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Culture and Context: Upstream Determinants of Cervical Cancer Among Haitian Immigrants Living in Miami, Florida

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CULTURE AND CONTEXT: UPSTREAM DETERMINANTS OF CERVICAL CANCER AMONG HAITIAN IMMIGRANTS LIVING IN MIAMI, FLORIDA

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In 2011 over 500,000 women will be diagnosed with cervical cancer worldwide and approximately 250,000 will die of the disease. The majority of incident cases will occur among women who lack routine access to Papalanicolou (Pap) test screening. While access-related factors, such as income and health insurance status, are primary drivers of screening utilization research suggests that a number of individual and contextual social and cultural factors, such as low cervical cancer knowledge, lower educational attainment and non-Western health beliefs can exert an independent or multiplicative effect. Among the immigrant Haitian population of Miami, Florida the incidence of cervical cancer is more than four times greater than that observed in the non-Hispanic White population of Miami-Dade County, Florida and the Pap screening rate is approximately half the national average for U.S. Blacks. The reasons underlying this disparity have not been fully described in this population. This dissertation examines the association between knowledge and screening and evaluates how individual cultural beliefs, the sociocultural environment, and the socioeconomic context of the neighborhoods where these women reside may be upstream determinants of cervical cancer knowledge and Pap screening.
Dedication
For my colleagues, who always helped (EK, TKS, BB, IB, HL, MH, TC),
For my family, who always believed (JAK, KK, LP, KEK, RF, RC, JCK),
For my soon to be wife, who always edited (RS),
For Haitian women whose lives we hope to improve,

This work is for all of you.

JKK (4.12.2012)
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CHAPTER 1. INTRODUCTION

Overview

Cervical cancer is rapidly approaching the status of a public health victory. Our comprehension of etiology, prevention and treatment is tantamount to other eradicated infectious diseases such as polio. It is known that persistent infection by high risk human papillomavirus (HR HPV) is a necessary cause of cervical cancer (Bosch et al., 2003; Wallboomers et al., 1999). Within the past five years two vaccines (Guardasil™ and Cervarix™) against two types of HR HPV known to cause 70% of invasive carcinomas worldwide have been developed and dispersed. Routine screening using cytology-based, clinical examination and testing procedures, such as the Papalanicolau (Pap) smear screening is a moderately sensitive and specific procedure for the detection of pre-cancerous lesions. Finally, outpatient-based, non-surgical procedures including cryotherapy and loop excision electrosurgical procedure (LEEP) can be used to treat pre-cancerous lesions. Despite these advances in the prevention, identification, and treatment of cervical cancer it is estimated that more than 500,000 women worldwide will die of the disease in 2011 (WHO 2010). The majority of these deaths (over 85%) will occur among women in developing nations (Ferlay et al., 2010; Jemal et al., 2011) and, in the U.S., among women who are disenfranchised from the formal healthcare system including immigrants, ethnic minorities, and those of low socioeconomic status (SES) (Datta et al., 2006; A. Nelson, 2002). Reducing cancer disparities remains a priority of the U.S.
Department of Health and Human Services (DHHS) Healthy People decennial goals and the overarching theme of the American Cancer Society (ACS) 2015 Challenge Goals (Byers et al., 1999).

The disparity in cervical cancer mortality observed for these population subgroups mirrors epidemiologic patterns in cervical cancer incidence (Downs et al., 2008). Surveillance Epidemiology and End Results (SEER) data from the U.S. show that over the past 40 years the incidence of cervical cancer has declined as Pap screening rates have increased (R. A. Smith et al., 2006) but that ethnic minorities and immigrants continue to be diagnosed at a significantly higher rate compared to both non-Hispanic Whites (NHWs) and Blacks (Downs et al., 2008; Ward et al., 2004). Among the immigrant Haitian population of Miami, Florida the incidence rate of cervical cancer is more than four times greater than the surrounding population (Barbee et al., 2010; Kobetz, Menard, Barton, et al., 2009). Routine, on-schedule Pap screening is the most efficacious tool to reduce this burden. A rapid assessment survey of the Haitian immigrant population found that only 44% of women surveyed reported having at least one Pap screening in the past three years, approximately half the national average for Black women (Kobetz, Menard, Barton, et al., 2009). While population-based studies show that Pap testing rates among Blacks nationally are comparable to NHWs (Downs et al., 2008) these aggregations mask the true experience among ethnic minorities and illustrate that current solutions, such as the National Breast and Cervical Cancer Early Detection Program have missed a portion of their target population (Kobetz, Menard, Barton, et al., 2009).
The factors underlying the screening disparity in the immigrant Haitian population have not been quantitatively explored. Certainly, the lower socioeconomic status (SES) of the population plays a significant role in limiting access to care but a host of other social and cultural factors may also be at play. A comprehensive review of racial and ethnic health disparities in health published by the Institute of Medicine (IOM) describes how cancer disparities arise from the interplay of economic, social, and cultural factors (Figure 1)(A. Nelson, 2002).

**Figure 1. Factors that influence cancer disparities (Adapted from Ward E (Ward et al., 2004) , Freeman HP (Freeman, 1989) and IOM (A. Nelson, 2002).**

![Diagram of Economic, Social, and Cultural Factors](image)

The IOM assessment illustrates the dynamic relationship between these factors along the cancer continuum. A significant body of research has found that individual-level access and knowledge-related factors are the most important determinants of screening in ethnic minority populations. Recently, public health research has also found evidence that the economic, social and cultural attributes of communities themselves exert a separate influence on the risk of cervical cancer and to a limited extent individual behaviors, such as Pap
screening. No studies have attempted to quantify the impact of culture on Pap screening in the immigrant Haitian population. Moreover, none have taken a multilevel approach to examine the relationship between community SES and women’s comprehension of cervical cancer and their utilization of Pap screening. This dissertation aims to fill that gap in understanding by examining how deprivation in material and social resources, coupled with non-Western conceptualizations of health, may reduce a woman’s comprehension of disease etiology and reduce her utilization of prevention tools.

Haitians tend to be underrepresented in cancer research as a result of structural, cultural and linguistic factors (Giuliano et al., 2000). Over the past seven years the University of Miami Disparities and Community Outreach Core (DCO Core) has developed and implemented a campus-community partnership comprised of academic researchers and community members from Little Haiti, the predominantly Haitian ethnic enclave of Miami, Florida. This partnership aims to address this research disparity by conducting Community-based participatory research (CBPR) studies to understand the factors related to the high incidence of cervical cancer from a biocultural model of disease. To accomplish this task community members and academic researchers are equitably involved in the design and implementation of a new approach to screening aimed at circumventing the economic, social and cultural barriers to Pap screening. This approach paired an at-home cervical self-sampling tool that tests for HR HPV infection with a network of Community health workers (CHW) to disseminate the
test, provide cervical cancer education, and navigate women to appropriate follow-up care.

**Dataset & Specific Aims**

This dissertation utilizes data collected during one phase of this CBPR initiative, conducted between 2007-2008, entitled “Pap tes Lakay”, or “Pap test in House” that distributed the self-sampling intervention and which also collected data on Pap screening behavior, socio-economic characteristics and sociocultural barriers. The IOM model (Figure 1) is used as a framework for the identification of relevant individual and community attributes thought to be drivers of Pap screening behavior. Theories from the fields of health behavior (the Health Belief Model – HBM) and social epidemiology (Social-Ecology – SE) are used to select and test specific economic, social, and cultural variables may function as impediments to cervical cancer knowledge and recent Pap screening at both the individual- and community-level.

For this work several terms require definition: cervical cancer knowledge, psychocultural beliefs, sociocultural identity, and context.

- **Cervical cancer knowledge** refers to a woman’s understanding of the Western biomedical model of cervical cancer etiology and her comprehension of Pap screening guidelines. Scale measures of the level of knowledge were created using queries taken from the Behavioral Risk Factor Surveillance System (BRFSS 2007) and the Health Information National Trends Survey (HINTS 2007).
• *Psychocultural beliefs* refers to the set of individually held beliefs regarding cervical cancer that are consistently reported by Haitians, such as perceiving cervical cancer as a fatal diagnosis (cancer fatalism), being hit in the lower abdomen causes cervical cancer, and multiple abortions can cause cervical cancer (Menard, Kobetz, Maldonado, et al., 2010). While these are only a select few responses they were chosen to represent a woman’s level of identification with traditional Haitian cultural beliefs surrounding cervical cancer and were available from the dataset ¹.

• *Sociocultural identity* refers to distribution of specific neighborhood community resources that are related to either Haitian social and cultural phenomenon. It is hypothesized to represent the level of cultural identify that a population segment, living in a specific area, is exposed to through their neighborhood environment. For this dissertation it is measured as the geographical distribution of Haitian botanicas².

• *Context* refers to the socioeconomic (SES) characteristics of a geographically defined space (Diez Roux, 2002).

Two separate studies are presented in this dissertation: Study 1 examines individual-level predictors, including socioeconomic status, psychocultural beliefs,

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¹ Further explication of this reasoning is presented in Study 1, Methods. The selection of these representative factors reflected the variables available within the dataset and the results of a principal components analysis which revealed that these three variables were representative of the hypothesized construct.

² Further explication of this reasoning is presented in Study 1, Methods. These resources are known to influence gynecological health and are hypothesized to reflect the degree of acculturation within an area.
and the sociocultural environment, of recent Pap screening and cervical cancer knowledge. Study 2 examines upstream, or contextual, predictors of both knowledge and screening, examining how socioeconomic characteristics of a geographically defined area affect both outcomes. The specific aims of this dissertation are:

- **Specific Aim 1:** To create a conceptual framework to understand the influence of psychocultural beliefs, sociocultural identity and context on cervical cancer knowledge and recent Pap screening within the Haitian immigrant community.

- **Specific Aim 2:** To use both personal survey data and neighborhood assessments to quantitatively evaluate the influence of psychocultural, sociocultural and contextual personal and community characteristics on cervical cancer knowledge and recent Pap screening.

**Cervical Cancer Mortality**

In 2008 cervical cancer was the third most commonly diagnosed cancer in women, accounting for 9% (529,800) of total new cancer cases and 8% (275,100) of total cancer deaths worldwide (Ferlay et al., 2010). Over 85% of these deaths occur in developing countries (Ferlay et al., 2010; Jemal et al., 2011). The cumulative mortality risk for cervical cancer is low in developed nations; 0.5% in North America compared 3.8% in Eastern and Western Africa and 2.5% in South America (Ferlay et al., 2010). Across the globe the burden of disease is greatest among women living in areas where access to healthcare is
limited (Kamangar et al., 2006). While mortality is lower between the U.S. and other nations, within the U.S., being a minority, foreign born, and of low socioeconomic status is associated with an increased risk of mortality from cervical cancer (Akers et al., 2007; Bach et al., 2002; McDougall et al., 2007; O'Fallon et al., 2002; Shavers et al., 2002). Nationally, Blacks are more than twice as likely to die from cervical cancer as non-Hispanic whites (NHWs) (Powe, 2007; Watson et al., 2008). Between 2004-2007, the average age-adjusted death rate was 4.4\(^3\) for Blacks and 2.2 for NHWs. In Florida, the age-adjusted death rate (AADR) from 2007-2009 was 4.1 for Blacks, 2.3 for Hispanics, and 2.2 for NHWs (FCDS 2010). The disparity in mortality reflects, in large part, the fact that ethnic, minority, and women of low SES women are typically diagnosed at older ages and with more advanced, or later-stage, disease. (Bach et al., 2002; Bandura, 2001; Downs et al., 2008; Ferrante et al., 2000; Freeman et al., May 2005; Liu et al., 1998; Newmann et al., 2005). Later-stage diagnosis reflects a lack of access to both timely and appropriate follow-up treatment as well as screening according to recommended guidelines. Cervical cancer incidence data illustrates how a lack of screening is ultimately a significant factor in mortality for the Haitian population.

**Cervical Cancer Incidence**

Since the mid-1970’s incidence from cervical cancer has declined by 75% in the U.S. (Ries et al., 2007). Much like mortality rates, there remains a significant gap in incidence rates between minorities and NHWs (Howlader et al., 2011). Based  

\(^3\) All mortality and incidence rates are per 100,000 females unless otherwise stated.
on SEER data from 1975 and 2008, the incidence rate among NHWs peaked at 13.3 in 1975 and decreased linearly to 6.3 in 2008. For Blacks, the incidence of cervical cancer was 33.1 in 1975 and declined to a low of 8.5 in 2007. The latest available data show that the 5-year average incidence rate from 2004-2008 was 8.0 for NHWs and 10.0 for Blacks.

Among Black women the incidence rate ratio compared to NHWs of invasive to *in situ* cancer was 2.49 to 1.79 from 1976-2000 and highest among the oldest age groups (S. S. Wang et al., 2004). For Black women diagnosed with invasive cancer the rate of regional/distant diagnosis was 6.2 compared to 2.9 for NHWs, and again highest among the oldest segments of the population (McDougall et al., 2007). In the Haitian community of Miami, Florida, the estimated incidence of cervical cancer was approximately 38.0 in 2007, more than four times the rate among Blacks nationally and three times greater than for females (11.2) in surrounding Miami-Dade County, Florida during the same year (Babu, 2010). Numerous studies show that cervical cancer incidence among immigrants primarily reflects a lack of access to screening, as well as, to appropriate and timely follow up for detected abnormalities (Carmichael et al., 1984; Carrasquillo et al., 2004; De Alba et al., 2004; Downs et al., 2008; Fruchter et al., 1986; Goel et al., 2003; Hogenmiller et al., 1995; Janerich et al., 1995; Johnson et al., 2008; Kenter et al., 1996; Kobetz, Menard, Barton, et al., 2009; McDonald et al., 2011; Nasca et al., 1991; Prevention, 2007; Scarinci et al., 2010; Scheppers et al., 2006; Stuart et al., 1997; H. Y. Sung et al., 2000; Wingo et al., 1999). The reasons underlying this lack of screening while largely attributable to economic
and access-related factors but also may include other social and culturally specific issues that are more amenable to change through community-based interventions.

**Cervical Cancer Screening**

The most significant predictor of cervical cancer incidence and mortality in the U.S. is Pap screening utilization (Freeman et al., May 2005; Greer et al., 2010; Newmann et al., 2005). A significant proportion of the observed decline in cervical cancer incidence rates in the U.S. is attributable to widespread implementation of Pap screening following U.S. Preventative Services Task Force (USPSTF) guidelines (Freeman et al., May 2005; *Guide to Clinical Preventive Services*, 1996; Saslow et al., 2003; Waxman, 2005). A large body of evidence shows that the most vulnerable members of the population including immigrants, ethnic minorities, and older women of lower SES are less likely to be screened and have higher rates of cervical cancer (Bacquet et al., 1991; Hakama et al., 1982; Howlader et al., 2011; Singh et al., 2006; Singh et al., 2003, 2004; Tomatis, 1992).

In the U.S. between 55-60% of cervical cancer cases arise in women who fail to meet screening guidelines (Seeff, 2003; Spence et al., 2007; Waxman, 2005). Among immigrant populations specifically, data from the National Health Interview Study (NHIS) found 18% of foreign-born women (compared to only 5% of U.S. born women) reported never having had Pap smear in their lifetime (Tsui et al., 2007). This difference is exacerbated for less acculturated women. Two separate studies of Hispanic immigrants found that approximately 60% of recent
immigrants (< 10 years in the U.S.) had not received a Pap test in the past 3 years compared to approximately 71% of U.S. born women (Carrasquillo et al., 2004; Swan et al., 2003). A similar finding was reported by De Alba et al. (De Alba et al., 2005) who found a 40% increase (OR = 1.40, 95% CI: 1.03-1.90) in lifetime Pap screening among immigrant women who had been in the U.S. for more than 10 years. Citizenship status is also predictive of screening; 76% of noncitizens and 81% of naturalized citizens reported lifetime Pap screening compared to 87% of U.S. born women (Echeverria et al., 2006).

In the only national study comparing Black immigrants to their U.S. born counterparts Singh et al. (2006) showed using NHIS data from 2003 that, after adjustment for other individual covariates (including age, sex, marital status, family size, place and region of residence, education, employment status, and family income), Black immigrants were 61% less likely (OR = 0.39, 95% CI: 0.24-0.63) to report lifetime Pap screen. These findings are consistent with those reported by Kobetz et al. (2009); only 67% of Haitian immigrants in Miami reported having at least one Pap screening in their life and of those only 44% reported having this test within the past three years. Overall, the underutilization of Pap screening among immigrants and ethnic minorities may reflect the differential access to social and material resources (Bazargan et al., 2004; Behbakhht et al., 2004; Hiatt et al., 2001; Sambamoorthi et al., 2003). The majority of Haitians in Miami are recent immigrants, non-naturalized citizens, and lack the social and economic resources to access medical care. Studies examining the association between social and cultural context may provide new insights into
how cervical cancer prevention programs can be improved to address barriers at both the individual and community level.

