistically significant, the variables were retained in the model. If the p-value was not statistically significant, the redundant variables were dropped from the model. This process was repeated until the full regression model containing all the relevant variables was obtained (Table 10). The iterative, stepwise, logistic procedures used in building the full, and final logistic model are presented in Appendix B.

Two interaction terms (*interaction_Black ethnic origin* and *interaction_Hispanic ethnic origin*) were formed to evaluate the effect of the moderator variable *ethnic origin*

111

on the relationship between primary care provider recommendation and cervical cancer

screening compliance. *Ethnic origin* consisted of three levels *Black ethnic origin,*

Hispanic ethnic origin, and the referent level, *White ethnic origin*.

Table 10

Model H: Final Model of Adjusted Odds Ratio Estimates for Covariates of Compliance with the 1999 Cervical Cancer Screening Guidelines of the ACS

Variable Name	β estimate	Adjusted OR	95% CI	P-value
Child-bearing age	0.57	1.78	1.50 – 2.08	<.0001
Black ethnic origin	0.60	1.83	1.51 – 2.22	<.0001
Hispanic ethnic origin	0.30	1.34	1.00 – 1.89	0.0847
Have health coverage	0.80	2.23	1.90 – 2.63	<.0001
Had mammogram	0.60	1.82	1.55 – 2.14	<.0001
Had breast exam	0.84	2.32	1.87 – 2.88	<.0001
Smoking status	0.30	1.35	1.17 – 1.55	<.0001
Body mass index	0.38	1.46	1.28 – 1.67	<.0001
Had hysterectomy	0.47	1.60	1.36 – 1.88	<.0001
Cervical cancer screening advice	0.63	1.90	1.61 – 2.17	<.0001

The interaction terms were added to the model (Table 11). The iterative stepwise

procedure was used to select the variables that best fit the logistic regression model. The

model Chi-square was used to assess the overall logistic model by comparing the

difference in the Likelihood Ratio Chi-square between the full model and the full model

with interaction terms. The residual Chi-square test was used to determine which model

was a better fit for the data. The p-value of the Chi-square at the alpha level of 0.05 was

not statistically significant, ($p = 0.6998$). Therefore the interaction terms were dropped

from the model. Although *Hispanic ethnic origin* was not statistically significant it was

forced to remain in the model because the Hispanic American women needed to be

controlled for in the analysis. The final regression model is displayed in Table 10.

112

Table 11

Model I: Adjusted Odds Ratio Estimates for Covariates of Compliance with the 1999 Cervical Cancer Screening Guidelines of the ACS with Interaction Terms

Variable	β estimate	Adjusted OR	95% CI	P-value
Child-bearing age	0.57	1.78	1.50 – 2.08	<.0001
Black ethnic origin	0.62	1.83	1.51 – 2.22	<.0001
Hispanic ethnic origin	0.21	1.34	1.00 – 1.89	0.3007
Have health coverage	0.82	2.23	1.90 – 2.63	<.0001
Had mammogram	0.60	1.82	1.55 – 2.14	<.0001
Had breast exam	0.84	2.32	1.87 – 2.88	<.0001
Smoking status	0.30	1.35	1.17 – 1.55	<.0001
Body mass index	0.38	1.46	1.28 – 1.67	<.0001
Had hysterectomy	0.47	1.60	1.36 – 1.88	<.0001
Interaction_Black ethnic origin	-0.03	1.00	0.66 – 1.44	0.8768
Interaction_White ethnic origin	0.32	1.38	0.64 – 3.00	0.4162
Cervical cancer screening advice	0.62	1.86	1.56 – 2.19	<.0001

Regression Diagnostics Analyses

The following diagnostic tests were performed on the final logistic regression model developed during the model building stage of the analysis. The tolerance statistic was used to assess multicollinearity. High values of the tolerance statistic were correlated with low multicollinearity. The tolerance statistic ranged from 0.64 to 0.98 indicating low multicollinearity among the independent variables. Several statistics produced by the logistic procedure were used to measure the influence of each observation. Influence statistics indicated how much a given feature of the model changes if a particular observation is deleted from the model fit (Allison, 1999). The influence statistics are the: (a) hat matrix diagonal statistic, (b) DFBETA statistic, (c) C statistic and (d) CBAR statistic. The hat matrix diagonal, also described as a leverage statistic, identified cases, or observations that influenced the logistic regression model more than others. The leverage statistic values were between 0.0 (no influence on the model) and 1.0

113

(completely determined the model). Influence statistics measured the effect that deleting

an observation would have on each of the regression coefficients. The DFBETA statistic

indicated cases or observations that were poorly addressed by the model. The DFBETA

statistic measured the change in the logit coefficients if a case was dropped from the

model. The cutoff criterion for observations with poor fit was where the DFBETA was

>1.0. The C and the CBAR statistics are a third measure of influence on an individual

observation. These statistics are standardized measures of the approximate change in all

regression coefficients that would occur if an individual observation was deleted from the

model. The Pearson (RESCHI) and deviance (RESDEV) residuals are standardized

residuals used to identify observations that are not well explained by the model. The

cutoff criterion for observations with poor fit was where the RESCHI

was >2.0, and RESDEV was >3.0 (Allison, 1999). These procedures were used to

evaluate each of study null hypotheses associated with the research questions.

<div align="center">Summary of the Data Analyses</div>

Research Question 1

The first research question posed whether there was an association between each

of the selected covariates of cervical cancer screening behavior and compliance with the

1999 annual cervical cancer screening guidelines of the ACS as recommended in this

ethnically diverse population of American women. The null hypothesis posited that there

was no association between each of the selected determinants of cervical cancer

screening behavior, and compliance with the 1999 cervical cancer screening guidelines of

the ACS in this ethnically diverse population of American women.

<div align="center">114</div>

Nine of the fourteen selected covariates (64.3%) of cervical cancer screening behavior were found to be significantly associated with the dependent variable *compliance with the 1999 annual cervical screening guidelines of the ACS.* The independent covariate variables were *black ethnic origin, child-bearing age, have health coverage, had mammogram, had breast exam, smoking status, body mass index, had hysterectomy* and *cervical cancer screening advice* (Table 10).

Black ethnic origin. Black American women were 1.83 (CI=1.51-2.22) times more likely than the referent group, White American women, to have had an annual Papanicolaou smear test as recommended by the 1999 guidelines of the ACS.

Child-bearing age. Black, Hispanic and White American women who were of childbearing age (18 to 44 years of age) were 1.78 (CI=1.50-2.08) times more likely to have had an annual Papanicolaou smear test than those women who were not of childbearing age (45 to 64 years of age).

Have health coverage. Women who had health coverage were 2.23 (CI=1.90-2.63) times more likely to have had an annual Papanicolaou smear test than women who did not have health coverage.

Had mammogram. Women who had had a mammogram were 1.82 (CI=1.55-2.14) times more likely to have had an annual Papanicolaou smear test than women who had not ever had a mammogram.

Had breast exam. Women who had had a clinical (physical) breast exam were 2.32 (CI=1.87-2.88) times more likely to have had an annual Papanicolaou smear test than women who in the study sample who had not had a breast exam.

115

Smoking status. Women who were non-smokers were 1.35 (CI=1.17-1.55) times more likely to have had an annual Papanicolaou smear test than women who were smokers.

Body mass index. Women who were not obese (BMI <27.3 kg/m^2) were 1.46 (CI=1.28-1.67) times more likely to have had an annual Papanicolaou smear test than women who were obese (BMI≥27.3 kg/m^2).

Had hysterectomy. Women who had not had a hysterectomy were 1.60 (CI=1.36-1.88) times more likely to have had an annual Papanicolaou smear test than women who in the study sample who had had a hysterectomy.