**Conceptual Framework: Study 1**

Creating a comprehensive understanding of the social, economic, and cultural drivers of screening behavior is necessary to design sustainable, community-tailored public health screening programs and identify the most at-risk subpopulations. Study 1 of this dissertation builds upon the previously published findings of Menard et al. (Menard, Kobetz, Maldonado, et al., 2010) by modeling a conceptual pathway between both psychocultural health beliefs and structural sociocultural factors as influences on health knowledge and screening behavior. In this previous work researchers showed qualitatively that social and cultural beliefs were barriers to Pap screening. The framework of the Health Belief Model (HBM) proposed by Marshall Becker (Becker et al., 1975) provides a starting point by which to model a woman’s understanding of cervical cancer etiology and screening guidelines in relation to her likelihood of obtaining a Pap screening.

The HBM (Figure 2) states that behavioral action is a result of personal characteristics regarding the perceived threat of disease and efficacy related to taking an action to prevent disease. It provides a systematic method to explain, and subsequently predict, preventive health behavior, based on measurable dimensions (Janz et al., 1984; Rosenstock, 1966). Six dimensions of were identified that influence the likelihood of taking a preventative health action.
These include the perception of susceptibility to and seriousness of disease as well as the benefits of and barriers to the taking the action. They also include cues to action such as media messages and self-efficacy for taking the action. They can be measured using health-knowledge related questions (such as comprehension of disease etiology, beliefs in the value of preventive screening) to create summary indexes. This index can be conceptualized as representing one's level of cervical cancer knowledge (Maiman et al., 1977).

Each of these dimensions may be influenced by culture and sociodemographic factors. A large body of literature upholds that individual-level psychocultural beliefs are important determinants in Pap screening behavior across a diverse set of ethnic, minority populations including Hispanics, Asians, and to a limited extent, African-Americans and Haitians (Johnson et al., 2008). Cultural beliefs may impose ideological constraints that are barriers to specific health literacy and
reduce screening utilization. These beliefs, identified specifically in the immigrant Haitian population as barriers to cervical cancer screening, include modesty related to screening procedure and a fatalistic view towards a cancer diagnosis have been (Green et al., 2005; Kobetz et al., 2010; Menard, Kobetz, Maldonado, et al., 2010). Other attributes, such as access to economic and social resources including income and education form structural barriers to the utilization of Pap screening (Austin et al., 2002; Breslow et al., 1997; Brownstein et al., 1992; Fylan, 1998; Harlan et al., 1991; Paskett et al., 2004; Pearlman et al., 1999; J. F. Sung et al., 1997) Specifically among Haitian immigrants these include having a female healthcare provider, having health insurance, low English proficiency, immigration status, and lack of screening knowledge.

Since its inception in the 1960’s, the HBM has provided a strong theoretical rationale and causal mechanism of behavioral action. While the HBM is a reasonable model to explore individual factors in relation to prevention behaviors it does not provide insight into how higher-level social process may indirectly drive behavior. Studies suggest that both the utilization of cancer screening tests, and in particular cervical cancer (Coughlin et al., 2008; Datta et al., 2006), is a function of both individual and social factors operating at the community-level (Kagawa-Singer, 1995). Studies have not explored these factors among an urban, immigrant populations.

Social-Ecology (SE) theory, originally conceptualized in Urie Brofenbrenner’s “Model of the ecology of human development” (Bronfenbrenner, 1979) (Figure 4),
provides an adjunct theoretical perspective to explain the cervical cancer
disparity experienced by ethnic minority populations from the community level.

**Figure 3. Hierarchical organization of Social-Ecological Theory based
on Urie Bronfrenbrenner’s Model of the Ecology of Human Development**

These social, economic, environmental and even cultural community phenomena
operate beyond individual-level level. These contextual economic, social, and
cultural features of communities themselves have been associated with a diverse
array of adverse health outcomes, from cardiovascular disease to cancer (Diez
Roux, 2001). SE theory extends this conceptualization to health and health
behaviors and posits that they result from the interrelationships of multiple levels
of influence (Kaplan, 1999; Krieger, 2001; Macintyre et al., 2002; McLeroy et al.,
1988; Robert, 1999). SE theory, in the context of cervical cancer screening,
proposes that an individual’s learning of behavior was fundamentally affected by these influences (Bronfenbrenner, 1977, 1979).

Broadly conceptualized there are four hierarchically ordered spheres of influence: macro-systems (e.g. national political systems, economic philosophies), exo-systems (e.g. culture/community philosophies and attributes) meso-systems (e.g. neighborhood institutions, healthcare network), micro-systems (e.g. individual beliefs, psychosocial attributes). According to Bronfenbrenner the exo-system “is an extension of the mesosystem embracing other specific social structures, both formal and informal, that do not themselves contain the developing person but impinge upon or encompass the immediate settings in which that person is found, and thereby influence, delimit, or even determine what goes on there.” Cultural beliefs or identity may be expressed at the level of the individual but can also represent a component of the exo-system, such as the degree of cultural identity that a group maintains after immigration.

Culture, by definition, is the collection of patterned ideas, social structures, and resources that are specific to a community itself existing separate from individuals or institutions (Barnouw, 1979). Operating above the level of the individual, social theorist, Pierre Bourdieu, stated that cultural factors create “social practice”. Social practice refers to the idea that individual actions are steeped in the wider structures and patterns of a community, referred to as the *habitus* (Bourdieu, 1980, 1990). Culture impacts all aspects of life, but, specifically important for health behaviors are the conceptual orientations to the
causes, symptoms, and treatments for specific conditions and the physical institutions or resources providing this care, such as traditional healers and traditional healing products. These factors may shape individual beliefs regarding the efficacy and acceptability of Western medicine or provide opportunities and rational for engaging in other non-Western preventive healthcare behaviors.

Previous research has only evaluated culture as an individual expression and not as a social construction. Study 1 addresses this idea by using a novel, community-specific measure to represent the level of cultural identity of the neighborhood where a Haitian woman resides. The location and density of Haitian botanica, traditional health and religious store, are used as a proxy variable to represent the potential role of the sociocultural environment (exo-system) on the cervical cancer knowledge and screening behavior.

**Conceptual Framework: Study 2**

The culture of a community is not the sole, community level factor potentially affecting health outcomes. Bourdieu’s concept of the *habitus* is composed of other social processes such as socioeconomic conditions. While individual-level factors explain a large portion of the Pap screening behaviors research also suggest that the socioeconomic conditions of neighborhoods themselves, are important upstream determinants of healthcare utilization. Sociological theories of the culture of poverty and the underclass state that living in socially, economically, and physically deprived neighborhoods or communities reduces the opportunities available for individuals to engage in health prevention behaviors (Shaw et al.,
1969; Wilson, 1987). This community context is most often represented by neighborhood SES.

Neighborhood SES, while constructed through individual attributes, is representative of aggregate social processes and is therefore conceptually distinct from, and not a proxy for, individual SES (Diez Roux, 2001). This theoretical orientation states individual characteristics, such as income, determines the proportion of individuals living in poverty (a commonly used measure of area SES), which in turn reflects other social aspects of a community that cannot be measured on an individual level such as crowding, crime, or the lack of social or health services (Macintyre et al., 1993; Robert, 1999). In this way the compositional characteristics (individual attributes summed to the aggregate) of an area, represent higher-level phenomena that can be either indirect or direct influences on health behaviors and predictors of those behaviors (such as knowledge). To estimate the effects of neighborhood context on health public health research routinely relies on area-based socioeconomic measures (ABSMs) from the U.S. census to represent an individual’s level of exposure to the social and material resources within an area (Krieger, 2002). ABSMs can be measured at various geographic scales; however it is widely acknowledge that using census block data provides the most precise measure for these influences on individuals (Krieger, 2002; Krieger et al., 1997).

Social epidemiology literature conceives a variety of general mechanisms by which area context affects health. As proposed by Roberts (Robert, 1999) area SES can affect health through two pathways: 1) by directly shaping the SES of
individuals or (2) by affecting the physical and social environment which influence
the “culture” of a community. Similarly, Macintyre (Macintyre et al., 2002;
Macintyre et al., 1993) proposes that five aspects of neighborhoods may be
health promoting or damaging including: (1) physical features of the environment
shared by all residents such as air and water quality; (2) availability of health
environments at home, work, and play (such as green space); (3) services
available to support people in their daily lives (such as transportation and
education); (4) the sociocultural features of a locality (such as community cultural
venues); and (5) the reputation of an area (such as neighborhood
stigmatization). Living in lower SES neighborhoods may affect health by directly
lowering an individual residents SES reducing the opportunities of involvement
in benevolent behaviors (such provision of spaces for exercise, availability of
nutritious foods, accessibility to specialist physicians including OB-GYNs)
(Robert, 1999).

In general, living in neighborhoods of low SES is associated with increased
negative health outcomes such as cardiovascular disease and stroke (Chaix,
2009; Chaix et al., 2007; Galea et al., 2010; G. D. Smith et al., 1998), reduced
cancer survival (Lian et al., 2011; Singh et al., 2004), lower self-rated
health(Engstrom et al., 2008; Giatti et al., 2010; S. V. Subramanian et al., 2001;
S. V. Subramanian et al., 2006) and increased overall mortality risk(Guest et al.,
1998; Waitzman et al., 1998). More recently, there is evidence that cancer
incidence, stage, survival, and mortality differs by these socioeconomic
characteristics of neighborhoods. Among men and women, regardless of
race/ethnicity, those living in higher poverty areas (> 20%) had significantly higher rates of late-stage cancer diagnoses and lower survival across multiple cancer sites (lung, prostate, breast, colorectal, and cervical) compared to those living in low poverty areas (<10%) (Singh et al., 2004).

Multiple studies have examined ABSMs in relation to Pap screening behavior and find mixed evidence that socioeconomic context influences this outcome (L. C. Baker et al., 2004; Benjamins et al., 2004; Coughlin et al., 2010; Coughlin et al., 2006; Coughlin et al., 2008; Datta et al., 2006; Fukuda et al., 2005; Schootman et al., 2006; Wells et al., 1998; Woltman et al., 2007). Studies employing only individual-level theoretical frameworks, such as the HBM, to understand behavior, cannot examine these upstream social factors. Recently, with the advent of statistical methodology to study multilevel frameworks which is easily accessible to researchers one can investigate whether these factors play a role at all above and beyond individual-level correlates (Diez Roux, 2007). This methodology is particularly appropriate in Community-based participatory research, where ultimately the goal is to use research to shape social change. Community interventions, which incorporate an understanding of how social processes are important drivers of health, may create more sustainable solutions to address health disparities.

Building upon the individual-level factors important to screening found in Study 1, Study 2 uses a multilevel framework to explore the influence of context independent of individual-level risk factors as is recommended in the social epidemiology literature (Aral et al., 2005; Diez Roux, 2001, 2002, 2007; Diez
Roux et al., 2001; Krieger, 1994; Macintyre et al., 2002; Macintyre et al., 1993; Smiley et al., 2010). For cancer screening in particular, recent studies have advocated for using a multilevel modeling approach for ascertaining the independent effects of contextual factors on individual level outcomes (Balluz et al., 2004; Datta et al., 2006; Hiatt et al., 2002; Mobley et al., 2010; David E. Nelson et al., 2003). Only five such studies have examined the independent contribution of ABSMs to Pap smear screening, (Coughlin et al., 2008; Datta et al., 2006; Fukuda et al., 2005; Schootman et al., 2006; Woltman et al., 2007), only three of which were conducted the U.S. (Coughlin et al., 2008; Datta et al., 2006; Schootman et al., 2006). No studies have examined contextual attributes in relation to health outcomes among ethnic minority populations specifically and no studies of Pap screening or cervical cancer knowledge have been conducted using census block group level data within an urban environment.

**Dissertation Hypotheses**

Figure 4 presents the proposed conceptual model and the pathways between predictors and outcomes to be quantitatively examined across both studies. In each of the two studies presented, the main outcomes are: (1) having above average cervical cancer knowledge and (2) having a recent Pap screening.

The vertical axis illustrates the multiple levels of influence proposed by SE theory to affect both outcomes. The components of the HBM are contained within the heavily shaded lines. Boxes represent each measured matrix of factors that were determined to be of importance to both outcomes based on a literature review.
and available data. Arrows to outcomes indicate potential predictors and crossing lines indicate interactions to be tested.

Mediation pathways from the Culture and Context domains are examined in relation to both outcomes and relevant predictors.

![Conceptual model](image)

**Figure 4.** Conceptual model for hypothesized relationships of Context, Culture, Demographics and Knowledge in relation to Pap smear screening among the Haitian immigrant population.

**Study 1**

Broadly conceived Study 1 begins conceptually, by applying theory of individual-level behavior, the HBM framework, to evaluate how cervical cancer knowledge relates to Pap screening behavior within the population. Chi-square statistics and unconditional logistic regression are used to quantify the stratum specific
proportions and measures of association between demographics, cervical cancer knowledge and recent Pap screening. The specific hypotheses to be evaluated are presented below (pathways are correspondingly labeled in Figure 4):

**Hypothesis 1a**: The proportion of women who have had a recent Pap will be lower among those having below average cervical cancer knowledge.

**Hypothesis 2a**: The proportion of women who have a had a recent Pap will be lower among those with less education and income or who do not have health insurance or a usual source of care.

**Hypothesis 3a**: The proportion of women who have below average overall cervical cancer knowledge will be lower among women with less education and income or who do not have health insurance or a usual source of care.

The next phase of this study measures the influence of culture (psychocultural beliefs and the sociocultural environment) on cervical cancer knowledge. Cultural factors are explored as both modifier of the association between knowledge and demographics. The specific hypotheses to be tested are:

**Hypothesis 4a**: The proportion of women who have below average overall cervical cancer knowledge will be higher among women who have an above average level of psychocultural beliefs.
**Hypothesis 5a:** The proportion of women with below average overall cervical cancer knowledge will be higher for women living in areas with a greater level of Haitian sociocultural identity.

**Hypothesis 6a:** The proportion of women who have below average overall cervical cancer knowledge will be higher among women who have an above average level of psychocultural beliefs and those with less education and income or who do not have health insurance or a usual source of care (interaction pathway).

**Hypothesis 7a:** The proportion of women who have below average overall cervical cancer knowledge will be higher among women who live in areas with a greater level of Haitian sociocultural identity and those with less education and income or who do not have health insurance or a usual source of care (interaction pathway).

**Hypothesis 8a:** The proportion of women who have a recent Pap will be lower among women with an above average level of psychocultural beliefs or those living in areas with a greater level of Haitian sociocultural identity (potential mediation pathway)

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4 The final hypothesis tests the potential of cultural factors as mediators of the knowledge-Pap screening relationship (given that other criteria including Hypothesis 1a is confirmed and if results indicate that adjusted for either psychocultural or sociocultural indicators knowledge is less predictive of recent Pap compared to unadjusted results from 1a):
Study 2

In Study 2, SE theory is used as a conceptual orientation to test whether context (measured using census tract ABSMs), at the neighborhood level, is associated with recent Pap screening and cervical cancer knowledge. A hierarchical logistic regression model is used to test for associations between both outcomes and area-level indicators adjusted for individual SES and other significant individual-level covariates. Similarly to Study 1 this study hypothesizes and tests whether these upstream factors are direct and indirect predictors of outcomes. The specific hypotheses to be tested in Study 2 are:

**Hypothesis 1b:** Increasing neighborhood socioeconomic deprivation, represented by single indicators of occupational status, educational attainment, poverty level, median income, proportion foreign born, linguistically isolated, female-headed households, and a composite index all these factors, will reduce the likelihood of recent Pap screening, adjusted for individual-level correlates of SES.

**Hypothesis 2b:** Increasing neighborhood socioeconomic deprivation (tested using the same factors as in H1b) will reduce the likelihood of recent Pap screening, adjusted for both individual-level predictors of Pap screening and individual-level SES.

**Hypothesis 3b:** Increasing neighborhood deprivation will reduce the likelihood of above average cervical cancer knowledge, adjusted for individual-level correlates of SES.
**Hypothesis 4b:** Increasing neighborhood socioeconomic deprivation will reduce the likelihood of above average cervical cancer knowledge, adjusted for both individual-level predictors of knowledge and individual-level SES.