Cervical cancer screening advice. Women who had been advised by their primary care provider about cervical cancer screening were 1.90 (CI=1.61-2.17) times more likely to have had an annual Papanicolaou smear test than women who had not been advised by about cervical cancer screening by their primary care provider.

Research Question 2

The second research question inquired whether there was a difference in the magnitude of the association between ethnic origin and compliance with the 1999 cervical cancer screening guidelines of the ACS. The null hypothesis posited that there was no difference in the magnitude of the association between ethnic origin and compliance with the 1999 cervical cancer screening guidelines of the ACS.

The results of the analyses showed that Black American women were 1.83 times more likely than the referent group, White American women, to have had an annual Papanicolaou smear test as recommended by the 1999 guidelines of the ACS.

Research Question 3

The third research question asked whether there was an association between primary care provider advice about cervical cancer screening and compliance with the 1999 cervical cancer screening guidelines of the ACS. The null hypothesis posited that there was no association between primary care provider advice about cervical cancer screening and compliance with the 1999 cervical cancer screening guidelines of the ACS.

The results of the analyses indicated that in the study sample, the Black, White, and Hispanic American women who had been advised by their primary care provider about cervical cancer screening were 1.90 (CI=1.61-2.17) times more likely to have had an annual Papanicolaou smear test than women who had not been advised by about cervical cancer screening by their primary care providers.

Research Question 4

The fourth research question asked whether the association between primary care provider advice about cervical cancer screening and compliance with the 1999 cervical cancer screening guidelines of the ACS was moderated by ethnic origin. The null hypothesis posited that ethnic origin did not moderate the association between primary care provider advice about cervical cancer screening and compliance with the 1999 cervical cancer screening guidelines of the ACS. The results indicated that the association was not moderated by ethnic origin (p=0.8768, p=0.4162). In other words, there was not any difference in primary care provider advice and subsequent cervical cancer screening compliance among Black, White and Hispanic American women.

117

CHAPTER FIVE: SUMMARY, DISCUSSION, CONCLUSIONS,

RECOMMENDATIONS

Summary

Black American women have the highest age-adjusted mortality rate for cervical

cancer among all ethnic groups with 5.6 cervical cancer deaths per 100,000. For Hispanic

American women the rate is 3.6 cervical cancer deaths per 100,000, and White American

women 2.6 cervical cancer deaths per 100,000. The age-adjusted mortality rates for

cervical cancer for all ethnic groups is 2.9 deaths per 100, 000 (Ries et al., 2004). The

literature suggests that the number of deaths from cervical cancer in the United States

could be reduced by preventive screening, a public health intervention strategy (CDC,

1998-1999; DHHS. Race and health: Cancer management, 1999; Franco, Duarte-Franco,

& Ferenczy, 2001; Holmquist, 2000; Klaes, et al. 2001; Koop, 1997; MMWR, 1997;

Runowicz & Fields, 1999; Sasieni & Adams, 1999; Schiffman, Brinton, Devessa &

Fraumeni, 1996).This investigation was proposed on the premise that if cervical cancer

screening rates could be increased in this population of women, particularly among Black

American women, then the mortality rates would decrease (CDC, 1998-1999; DHHS.

Race and health: Cancer management, 1999; Franco, Duarte-Franco, & Ferenczy, 2001;

Holmquist, 2000; Klaes, et al. 2001; Koop, 1997; MMWR, 1997; Runowicz & Fields,

1999; Sasieni & Adams, 1999; Schiffman, Brinton, Devessa & Fraumeni, 1996).

Therefore, the primary objective of this investigation was to study the association among the covariates of compliance with the 1999 cervical cancer screening guidelines of the ACS (cervical cancer screening behavior) and to explore the relationship between primary care provider advice about cervical cancer screening and compliance with these screening guidelines in an ethnically diverse population of American women. The secondary purpose of this study was to examine the utility of the Preventive Health Model as a theoretical model in guiding research in cervical cancer screening behavior in this ethnically diverse population of women, using survey data from the 1999 Behavioral Risk Factor Surveillance System.

The findings of this study will be further discussed in terms of the research questions posed.

Research Question 1

Is there an association between each of the selected covariates of cervical cancer screening behavior and compliance with the 1999 cervical cancer screening guidelines of the ACS in this ethnically diverse population of American women?

Nine covariates of cervical cancer screening behavior were found to be significantly associated with compliance with the 1999 annual cervical screening guidelines of the ACS. The results indicated that Black, Hispanic and White American women of child-bearing age (18 to 44 years of age) who (a) had health care coverage, (b) had had a screening mammogram, (c) had had a clinical (physical) breast examination, (d) were non-smokers, (e) were not obese, (f) had not had a hysterectomy and (g) had been advised by their primary care providers about cervical cancer screening were approximately twice as likely as to have been compliant with the 1999 cervical

119

cancer screening guidelines of the ACS, as those women without these characteristics. Conversely, the women in the study sample who were older and not of child-bearing age (45 to 64 years of age) who (a) did not have health care coverage, (b) had not had a screening mammogram, (c) were smokers, (d) were obese (had a body mass index ≥ 27.3 kg/m^2), (e) had had a hysterectomy, were less likely to have been compliant with the 1999 annual cervical cancer screening of the ACS.

Research Question 2

Is there a difference in the magnitude of the association between ethnic origin and compliance with the 1999 cervical cancer screening guidelines of the ACS?

Black American women were nearly twice as likely as White American women to have had an annual Papanicolaou smear test as recommended by the 1999 cervical screening guidelines of the ACS. Conversely, White American women were 0.55 times less likely than the Black American women to have had an annual Papanicolaou smear test. Although the effect of the Hispanic American group was not found to be statistically significant, the information indicated that Hispanic American women had screening characteristics that were similar to those of the White American women. Therefore, Hispanic American women were less likely than Black American women to have had an annual Papanicolaou smear test.

In practical terms the results indicated that White American women of child-bearing age (18 to 44 years of age) who had health care coverage, had had a screening mammogram, had had a clinical (physical) breast examination and had been advised by their primary care providers about cervical cancer screening were approximately half as likely as Black American women of the same status, to have had an annual Papanicolaou

120

smear test. Hispanic American women were also more likely to have had similar screening characteristics as those of the White American women, and thus, they were less likely to have had an annual Papanicolaou smear test.

The cervical cancer screening rate was defined as the percentage of women 18 to 64 years of age who were enrolled in a health plan and had had a Papanicolaou screening smear within a year of being interviewed for the 1999 BRFSS (National Committee for Quality Assurance, 2002). The goal of *Healthy People 2000* was for women in the nation to attain an average cervical cancer screening rate of 85% and for *Healthy People 2010* the goal was 90% (Healthy People 2010, 2000; Healthy People 2000 Final Review, 2001). The average cervical cancer screening rates in 1999 for the women in the study sample were: (a) 80% for Black American women, (b) 71.2% for White American women, and (c) 76.0% for Hispanic American women. It can, therefore, be observed that even though Black American women were twice as likely as White American women to have been compliant with the 1999 annual cervical cancer screening guidelines of the ACS, both groups fell short of meeting the minimum *Healthy People 2000* cervical cancer screening rate goal. Hispanic American women are also included in this sub-optimal group of screeners because their cervical cancer screening rate is higher than that of White American women, but lower than the rate of Black American women.

Research Question 3

Is there an association between primary care provider advice about cervical cancer screening and compliance with the 1999 cervical cancer screening guidelines of the ACS?

One of the objectives of this study was to investigate the association between primary care provider advice about cervical cancer screening and compliance with the 1999 annual cervical cancer screening guidelines of the ACS. The results showed that there was a statistically significant association between these two variables, namely that Black, Hispanic and White American women, who had been advised by their primary care provider about cervical cancer screening, were about twice as likely to have had an annual Papanicolaou smear test as women who had not been advised about cervical cancer screening by their primary care providers.

<u>Research Question 4</u>

Is the association between primary care provider advice about cervical cancer screening and compliance with the 1999 cervical cancer screening guidelines of the ACS moderated by ethnic origin?

It also was found that ethnic origin did not moderate the association between primary care provider advice about cervical cancer screening and compliance with the 1999 cervical cancer screening guidelines of the ACS. In other words, primary care provider advice about cervical cancer screening did not differentially impact the Black, White or Hispanic American women in any statistically significant manner.

The responses to research questions 3 and 4 were extremely important because they emphasized that primary care provider advice about cervical cancer screening was equally important for compliance with the 1999 annual cervical cancer screening guidelines of the ACS among Black American, Hispanic American and White American. The implication of the responses to these questions will be discussed in the next section of the chapter.

<u>Discussion</u>

<u>Implications for Public Health Intervention Strategies</u>

Intervention strategies need to be developed that are specifically tailored to older

women who are no longer of child-bearing age. To develop these strategies it is important

to understand the reasons for underutilization of cervical cancer screening in this

population of women. Calle et al. (1993) suggest that the decrease in regular cervical

cancer screening among older women could be due to a decrease in regular gynecological

examinations among these women. Wells and Horm (1997) report that when the

reproductive needs and care of women about 45 to 59 years of age change, they are less

likely to obtain Papanicolaou screening tests. The reason for this decline in frequency or

regularity is that the women seek less of, or a different kind of care than they did during

their reproductive years. The authors suggest that it is imperative to address this

population of women with tailored messages. Amonkar and Madhavan (2002) imply that

the decrease in cervical cancer screening among older women is due to the less stringent

recommendations made by primary health providers once three or more annual

Papanicolaou smears have been normal. Gulitz, Bustillo-Hernandez and Kent (1998)

report that lack of primary care provider recommendation is a major predictor of

underutilization of cervical cancer screening in this population of women. Mandelblatt

and Yabroff (2000) also report that physicians do not consistently recommend cervical

cancer screening to older women (not of child-bearing age) and physician

recommendation is one of the strongest predictors of screening. Because older women

participate less regularly in cervical cancer screening than younger women, the cervical

lesions, when discovered, may be at more advanced stage and less responsive to

123

treatment than those of younger women (White, Begg, Fishman, Guthrie, & Fagan, 1993; Masood, 1997). It can be seen from the literature that the Black American, Hispanic American and White American women who are 45 to 64 years of age, are at a higher risk of developing cervical cancer than their younger counterparts, in part, because of their poorer compliance with cervical cancer screening guidelines.

Primary care provider recommendation has an important impact on compliance with cervical cancer screening guidelines. It is, therefore, imperative for primary care providers to encourage compliance with screening, guidelines, particularly women who are beyond child-bearing age. Primary care providers could discuss the rationale of cervical cancer screening in older women especially if the women still have intact uteri. It is also important for women to know about their personal screening options, for example whether she should continue to be screened on an annual basis, less frequently or not at all. It would also be helpful to provide the patients with information about scheduling a Papanicolaou test. These women could then be given literature to take home with them, with the assurance that they could call the primary care provider's office if they had any further questions about cervical cancer screening. These women could be sent a reminder close to the time of time of their next examination. If the women do not return for their next visit, they should be contacted. Vogt, Glass, Glasgow, La Chance and Lichtenstein (2003) concluded the best way to follow-up on these patients is to send them a second reminder card or letter. If there was still no response, then a personal telephone call would elicit the best response from the patient.

Another intervention strategy to encourage older women to increase their cervical cancer screening rates would be to provide outreach and integrated preventive services at

community-based sites, as opposed to the offices of primary care providers. Educational programs about the importance of cervical cancer screening in older women and Papanicolaou smear tests could be offered on-site in housing complexes (White, Begg, Fishman, Guthrie & Fagan, 1993). Mobile clinical units could be used to provide identical services and encourage older women to participate in community-based cervical cancer screening programs (Masood, 1997).

Utilizing White Americans as the referent group in public health research is standard procedure, and there are a number of reasons for this practice. White Americans usually comprise the largest ethnic group in a multi-ethnic study, SAS® automatically defaults to the largest group as the referent group, researchers are taught to utilize the largest group as the referent group, and White Americans often have better health outcomes than the other ethnic groups, therefore, it is reasonable to make this group the base to which all the others are compared. In this study White American women were selected as the referent group because their screening outcomes (as opposed to screening rates) are better than the Black American and Hispanic American women, i.e. their mortality rates are lower than in either of the other two groups. However, the screening rates of White American women (71.2%) are far from optimal, so the implications of the higher cervical cancer screening rates of the Black American women (80.0%) in this sample need to be interpreted with caution because their screening rates are also not optimal. Therefore, in terms of reality and practicality, it does not matter that the Black American women have higher cervical cancer screening rates; both groups of women need active public health intervention strategies to increase their screening rates. The

same argument can be applied to the Hispanic American women who also have a sub-optimal cervical cancer screening rate (76.0%).

However, a way to improve the rates would be to develop community-based participatory networks to raise the awareness of the benefits and importance of regular cervical cancer screening throughout a woman's lifetime. Community-based participatory networks are crucial for the implementation and success of any public health intervention to improve annual cancer screening rates. Interventions work best when the community itself is vested in the objectives and goals of the public health intervention. The networks often consist of equal partnerships among community members, community-based organizations, academic institutions and health agencies working together to address the health issues of the community. For an intervention to be implemented effectively, community members themselves have to participate in designing, developing, implementing and evaluating the programs. It is also essential for the community partners to ensure that the messages are crafted and delivered in such a manner as to encourage cervical cancer awareness among the women so that they understand: (a) the need for women of all ages to be screened regularly for cervical cancer throughout their lifetime, (b) women's reproductive health, especially the location of the cervix in relationship to the uterus, (c) the significance of being asymptomatic for cervical cancer, and the reasoning behind cervical cancer screening, and screening in general, (d) how a Papanicolaou test is performed, and the meaning of the test results, (e) the stages of cervical cancer and, (f) the importance of compliance with cervical cancer screening guidelines.

In this population of women the message that needs to be emphasized is that cervical cancer is can be prevented, treated and cured if detected early. Cervical cancer prevention and early detection of cervical cancer can be enhanced by annual screening as recommended by the ACS (Masood, 1997).

There still remains the disturbing fact that although Black American women do have higher screening rates than White American women, their mortality rates remain higher (Makuc, Fried & Kleinman, 1989; Martin, Parker, Wingo & Heath, 1996; CDC/NCCDPHP. BRFSS: Prevalence data, 2002). Given the cross-sectional design of the study, it is not possible to make inferences about which women, if any, died from cervical cancer. However, it is known that Black American women present with a more advanced stage of cervical cancer at diagnosis, an occurrence thought to be a consequence of underutilization of cancer screening services in this group (Shavers & Brown, 2002).

Factors which have been reported to be associated with disproportionate cervical cancer mortality among Black American women, resulting in underutilization of cervical cancer screening services include: (a) lack of knowledge about cervical cancer and the implications of abnormal Papanicolaou smear results, (b) lack of adequate follow-up of abnormal Papanicolaou smears, (c) lack of community participation in helping women to navigate the health system, and (d) lack of community involvement in discussions about the serious repercussions of not following-up on abnormal Papanicolaou smear test results, especially for Black American women (Allen-Barash, Foster, Mitchell & Fletcher, 1997; Bigby, Ko, Johnson, David, & Ferrer, 2003). It is imperative that the gravity of underutilization is emphasized in discussions among the community-based

127

partners, during the process of designing and developing culturally, and linguistically appropriate cervical cancer educational messages for women in the community.