**Relevance and Implications**

This research is the first to quantify the association between predictors of Pap screening among a large population of immigrant Haitians living in Miami, Florida. Furthermore, it examines, for the first time in an immigrant minority population, the association between context and a preventative health behavior.

This work addresses can aid public health practitioners in several ways. First, research on culture and cervical cancer screening (including knowledge) has primarily utilized qualitative methods, such as focus groups and in-depth interviews. Employing a qualitative strategy provides accuracy for identifying important drivers of behavior but lacks precision for public health practitioners to identify mechanisms of behavior and strategies for intervention (Winter, 2000). To do so, study 1 adapts theories of health behavior and social epidemiology specific to the Haitian community to improve precision of measurements and ensure social and cultural relevancy of findings (Freudenberg et al., 1994).

Second, Study 1 develops a quantitative scale-based measure of psychocultural beliefs which has not been previously established in the literature for the Haitian population. Finally, Study 1 provides a novel conceptual and methodological approach (community-based mapping of sociocultural environmental identity) for evaluating cultural factors beyond individual level beliefs.
Study 2 adds to the growing body of contextual analysis literature by modeling the effects of a comprehensive set of ABSMs in a small-area study among an urban, ethnic minority population. Previous studies of cervical cancer screening utilize variety of ABSMs (most notably poverty and education) inconsistently, and report positive, negative, and null associations (L. C. Baker et al., 2004; Benjamins et al., 2004; Coughlin et al., 2010; Coughlin et al., 2006; Coughlin et al., 2008; Datta et al., 2006; Fukuda et al., 2005; David E. Nelson et al., 2003; Siahpush et al., 2002; Woltman et al., 2007). These studies have exclusively occurred in either population-based cohorts utilizing data from national surveys where the smallest geographic area represented is the county-level. Furthermore, studies conducted at smaller levels (such as census tracts) do not differentiate ethnic minorities from typical race-based cohorts (NHWS, Black, Hispanic) which masks the substantial variation in behavior that can occur as a result of cultural differences. Methodologically, many of these studies use standard single-level logistic regression and fail to account for nested structure of the data in examining contextual factors. Determining which factors and at what level SES is predictive of Pap screening may help to identify how social determinants of health are important among chronically disadvantaged populations.

Finally, these analyses can identify direct or indirect mechanisms through which these factors influence behaviors providing a richer understanding of the potential causal mechanisms that underlie behavior as is advocated for by social epidemiology researchers (Krieger, 1994; Robert, 1999). Therefore, these studies
can provide data as to the best practices for the implementation of community-based cervical cancer screening programs in this community. For example, incorporating community cultural venues, such as Haitian botanicas as a resource for cervical cancer education may be a mechanism to reach high-risk women. Furthermore, given the limited resources available for Pap screening in the community, interventions may be more successful if they target specific community segments using geographically defined areas based on important sociocultural or contextual descriptors of these areas. These types of community-based interventions will be more efficacious and efficient if they are informed by an understanding how culture and context influence knowledge and screening within this population.
CHAPTER 2. DATA SOURCES, PREVIOUSLY PUBLISHED FINDINGS AND GIS/MULTILEVEL ANALYSIS METHODS

Overview of CBPR

To evaluate the proposed hypotheses this dissertation utilizes data from a CBPR initiative to reduce the burden of breast, cervical and colorectal cancer within the immigrant Haitian community of Miami, Florida. CBPR is research methodology, increasingly popular in public health that shifts the focus of traditional epidemiologic inquiry from research within a community to research with a community. Public health practice has recently recommitted to embracing this type of participatory action research as a methodological framework because of its focus on addressing the social determinants of health. In populations like those immigrant Haitians living in Miami, CBPR can assuage concerns of participants regarding the purposes of academic research and bring them to the table as equitable partners for its production (Minkler, 2000; Minkler et al., 2003). CBPR provides a voice to those individuals who before were only “researched”, and by so doing instills the values and beliefs of community members into the process to ensure that research is mutually beneficial and results in action towards social change. This shift that CBPR initiates, which prioritizes community collaboration throughout the research process, from study design and implementation to dissemination of findings, has been effective in enhancing the impact of public health campaigns throughout those ethnic, minority communities who are disenfranchised from the formal healthcare system (Minkler, 1997, 2000; Minkler et al., 2003).
CBPR was born from the work of Kurt Lewin as a means to overcome social inequalities (Lewin, 1946) and further work by the educator Palou Freire among disadvantaged populations of Brazil. Their work highlighted the importance of having communities identify their own problems and solutions in order to advance sustainable social change (Freire, 1992). The eight key principles of CBPR in public health research proposed by Israel and colleagues (Israel et al., 2003) are: recognition of the community as a unit of identity, a focus on strengths and resources within the community, the facilitation of collaborative partnerships in all phases of the research, the integration of knowledge and action for mutual benefit of all partners, the promotion of co-learning to create an empowering process that attends to social inequalities, to utilize a cyclical and iterative process, to address health from both positive and ecological perspectives and to disseminate findings and knowledge gained to all partners. By changing the orientation of research from an academic pursuit to one which privileges community members’ insights, knowledge, and skills CBPR is able to address risk factors and conditions within communities that may not be readily apparent using traditional means of data gathering such as population-based surveys (Chinman et al., 2004; Minkler, 1997, 2000; Minkler et al., 2003).

Herein lies the strength of CBPR research: its accuracy and relevance to a specific community. However, this fact inherently limits the researchers ability to focus on obtaining precise quantitative estimates of risk or prognostic factors in
health outcomes because of its focus on “process” more than “outcomes”. Given this focus on process it is necessary for CBPR research to utilize other data sources when exploring large, scale social and cultural phenomenon that may by important determinants of health outcomes. By undertaking analyses, such as multilevel modeling, research can increase the precision of CBPR in uncovering the links between sociocultural factors and health. The current research program in Little Haiti has utilized a multitude of methods, ranging from rapid assessment surveys, in-depth interviews, windshield surveys, and census-level data to that end.

**Overview of Community Academic Partnership and “Pap tes lakay”**

To address the cervical cancer disparity specifically university researchers, using a CBPR framework, have developed a community-academic partnership, Patnè en Aksyon, (“Partners in Action”) to address the individual, social, and environmental factors contributing to the excess burden of cancer in the community. To date, this partnership, created through a grant from the National Cancer Institute (R21-CA-11981-01) has created the infrastructure for conducting multiply nationally funded studies of breast, cervical, and colorectal cancer screening. This partnership has as its mission: to develop sustainable interventions that both reflects and builds upon specific community strengths and creates support for biomedical research by building community capacity (infrastructure, knowledge, and a CHW workforce). Bi-monthly meetings of a Community Advisory Board (CAB) have been held successively since the
partnerships inception in 2004 to design, conduct and evaluate cancer prevention research ongoing in the community.

In 2007 as a part of this initiative the partnership developed a CHW and cervical self-sampling intervention, Pap tes Lakay (“Pap test in House”). The research goals of this study were to document the prevalence of HR HPV, assess exposure to feminine hygiene practices, and evaluate the knowledge, attitudes and beliefs in the Haitian immigrant population regarding cervical cancer screening. A review of findings to date is published in several articles by Kobetz et al. (Kobetz et al., 2012; Kobetz et al., 2010; Kobetz, Menard, Barton, et al., 2009; Kobetz, Menard, Diem, et al., 2009). Enrolled participants completed a single cervical self-sampling procedure, a demographic, health, acceptability, and knowledge questionnaire, and received appropriate and timely follow-up treatment for detected cervical abnormalities.

Community Health Workers

To maximize recruitment in terms of time and cost, to foster co-learning and develop community capacity for the delivery of healthcare, and to reflect cultural considerations including modesty and taboos in discussing women's health, CHWs were employed for data collection (Andrews et al., 2004). Broadly defined, CHWs are community members who work primarily in communities that lack access to adequate care and serve as connectors between health care consumers and providers (Witmer et al., 1995). Their role spans a wide continuum, from lay health educators to formal medical practitioners (Love et al.,
An integrated CHW infrastructure has been an important aspect of many public health initiatives and has gained renewed focus with the increase in the use of CBPR principles and methodologies in research. By employing CHWs in these roles health research has been more successful in developing sustainable partnerships, increasing local capacity for healthcare and increasing access to care (Swider, 2002; Zuvekas et al., 1999).

In this study CHWs were nominated by members of the CAB from within their own organizations. They were women of Haitian descent, spoke both Haitian Kreyol and English and were considered community insiders. CHWs underwent didactic instruction on conducting quantitative research and hands-on training with the self-sampler device over a week long period before beginning participant recruitment.

**Participants**

Participant recruitment occurred between August 2007 and April 2008; the study population consisted of women aged 18 or older who had not had a surgical hysterectomy, had no history of cervical, ovarian, or uterine cancer, and who were of Haitian descent. Participants were recruited from community throughout the Little Haiti neighborhood of Miami known to CHWs through business, religious, and social networks. These sites included laundromats, churches, health clinics, and flea markets. Snowball, or convenience sampling, was used as the method of recruitment. Due to the strong distrust for academic research and concerns regarding immigration status, participant selection based on
stratified block group sampling, or other similar sampling schemes, was not a viable option for recruiting the study population. In this study and keeping with the principles of CBPR epidemiological sampling rigor and internal validity were of lower priority than upholding CBPRs philosophical orientation towards community engagement. Furthermore, the previously mentioned barriers to research in this community necessitated the utilization of convenience sampling scheme. Previous research by Kobetz et al. using a random address selector within predominantly Haitian neighborhoods for either door to door recruitment or mailed solicitation resulted in response rates of less than 5% (personal communication Dr. Erin Kobetz).

To that end CHWs approached all women in these venues who appeared to be of Haitian descent and 18 years of age and older, told them about the study, and the gauged their level of interest in participating. Women meeting the eligibility criteria were given a follow-up appointment time, either at their home or at the Center for Haitian Studies (CHS), the local non-profit Health clinic, to complete the full questionnaire and the self-sampling procedure\(^5\). Women were compensated for their time with a $25 giftcard to a local area supermarket. Those women who completed the self-sampling procedure and who tested positive for any HPV infection were directed to follow-up care at CHS, provided at no cost, where they received colposcopy, Pap smear, and treatment via cryotherapy and/or LEEP as appropriate. Women were simultaneously screened for sexually

\(^5\) Full details regarding the sampling procedure can be found in subsequent chapters and in published work by Barbee et al (2009) [16]
transmitted infections (STIs) including Chlamydia, Gonorrhea, Trichomonas Vaginalis and vaginal infections including bacterial Vaginosis, Gardernella, and Candidia. During enrollment CHWs approached 362 women to participate in the study. A total of 290 were eligible to participate and 246 (84.5%) completed the cervical self-sampling and study questionnaire (Barbee et al., 2010). The final sample used for these analyses was 242; 4 women were excluded because of missing address data.

Overview of GIS Methodology

All enrolled participants provided data on their current home address; Haitian botanica locations were obtained from interviews with CHWs and a community neighborhood mapping assessment. All physical location data was compiled using Geographic Information System (GIS) mapping. GIS has been used to assess the distribution of compositional and structural features of a community, across space and their relation to wide-array of health outcomes (Andes et al., 1995; Dulin et al., 2010; Graves, 2008; McLafferty, 2003; Mullan et al., 2004; Nykiforuk et al., 2011; R. Phillips et al., 2003; R. L. Phillips et al., 2000; Rushton, 2003; H. A. Smith et al., 2003; F. Wang et al., 2005). These studies have focused on spatial accessibility to healthcare providers and include such factors as the number, density, or distance to physician providers, community health centers and their relations to access and utilization of services. Linking the location of other features, such as churches, restaurants, schools, grocery stores, or botanicas, permits the examination of the general relationships between health and the hypothesized association with social, economic, cultural, and
environmental contextual attributes (Bazemore et al., 2010; Nykiforuk et al., 2011). Recent evidence suggests that these types of community mapping exercises are useful in investigating community-specific resources that may impact healthcare utilization (Coughlin et al., 2010; Coughlin et al., 2008; Cubbin et al., 2008).

To accomplish the aims of this research addresses provided by study participants during the study period were geocoded using the Miami-Dade county street map shapefiles for 2010 and the latitude-longitude coordinates were compiled by the ArcGIS program v.10.1 (ESRI Inc, 2011). The physical addresses of Haitian botanica were recorded during the community windshield survey⁶. Coordinates representing geographic administrative boundaries (census blocks, counties) as well as street locations are available from the U.S. Census and county offices. Census TigerLine™ files were taken from U.S. Bureau of the Census while Street data was provided by the Miami-Dade County Department of GIS (both available freely online at http://www.census.gov/geo/www/tiger/ and http://www.miamidade.gov/gis/). The study participant and botanica locational data were overlaid allowing the calculation of two key datapoints: distance to nearest Haitian botanica and census block group of residence. Study 1 utilizes the former data to map the distribution and estimate the effects of living in areas of greater Haitian sociocultural identity in relation to cervical cancer knowledge and Pap screening behavior. Study 2 uses the census block group code of residence to obtain neighborhood estimates of socioeconomic data (ABSMS) and

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⁶ Detailed information regarding the design of the windshield survey is included in Chapter 3 – Methods.
estimate the effects of differences in context on both outcomes using multi-level analysis methods.

**Overview of Multilevel Analysis Methods**

Multilevel models (also known as hierarchical, random or mixed effects models) are a necessary data analytic technique to evaluate the independent contribution of neighborhood-level features on individual-level outcomes. In Study 2 the hypothesized association between context and outcomes renders this technique necessary. In standard ordinary least squares (OLS) regression a central assumption is that all observation be independent of one another. This means that the knowledge of the outcome in one individual does not provide any information regarding the outcome in another individual (Cohen, 2003). If the assumption of independence fails then the standard errors of regression coefficients are underestimated inducing overestimation of the significance of predictor variables (Kleinbaum et al., 1998). This spatial clustering is addressed using hierarchical modeling techniques where the source of variation is explicitly portioned into two random components: individual error and second-level (or area-based) error. In this analysis recent Pap screening and cervical cancer knowledge are hypothesized to be clustered by neighborhood (census block group) of residence⁷.

Multilevel models were fit using PROC GLIMMIX in SAS (SAS Institute Inc., Cary NC). This method of analysis provides a robust framework to analyze

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⁷ A detailed analysis of this methodology, using census block/tract boundaries to approximate neighborhoods, including rational, biases and limitations is included in Chapter 4 – Methods.
hypothesized, geographically correlated outcomes when predictor variables are measured simultaneously at different levels (S. Subramanian, 2004; S. Subramanian et al., 2004; S. V. Subramanian et al., 2003). Unbiased estimates of area-based effects are obtained by conditioning on individual-level predictors of SES and other risk factors as appropriate. Using a random intercept model, as opposed to a fixed effects model, allows for sampling variability and the possibility that not all of the important structural components are included in the model (Diez Roux, 2002). Two summary estimates result from fitting this model: the Inter-Class Correlation Coefficient (ICC) and the unbiased beta parameter estimate for the second level predictors. Exponentiating the parameter estimates provides the odds ratio for the likelihood of event compared to not experiencing the event; equivalent to the adjusted estimates obtained in single-level logistic regression models.

**Previously Published Studies**

Prior to the publication of this dissertation several other studies, using data obtained from the *Pap tes Lakay*, were published. These three studies examined the acceptability of the cervical self-sampling intervention, the distribution of HR-HPV in the population and HPV knowledge in the population compared to national estimates. The first published data showed that the cervical self-sampling intervention was an efficacious and viable alternative to Pap smear screening for Haitian women (Barbee et al., 2010). Women overwhelmingly responded favorably to the procedure: 95.1% indicated they found the self-sampler easy to use, 97.6% found it comfortable to use at home, 40.8% reported
experiencing any pain or discomfort, 86.8% preferred it over the Pap smear, and 98.4% stated they would recommend it to a friend.

The next published study from this dataset provided the first data of its kind on the distribution of high risk human papillomavirus (HR HPV) infection and associated risk factors within this, or any other Haitian population, in the country (Kobetz et al., 2012). Among participants the crude cross-sectional prevalence of any HPV infection was 20.7% and the prevalence of any HR HPV infection was 13.2%. The most significant risk-factor for infection was age. A bi-modal distribution, with the youngest and oldest women having the highest prevalence of both any and HR HPV infection, was observed that was similar to other studies examining the HPV distribution in Latin America and the Caribbean.