Such discussions could also help to highlight previously unknown reasons for the differences in cervical cancer mortality among Black American, White American and Hispanic American women in the study sample that in turn, could be attributed to the processes involved in obtaining an annual Papanicolaou smear test.

Evaluation of the Preventive Health Model

A secondary objective of this study was to assess the utility of the Preventive Health Model. This theoretical model was developed by researchers in the field of cancer prevention and control specifically to understand preventive health behavior (Myers et al. 1994; Myers et al. 1996). The Preventive Health Model was evaluated for its utility according to the criteria of theory evaluation suggested by Tzeng and Jackson (1991). These researchers generated six criteria from the literature: (a) formalization, (b) flexibility, (c) parsimony, (d) falsifiability, (e) fruitfulness, and (f) scientific self-regulation.

"Formalization is the extent to which a theory, or theoretical model is clear and its statements and variables are explicitly defined and consistently used" (Tzeng & Jackson, 1991, p.72). The Preventive Health Model incorporates all of these criteria. It is a theoretical model that has been derived from constructs of the Health Belief Model, the Theory of Reasoned Action and Social Cognitive Theory that are thought to be important in predicting preventive health behavior, such as cancer screening (Carver & Scheier as cited in Myers, et al., 1994).

128

"A good theory, or theoretical model needs to remain flexible enough to accommodate new evidence, and thus, can never become completely closed " (Tzeng & Jackson, 1991, p. 62). The Preventive Health Model is flexible as seen by the fact that investigators have used different combination of constructs from the Preventive Health Model in their various research projects. Myers et al. (1994) added the construct of preventive intention to the model to see whether the degree of intention to perform or engage in preventive health behavior increased the predictive power of the model. Myers et al. (1996) and Gwede (2001) did not collect any data on program factors, therefore the construct of program factors was removed from their models. Finally, Watts, Vernon, Myers and Tilley (2003) used all the constructs of the Preventive Health Model in their study of colorectal cancer screening among male automotive workers.

"Parsimony is the extent to which a theory, or theoretical model attempts to account for complex phenomena in terms of parsimonious constructs" (Tzeng & Jackson, 1991, p. 72). The most useful theory is one that can generate accurate predictions with the fewest prior assumptions and the simplest propositions. Different constructs of the model have been used by various researchers to determine covariates of preventive health behavioral intent, or the behavior itself, using a few prior assumptions and simple propositions. The Preventive Health Model was developed specifically to understand and determine the covariates of preventive health behavior (Myers, Ross, Jepson, Wolf, Balshem, Millner, & Leventhal, 1994).

"A good theory or theoretical model must be amenable to operational definitions" (Tzeng & Jackson, 1991, p. 62,). Operational definitions are the processes by which constructs or variables are defined in terms of the methods, procedures and techniques

used to explain them. These definitions are important in evaluation of a theory or theoretical model because they provide a uniform standard by which they can be objectively tested and proved wrong (falsified). The Preventive Health Model is amenable to operational definitions and its constructs were operationalized by variables from the 1999 BRFSS questionnaire. It also has been tested objectively by different researchers in the field of preventive health behavior.

"Fruitfulness is the extent to which a theory or theoretical model stimulates further research" (Tzeng & Jackson, 1991, p. 72). The Preventive Health model has been used in studies to explain: (a) colorectal cancer screening behavior in men and women (Myers et al., 1994, Watts, Vernon, Myers & Tilley, 2003), and (b) prostate cancer screening behavior in African American men (Myers, Wolf, Mckee, McGory, Burgh, Nelson, & Nelson 1996; Gwede, 2001). The theoretical model is being used in this study to explain the relationship between primary care provider advice about cervical cancer and compliance with cervical cancer screening guidelines.

"A good theory should keep itself 'in-check' by utilizing scientific techniques designed to optimize empirical objectivity and theoretical objectivity (Tzeng & Jackson, 1991, p. 64). The best method of scientific self-regulation is to have research articles published in scholarly, peer-reviewed journals. In this way the research methods and results using the Preventive Health Model have been added to the existing body of knowledge by the investigators.

Variables from the 1999 BRFSS were used, in this study, to measure the constructs of the Preventive Health Model. A number of the socio-demographic variables that were used to measure the background factors construct were dropped from the final

130

logistic regression model because they did not gain statistical significance. These variables were *marital status, education level, employment status, income level* and *state FIPS codes.* The representation factor construct and the social influence factor construct were each measured by a single variable. These two elements were *convenience of medical facility location* and *satisfaction with primary care provider.* There was not enough data collected on these variables for them to be included in the final logistic regression model. The Preventive Health Model was modified accordingly, and the results of the study are displayed in Table 12.

Table 12

The Modified Preventive Health Model

Constructs of the PHM	Variables from 1999 BRFSS	References
Background Factors Construct		
1. Socio-demographic variables		
Age	Child-bearing age	Hiatt, et al., 2002
Ethnic origin	Ethnic origin	NCI, 2004
Insurance coverage	Health coverage	Hiatt, et al., 2002
2. Past screening behavior variables		
Mammography	Had mammogram	Simoes, et al., 1999
Breast exam	Had breast exam	Simoes, et al., 1999
3. Health profile variables		
Tobacco use	Smoking status	Simoes, et al., 1999
Obesity (BMI)	Body Mass Index	Simoes, et al., 1999
Hysterectomy	Had hysterectomy	Smith, et al., 2003
Program Factor Construct		
Screening advice	Cervical cancer screening advice	Baranowski, et al., 1997

It was found that socio-demographic variables, past screening behavior variables and health profile variables that measured the background factors construct were highly associated with compliance to the cervical cancer screening guidelines. The variables that

131

measured the representation factor construct and the social influence factor structure could not be assessed in this study because of lack of data. Therefore, these constructs were not included in the modified Preventive Health Model. The variable *cervical cancer screening advice* was used to measure the program factor construct and also was found to be associated strongly with compliance to cervical cancer screening guidelines. The Preventive Health Model has been utilized effectively to guide the research on factors associated with compliance to these cervical cancer screening guidelines as evaluated by the criteria suggested by Tzeng and Jackson (1991).

<div align="center">Conclusions</div>

Limitations of the Study

The major limitation of this study is that the study design was a cross-sectional or prevalence study in which the status of the exposure (primary care provider advice about cervical cancer screening) and the attribute of interest (compliance with the 1999 cervical cancer screening guidelines of the ACS) were assessed simultaneously among individuals in the study sample. Therefore, it was not possible to determine whether primary care provider advice about cervical cancer screening resulted from, or preceded, compliance with screening guidelines. This limitation must be taken into account when interpreting the data because temporal and causal inferences cannot be determined. It was possible to conclude that there was an association between compliance with cervical cancer screening guidelines and primary care provider advice about cervical cancer screening when all the other variables were accounted for (adjusted) in the statistical logistic regression model and theoretical Preventive Health Model. The data produced may be of

great value to public health professionals in assessing the health care needs of an ethnically diverse population of women (Hennekens & Buring, 1987).

These results are only generalizable to the population of women who identified themselves as being: (a) Black (non-Hispanic), White (non-Hispanic) and Hispanic (Black and White) American women, 18 to 64 years of age who (b) reported that they had received a preventive Papanicolaou smear test (c) resided in the states of Louisiana, Missouri, South Carolina, Texas, Virginia and Wyoming in 1999, and (d) responded to the question "During the past year, have you received advice from your primary care provider about your sexual practices and sexually transmitted diseases?" [This question is a proxy for the question "Has your primary care provider ever advised you about cervical cancer screening?"]. However, the methods used to obtain these results can be adapted for use in other studies.

<u>Contribution of the Study to the Body of Knowledge</u>

There are a number of contributions this study has made to the body of knowledge. The Preventive Health Model has not been used to determine preventive cervical cancer screening behavior in women. It has been used in studies to explain: (a) colorectal cancer screening behavior in men and women (Myers et al., 1994, Watts, Vernon, Myers & Tilley, 2003), and (b) prostate cancer screening behavior in African American men (Myers, Wolf, Mckee, McGory, Burgh, Nelson, & Nelson 1996; Gwede, 2001). This study has shown the "fruitfulness " of the Preventive Health Model by stimulating further research in a different area of preventive health behavior than had been studied previously. The background factors construct was extended to encompass the health profile variables. These variables had not been used by any other researcher to

determine preventive health behavior. This achievement indicates the flexibility of the model as, an important factor in preventive health behavior research, because there are many different combinations of variables that can affect health behavior. Another contribution to the body of knowledge is that this is the only study in which the Preventive Health Model has been used with secondary data from a national data set to answer a series of research questions on preventive health behavior. It showed how well this theoretical model could be used to guide research. Finally, this is the only study in which "intention to perform a preventive health behavior" was not an intermediate or final outcome. The Preventive Health Model was used with the 1999 BRFSS data set to answer the specific research questions, because the data set contained questions pertaining to (self-reported) health behavior rather than to (self-reported) knowledge, attitudes, and perceptions of, or intentions to perform health behavior. Moreover, this data set contains survey questions specific to preventive screening behavior, including cervical cancer screening behavior (CDC/NCCDPHP. About the BRFSS, 2002; Coughlin, Uhler, Hall & Briss, 2004).

This study also adds dimensions to the body of knowledge related to disparities research. It results revealed that Black American, White American and Hispanic American women were more similar in their screening behavior than dissimilar. Therefore, when thinking about cost-effective, public health intervention strategies, it would be better to concentrate on the similarities across the groups first and design intervention strategies to address as many of the women as possible. The next step would be to look at the dissimilarities across ethnic origins, and where appropriate, tailor extremely specific interventions to the population segments in question. The study also

showed that caution should be used in interpreting results when using the White American women as the base or referent group. It is imperative not to assume that their outcomes are better than those of other women. The data must be checked carefully before drawing that conclusion. Finally, this study contributes to the literature by showing that the disparity among the women is in age, women of child-bearing age (18-44 years) versus women not of child-bearing age (45 to 64 years), rather than in ethnic origin. There are few data in the literature demonstrating an association between primary care provider recommendation and compliance with cervical screening guidelines. These findings contribute to the body of knowledge, namely that compliance with cervical cancer screening guidelines is associated with specific primary care provider advice about this screening.

The results of this study would enable public health researchers to develop and design intervention programs that could be tailored to specified population segments (DHSS. Race and health: cancer management, 1999; Glanz & Rimer, 1997). Such interventions may increase cervical screening to more optimal levels among the diverse groups of women in the nation, thereby, not only reducing the differences in mortality rate, but also reducing the overall mortality rate from cervical cancer.

HPV DNA Screening, HPV Vaccine Trials and Public Health Intervention Strategies

In 2005 the ACS included HPV DNA recommendations for cervical cancer screening. "Screening should be done every year with conventional Papanicolaou smear tests or every two years using the liquid-based tests. At or after 30 years of age, women who have had three consecutive, normal results may elect to be screened every two to three years. Alternatively, cervical cancer screening with HPV DNA testing and or

135

liquid-based cytology could be performed every three years. Physicians may suggest that a woman screen more often if she has certain risk factors, such as HIV infection or a compromised immune system" (ACS, 2005, p. 60).

As previously stated in Chapter 2, the most likely causative agent of cervical cancer and its precursors is the human papillomavirus (HPV) (Cuzick, 2000; Hoffman & Cavanagh, 1996; Palefsky, 2003; Rohan, Burk, & Franco, 2003). Persistent infection with one or more types of HPV is an important etiological factor in the development of precancerous lesions with progression to invasive cervical cancer. Worldwide, HPV DNA is detected in about 99.7% of all invasive cancers (Sellors et al., 2003). The incidence of carcinogenic HPV is highest in younger women aged 15 to 20 years of age, however, the infection clears spontaneously in 60% of this population (Cohen, 2005; Gray & Walzer, 2004; Sellors et al., 2003). In the United States, the prevalence of HPV infection declines to very low levels by the time a woman reaches 50 years of age, and identification of high-risk HPV genotypes, by the hybrid capture technique, is extremely rare in post-menopausal women. Therefore any HPV infection found in older women is most likely to be due to persistent infection with high-risk HPV genotypes (Ferenczy, Gelfand, Franco & Mansour, 1997; Schiffman & Castle, 2003). It is also known that: (a) HIV-positive women have a higher incidence of cervical HPV infection than HIV-negative women, (b) cervical HPV infection is more persistent in the HIV-positive population, (c) the incidence of invasive cervical cancer is increased in HIV-positive women, and (d) HIV-positive women with lesions have higher HPV viral loads than HIV-negative women (Palefsky, 2003; Schiffman, et al., 2000).

Several researchers have examined the role of using HPV DNA tests as the primary (preventive) tool in screening for invasive cervical cancer (Cuzick, 1995). However, there are a number of issues that need to be resolved before this can be realized. One of the major issues in using HPV DNA testing as the primary screening test for cervical cancer is that its specificity is presently worse than that of cytology. That is, the probability of the HPV DNA screening test correctly identifying a woman who does not have cervical cancer (the true negative rate) is worse than that of the conventional Papanicolaou smear screening test (Rohan, Burk, & Franco, 2003). Other issues that need to be determined include: (a) the most appropriate ages at which to begin and end HPV DNA testing, (b) the frequency of screening, (c) the utility of incorporating measures of high HPV viral load in lesion management, and (d) the cost-effectiveness of this approach to screening. Large-scale, randomized, controlled clinical trials are needed to evaluate: (a) whether widespread HPV DNA testing is either feasible or affordable, (b) whether such testing will eventually lead to fewer cases of invasive cervical cancer, or reduce the mortality of the disease (Cuzick, 2000; Schiffman, et al., 2000; Rohan, Burk, & Franco, 2003). Cytology will continue to be the major screening method for cervical cancer prevention until these issues with HPV DNA screening have been resolved (Schiffman, et al., 2000). It has been recommended that HPV DNA testing be used as an adjunct to routine cytological screening, especially as it has a higher sensitivity than cytology. That is, the probability of the HPV DNA screening test correctly identifying a woman who has invasive cervical cancer (the true positive rate) is better than that of the conventional Papanicolaou smear screening test (Cuzick, 1995; Rohan, Burk, & Franco, 2003; Tjalma, Arbyn, Paavonen, Van Waes & Bogers, 2004). Even though addition of

the HPV DNA test to the Papanicolaou smear test is thought to increase the sensitivity for

detecting invasive cervical cancer, and allows for larger screening intervals (Franco,

2003; ACS, 2005), clinical trials have not shown any reduction of cancer incidence in

populations where HPV DNA testing was added to cytological screening (Hinkula et al.,

2004). Ongoing trials need to be extended in terms of size and duration, in order to

examine ways in which HPV DNA testing could be used as a primary (preventive) tool in

screening for invasive cervical cancer (Tjalma, Arbyn, Paavonen, Van Waes & Bogers,

2004).

The cytological screening programs that have helped to reduce the incidence rates

of invasive cervical cancer in developed countries in the world, are either not available or

are too expensive for women in developing countries. Researchers believe that women in

the developing world could benefit the most from vaccination programs which target

invasive cervical cancer (Cohen, 2005; Schreckenberger, & Kaufmann, 2004; Tjalma,

Arbyn, Paavonen, Van Waes & Bogers, 2004). However, women in the United States

who are not screened, or who are underscreened could also benefit from such vaccination

programs.