The final study previously published found lower knowledge of cervical cancer risk factors compared to the general population of African Americans in the U.S. In contrast to estimates obtained from the Health Information National Trends Survey (HINTS), conducted by the National Cancer Institute on a biennial basis (D. E. Nelson et al., 2004), 22.0% of Haitian women reported knowing that HPV is the cause of cervical cancer compared to 72.0% of non-Hispanic black women nationally.

Review

The studies contained within the next two chapters expand upon the initial findings of the Pap tes Lakay study by providing a quantitative evaluation factors
associated with recent Pap screening and cervical cancer knowledge. Specifically, both examine the influence of the socio-cultural and socioeconomic experience of the women residing in the Little Haiti community to further our understanding of the upstream determinants of the cervical cancer burden. To our knowledge these studies are the first to use GIS and multilevel methodology (in addition to the standard assessment of traditional predictors/risk factors and outcomes) with a CBPR initiative. Study 1 is an investigation of the cultural factors that may be important drivers of knowledge and behaviors within the community. Study 2 advances the cervical cancer screening literature by evaluating, for the first time, small area variation in context and its association with screening and knowledge within an ethnic minority population.
CHAPTER 3. STUDY 1: PSYCHOCULTURAL AND 
SOCIOCULTURAL FACTORS RELATED TO CERVICAL CANCER 
KNOWLEDGE AND RECENT PAP SCREENING AMONG A 
POPULATION OF IMMIGRANT HAITIANS IN MIAMI, FLORIDA.

Overview

Between 1975-2008 cervical cancer rates have declined significantly in the U.S., from approximately 13.3 to 6.3 for white females and from 33.1 to 9.2 for black females (Howlader et al., 2011). Despite such improvement, low-income ethnic minorities still shoulder a disproportionate burden of disease (Calle et al., 1993; Downs et al., 2008; Howlader et al., 2011; Lin et al., 2002; Seeff, 2003). In the U.S., nearly 80% of all incident cervical cancer cases occur in ethnic minority populations (Parkin et al., 2002). In the Haitian community of Miami, Florida, the estimated incidence of cervical cancer was approximately 38.0 in 2007, more than four times the rate among Blacks nationally and three times greater than for females (11.2) in surrounding Miami-Dade County, Florida during the same time period (Babu, 2010).

This disparity among immigrant Blacks nationally, and Haitians in Miami, primarily reflects a lack of access to screening as well as appropriate and timely follow up for detected abnormalities (Carmichael et al., 1984; Carrasquillo et al., 2004; De Alba et al., 2004; Downs et al., 2008; Fruchter et al., 1986; Goel et al., 2003; Hogenmiller et al., 1995; Janerich et al., 1995; Johnson et al., 2008; Kenter et al., 1996; Kobetz, Menard, Barton, et al., 2009; McDonald et al., 2011; Nasca et al., 1991; Prevention, 2007; Scarinci et al., 2010; Scheppers et al., 2006; Stuart et al., 1997; H. Y. Sung et al., 2000; Wingo et al., 1999). In a National
Health Interview Study (NHIS) 5% of US native born-women and 18% of foreign-born women reported never having had a cervical cancer screening test (Tsui et al., 2007). Consistently, for U.S. immigrants and ethnic minorities, who tend to be of lower SES, the ability to access culturally competent and affordable care are the key individual predictors of routine cervical cancer screening (Brown, 2011; Scheppers et al., 2006; J. F. Sung et al., 1997). Specifically, women of lower English proficiency, who are unemployed, who do not have health insurance, without a usual source of care and who have not received a physician recommendation to be screened are less likely to have a recent Pap screening (Bazargan et al., 2004; Downs et al., 2008; F. M. Gany, Shah, et al., 2006; Garrett et al., 1998; Harlan et al., 1991; Mandelblatt et al., 1999; O’malley et al., 2002; Panos et al., 2000). These findings are consistent with those reported by Kobetz et al. (2009) during a rapid assessment survey of 1000 Haitian women (Kobetz, Menard, Barton, et al., 2009), 67% of those surveyed in the ethnic enclave of Little Haiti, Miami reported having at least one Papanicolau (Pap) smear screening in their life and only 44% reported having this test within the past three years per current U.S. Preventive Health Task Force (USPHTF) guidelines (Saslow et al., 2003).

Access-related socioeconomic factors alone are insufficient to fully account for reduced screening rates among ethnic minority blacks (Menard, Kobetz, Maldonado, et al., 2010). Rates of recent Pap screening among African-American women are approximately equal compared with non-Hispanic whites (NHWs) in U.S. national surveys (Downs et al., 2008) even though these women
were of comparatively lower SES. Increasingly, research shows that knowledge, attitudes, and beliefs regarding cervical cancer etiology and Pap screening guidelines reduce the likelihood that they women utilize screening tests (Mupepi et al., 2011; Nuno et al., 2011; Redwood-Campbell et al., 2011). Having knowledge of disease etiology and the benefits of prevention are necessary, according to theories of behavioral such as the Health Belief Model (HBM), to utilize preventive health services if they are available (Janz et al., 1984).

Similarly, non-Western, culturally based health views on health are often at odds with Western beliefs and practices of disease prevention. A comprehensive review of Pap screening indicated that holding non-Western health prevention orientations (such as a humoral view of health) and having a fatalistic view toward cancer were consistently reported by women who did not undergo screening (Johnson et al., 2008). Research among ethnic minority subgroups shows that as the level of cancer knowledge decreases, including understanding of disease etiology, comprehension of preventive health concepts and guidelines and level of ethnic or cultural health isolation so too does both the odds of lifetime or recent Pap screening (Austin et al., 2002; Breslow et al., 1997; Brown, 2011; Brownstein et al., 1992; Carter et al., 2002; Fylan, 1998; Harlan et al., 1991; Paskett et al., 2004; Pearlman et al., 1999; J. F. Sung et al., 1997).

The HBM provides a framework to investigate why culture interacts with individual-level health beliefs and impacts cancer screening behavior (Janz et al., 1984; Rosenstock, 1966). Haitian women’s limited knowledge of cervical cancer etiology and screening guidelines are likely barriers to screening. But according
to the HBM framework, as expanded by Rosenstock (Rosenstock et al., 1988), demographic variables and what Rosenstock terms “sociopsychological” factors, are effect modifiers altering the uptake of cervical cancer screening (Gillam, 1991). This sociopsychological dimension represents the influence of socially experienced factors, for instance the health beliefs of a culture and an individual’s level of identification with those beliefs. Experiencing and embodying culture is not a static process. No studies have attempted to incorporate an area-based measure of culture that can be conceptually distinct from individually reported measures of acculturation and that may reflect an actual social, cultural, and physical resource for health information within a community.

Therefore, for Haitian women their level of cultural health identification or exposure to a culturally isolated environment may be moderator of the association between knowledge and screening. While numerous evaluations have examined how holding certain culturally-based beliefs regarding cervical cancer, or cancer in general, is a barrier to screening no studies have examined this association among Haitian immigrants nor how individuals health behaviors may vary according to one’s sociocultural experience. By examining whether women are more likely to have cervical cancer knowledge or be screened when they: (1) less strongly identify with these beliefs or (2) reside in areas with less Haitian cultural identity it is possible to understand the spatio-temporal, cross-level (individual to community) influence of culture as it impacts health knowledge and behaviors.
Identifying if these types of sociocultural features that influence health may provide a strategy for the identification of population subgroups that are at higher risk for adverse cervical cancer outcomes. To fill this gap in understanding the specific aims of this paper are to:

1. Evaluate whether cervical cancer knowledge is predictive of recent Pap smear screening (defined as having had at least one Pap smear within the last 3 years) within the immigrant Haitian population of Miami, Florida.
2. Test whether individuals having a greater level of identification with culturally-based health beliefs are associated with screening and/or knowledge.
3. Measure and report on the Haitian sociocultural environment by examining the location of Haitian botanicas, and test whether living in a richer Haitian sociocultural environment is associated with having cervical cancer knowledge and/or recent Pap screening.
4. Test whether these psychosocial or sociocultural factors modify the association between demographic characteristics and cervical cancer knowledge.

To our knowledge no other studies have examined the predictors of Pap screening in the Haitian immigrant population and whether cultural factors are
drivers or modifiers of this behavior. This research may be important for identifying geographic areas for targeted interventions. Moreover, it may provide insights into mechanism for delivering those interventions, such as whether it may be necessary to incorporate Haitian botanicas, and their proprietors, into future CBPR research initiatives aimed at reducing cervical cancer morbidity and mortality.

Background and Hypotheses

Association Between knowledge and Recent Pap Screening

Aim 1 of this study is addressed using the conceptual framework of the HBM and testing for an association between overall cervical cancer knowledge and recent Pap screening. The six dimensions of the HBM: the perception of susceptibility, seriousness, benefits, barriers, cues to action and self-efficacy. The likelihood of taking the preventive health action is a function equally weighted amongst the components according to value expectancy theory (Janz et al., 1984; Rosenstock, 1966; Rosenstock et al., 1988). No standardized set of questions exists to assess each component although there are strong similarities across the literature. Overall, responses to questions regarding cervical cancer risk factors and cervical cancer screening guidelines are used to create a summary measure representative of the dimensions of the HBM (Johnson et al., 2008). A woman’s knowledge of cervical cancer etiology, including associated risk factors, symptomology and treatment, describes her perception of susceptibility to and severity of disease. Studies of immigrant women find higher Pap screening utilization among women who know that that cervical cancer is caused
by HPV infection, cervical pre-cancers show no signs or symptoms, who believe that a Pap screening is necessary to prevent disease and who understand treatment for pre-cancerous lesions is available and effective (Behbakht et al., 2004; Carpenter et al., 1995; Chigbu et al., 2011; Esin et al., 2011). A study of African American and Hispanic immigrants in Chicago, Illinois found women who “did not know it was possible to get cervical cancer” were more than twice as likely (OR = 2.6, 95%CI 1.1-6.4) to not report any lifetime Pap screening (Behbakht et al., 2004). In an population of Turkish women found that among those without a recent Pap screening 75.2% believed that they were “not at risk for cervical cancer” (Esin et al., 2011).

Ethnic minorities may also have lower cervical cancer screening knowledge compared to NHWs. These variables represent a woman’s perception of the benefits of, barriers to, and self-efficacy for Pap screening. A UK study found that knowledge of cervical cancer screening was lower among ethnic minorities (66%) compared to NHWs (84%) (Robb et al., 2010). Overall, not comprehending that screening can prevent cervical cancer, misinformation or misunderstanding the timing and frequency of Pap screening, and knowing how or where to obtain screening lower screening rates among ethnic minorities (Allahverdipour et al., 2008; Carter et al., 2002; Lawsin et al., 2011; Mangoma et al., 2006; Redwood-Campbell et al., 2011). A study of Hispanic women asked four questions: “What is a Papanicolaou test?”, “A Pap test can…”, “The Human Papillomavirus is a virus that…”, and “When should screening tests [for cervical cancer] be done?” to
assess screening and prevention comprehension (Lawsin et al., 2011).

Responses varied significantly according to country of origin and women having a recent Pap screening answered 61% of cervical cancer questions correctly compared to 47% of those without recent screening (p<.01). Similarly, a qualitative study across a diverse population of woman with a non-English primary language (Arabic, Cantonese, Somali, Dari, and Spanish) found those lacking information on the necessity of screening, how the procedure is performed, and misunderstanding the implications of abnormal test results were less likely to be screened (Redwood-Campbell et al., 2011). Among low-income Black residents of New York City increasing knowledge of the frequency and timing of screening tests was associated with a nearly 3-fold increase (OR = 2.71, 95% CI:2.02-3.63) in recent Pap screening while knowledge regarding the importance of early detection was associated with 2-fold (OR = 1.79, 95% CI:1.19-2.68) increase (Carter et al., 2002). This evidence suggests that a primary determinant of screening is the accumulated cervical cancer etiologic and Pap screening guideline knowledge.

**Psychocultural Beliefs and Cervical Cancer Knowledge.**

Aims 2 explores the role of psychocultural health beliefs as they relate to cervical cancer knowledge and Pap screening behavior. The influence of culture on behavior reflects the concept of social practice, developed by Pierre Bordieu, which states that individual behavior does not occur separate from the influence of wider structures and patterns within a community. Bourdieu’s concept of the *habitus* (Bourdieu, 1980, 1990) states that conscious and deliberate intentions
are an insufficient explanation of individual behavior. A key component of understanding the *habitus* is that individuals are not consciously aware of its influence and therefore its influence can be observed in individual's behaviors, but not reported by those individuals. Culture is learned behavior shared by the members of a society, acquired through experience, and is a way of life that accounts for how and why individuals form beliefs, attitudes, and behavior (Barnouw, 1979) and can be conceptualized as a formative component of the *habitus*. Therefore, preventative health behaviors are influenced by both an internal, individual conceptualization of disease that will be in part influenced by external, or community-based, aspects of the socio-cultural environment (Frohlich et al., 2001).

At the individual-level there are several identified belief structures that impact Pap screening utilization. Holding a humoral orientation toward health and perceptions of cancer fatalism are individual psychocultural barriers to screening (Chavez et al., 1997; Chavez et al., 2001; Conrad et al., 1996; McMullin et al., 2005; Powe et al., 2006) and understanding of cancer screening knowledge (Dettenborn et al., 2005; Harris et al., 2003a; Lukwago et al., 2003; Powe, 1996; Powe et al., 2003; Powe et al., 1995) across diverse ethnic groups. A humoral conception of health states that illness is a result of internal imbalance of bodily fluids characterized by fluid deficits and excesses, extreme temperatures, and cleanliness/dirtiness and upholds the idea of self-determination in health and disease prevention (Foster, 1994; Minn, 2001). Women holding this health
orientation are much less likely to participate in cervical cancer screening and when encountering financial, logistic, or emotional barriers were more likely to utilized traditional preventive measures (Gregg et al., 2011; Jenkins et al., 1996). Among Latina immigrants those who responded that they would “rather not know if they had disease” or “there is nothing one can do to prevent it” were 42-55% less likely to have a recent Pap screen (Chavez et al., 1997). At the same time a study of African American women found that those who participated in breast or cervical cancer screening who scored low in their comprehension of cervical cancer or screening were less likely to be screened if they held fatalistic viewpoints (Harris et al., 2003b; Lukwago et al., 2003). Similarly, having strong, fatalistic view towards a cancer diagnosis may reduce one’s perceptions of the benefits of screening leading them to not being screened. One study found that among a sample of non-Hispanic Blacks, women who had less knowledge about breast cancer had higher levels of cancer fatalism (Harris et al., 2003b).

In general, the Haitian immigrant cultural conception of health is incongruent with theories, understanding, and practice of Western preventive medicine. Haitian women hold a strong humoral orientation of health and this, along with structural (such as healthcare access, low English proficiency, immigration status, and lack of screening knowledge) and psychosocial factors (fears of modesty related to screening or cancer fatalism) serve as a barrier cervical cancer screening among Haitian women (Kobetz et al., 2010; Menard, Kobetz, Maldonado, et al., 2010). The relationship between culturally-based health beliefs and screening may be
the result of these cultural factors impacting knowledge, and thereby indirectly influencing screening behavior.

**Sociocultural Identity and Cervical Cancer Knowledge.**

Aim 3 of this study explores the association of the sociocultural environment in relation to cervical cancer knowledge and screening behavior. Increasingly, public health research acknowledges that the social, cultural, and physical attributes of where we live are embodied in our beliefs and orientations towards health (Diez Roux, 2001; Macintyre et al., 1993; Pickett et al., 2001). Specifically, the culture of one’s community has many social and physical attributes that may be a distinct mechanism of influence on behaviors. While traditionally culture in social psychology is viewed as discrete and bounded (Triandis, 1989), recognizing that culture may, in fact, be dynamic over time and across space recognizes that individuals will exist within a range of level of cultural identification within the community and neighborhood in which they live. No public health research has evaluated the importance of external environmental influences, related to culture, on the formation of knowledge or the practice of Pap screening (Burke et al., 2009).

Bordieu’s concept of the *habitus* incorporates a full set of social, cultural and physical environmental characteristics that interact with our conceptualization of agency. Agency is our belief in our unique ability to carry out any specific action or behavior; opportunities to engage in behavior are directed by the structural factors within our community. Alfred Bandura’s work on Social Cognitive Theory
(Bandura, 1977, 2001) illustrated the reciprocal relationship between a person, their environment, and their behaviors. The cultural environment shapes an individual’s understanding of disease etiology and constructs societal norms for health promotion and prevention which in turn affect how individuals believe or engage in Western healthcare. The physical presence of resources that are specific to a set of cultural beliefs, such as Haitian botanicas, which are known to be associated with the dissemination of non-Western health information and resources for its practice (Menard, Kobetz, Diem, et al., 2010; Menard, Kobetz, Maldonado, et al., 2010), may be a component of the habitus and a factor of the external environment that affect individual agency.