Two types of HPV vaccines can be differentiated. These are: (a) therapeutic

vaccines which induce cell mediated immune responses against epithelial cells infected

with HPV, and (b) prophylactic vaccines which prevent primary HPV infection by

inducing virus-neutralizing antibodies which protect against new, but not established

infections (Schreckenberger, 2004; Tjalma, Arbyn, Paavonen, Van Waes & Bogers,

2004). Preclinical and clinical studies have shown that therapeutic vaccines need more

appraisal because the problem of lack of clinical responses due to tumor immune evasion

(Schreckenberger, 2004). Stanley, 2003 suggests that therapeutic HPV vaccines are likely to only clear the cervical cancer completely in a tiny proportion of the cases whether the vaccine is used alone or with immunomodulators. The researcher suggests that the vaccines may be used as adjunct therapy to prevent the reoccurrence of invasive cervical cancer, or HPV infection, after the cancerous lesions have been surgically removed.

Two different prophylactic vaccines have been developed and tested in more than 3000 human participants in phase II clinical trials. These vaccines were made by Merck & Company of Rahway, New Jersey, and GlaxoSmithKline (GSK) Biologicals of Rixenart, Belgium. Both vaccines prevented persistent infection in 100% of the women vaccinated against the disease, and reduced cervical abnormalities by 90% (Cohen, 2005; Harper, et al., 2004). However, these vaccines still have to be proven to be safe and effective in larger phase III clinical trials with long term follow-up, and also confirm that vaccination does prevent cervical cancer. The vaccines are currently under study in over 50,000 human participants the United States, and countries of South America, Europe, Asia and Africa, and the trials are projected to end between 2007 and 2010 (Cohen, 2005; Tjalma, Arbyn, Paavonen, Van Waes & Bogers, 2004).

There are a number of issues that need to be resolved before HPV vaccination could possibly be implemented as an effective public health measure for reducing the global burden of cervical cancer (Harper, et al., 2004; Tjalma, Arbyn, Paavonen, Van Waes & Bogers, 2004). The first issue is the number of HPV genotypes that should be included in the vaccines to target cervical cancer. Merck and GSK used HPV 16 and 18 as the foundation of their vaccines, but these HPV genotypes together only give protection against 70% of the cervical cancer cases (Cohen, 2005). It is not known

139

whether antibodies created for one genotype of HPV will protect against other genotypes, which indicates the need for multivalent vaccines. HPV genotypes 16, 18, 45, 31 and 33 are responsible for 85% of all cervical cancer. Therefore, in order to be effective for at least 80% of the population, the vaccines, in theory, should contain at least four to five of the most common oncogenic HPV genotypes of that region or country, because oncogenic HPV genotypes are region and country specific. However, the combination of several HPV genotypes in one vaccine could (a) cause other unforeseen problems, (b) create more manufacturing difficulties and (c) increase the cost of production of the vaccine thereby increasing its price (Cohen, 2005; Schiffman & Castle, 2003; Tjalma, Arbyn, Paavonen, Van Waes & Bogers, 2004).

Other important issues that need to be resolved are questions regarding the duration of the vaccine-induced immunity, and the minimum protective level of the HPV antibodies. These have not been evaluated and follow-up studies are needed to establish the facts. It is known that antibodies acquired after a natural infection with HPV will persist for decades, but decrease over time in women who do not have HPV-associated lesions (Carter, et al., 2001). For the vaccine to be efficacious it would need to confer immunity for several decades, conceivably, with a booster vaccination after 5 or 10 years (Tjalma, Arbyn, Paavonen, Van Waes & Bogers, 2004).

Issues involving the optimal timing for HPV vaccination and which groups to vaccinate need to be addressed. Until the duration of the vaccine-induced immunity is known, it will be difficult to determine the appropriate age groups that would most rapidly prevent the spread of HPV infection in the population. Evidence from the preclinical and clinical studies suggests that the prophylactic HPV vaccine should be

administered to young men and women before they become sexually active. However, it is not known whether men will be protected against HPV infection or HPV-induced clinical disease resulting from infection. Individuals who are immunocompromised are at a higher risk of persistent HPV infection and the development of HPV-related diseases, including cervical cancer. It is not known whether a prophylactic HPV vaccine would be of benefit to these individuals. It is imperative that studies be initiated to determine exactly which individuals in the population would benefit from being vaccinated against HPV (Cohen, 2005; Harper, et al., 2004; Tjalma, Arbyn, Paavonen, Van Waes & Bogers, 2004).

Until these issues with HPV DNA screening and HPV vaccination are resolved, women should abide by the cervical cancer screening guidelines recommended to them by their primary care providers. With the confusion that could arise from reports in the media about HPV DNA testing and HPV vaccination, a clear and concise message that all women should be screened regularly throughout their life, is even more relevant and crucial than ever before. "When and even if the cervical cancer screening can be stopped is unclear, it seems that cervical cancer screening should be continued for at least a whole generation of women who are already infected" (Tjalma, Arbyn, Paavonen, Van Waes & Bogers, 2004, p. 758).

<u>Recommendations for Future Research</u>

The cross-sectional design of this study limited the inferences that could be drawn from the results. Neither the temporal relationship, nor the causal relationship between the dependent variable (compliance with the annual 1999 cervical cancer screening guidelines of the ACS) and the focal independent variable (primary care provider advice

141

about cervical cancer screening) could be assessed. The cross-sectional design only allowed for associations to be drawn between each one of the independent variables and the dependent variable in the study. Patterns of screening behavior could not be determined because the women were asked about their screening practices at a single point in time. Thus, it was not possible to tell whether a woman had a pattern of being screened annually, or whether she had just been screened at the point in time when she was asked the question "How long has it been since you had your last Pap smear?"

A similar study should be performed using a longitudinal, prospective cohort study design. This would improve the capacity to establish a temporal sequence and causality. In this study the women would be followed for at least ten to fifteen years, and questions from the BRFSS would be utilized. The BRFSS questionnaires contain questions which have been designed to collect data on general self-reported health behavior. The data are then used for planning, implementing, managing and evaluating health promotion and disease prevention programs in the United States and its territories. Factors assessed by the BRFSS include tobacco use, general health status, health coverage, and the use of cancer screening services (CDC/NCCDPHP. About the BRFSS, 2002). In order to adapt the questions for use with the more specific research methods dictated by the study questions, the questions from the BRFSS need to be modified in the following manner. A question concerning primary care provider advice about cervical cancer screening should be developed. For example, women should be asked specifically about how often their primary care provider advised them to screen for cervical cancer. This question should be put into the Women's Health core section and be asked of women in all of the reporting sites.

Two other questions should be added to the Women's Health core section, one of them should be a measure of health literacy and the other should be a measure of acculturation. Health literacy is "the ability to read and understand written materials commonly encountered in health care settings" (Scott, Gazmararian, Williams & Baker, 2002, p.395). Acculturation refers to "the extent to (and the process through) which … minorities participate in the cultural traditions, values, beliefs, assumptions, and practices of the dominant … society (acculturated), remain immersed in their own cultures (traditional), or participate in the traditions of their own culture and of the dominant … culture as well (bicultural)" (Landrine & Klonoff, 1994, p. 104) Low acculturation and low health literacy are thought to contribute to lower rates of cervical cancer screening, so it is important to control for these variables in the study (Selden, Zorn, Ratzan & Parker, 2000).