To address this gap culture is conceptualized and measured as an area-based exposure, not as an individually held belief as previous. It is hypothesized that women living in close proximity to cultural venues (Haitian botanicas) will be less likely to engage in Western preventive medicine for several reasons. First, in general, botanicas are culturally meaningful sites of health advice, care, and spiritual guidance among Latin American and Caribbean communities, including the Haitian population of Miami (Menard, Kobetz, Diem, et al., 2010; Zephir, 2004). Botanicas, ethnic healing-religious stores provide a physical and social space for the exchange of information and these resources for traditional, culturally-based healthcare (Anderson et al., 2008; Fisch, 1968; Gomez-Beloz et al., 2001; Menard, Kobetz, Diem, et al., 2010; Reiff et al., 2003; Viladrich, 2006). Botanicas often serve women who are uninsured and living below the poverty (Reiff et al., 2003). The botanica is seen as a complimentary component to a
pluralistic approach to medical care where owner's often function as healers (Anderson et al., 2008). Women report altering their use of physician directed treatment based on the recommendation of the botanica owner (Reiff et al., 2003). These stores also provide traditional remedies for the treatment of not only “folk” illnesses but for somatic symptoms (Gomez-Beloz et al., 2001). A Haitian woman living in close proximity to many botanicas may be more likely to use those stores or to have her own cultural knowledge subconsciously reinforced compared to a woman never exposed to such environments. A study of Latino botanica users found that 65% of patrons stated they knew of this botanica because it was located within their community and the average number of self-reported visits by each participant to the store in the past year was 13 (Gomez-Beloz et al., 2001).

In the Haitian population of Miami Menard et al. (Menard, Kobetz, Diem, et al., 2010) canvassed local area botanicas to evaluate their role in the feminine hygiene practices, a potential risk factor for persistent HR HPV infection, of Haitian immigrants. These findings showed that botanica owner’s knowledge of cervical cancer etiology was limited and gynecological diseases were thought of as ‘sent’ sickness (“malign magic”). Their orientation toward preventive health practices emphasizes maintaining proper hygiene, through timely self-treatment using traditional herbal and chemical remedies. While this research focused on the construction of feminine hygiene practices it highlights the importance of
these venues for immigrant Haitians in their conceptualization of gynecological disease etiology and prevention.

Second, in the context of the HBM cues to action are the final descriptor of the likelihood of engaging in a preventive health behavior. One study evaluated these among African American and found that a “fear of contracting cancer” increased screening. Another study women reports that Haitian women with a female healthcare provider were more likely to be screened compared to those with a male provider. As these factors provide a cue to action, the sociocultural environment may provide a cue to inaction for Haitian women. Living in an environment that is highly contextualized by Haitian culture may reinforce traditional cultural beliefs regarding gynecological health, be a marker of limited opportunity to engage in preventive healthcare, or may provide limited opportunity to gain outside Western medical knowledge. As botanicas are venues for obtaining information regarding traditional health beliefs and remedies they may modify how personal cognitive and material resources affect Pap screening. Neighborhoods with less cultural identity may lower one’s exposure to cultural phenomenon within their neighborhood environment much like how increasing fast-food restaurant density is associated with higher levels of metabolic diseases. Women with less material resources may be less able to access screening, have access to botanicas, and therefore develop less overall cancer knowledge resulting in lower uptake of Pap screening.
Methods

Questionnaire and Scale development

Questions utilized in this analysis were generated directly from previously validated instruments (including national surveys and community-specific instruments) and both translated and back-translated from English to Haitian Kreyol. Recent cervical cancer screening was assessed by participant self-report. Women were asked “Have you had at least one Pap smear in the last 3 years?” Questions regarding screening guideline comprehension and cervical cancer etiologic knowledge were adapted from the Behavioral Risk Factor Surveillance System Questionnaire (Behavioral Risk Factor Surveillance System Survey Questionnaire, 2007) and HINTS questionnaires (Cantor et al., 2005). Total composite scores were created to create a scale of overall cervical cancer knowledge that combined elements of both the screening guidelines comprehension and cervical cancer etiology and risk factor domains. The composite scale included three and five items from both domains, respectively.

Screening guideline knowledge was judged according to correct responses to the following questions: (q1) How often do you think a woman your age should have a pap smear? Correct response included any of the following: yearly, every two years, or every three years. (q2) Do you think that women should receive yearly Pap smears once they are 18? (Correct response = “Yes”) (q3) Do you think that when you stop having children you no longer need to have Pap smears? (Correct response = “No”).
The cervical cancer etiologic and risk factor knowledge scale was created from the following 5 questions: (q4) Have you heard of HPV? (“Yes” responses were considered correct for the purposes of analysis) (q5) Do you think that cervical pre-cancers and early cancer show symptoms or signs? (Correct response = “No”) (q6) Do you think that women who smoke are more likely to develop cervical cancer? (Correct response = “Yes”) (q7) Do you think that having a higher number of sexual partners increases your risk for cervical cancer? (Correct response = “Yes”) (q8) Do you think that Black women develop cervical cancer more often than White women? (Correct response = “Yes”).

Cultural belief questions were generated based on data obtained from in-depth interviews conducted as a part of a breast cancer screening study by Kobetz et al. (2009) (Kobetz, Menard, Diem, et al., 2009). These questions assessed humoral perceptions of health and cancer fatalism and included the following: (q9) Do you think that being hit in your lower abdomen can cause cervical cancer? (q10) Do you think that most women diagnosed with cervical cancer die from the disease? (q11) Do you think that multiple abortions can cause cervical cancer? Women were assigned a scale value, where those who responded “No” to all questions had the lowest level of identity with traditional Haitian cultural health beliefs and those responding “Yes” to all three had the highest level.
Responses to all questions were coded as either 1 or 0, indicating a correct or incorrect response, agreement or disagreement, for each question among the three scales. “Don’t know” responses were coded as incorrect for both the screening guideline and etiologic and risk factor knowledge responses. Using results from a principal components analysis and the minimum Eigen value criteria all screening guideline questions (q1-q3) were combined with two elements from the cervical cancer knowledge domain (q4 and q5) to create the overall cervical cancer knowledge scale. The questions which did not meet the minimum factor loading requirement of 0.3 (REF) and were dropped from the scale included q6-q8. These questions showed no evidence (low communality and factor loading estimates) of being important components of the overall cervical cancer knowledge construct. An overall cervical cancer knowledge composite score was created by summing the total number of correct responses to these five remaining questions. The mean score (2.71, range 0-5) was used as a cutpoint for having “below average” and “above average” overall cervical cancer knowledge. Women in the below average category were coded as 0 for analysis and women in the above average category were coded as 1. The cultural beliefs scale was similarly constructed by summing the total number of “Yes” responses for each participant. The mean score (2.72, range 0-3) was used as a cutpoint for having “weak” or “strong” identification with cultural health beliefs. Women in the “weak” category were coded as 0 for analysis and women in the “strong” category were coded as 1.
Geographic Analysis

There were two mapping exercises conducted in this analysis. First, participant addresses were geocoded using ArcGIS v.9 (ESRI, 2009, Redlands, CA). An address locator was created from Miami Dade county street file (MDC.GeoStreets 2010) available through the Miami-Dade County GIS department (http://miamidade.gov/wps/portal/Main/GIS#). The second mapping component documented the physical location of Haitian botanicas. Initially, a list of Haitian botanicas was generated by CHWs after consulting a local Haitian business directory for the seven census tracts that comprise the geographic extent of the “Little Haiti” neighborhood and based on their own knowledge and experience as community members. A windshield survey was completed during July and August 2011 by two university researchers. Windshield surveys are an important methodology for documenting neighborhood characteristics that may be difficult for survey respondents to accurately describe and quantify (Raudenbush et al., 1999). Each botanica location identified by CHWs was groundtruthed (physical inspection for existence/operation and verification of address). While CHWs had provided an initial area for the survey, after inspection of the geographical distribution of study participants it was revealed that the historic neighborhood of Little Haiti did not include the majority of home addresses of participants and therefore may not provide the only source of botanicas.
To provide a more rigorous evaluation of the distribution of botanicas, ½ mile buffers were created surrounding participants' homes using the buffer feature of ArcGIS. Due to the large area included in the buffer zones, a random selection methodology was employed to select buffers to be canvassed for the presence of botanicas. Similar methodologies have been employed to study neighborhood effects (so called rook-neighbor methodology) when the cost in both resources and time for collecting data on every single block is prohibitive (Lee 2001). A random number generator was produced (ranging from 1-242) and one participant was selected by matching the random number with a participant ID number. Continuing in numerical order, the next ID number with a matching age category was selected as a control. Researchers drove each buffer area surrounding the randomly selected participants and recorded the physical store addresses of each botanica identified within the buffer in the same fashion as previously employed.

A driver and data collector traveled together in one vehicle and simultaneously looked for the presence of botanicas by identifying stores with names or markings indicating they were purveyors of traditional Haitian botanica merchandise. A total of 14 stores were identified and were open for business in the Little Haiti neighborhood. An additional 7 stores were identified through random participant selection methodology. The surveyed area covered approximately 327 km² (total area included in all ½ mile buffers surrounding participants was 790 km²). A map of the participant residences and ½ mile
buffers surrounding both participant’s homes and botanicas are presented as Figure 1.

The total number of botanicas contained within a ½ mile radius of participant’s homes was calculated in ArcGIS. Overall, 68.2% of participants did not live within ½ mile of any botanica and 25.3% lived in areas with 1-3 stores. The maximum observed number of stores within ½ mile was 12. The mean number of stores within ½ mile was 0.88. Using this cutpoint a bivariate indicator of environmental exposure to botanicas was created; women living within ½ mile of at least one botanica were coded as 1 and those living in areas without a botanica within ½ mile were coded as 0 for analysis.

Statistical Analyses
All descriptive and inferential statistics were calculated using standard procedures in SAS v.9.2.3 (SAS Institute, Cary NC). Cronbach’s alpha statistic was calculated as a measure of the internal reliability for the overall cervical cancer knowledge and cultural beliefs scales. The two main outcome variables of interest were the proportion of women with a recent Pap smear and the proportion of women with “high” overall cervical cancer knowledge. These outcomes were stratified by participant characteristics and individual questions related to screening guideline comprehension, cervical cancer knowledge, and cultural beliefs questions. To examine the variation in proportions of outcomes across predictors Chi-square test statistics, including Pearson’s Chi-square (for dichotomous predictors), Mantel-Haenszel Chi-square test (for categorical
predictors with \( \geq 3 \) levels) and the Cochran-Armitage Chi-square test for trend (for ordinal predictors with \( \geq 3 \) levels) were calculated. Next, these outcomes were examined in relation to the cultural belief scale and the environmental botanica exposure variable. Finally, the association between overall cervical cancer knowledge and predictor variables was assessed using multivariate unconditional logistic regression models. Model fit was assessed using the Likelihood ratio test by comparing the – 2 Log Likelihood statistics between the full and reduced models while the discriminatory power of each model was assessed using the receiver operating characteristic curve (ROC) and calculated as the area under the curve (AUC). Measures of association, including odds ratios, 95% confidence intervals and Wald Chi-square test statistic, and predicted probabilities were calculated to quantify the association between categorical predictor variables and overall cervical cancer knowledge. Effect modification was tested for between environmental botanica exposure and individual-level covariates of overall cervical cancer knowledge by fitting an interaction term in the multivariate model. Calculated p-values \( \leq 0.05 \) were considered statistically significant.

**Results**

Characteristics of the sample population are presented in Table 1. The available sample size for the study was 242. The majority of participants were 31-50 years old (62.8%), were married (52.5%) compared to those who had never been married (29.3%), spoke predominantly Haitian Kreyol with their healthcare provider (52.5%) and had spent less than 10 years in the U.S. (56.6%). A large
proportion had not completed high school (49.2%), 44.6% were unemployed, and 52.9% had an annual income of ≤$15,000 USD. Only 14.9% had health insurance and 49.6% stated they had a regular source of healthcare. Almost half had at least three pregnancies (49.6%) and for slightly less than half their first pregnancy was before they were 22 years old (43.3%). Overall, 78.9% reported that they had ever had a Pap smear but only 60.3% stated they had a Pap smear within the past 3 years.

Table 2 presents the proportion of women with a recent Pap by participant characteristics. The proportion of women screened varied significantly according to marital and employment status, time in the U.S., language spoken with a healthcare provider and having a regular place for medical care. A higher proportion of women who were married (67.7%) had a recent screen compared to all other groups (p=0.04). More than two-thirds of women who resided in the U.S. for 10 years or more (67.6%) had a recent Pap compared to 54.7% of women who were in the U.S. for less than 10 years (p=0.04). Similarly, 71.3% of those who were able to converse in either Haitian Kreyol or English with their healthcare provider had a recent Pap compared to 50.4% of women who spoke only Kreyol (p<.001). Two-thirds of women who were employed (66.4%) had a recent Pap compared to 52.8% of unemployed women (p=0.03) and 69.2% of those with a regular place for medical care, compared to 51.6% of those without a regular source of medical care, had a recent Pap (p<.01). There was a decreasing trend in the proportion of women with a recent Pap as age increased.
although this difference was not significant (p=0.08). There was no evidence of any difference based on education, income, or health insurance status.

Table 3 presents the overall correct and incorrect response rate to the cervical cancer screening guidelines, cervical cancer knowledge questions, and overall knowledge scale by recent Pap smear status. Only 67.8% of women correctly answered the question regarding the recommended frequency of Pap smear but over 80% reported that women should receive yearly Pap smears after the age of 18 (82.6%) and that women should continue to receive yearly Pap smears once they stopped having children (88.0%). A greater proportion of women who had a recent Pap smear were able to correctly answer all questions regarding screening guidelines. The only statistically significant difference between the proportions correct (63.9%) and incorrect (34.5%) was when women were asked if they thought that after they stopped having children they no longer needed Pap smears (p<.01). These proportions stand in contrast to the observed proportion of participants correctly answering questions about cervical cancer etiology. Only 21.9% had ever heard of HPV and 12.4% thought that cervical pre-cancers did not show any symptoms or signs. Correct identification of risk factors was similarly low: 24.5% correctly identified smoking, 23.1% correctly identified number of sexual partners, and 35.1% correctly identified race/ethnicity as risk factors for cervical cancer. When stratified by recent Pap screening a higher proportion of women with knowledge of HPV (73.6%) compared to those without (56.6%) had a recent Pap smear (p=0.03). A higher proportion of women (76.7%) who knew that cervical pre-cancers show no signs or symptoms had a recent
Pap screening compared to 58.0% of women without this knowledge (p=0.05). There was no statistically significant difference in the proportion of women who had a recent Pap by correct and incorrect responses to the remaining knowledge questions.

A summary scale of psychocultural beliefs was created using principal component analysis. The scale had low internal reliability (α = 0.28). Low α values were also found when summary scales were made for the screening guideline comprehension and cervical cancer knowledge domains independently (α = 0.22 and α = 0.27 respectively, data not shown). Given this limitation however, the overall cervical cancer knowledge scale was significantly associated with recent Pap smear screening. There was a significant increasing trend in the proportion of women with a recent Pap smear as the total number of correctly answered questions increased (p<.0001). After categorizing responses using the mean as a cutpoint 37.6% of women had below average overall knowledge and 62.4% had above average knowledge. For women with above average cervical cancer knowledge 67.6% had a recent Pap compared to 48.4% of women with below average level of knowledge (p<.01). The multivariate model of screening is presented in Table 4. Adjusted for those statistically significant covariates in the univariate analysis patient-provider language, having a regular place for medical care, and cervical cancer knowledge were associated with screening in the multivariate model. Not having a regular place for medical care was associated with a 47% reduction (OR = 0.53, 95% CI: 0.30-0.93) in the odds of recent Pap screening while women with above average knowledge were
approximately twice as likely to have a recent Pap screening (OR = 1.83, 95% CI: 1.04-3.24) adjusted for all other covariates. Similarly, women who spoke both English and Kreyol with their healthcare provider were 77% more likely to have had a recent Pap screening (OR =1.77, 95% CI: 0.99-3.16).

Table 5 shows the proportion of women with above average overall knowledge and individual participant characteristics. Age, education and language spoken with healthcare provider were associated with above average cervical cancer knowledge. Knowledge decreased with increasing age: 75.0% of women 18-30, 62.8% of women 31-50, and 48.2% of women 51 or older had above average knowledge scores (p = 0.03). A higher proportion of women with a high school education or greater (75.6%) had above average knowledge compared to women with less than a high school education (p<.001). A higher proportion of women (74.8%) who spoke both Kreyol and English with their healthcare provider compared to those who only spoke Kreyol (51.2%) had above average knowledge (p<.001). There was no difference in the proportion of women who had above average knowledge by Marital status, time spent in the U.S., income, having health insurance and having a regular place for medical care.

The relation between knowledge and individual psychocultural beliefs identification is presented in Table 6. Overall, the majority of women strongly identified with cultural health beliefs: 78.1% of participants answered yes to all three questions. Measure of the scale reliability (α = 0.36) was higher compared to the screening guideline, cancer knowledge, and overall knowledge scales but
was still low compared to the standard minimally acceptable reliability score of \( \alpha = 0.40 \). There were no statistically significant differences between responses to individual questions, or the psychocultural beliefs scale, in relation to either recent Pap or overall knowledge.

The level of Haitian sociocultural identity (using the Haitian botanica density metric) was predictive of having above average cervical cancer knowledge but not recent Pap screening (Table 7). More than two-thirds of women (68.2\%) did not live within ½ mile of a botanica. Of these women 70.3\% had above average knowledge compared to 40.0\%, 81.8\%, and 42.1\% of women who lived in proximity to 1, 2 and 3 botanicas, respectively. No women who residing within ½ mile of 4 or more answered 3 or more of the overall knowledge questions correctly. When exposure to botanicas was dichotomized at the mean cutpoint (mean = 0.88) 45.5\% of women with an above average exposure had above average overall knowledge compared to 70.3\% of women who did not live within ½ mile of a botanica (p<.001).

Table 8 shows results of a multivariate unconditional logistic regression model predicting above average knowledge by participant characteristics and environmental exposure to botanicas. Model 1 and 2 show results of first-order multivariate analysis. Education, language spoken with a healthcare provider, and community-level botanica exposure were significant predictors of above average overall knowledge. The AUC for each models were 0.69 and 0.71 respectively. The third model included all second order interactions; only education and environmental botanica exposure showed evidence of a
multiplicative effect (p=0.03). There was an increase in the AUC to 0.73. The final proposed model removed the language spoken with provider and environmental botanica exposure interaction resulting in a non-significant difference in model fit (Log Likelihood test difference = -0.5, df = 1, p-value = 0.48) and a similarly negligible change in the predictive nature of the model (ROC AUC = 0.73, Mann-Whitney ROC contrast compared to full second-order model estimate = -0.003, p-value = 0.49). Women with less than a high school education and who did not live within ½ mile of a botanica were almost 5 times as likely to have above average overall knowledge compared to those living within ½ mile of 1 or more botanicas (OR 4.95, 95%CI: 2.18-11.3). Women living in areas within ½ mile of 1 or more botanicas without a high school education were more than 7 times as likely (OR 7.26, 95% CI 2.41-21.8) to have above average knowledge compared to those without a high school education. Figure 6 graphically depicts the estimated odds ratio and 95% confidence intervals for the interaction terms. There was no association (confidence interval includes null value of 1) between women living in areas without botanicas and education level. Figure 7 shows the predicted probabilities for having above average cervical cancer knowledge depending upon the level of education and environmental botanica exposure. Overall, the probability of having above average overall knowledge was the lowest among women who spoke only Kreyol, had less than a high school education, and lived within ½ mile of one or more botanicas (Pred. Prob = 0.22, 95% Error bars 0.13-0.36) while the highest predicted probability was for women speaking both English and Kreyol with their healthcare provider, having at least a
high school education, and not living within ½ mile of any botanica (Pred. Prob. = 0.81, 95% error bars: 0.63-0.91). A similar result was seen for women differing only by their exposure to the sociocultural environment. Those living within ½ mile of a botanica were only slightly less likely to have above average cervical cancer knowledge (Pred. Prob. = 0.80, 95% error bar: 0.70-0.88).

**Discussion**

The three primary findings of this study were: (1) cervical cancer knowledge is predictive of recent Pap screening among Haitian women, (2) the overwhelming majority of Haitian women in the study (94.6%) had a high-level of individual identification with culturally-held beliefs about cervical cancer, and (3) that cervical cancer knowledge is itself dependent upon education level which is negatively influenced by living near greater concentrations of Haitian botanicas. The psychocultural belief scale was not associated with knowledge or screening, and therefore could not explain nor modify the relationship between knowledge and screening. This study did find evidence that the sociocultural environment and sociodemographic factors interact in predicting cervical cancer knowledge. Living nearer to a higher density of Haitian botanicas reduced cervical cancer knowledge, but not screening. Women of lower educational attainment fared the worst in terms of knowledge which may be a result of living in less acculturated neighborhoods where opportunities to understand and engage in preventative health behaviors are limited.

Other studies show that increases in socioeconomic status lead to increases Pap screening utilization for immigrants (Carrasquillo et al., 2004; Echeverria et al.,
Women, who had been in the U.S. longer, were employed, who had the ability to communicate in English and Kreyol with their healthcare providers, and who had usual source of medical care were more likely to be have had a recent Pap screening in this study. This may reflect the influence of acculturation which in general leads to greater access to the social and material resources necessary to engage in Western preventive health behaviors for ethnic minorities and specifically among Haitian immigrants (Green et al., 2005; Leyden et al., 2005). Efforts to increase screening within the Haitian community should be focused on those individuals who are the most recent arrivals in the U.S. Further research should examine whether if indeed, the burden of cervical cancer itself, is highest among that group of recent immigrants. This study has not yet been undertaken in the Haitian community.

While this work highlights that these individual-level socioeconomic factors are important, the results also suggest that knowledge and beliefs are, in part, another integral component of Pap screening behavior. In the fully adjusted individual-level model of screening women reporting above average cervical cancer knowledge were 1.83 (95% CI: 1.04-3.24) times as likely to have had a recent Pap screening.

This finding has been previously noted in the literature (Brown, 2011; Fylan, 1998; Harlan et al., 1991; J. F. Sung et al., 1997) but never specifically for Haitian women. Other studies of immigrant populations show that individuals with low health literacy are less likely to undergo routine cancer screening (D. W. Baker et al., 1997; Lindau et al., 2001a, 2001b). This suggests that interventions
aimed at increasing Haitian women’s understanding of cervical cancer etiology and screening guidelines could be an important component to increase screening rates within the population, given the socioeconomic barriers that already exist. Lower rates of screening among older minority women has also been previously documented (Ostbye et al., 2003) and is a significant contributor to incidence and mortality (Bach et al., 2002; Bandura, 2001; Downs et al., 2008; Ferrante et al., 2000; Freeman et al., May 2005; Liu et al., 1998; Newmann et al., 2005). In this study, 48.2% of older women had high cervical cancer knowledge compared to 62.8% of women aged 31-50 and 75.0% of women 18-30. Our data suggest that this association may be a function of a combination of knowledge and access-related factors, and not solely related to SES alone given that the approximately half of all women sampled were lower income, unemployed, and had less than a high school education. In our estimation of the correlates of overall cervical cancer knowledge women who spoke both Kreyol and English with their healthcare provider were twice as likely (OR = 2.01, 95% CI: 1.10-3.67) to have above average cervical cancer knowledge. Therefore, educational interventions should focus on women who are older, less educated, and who are monolingual Kreyol speakers.

Easing communication between patients and providers needs to be a focus of intervention and could be accomplished by either increasing those Haitian speaking healthcare providers or ensuring that adequate translation services are provided during visits when cancer-screening information will be presented. As noted, having a physician recommendation for screening is predictive of
screening behavior in ethnic minority populations. Differences between immigrants and healthcare providers in terms of language compatibility may lead to poorer communication about the importance of cancer screening, and result in lower screening rates (Jacobs et al., 2005). Moreover, a physician recommendation to be screened, a strong driver of the behavior, will be much less likely to be understood if patient provider communication is limited.

A conversation between a patient and provider is necessary for screening to have maximum impact at the minimum cost by assessing the patients priorities, decision-making behaviors and disease knowledge comprehension (Nguyen et al., 2003). Patients also need interaction and care that is respectful of their culturally based personal values (Giuliano et al., 2000; Hiatt et al., 2001). Evidence shows that for ethnic minorities a provider addressing concerns related to cultural factors such as a lack of preventive care orientation or personal modesty increases screening and follow-up for detected abnormalities (Fruchter et al., 1986; F. Gany et al., 2007; F. M. Gany, Herrera, et al., 2006; Johnson et al., 2008).

These factors have already been documented as barriers to screening among Haitian immigrants (Kobetz et al., 2010; Menard, Kobetz, Maldonado, et al., 2010). In this study 61.8% of women who held fatalistic views of a cervical cancer diagnosis had a recent Pap screening compared to 41.2% of those without those views. While this difference was not statistically significant (p = 0.09), nor was the summary psychocultural orientation scale, it does show quantitative evidence that a woman’s psychocultural orientation to health beliefs
do matter. These findings support those in a summary review by Johnson et al. (Johnson et al., 2008) which found that holding a humoral health orientation and a fatalistic view of a cancer diagnosis resulted in less screening uptake. The lack of significant findings in this study may reflect two important limitations. First, the psychocultural beliefs scale was not internally reliable ($\alpha = 0.36$). Future research should develop a culturally-based belief scale to investigate these types of disparities in culturally held beliefs as they relate to preventive health behaviors. Second, there was little variation in reported psychocultural responses. Nearly all women (94.6%) reported agreeing with at least two of the three cultural belief items, specifically those questions asked in order to assess their humoral orientation to health and cancer fatalism. Given these limitations it is important to note that no study using this methodology to quantify the psychocultural beliefs has been undertaken in the Haitian population.

While psychocultural beliefs were not significantly associated with knowledge or screening the sociocultural environment was a significant predictor of cervical cancer knowledge. Neighborhood mapping of these resources by a windshield survey found 21 of these establishments concentrated in several business districts in two distinct areas of Miami-Dade county (Figure 1). While 70.3% of women living in areas without a botanica within $\frac{1}{2}$ mile had above average knowledge only 45.5% of those living near one or more had above average cervical cancer knowledge ($p<.001$). Adjusted for patient-provider communication compatibility, women with less than a high school education and living in close proximity to a greater number of botanicas were almost 7 and a half times as
likely (OR = 7.26, 95% CI: 2.41-21.8) to have above average cervical cancer knowledge. The predicted probability of correctly answering at least three out of five cervical cancer knowledge questions was below 25% for women with less than a high school education and living near one or more botanicas while for those with a high school education and no exposure to botanicas this probability approached 75%.

These findings may reflect several important concepts of how the cultural environment affects healthcare utilization: first, women living in closer proximity to more botanicas may more frequently utilize them and receive incorrect information pertaining to gynecological health. Among the ethnic botanicas of New York City 65% of women said they knew of it because it was located in their neighborhood and of those users they visited their store, on average, 13 times per year (Gomez-Beloz et al., 2001). The botanica may provide an alternative place for engaging in healthcare and receiving health knowledge for those with little access to the formal healthcare system. As previously mentioned, the information provided by botanicas reflects the prevailing knowledge of its proprietor which is heavily focused on non-Western traditional remedies (Menard, Kobetz, Diem, et al., 2010; Menard, Kobetz, Maldonado, et al., 2010). Research among Haitian healthcare providers in New York City found that only 16% of those providers surveyed reported disseminating Pap screening guidelines to their patients in their practice (F. Gany et al., 2007). While we did not undertake an evaluation of provider practices the low-level of knowledge regarding etiology and screening may in part reflect low levels of communication.
Next, a greater density of botanicas might reflect a less acculturated neighborhood where, as a result of lower socioeconomic status, women are less likely to have resources for preventative healthcare. Women with lower education may use these stores to an even greater extent because of a lack of resources for obtaining Western medical care or simply because they are unaware of the purposes of screening for illness prevention. Because many women reported patient-provider language compatibility issues it is apparent then that they may be going outside of their local neighborhoods for care or that care within those neighborhoods is not provided by Haitian providers. The association found between knowledge and botanicas may indicate that sociocultural identity is a confounder of the relationship between access-related factors and knowledge.

In keeping with the principles of CBPR it may be appropriate to bring the botanica proprietors into a discussion on women’s health in general and, specifically, the prevention and treatment of gynecological illness. Here, only a strong community-academic partnership would be able to bridge the gap between cultural practices and Western medicine. By not just including community leaders, but also establishing that “cultural leaders” are an important component of a comprehensive educational campaign in women’s health educational interventions may be more sustainable.

This research has highlighted how social and cultural structures at both the individual and community level function as external and internal influences to the provision of cervical cancer prevention in the immigrant Haitian community. It is apparent that in general higher levels of poverty and sociocultural isolation lead
to reduced utilization of Pap screening and impact Haitian women’s understanding of gynecological health. Botanicas may be one Haitian specific cultural resource that provides a “cue to action” for perpetuating non-Western health beliefs and a barrier to accessing cervical cancer etiologic and screening knowledge. Notwithstanding the complexities involved in the mechanisms of these cultural processes on the generation of health knowledge it is an important and novel finding that these factors vary geographically and that this in part explains some of the variation in cervical cancer knowledge among Haitian immigrants. By not solely focusing on the sociodemographic correlates of knowledge and behavior, to understanding sociocultural features and context, public health research can begin to better conceptualize biocultural models of disease and develop interventions that address cultural barriers to disease prevention.
Table 1. Sociodemographic characteristics of the study sample (n = 242).

<table>
<thead>
<tr>
<th>Individual Characteristic</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
</tr>
<tr>
<td>18-30</td>
<td>14.9</td>
</tr>
<tr>
<td>31-50</td>
<td>62.8</td>
</tr>
<tr>
<td>≥ 51</td>
<td>22.3</td>
</tr>
<tr>
<td>Education</td>
<td></td>
</tr>
<tr>
<td>&lt; High school</td>
<td>49.2</td>
</tr>
<tr>
<td>≥ High school</td>
<td>50.8</td>
</tr>
<tr>
<td>Marital Status</td>
<td></td>
</tr>
<tr>
<td>Never been married</td>
<td>29.3</td>
</tr>
<tr>
<td>Married/living with partner</td>
<td>52.5</td>
</tr>
<tr>
<td>Divorced/widowed/separated</td>
<td>18.2</td>
</tr>
<tr>
<td>&lt; 10 years in the U.S.</td>
<td>56.6</td>
</tr>
<tr>
<td>Employed</td>
<td>55.4</td>
</tr>
<tr>
<td>Speak predominantly Kreyol with healthcare provider</td>
<td>52.5</td>
</tr>
<tr>
<td>Income &lt; 15K†</td>
<td>52.9</td>
</tr>
<tr>
<td>Ever had a Pap smear</td>
<td>78.9</td>
</tr>
<tr>
<td>Pap smear within past 3 years</td>
<td>60.3</td>
</tr>
<tr>
<td>Health Insurance</td>
<td>14.9</td>
</tr>
<tr>
<td>Regular place for medical care</td>
<td>49.6</td>
</tr>
<tr>
<td>Number of pregnancies</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>9.5</td>
</tr>
<tr>
<td>1-3</td>
<td>40.9</td>
</tr>
<tr>
<td>&gt; 3</td>
<td>49.6</td>
</tr>
<tr>
<td>Age at first pregnancy ‡</td>
<td></td>
</tr>
<tr>
<td>≤ 21</td>
<td>43.3</td>
</tr>
<tr>
<td>≥ 22</td>
<td>56.7</td>
</tr>
</tbody>
</table>

† Non-respondents (n = 62) income was imputed from census block group values.
‡ Non-respondents (n=27) are those who never were pregnant or never gave birth.
Table 2. Proportion of women with recent Pap smear screening and participant characteristics.