There is not a question asked on the specific type of primary care provider visited by the women (e.g. family practitioner, internist etc.) in the BRFSS questionnaire. To better assess the association between compliance to annual cervical cancer screening guidelines and primary care provider advice about cervical cancer screening, a question needs to be included on the type of primary care provider visited by the women in the study. Fos and Zungia (1999) defined primary care providers as being: (a) family practice physicians, (b) general practice physicians, (c) obstetrics-gynecology physicians, (d) internal medicine physicians, (e) pediatric physicians, and (f) nurse practitioners. A final modification to the BRFSS questionnaire would be to include a response for question refusal, which would contribute to the design of the questionnaire for further surveys.

143

The BRFSS is a computer-assisted, telephone interview survey. Therefore, by definition, women without telephones were excluded from participating in the study. Women without telephones and without health plans could be enrolled into the prospective study by using supplementary questionnaires and enrollment techniques designed and approved by members of the community-based participatory networks. Doing so would allow results from the study to be more generalizable than those of the current cross-sectional study. A longitudinal, prospective cohort study design would allow the temporal relationship, and the causal relationship between the focal independent variable (primary care provider advice about cervical cancer screening) and the dependent variable (compliance with the annual 1999 cervical cancer screening guidelines of the ACS) to be assessed.

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Appendices

Appendix A

Panel of Experts

John Large, Ph.D.   Expertise in quantitative and statistical

                                           analysis

Kofi Marfo, Ph.D.   Expertise in measurement and theory,

                                           application of theory to practice

Thomas Mason, Ph.D.   Expertise in cancer epidemiology, principles

                                           of cancer screening and secondary data

                                           analysis

Richard Roetzheim, M.D.   Expertise in preventive medicine, primary

                                           care research, cancer screening practice and

                                           secondary data analysis using SAS$^{®}$

Patricia Romily, M.D.   Expertise in diagnostic ultrasound and

                                           diagnostic radiology

The Stepwise Logistic Regression Procedure for Model Selection

Model A: Adjusted Odds Ratio Estimates for the Socio-demograhic-(9) Covariates of Compliance with the 1999 Cervical Cancer Screening Guidelines of the ACS

Variable	β estimate	Adjusted OR	95% CI	P-value
Child-bearing age	0.42	1.52	1.33 – 1.73	<.0001
Black ethnic origin	0.54	1.71	1.42 – 2.08	<.0001
Hispanic ethnic origin	0.34	1.40	1.00 – 1.96	0.0449
Marital status	-0.13	0.88	0.76 – 1.01	0.0719
Education level	0.21	1.24	1.08 – 1.41	<.0016
Employment level	-0.09	0.92	0.80 – 1.10	0.2408
Income level	0.26	1.30	1.11 – 1.52	0.0009
State FIPS codes	-0.01	1.00	1.00 – 1.00	0.1013
Have health coverage	0.86	2.36	2.00 – 2.80	<.0001
Cervical cancer screening advice	0.62	1.90	1.61 – 2.16	<.0001

1. Likelihood Ratio Test of Model A versus Model B with 4 degrees of freedom
   Chi-square p-value=0.0318
2. *Hispanic ethnic origin, marital status, employment status* and *state FIPS codes* not statistically significant, dropped from Model A
3. Model A retained with statistically significant covariates = Model B

Model B: Adjusted Odds Ratio Estimates for Socio-demograhic-(6) Covariates of Compliance with the 1999 Cervical Cancer Screening Guidelines of the ACS

Variable	β estimate	Adjusted OR	95% CI	P-value
Child-bearing age	0.41	1.52	1.33 – 1.73	<.0001
Black ethnic origin	0.56	1.71	1.42 – 2.08	<.0001
Hispanic ethnic origin	0.33	1.40	1.00 – 1.96	0.0449
Education level	0.21	1.23	1.08 – 1.40	0.0018
Income level	0.26	1.30	1.11 – 1.52	0.0009
Have health coverage	0.86	2.36	2.00 – 2.80	<.0001
Cervical cancer screening advice	0.62	1.90	1.61 – 2.16	<.0001

1. *Hispanic ethnic origin* (p-value=0.0449) retained to control for the effects of Hispanic American women in the study sample
2. Likelihood Ratio Test of Model A versus Model B with 3 degrees of freedom
   Chi-square p-value=0.0786
3. Model B retained with RACEGRB = Model C

The Stepwise Logistic Regression Procedure for Model Selection

Model C: Adjusted Odds Ratio Estimates for Socio-demographic-(6) and Screening-(1) Covariates of Compliance with the 1999 Cervical Cancer Screening Guidelines of the ACS

Variable	β estimate	Adjusted OR	95% CI	P-value
Child-bearing age	0.71	2.03	1.74 – 2.37	<.0001
Black ethnic origin	0.52	1.68	1.39 – 2.03	<.0001
Hispanic ethnic origin	0.33	1.39	1.00 – 1.94	0.0523
Education level	0.21	1.23	1.08 – 1.40	0.0023
Income level	0.17	1.18	1.03 – 1.37	0.0203
Have health coverage	0.80	2.22	1.88 – 2.63	<.0001
Had mammogram	0.57	1.77	1.52 – 2.07	<.0001
Cervical cancer screening advice	0.67	1.96	1.69 – 2.28	<.0001

1. *Had mammogram* added
2. Likelihood Ratio Test of Model C versus Model B with 1 degree of freedom
   Chi-square p-value=0.0202
3. Model C retained with statistically significant covariates = Model D

Model D: Adjusted Odds Ratio Estimates for Socio-demographic-(6) and Screening-(2) Covariates of Compliance with the 1999 Cervical Cancer Screening Guidelines of the ACS

Variable	β estimate	Adjusted OR	95% CI	P-value
Child-bearing age	0.70	2.00	1.72 – 2.35	<.0001
Black ethnic origin	0.59	1.76	1.45 – 2.13	<.0001
Hispanic ethnic origin	0.35	1.40	1.01 – 1.97	0.0395
Education level	0.18	1.23	1.08 – 1.40	0.0085
Income level	0.13	1.14	1.00 – 1.32	0.0675
Have health coverage	0.78	2.25	1.92 – 2.65	<.0001
Had mammogram	0.51	1.67	1.43 – 1.96	<.0001
Had breast exam	0.78	2.22	1.79 – 2.75	<.0001
Cervical cancer screening advice	0.64	1.96	1.69 – 2.28	<.0001

1. *Had breast exam* added
2. Likelihood Ratio Test of Model D versus Model C with 1 degree of freedom
   Chi-square p-value=0.0674
3. *Income level* not statistically significant, dropped from Model D
4. Model D retained with statistically significant covariates = Model E

The Stepwise Logistic Regression Procedure for Model Selection

Model E: Adjusted Odds Ratio Estimates for Socio-demographic-(5) and Screening-(2) Health Profile-(1) Covariates of Compliance with the 1999 Cervical Cancer Screening Guidelines of the ACS

Variable	β estimate	Adjusted OR	95% CI	P-value
Child-bearing age	0.71	2.03	1.73 – 2.38	<.0001
Black ethnic origin	0.53	1.71	1.41 – 2.07	<.0001
Hispanic ethnic origin	0.31	1.36	0.97 – 1.91	0.0707
Education level	0.17	1.18	1.04 – 1.35	0.0114
Have health coverage	0.78	2.17	1.84 – 2.56	<.0001
Had mammogram	0.51	1.67	1.43 – 1.95	<.0001
Had breast exam	0.80	2.22	1.79 – 2.76	<.0001
Smoking status	0.26	1.29	1.12 – 1.49	0.0004
Cervical cancer screening advice	0.63	1.89	1.63 – 2.19	<.0001

1. *Smoking status* added
2. Likelihood Ratio Test of Model E versus Model D with 1 degree of freedom
   Chi-square p-value=0.0114
3. Model E retained with statistically significant covariates = Model F