<table>
<thead>
<tr>
<th></th>
<th>%</th>
<th>$\chi^2$†</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-30</td>
<td>50.0</td>
<td>0.08</td>
</tr>
<tr>
<td>31-50</td>
<td>65.8</td>
<td></td>
</tr>
<tr>
<td>≥ 51</td>
<td>51.9</td>
<td></td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; High school</td>
<td>58.0</td>
<td>0.46</td>
</tr>
<tr>
<td>≥ High school</td>
<td>62.6</td>
<td></td>
</tr>
<tr>
<td><strong>Marital Status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never been married</td>
<td>49.3</td>
<td>0.04</td>
</tr>
<tr>
<td>Married/living with partner</td>
<td>67.7</td>
<td></td>
</tr>
<tr>
<td>Divorced/widowed/separated</td>
<td>56.8</td>
<td></td>
</tr>
<tr>
<td><strong>Time in U.S.</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 10 years in the U.S.</td>
<td>54.7</td>
<td>0.04</td>
</tr>
<tr>
<td>≥ 10 years in the U.S.</td>
<td>67.6</td>
<td></td>
</tr>
<tr>
<td><strong>Employment status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employed</td>
<td>66.4</td>
<td>0.03</td>
</tr>
<tr>
<td>Unemployed</td>
<td>52.8</td>
<td></td>
</tr>
<tr>
<td><strong>Language used with healthcare provider</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speak predominantly Kreyol</td>
<td>50.4</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Speak both Kreyol and English</td>
<td>71.3</td>
<td></td>
</tr>
<tr>
<td><strong>Income†</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 15K</td>
<td>60.2</td>
<td>0.95</td>
</tr>
<tr>
<td>≥ 15 K</td>
<td>60.5</td>
<td></td>
</tr>
<tr>
<td><strong>Health Insurance?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>66.7</td>
<td>0.40</td>
</tr>
<tr>
<td>No</td>
<td>59.2</td>
<td></td>
</tr>
<tr>
<td><strong>Regular place for medical care?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>69.2</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>No</td>
<td>51.6</td>
<td></td>
</tr>
</tbody>
</table>

† Pearson $\chi^2$ for 2 x 2 table. For parameters with ≥ 2 rows, Chi-square test for general association, that is p1=p2=p3 (across rows).
Table 3. Knowledge and cultural beliefs among participants, individual responses and scales, and recent Pap smear screening (n = 242).

<table>
<thead>
<tr>
<th>Screening Guidelines Comprehension</th>
<th>Incorrect</th>
<th>Correct</th>
<th>(X^2)†</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often do you think a woman your age should have a pap smear?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you think that women should receive yearly Pap smears once they are 18?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you think that when you stop having children you no longer need to have Pap smears?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Etiologic Knowledge</th>
<th>Incorrect</th>
<th>Correct</th>
<th>(X^2)†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have you heard of HPV?(¥)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you think that cervical pre-cancers and early cancer show symptoms or signs?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you think that women who smoke are more likely to develop cervical cancer?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you think that having a higher number of sexual partners increases your risk for Cervical Cancer?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you think that Black women develop Cervical Cancer more often than White women?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Summary Scale§</th>
<th>Tot. correct</th>
<th>(\alpha = .28)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ordinal</td>
<td>0</td>
<td>2.5 16.7 &lt;.0001‡</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>6.6 43.8</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>28.5 52.2</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>45.5 63.6</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>14.1 73.5</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>2.9 100.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dichotomous</th>
<th>Below average</th>
<th>Above average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0-2</td>
<td>3-5</td>
</tr>
<tr>
<td></td>
<td>37.6 48.4</td>
<td>62.4 67.6</td>
</tr>
</tbody>
</table>

† Pearson Chi-Square statistic p-value; ‡ Cochran-Armitage trend test statistic p-value

\(¥\) An affirmative response "Have you heard of HPV" is included as a "correct" response for the cervical cancer knowledge scale.

§ Questions utilized for scale included those with statistical association of p<.15 with Pap smear screening last 3 years in both domain constructs.
Table 4. Multivariate logistic regression model† predicting recent Pap screening.

<table>
<thead>
<tr>
<th></th>
<th>Adjusted OR</th>
<th>95% CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-30</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>31-50</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>51</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; Highschool</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>≥ Highschool</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Marital Status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never been married</td>
<td>REF</td>
<td>-</td>
<td>0.11</td>
</tr>
<tr>
<td>Married/living with partner</td>
<td>1.81</td>
<td>0.96-3.41</td>
<td>-</td>
</tr>
<tr>
<td>Divorced/widowed/separated</td>
<td>1.00</td>
<td>0.44-2.28</td>
<td>-</td>
</tr>
<tr>
<td>Time in U.S.</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 10 years in the U.S.</td>
<td>RE</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>≥ 10 years in the U.S.</td>
<td>1.29</td>
<td>0.71-2.34</td>
<td>0.41</td>
</tr>
<tr>
<td>Employment status</td>
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<td></td>
</tr>
<tr>
<td>Employed</td>
<td>REF</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Unemployed</td>
<td>0.66</td>
<td>0.38-1.16</td>
<td>0.15</td>
</tr>
<tr>
<td>Speak predominantly Kreyol</td>
<td>REF</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Language used with health care provider</td>
<td>Speak both Kreyol and English</td>
<td>1.77 0.99-3.16)</td>
<td>0.05</td>
</tr>
<tr>
<td>Income†</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 15K</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>≥ 15 K</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Health Insurance?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>No</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Regular place for medical care?</td>
<td>Yes</td>
<td>REF</td>
<td>-</td>
</tr>
<tr>
<td>No</td>
<td>0.53</td>
<td>0.30-0.93</td>
<td>0.02</td>
</tr>
<tr>
<td>Cervical cancer knowledge</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Below average</td>
<td>REF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Above average</td>
<td>1.83</td>
<td>1.04-3.24</td>
<td>0.03</td>
</tr>
</tbody>
</table>

†Only significant terms from the univariate model are included in the full adjusted model.
Table 5. Proportion of women with above average overall cervical cancer knowledge

<table>
<thead>
<tr>
<th></th>
<th>%</th>
<th>$\chi^2_{\dagger}$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-30</td>
<td>75.0</td>
<td>0.03</td>
</tr>
<tr>
<td>31-50</td>
<td>62.8</td>
<td></td>
</tr>
<tr>
<td>$\geq$ 51</td>
<td>48.2</td>
<td></td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$&lt;$ High school</td>
<td>48.7</td>
<td>$&lt;$ .001</td>
</tr>
<tr>
<td>$\geq$ High school</td>
<td>75.6</td>
<td></td>
</tr>
<tr>
<td><strong>Marital Status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never been married</td>
<td>56.3</td>
<td>0.45</td>
</tr>
<tr>
<td>Married/living with partner</td>
<td>65.4</td>
<td></td>
</tr>
<tr>
<td>Divorced/widowed/separated</td>
<td>63.6</td>
<td></td>
</tr>
<tr>
<td><strong>Time in U.S.</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$&lt;$ 10 years in the U.S.</td>
<td>62.0</td>
<td>0.90</td>
</tr>
<tr>
<td>$\geq$ 10 years in the U.S.</td>
<td>62.9</td>
<td></td>
</tr>
<tr>
<td><strong>Employment status</strong></td>
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<td>Employed</td>
<td>64.9</td>
<td>0.37</td>
</tr>
<tr>
<td>Unemployed</td>
<td>59.3</td>
<td></td>
</tr>
<tr>
<td><strong>Language used with</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Healthcare provider</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speak predominantly Kreyol</td>
<td>51.2</td>
<td>$&lt;$ .001</td>
</tr>
<tr>
<td>Speak both Kreyol and English</td>
<td>74.8</td>
<td></td>
</tr>
<tr>
<td><strong>Income</strong>†</td>
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<td></td>
</tr>
<tr>
<td>$&lt;$ 15K</td>
<td>58.6</td>
<td>0.20</td>
</tr>
<tr>
<td>$\geq$ 15 K</td>
<td>66.7</td>
<td></td>
</tr>
<tr>
<td><strong>Health Insurance?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>63.9</td>
<td>0.84</td>
</tr>
<tr>
<td>No</td>
<td>62.1</td>
<td></td>
</tr>
<tr>
<td><strong>Regular place for</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medical care?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>66.7</td>
<td>0.17</td>
</tr>
<tr>
<td>No</td>
<td>58.2</td>
<td></td>
</tr>
</tbody>
</table>

$\dagger$ Pearson $\chi^2$ for 2 x 2 table. For parameters with $\geq$ 2 rows, Chi-square test for general association, that is $p_1=p_2=p_3$ (across rows).
<table>
<thead>
<tr>
<th>Individual Cultural Beliefs</th>
<th>Response</th>
<th>Pap smear in last 3 years (%)</th>
<th>(\chi^2)†</th>
<th>Above average overall knowledge (%)</th>
<th>(\chi^2)†</th>
</tr>
</thead>
<tbody>
<tr>
<td>lower abdomen can cause cervical cancer?</td>
<td>No</td>
<td>14.0 58.8 0.85</td>
<td>73.5 0.15</td>
<td>60.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>86.0 60.6</td>
<td>60.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>diagnosed with cervical cancer die from the disease?</td>
<td>No</td>
<td>7.0 41.2 0.09</td>
<td>52.9 0.40</td>
<td>63.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>93.0 61.8</td>
<td>63.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you think that multiple abortions can cause cervical cancer?</td>
<td>No</td>
<td>6.6 68.8 0.48</td>
<td>81.3 0.11</td>
<td>61.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>93.4 59.7</td>
<td>61.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summary Scale§</td>
<td>Tot. correct</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ordinal (\alpha = 0.36)</td>
<td>0</td>
<td>0.4 0.0 0.58 ‡</td>
<td>100.0 0.23 ‡</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>5.0 66.7</td>
<td>75.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>16.5 55.0</td>
<td>65.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>78.1 61.4</td>
<td>60.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dichotomous</td>
<td>Tot. correct</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weak</td>
<td>0-2</td>
<td>21.9 56.6 0.53</td>
<td>67.9 0.35</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>78.1 61.4</td>
<td>60.9</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

† Pearson Chi-Square statistic p-value; ‡ Cochran-Armitage trend test statistic p-value.
§ Includes all three questions from cultural beliefs domain.
Table 7. Sociocultural community identity in relation to Pap screening and cervical cancer knowledge.

<table>
<thead>
<tr>
<th>Environmental Cultural Exposure</th>
<th>Frequency</th>
<th>Pap smear in last 3 years?</th>
<th>Above average overall knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botanicas within 1/2 mile or participant home</td>
<td>0</td>
<td>68.2</td>
<td>63.6</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>8.3</td>
<td>50.0</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>9.1</td>
<td>72.7</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>7.9</td>
<td>42.1</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>2.5</td>
<td>16.7</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>1.7</td>
<td>50.0</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>1.2</td>
<td>33.3</td>
</tr>
<tr>
<td></td>
<td>8, 11, 12x</td>
<td>1.2</td>
<td>100.0</td>
</tr>
<tr>
<td>Dichotmous</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>None</td>
<td>68.2</td>
<td>63.6</td>
</tr>
<tr>
<td>High</td>
<td>≥ 1 within 1/2 mile</td>
<td>31.8</td>
<td>53.3</td>
</tr>
</tbody>
</table>

† Pearson Chi-Square statistic p-value; ‡ Cochran-Armitage trend test statistic p-value.

x 1 instance of each frequency (0.4% individually).
Table 8. Multivariate model of knowledge and environmental botanica exposure adjusted for participant characteristics.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Wald χ²</th>
<th>Model Fit p-value</th>
<th>ROC AUC</th>
<th>p-value - 2 Log L</th>
<th>AUC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>0.70</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>&lt;.01</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Language</td>
<td>0.02</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>&lt;.01</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Language</td>
<td>0.01</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Botanica</td>
<td>&lt;.01</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 3</td>
<td></td>
<td>278.5</td>
<td>0.03</td>
<td>0.73</td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>0.27</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Language</td>
<td>0.12</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Botanica</td>
<td>0.68</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education*Botanica</td>
<td>0.03</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Language*Botanica</td>
<td>0.47</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Final Model</td>
<td></td>
<td>279.0</td>
<td>0.48</td>
<td>0.72</td>
<td></td>
</tr>
<tr>
<td>Language used with</td>
<td>Odds</td>
<td>95% CI p-value</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>healthcare provider</td>
<td>Ratio</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Language used with</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>healthcare provider</td>
<td>Speak predominantly Kreyol</td>
<td>REF</td>
<td>-</td>
<td>0.02</td>
<td></td>
</tr>
<tr>
<td>Language used with</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>healthcare provider</td>
<td>Speak both Kreyol and English</td>
<td>2.01</td>
<td>1.10-3.67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Botanica</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>at Education= ≥ Highschool</td>
<td>None v ≥ 1</td>
<td>0.98</td>
<td>0.37-2.61</td>
<td></td>
<td></td>
</tr>
<tr>
<td>at Education= ≤ Highschool</td>
<td>None v ≥ 1</td>
<td>4.95</td>
<td>2.18-11.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>at botanica = none</td>
<td>≥ HS v &lt; HS</td>
<td>1.44</td>
<td>0.72-2.88</td>
<td></td>
<td></td>
</tr>
<tr>
<td>at botanica = ≥ 1</td>
<td>≥ HS v &lt; HS</td>
<td>7.26</td>
<td>2.41-21.8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Figure 5. Map of participants homes, ½ mile buffer, and location and proximity to botanicas.
Figure 6. Interaction plot showing calculated Odds ratios for above average cervical cancer knowledge and 95% CI for level of education and level of environmental exposure to botanica.
Figure 7. Predicted probability of above average cervical cancer knowledge for Haitian immigrants of Miami, Florida according to individual predictors and environmental botaniaca exposure stratified by language spoken with healthcare provider.
CHAPTER 4. STUDY 2. CONTEXTUAL ANALYSIS OF AREA-LEVEL SOCIOECONOMIC DEPRIVATION IN RELATION TO RECENT PAP SCREENING AND CERVICAL CANCER KNOWLEDGE WITHIN THE IMMIGRANT HAITIAN COMMUNITY

Overview

Between 1975-2008 cervical cancer rates have declined significantly in the U.S., from approximately 13.3 to 6.3 for white females and from 33.1 to 9.2 for black females (Howlader et al., 2011). Despite such improvement, low-income ethnic minorities still shoulder a disproportionate burden of disease (Calle et al., 1993; Downs et al., 2008; Howlader et al., 2011; Lin et al., 2002; Seeff, 2003). In the U.S., nearly 80% of all incident cervical cancer cases occur in ethnic minority populations (Parkin et al., 2002). In the Haitian community of Miami, Florida, the estimated incidence of cervical cancer was approximately 38.0 in 2007, more than four times the rate among Blacks nationally and three times greater than for females (11.2) in surrounding Miami-Dade County, Florida during the same time period (Babu, 2010).

At the individual level, HPV infection is the most proximal risk factor for carcinogenesis (Bosch et al., 2003; Bosch et al., 2002; Wallboomers et al., 1999). However, along the causal pathway to disease, there are other factors, such as screening and treatment, for which utilization is affected by personal characteristics including socioeconomic status (SES), health beliefs, knowledge and cultural or peer-group norms (Johnson et al., 2008). As demonstrated in Study 1 of this dissertation, individual correlates of Pap screening include marital status, time spent in the U.S., employment status, patient-provider language
compatibility, having a usual source of healthcare and having above average cervical cancer knowledge. Cervical cancer knowledge in turn was associated with age, patient-provider language and the multiplicative effect between residing in close proximity to a greater number of Haitian botanicas and individual educational attainment. The latter, conceptualized as a sociocultural exposure, represents only one component of a complex network of higher-level influences that may pertain to a woman’s ability to access health knowledge and utilize preventive medicine.

Other area-based features that may indirectly influence the (Diez Roux, 2007) access to information and healthcare resources are the social, economic, and physical characteristics of the neighborhood where a woman resides. These factors are associated with a number of healthcare outcomes and can be conceptualized as a set of factors forming the *habitus* as described by Pierre Bourdieu (Bourdieu, 1980). In sociological and public health research the socioeconomic characteristics of the neighborhood environment are used to approximate the distribution and functioning of these factors. A growing body of literature has shown that living in areas of lower SES negatively effects a wide-variety of health outcomes, from decreased overall mortality to lower cancer survival (Diez Roux, 2001, 2007; Krieger, Zierler, et al., 2003). A large proportion of immigrants and ethnic minorities reside in these lower SES neighborhoods (Berkman et al., 2000; Emmons, 2000; Evans et al., 2001; LeClere et al., 1997; *Poverty, inequality, and health: an international perspective*, 2000) and urban
patterns in racial and ethnic disparities in health are associated with area-based indicators of SES.

Area SES reflects an individual’s environmental exposure to the economic, educational, occupational or class status, the social conditions of a geographic area and the extent of opportunity available for healthcare utilization. Socioeconomic conditions can directly and indirectly drive health disparities by reducing the opportunities and access to preventive health services or to perpetuate the lower SES position of individuals (Duncan et al., 1998; Kawachi et al., 2003). Several studies have demonstrated that living in areas of lower SES reduces the likelihood of lifetime or recent Pap screening (Coughlin et al., 2010; Coughlin et al., 2006; Coughlin et al., 2008; Datta et al., 2006; Siahpush et al., 2002; Singh et al., 2003; Smiley et al., 2010; Stafford, 2003; Wells et al., 1998; Woltman et al., 2007).