Model F: Adjusted Odds Ratio Estimates for Socio-demographic-(5), Screening-(2) and Health Profile-(2) Covariates of Compliance with the 1999 Cervical Cancer Screening Guidelines of the ACS

Variable	β estimate	Adjusted OR	95% CI	P-value
Child-bearing age	0.67	1.96	1.68 – 2.30	<.0001
Black ethnic origin	0.61	1.85	1.52 – 2.24	<.0001
Hispanic ethnic origin	0.32	1.37	0.98 – 1.92	0.0643
Education level	0.14	1.15	1.01 – 1.31	0.0358
Have health coverage	0.77	2.16	1.83 – 2.55	<.0001
Had mammogram	0.52	1.69	1.44 – 1.97	<.0001
Had breast exam	0.80	2.23	1.79 – 2.77	<.0001
Smoking status	0.29	1.34	1.16 – 1.54	<.0001
Body Mass Index	0.38	1.47	1.28 – 1.67	<.0001
Cervical cancer screening advice	0.63	1.88	1.62 – 2.19	<.0001

1. *Body Max Index* added
2. Likelihood Ratio Test of Model F versus Model E with 1 degree of freedom gave
   Chi-square p-value=0.0357
3. Model F retained with statistically significant covariates = Model G

The Stepwise Logistic Regression Procedure for Model Selection

Model G: Adjusted Odds Ratio Estimates for Socio-demographic-(5), Screening-(2) and Health Profile-(3) Covariates of Compliance with the 1999 Cervical Cancer Screening Guidelines of the ACS

Variable	β estimate	Adjusted OR	95% CI	P-value
Child-bearing age	0.57	1.76	1.50 – 2.07	<.0001
Black ethnic origin	0.62	1.85	1.52 – 2.25	<.0001
Hispanic ethnic origin	0.30	1.36	0.97 – 1.90	0.0771
Education level	0.11	1.11	0.98 – 1.27	0.1141
Have health coverage	0.78	2.19	1.86 – 2.59	<.0001
Had mammogram	0.60	1.81	1.55 – 2.13	<.0001
Had breast exam	0.83	2.28	1.84 – 2.84	<.0001
Smoking status	0.28	1.32	1.14 – 1.53	0.0002
Body Mass Index	0.37	1.45	1.27 – 1.66	<.0001
Had hysterectomy	0.46	1.58	1.34 – 1.86	<.0001
Cervical cancer screening advice	0.62	1.86	1.60 – 2.16	<.0001

1. *Had hysterectomy* added
2. Likelihood Ratio Test of Model G versus Model F with 1 degree of freedom
   Chi-square p-value=0.1141
3. *Education level* not statistically significant, dropped from Model G
4. Model G retained with statistically significant variables = Model H

Model H: Final Model of Adjusted Odds Ratio Estimates for Covariates of Compliance with the 1999 Cervical Cancer Screening Guidelines of the ACS

Variable	β estimate	Adjusted OR	95% CI	P-value
Child-bearing age	0.57	1.78	1.50 – 2.08	<.0001
Black ethnic origin	0.60	1.83	1.51 – 2.22	<.0001
Hispanic ethnic origin	0.30	1.34	0.97 – 1.89	0.0847
Have health coverage	0.80	2.23	1.90 – 2.63	<.0001
Had mammogram	0.60	1.82	1.55 – 2.14	<.0001
Had breast exam	0.84	2.32	1.84 – 2.88	<.0001
Smoking status	0.30	1.35	1.17 – 1.55	<.0001
Body Mass Index	0.38	1.46	1.28 – 1.67	<.0001
Had hysterectomy	0.47	1.60	1.36 – 1.88	<.0001
Cervical cancer screening advice	0.63	1.90	1.61 – 2.17	<.0001

Appendix B (Continued)

The Stepwise Logistic Regression Procedure for Model Selection

Model I: Adjusted Odds Ratio Estimates for Covariates of Compliance with the 1999 cervical cancer screening guidelines of the ACS with Interaction Terms

Variable	β estimate	Adjusted OR	95% CI	P-value
Child-bearing age	0.57	1.77	1.50 – 2.08	<.0001
Black ethnic origin	0.62	1.85	1.46 – 2.35	<.0001
Hispanic ethnic origin	0.21	1.23	0.83 – 1.83	0.3007
Have health coverage	0.80	2.23	1.89 – 2.63	<.0001
Had mammogram	0.60	1.82	1.55 – 2.14	<.0001
Had breast exam	0.84	2.32	1.87 – 2.89	<.0001
Smoking status	0.30	1.35	1.17 – 1.55	<.0001
Body Mass Index	0.38	1.46	1.28 – 1.67	<.0001
Had hysterectomy	0.47	1.60	1.36 – 1.88	<.0001
Interaction_Black ethnic origin	0.03	0.97	0.66 – 1.44	0.8768
Interaction_Hispanic ethnic origin	0.32	1.38	0.64 – 3.00	0.4162
Cervical cancer screening advice	0.62	1.86	1.58 – 2.19	<.0001

1. Likelihood Ratio Test of Model I versus Model H with 2 degrees of freedom
   Chi-square p-value=0.6998
2. *Interaction_Black ethnic origin* and *interaction_Hispanic ethnic origin* not statistically significant, dropped from Model I
3. Model I retained with statistically significant covariates = Model H

Appendix C

Exemption Certification for Protocol No. 99341

USF

UNIVERSITY OF
SOUTH FLORIDA

EXEMPTION CERTIFICATION

MEMO: Chodaesessie Wellesley-Cole Morgan
                    17709 Ridgeway Point Place
                    Tampa, Fl 33647

FROM: Institutional Review Board / PGS:blk

SUBJECT: Exemption Certification for Protocol No. 99341

DATE: March 15, 2005

On November 16, 2000, it was determined that your project entitled, **"Comparison of the Determinants of Preventive Cervical Cancer Screening Behavior among Black/African, Hispanic/Latino and White American Women in the United States During 1999"** met federal criteria which exempts it from the regulations specified in the Common Rule.

On March 10, 2005, you requested the following change(s):

> Change in Study Title: The title has been changed from "Comparison of the Determinants of Preventive Cervical Cancer Screening Behavior among Black/African, Hispanic/Latino and White American Women in the United States During 1999" to "Cervical Cancer Screening Disparities in an Ethnically Diverse Population of Women Residing in the United States in 1999: A Secondary Analysis of Data from the 1999 Behavioral Risk Factor Surveillance System"

These changes have been noted in the file and do not impact the eligibility for exemption. The study continues to have Exempt Certification. Please remember that any grants connected to this project must be submitted to the Institutional Review Board for review.

Because the study has been certified as exempt, you will not be required to complete continuation or final review reports. However, it is your responsibility to notify the IRB prior to making any changes to the study. Please note that changes made to an exempt protocol may disqualify it from exempt status and may require an expedited or full review.

If you have any questions, please contact the Division of Research Compliance at (813) 974-5638

Pc: Robert McDermott, Ph.D.

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About the Author

Chodaesessie Wellesley-Cole Morgan was awarded the degree of Bachelor of Science with Honors, from the University of Sierra Leone, in 1975. She was awarded the degree of Master of Public Health from the University of South Florida, and was admitted to the doctoral program in 1995. Her areas of interest include epidemiology, health policy and evaluation research. Ms. Wellesley-Cole Morgan has won a number of academic scholarships and honors throughout her academic career, including membership, by nomination only, to the prestigious Delta Omega Society, the National Honor Society of Public Health.

Ms. Wellesley-Cole Morgan, her husband Dr. Beale Morgan, and their children Yeatie and Yannick are a family with international élan. They are multicultural and multilingual, have traveled to, lived, studied, and worked in many countries of the World. Ms. Wellesley-Cole Morgan and her family have resided in the United States since 1992.