Social-Ecology (SE) theory, originally conceptualized in Urie Brofenbrenner’s “Model of the ecology of human development” (Bronfenbrenner, 1979) posits that social conditions and processes occur at levels greater than the individual, from the meso- to macro-level (Bronfenbrenner, 1977). These processes are embodied into patterns of health and health behaviors of individuals nested within hierarchical social structures and institutions (Krieger, 2011). Contextual analysis, whereby the characteristics of geographic areas are modeled as predictors of individual-level outcomes, distinct from the characteristics of the individuals residing in those areas themselves, is a methodology for investigating how area characteristics shape health and health behaviors.
Area-based socioeconomic measures (ABSMs) are often used as indicators of relative neighborhood socioeconomic deprivation. The association between ABSMs and individual-level outcomes, conditional on individual-level SES correlates, is accomplished using a hierarchical modeling framework (Raudenbush et al., 2002; Raudenbush et al., 1999). This analysis avoids the biases imposed through traditional ecological analysis (Diez Roux, 2002; O’Campo, 2003) and provides the computational and theoretical tools for investigating the independent contribution of neighborhood socioeconomic given the natural clustering of individuals within neighborhoods that violates the analytical assumption regarding the independence of observations.

Exploration of the contextual sociodemographic factors related to knowledge and screening is necessary for understanding the multiple levels of influence that perpetuate the cervical cancer disparity within the immigrant Haitian population. Based on the conceptual model provided (Chapter 1, Figure 4) this chapter explores how socioeconomic context may influence screening directly or indirectly by changing an individual’s ability to obtain cervical cancer and Pap screening knowledge. To fill this gap in understanding the specific aims of this study are:

1. To examine the association between neighborhood SES and its direct effect on the utilization of Pap screening by immigrant Haitian women;

2. To examine the association between neighborhood SES and its direct effect on cervical cancer knowledge among immigrant Haitian women.
Understanding contextual characteristics that are independently associated with knowledge and screening can lead to the identification of geographic areas in which women are at an increased risk for delayed cervical cancer diagnosis. Interventions and resources can be more efficiently distributed by using this knowledge to guide resource allocation in large, urban, ethnic minority communities.

**Background**

A significant proportion of the observed decline in cervical cancer incidence rates in the U.S. is attributable to widespread implementation of the Pap screening test following U.S. Preventative Services Task Force (USPSTF) guidelines (Freeman et al., May 2005; *Guide to Clinical Preventive Services*, 1996; Saslow et al., 2003; Waxman, 2005). In the U.S. between 55-60% of cases arise in women who fail to meet screening guidelines (Seeff, 2003; Spence et al., 2007; Waxman, 2005). Studies show that the cervical cancer disparity among immigrant Blacks nationally, and Haitians in Miami, primarily reflects a lack of access to screening, as well as, to appropriate and timely follow up for detected abnormalities (Carmichael et al., 1984; Carrasquillo et al., 2004; De Alba et al., 2004; Downs et al., 2008; Fruchter et al., 1986; Goel et al., 2003; Hogenmiller et al., 1995; Janerich et al., 1995; Johnson et al., 2008; Kenter et al., 1996; Kobetz, Menard, Barton, et al., 2009; McDonald et al., 2011; Nasca et al., 1991; Prevention, 2007; Scarinci et al., 2010; Scheppers et al., 2006; Stuart et al., 1997; H. Y. Sung et al., 2000; Wingo et al., 1999). In a National Health Interview Study (NHIS) 5% of US native born-women and 18% of foreign-born women
reported never having had a cervical cancer screening test (Tsui et al., 2007). These findings are consistent with those reported by Kobetz et al. (2009) (Kobetz, Menard, Barton, et al., 2009); 67% of Haitian immigrants in Miami reported having at least one Pap screening in their life and of those only 44% reported having this test within the past three years.

Recently, attention has shifted to examining how social conditions of neighborhoods, or neighborhood context, may be important determinants of health outcomes, including screening utilization (Diez Roux, 2001; Krieger, 2001; Macintyre et al., 2002; Pickett et al., 2001). Studies on the influence of place and health draw broadly from theoretical orientations of social ecology theories of human development as described by Urie Bronfenbrenner (Bronfenbrenner, 1979). Extending Bronfenbrenner’s theory to health behaviors has been the focus of much social epidemiologic research. This research into Social-Ecological (SE) models of disease and health behaviors states that these outcomes are nested within higher-level social processes that operate within institutions such as schools, communities, and neighborhoods that dynamically interact with individual-level factors. Community context can be operationalized as aggregate functional status of the social, economic, and physical resources of a neighborhood. How well these processes function may be one of the upstream factors driving health and healthcare utilization (Berkman et al., 2000; Diez Roux, 2001; I. G. Ellen et al., 2003; Emmons, 2000; Evans et al., 2001; Gehlert et al., 2008; Krieger, 2011; LeClere et al., 1997; Macintyre et al., 2002; Macintyre et al., 1993; Pickett et al., 2001; Poverty, inequality, and health: an international
Immigrant and ethnic minorities tend to reside in more socioeconomically depressed neighborhoods which are characterized by, income gaps, high unemployment or underemployment and reduced educational opportunity resulting in reduced access to healthcare (Bartel, 1989; Camarota et al., 2003; Goldman et al., 2005; Kent, 2007; Stafford, 2003).

Many Haitians living in Miami-Dade County, Florida find themselves both impoverished, underemployed, or unemployed (Douyon et al., 2005) and residing in neighborhoods similarly characterized by poverty and other negative social status indicators, such as crowding (Stepick, 1992; Stepick et al., 1990). Pap screening utilization and cervical cancer etiology and screening knowledge may be directly influenced by the socioeconomic characteristics of neighborhoods impacted by the degree social cohesion, access to information, exposure to positive or negative health or media messages, and the availability, quality and cost of healthcare resources (Cubbin et al., 2005). Haitian residents of more impoverished areas may have less access to a usual source of care or gynecological physicians, owing to the limited resources of the community itself. Poorer communities may have a higher proportion of more recent immigrants who lack means (such as spendable income or health insurance) because of lower educational and occupational opportunities, to access care within and outside of their community. Given that the Haitian immigrant population of Miami, Florida is predominantly foreign born and more than half (56.5%) of study population had been in the U.S. less than 10 years (Kobetz et al., 2012) Haitian
women may have less educational and occupational opportunity because of the area where they live.

An emerging body of literature has tested this theory that neighborhood context is associated with Pap screening (L. C. Baker et al., 2004; Benjamins et al., 2004; Coughlin et al., 2010; Coughlin et al., 2006; Coughlin et al., 2008; Datta et al., 2006; Fukuda et al., 2005; David E. Nelson et al., 2003; Schootman et al., 2006; Siahpush et al., 2002; Wells et al., 1998; Woltman et al., 2007), although no studies have examined context in relation to cervical cancer knowledge specifically. Overall, there is evidence that Pap screening varies by geographical region. Between 1997 and 1999 across 98 major metropolitan cities in the U.S. the proportion of women reporting ever having a Pap smear varied between 77.2% to 91.7% (Coughlin et al., 2006; David E. Nelson et al., 2003). Similarly, Woltman et al (2007) found that 7.3% of variation in the lifetime occurrence of Pap screening across census areas in three Canadian cities was attributable to neighborhood census area variation. This geographical variation may relate to the contextual attributes of these cities although no studies have examined this variation at the level of the census tract for Pap screening (Pruitt et al., 2009).

The majority of studies examining contextual attributes of areas in relation to Pap screening have evaluated: the proportion of households living below the federal poverty line, the proportion of individuals with less than a high school education, the median income, and proportion of people unemployed. Only one study has used a composite index of neighborhood deprivation (Siahpush et al., 2002). All of these studies examined these factors at the county or state level (Benjamins et
al., 2004; Coughlin et al., 2010; Coughlin et al., 2006; Coughlin et al., 2008; Datta et al., 2006; Wells et al., 1998) or international equivalent (Fukuda et al., 2005; Siahpush et al., 2002; Woltman et al., 2007), or used metropolitan statistical areas (L. C. Baker et al., 2004; David E. Nelson et al., 2003; Schootman et al., 2006). Only four studies were multi-level analyses that used a hierarchical modeling procedure (Datta et al., 2006; Fukuda et al., 2005; Schootman et al., 2006; Woltman et al., 2007).

In single-level studies increasing neighborhood poverty was significantly associated with decreased the likelihood of screening (Coughlin et al., 2006; Wells et al., 1998). Couglin et al. (Coughlin et al., 2006) found that among African American women living in urban areas the odds of recent Pap screening declined with increasing area-level poverty and area-level education. Women living in areas with lowest proportion of households living in poverty (0-4.9%) were 8% (OR = 0.91, 95% CI: 0.69-1.21) less likely to have a recent Pap screening and those living in areas of 5.0-9.9% poverty were 22% (OR = 0.78, 95% CI: 0.62-0.99) less likely to report recent Pap screening compared to those living in areas with 20% poverty or more. One other study found poverty level (Benjamins et al., 2004) was not associated with ever or recent Pap screening. Only one single-level study found an association between education level and recent Pap screening (Coughlin et al., 2006). Women living in areas with the smallest proportion of individuals without a highschool education (0-14.9%) were 14% more likely (OR = 1.14, 95% CI: 0.94-1.38) and 16% more likely (15 -24.9%, OR = 1.16, 95% CI: 1.00-1.34) to have a recent Pap screening compared to those
living in areas with at least 25% of the population with less than a highschool education (Coughlin et al., 2006). Several others have explored this relationship and found no statistically significant association (L. C. Baker et al., 2004; Wells et al., 1998).

Two multilevel studies showed that increasing poverty was associated with a lower likelihood of Pap screening (Datta et al., 2006; Schootman et al., 2006) in univariate analysis but only one found neighborhood characteristics significantly associated with screening after adjustment for individual-level covariates (Datta et al., 2006). A study by Datta et al. (2006) of 59,090 Black Women’s Health Study participants showed a 20% increase in the odds of not having a recent Pap screening (OR = 1.2, 95%CI: 1.1-1.4) for women living in neighborhoods with highest poverty compared to the lowest after adjusting for individual-level covariates. On the other hand a study by Schootman et al. (Schootman et al., 2006) found no statistically significant association between poverty across MSAs, and lifetime occurrence of a Pap smear (OR 1.19, 95% CI 0.90-1.41) although the Interclass correlation coefficient for Pap smear was the highest (4.9%) out of all screening tests evaluated. One multilevel study in Japan evaluated a single indicator of income and found increasing income decreased the likelihood of screening, although this study was of individuals on health and welfare assistance (Fukuda et al., 2005). Finally, using a composite index of relative socioeconomic deprivation (17 weighted variables including education, income, unemployment, housing characteristics, and family structure) Siapush et
al. (Siahpush et al., 2002) found recent Pap screening declined as deprivation increased, but not after full adjustment for individual covariates.

Several other studies used different measures thought to be directly related to the provision of healthcare including physician density per counties and number of health clinics (Coughlin et al., 2008), average work commute time and the use of public transportation (Coughlin et al., 2010), and the proportion of immigrants per area (Woltman et al., 2007). The former two were not multilevel studies and found that increasing density of primary-care physicians (<100/100,000 = 83.5% screened v. ≥500/100,000 = 87.7%, p<.05) and office-based OB-GYN (<10/100,000 = 85.6% screened v. ≥30/100,000 = 87.5%, p<.05) was associated with increasing proportion of women with a recent Pap (Coughlin et al., 2008). In areas with less use of public transportation the odds of recent Pap screening were 20% higher (OR = 1.2, 95% CI: 1.0-1.4) compared to areas with less use of public transportation (Coughlin et al., 2010). In the latter multilevel study increasing proportion of immigrants reduced the likelihood of lifetime Pap screening by 66% (OR = 0.34, 95% CI: 0.19-0.59) after adjustment for individual-level covariates.

In the previous chapter cervical cancer knowledge was a predictor of screening behavior, and this association was modified by the environmental cultural exposure to Haitian botanicas. Given that sociocultural influences of neighborhoods impact knowledge it is conceivable that other features of the neighborhood environment are important upstream determinants of cervical cancer knowledge. Living in a disadvantaged community may present a barrier to
obtaining cancer screening knowledge. There is no literature regarding the effects of neighborhood socioeconomic deprivation in relation to cervical cancer knowledge.

Only one study of cardiovascular health knowledge found that a mean decrease in health knowledge (-1.12) for individuals living in neighborhoods characterized by high deprivation and mean increase (0.79) for individuals living in low-deprivation neighborhoods compared to those living in moderately deprived neighborhoods after controlling for individual-level SES using a Townsend material deprivation index (Cubbin et al., 2005). Deprived neighborhood environments may limit the choices women have in seeking health knowledge or their exposure to resources that highlight the benefits of preventive healthcare in general. Women living in more socioeconomically deprived neighborhoods may have less preventive healthcare knowledge, more heavily reliant on traditional culturally-based healthcare and information, and therefore may not utilize preventive medical services. Moreover, the social relationships between individuals are stressed and less functional in deprived neighborhoods. The exchange of information between women and healthcare providers, or between women themselves, may reduce the opportunity to share health-related knowledge (Cubbin et al., 2008).

The analyses conducted for this research are the first of their kind in an urban ethnic minority population that uses census-tract level data to approximate context using a multilevel modeling structure. Multi-level analyses of both overall
cervical cancer knowledge, recent Pap screening, and the potential interaction pathways are tested in this study to fill these gaps in the literature.

**Methods**

**Geography**

Neighborhood of residence is often used to approximate the geographic space most influential on health (Diez Roux, 2002; Macintyre et al., 2002; Macintyre et al., 1993; Pickett et al., 2001). Defining the representation of a neighborhood is the first step in examining the role of area context on individual health behaviors. The most consistently used approach in public health research is to approximate a neighborhood using the administratively-defined areas of the block group or census tract (Krieger, 2002). In this study participant addresses were geocoded and linked to their corresponding census block through the census block shapefiles available from the U.S. Census Bureau 2000 SF3 decennial census (www.census.gov/geo/www/tiger) online resources. Census data is compiled using a 1 in 6 probability sampling strategy to gather detailed demographic, social, economic, and physical characteristics of block groups. Block groups typically contain, on average, 1500 people are considered to contain a relatively homogenous groups of economic, social, and physical characteristics (Krieger, 2002; Krieger, Zierler, et al., 2003). Census tracts are a geographical unit consisting of approximately 4000 persons. There is no evidence of disagreement in results when health outcomes are evaluated at either level (Krieger, 2002). In this study participants resided in 98 different census blocks and a corresponding set of 49 census tracts. ABSMs were taken for each of the 98 census blocks and
applied to each individual residing in that area (methods describing the selection of these characteristics are found in the next section). A weighted average of the census block estimates for each indicator was calculated for each of the census tracts. Using this methodology was necessary for two reasons: (1) there were very few participants per block group and therefore some level of aggregation was necessary to obtain stable estimates from regression models and (2) using this average would increase the precision of the actual neighborhood values for each ABSM whereas there is a high-level of heterogeneity within census tracts.

Measures of Area-level Context

To examine the role of the contextual environment public health research uses neighborhood composition, the average of a selected social, economic, physical, or composite indicator, as a proxy for the contextual socioeconomic characteristics of a neighborhood (Krieger, Chen, et al., 2003; Krieger et al., 1997). This is conceptually distinct from using the attributes of individuals themselves in regression equations to estimate the effects of individual SES. A simple analogy: “the sum of the parts do not equal that of the whole” has been evoked in theoretical arguments, such as by Emile Durkheim (Durkheim, 1982), to show how context might act separately upon individuals regardless of their own individual position in society. The US Census provides a rich diversity of area-level indicators and summary indices to represent the average social, cultural, and physical context of a neighborhood (Krieger, 2001). There is no consensus which area-level indicators, or deprivation indices, should be utilized for analysis (Krieger et al., 1997; Lynch et al., 2000). However, the most widely
studied construct, SES, is used as an overall representation of the availability of material and social resources considered directly related to the health outcome under study. Economic indicators include measures of poverty, income, and employment, such as the percent unemployed or the proportion in working-class jobs (Krieger et al., 1997). Similarly, social functioning can be approximated using educational attainment, proportion of immigrants, rates of English and foreign languages spoken, and family-structure related variables, such as proportion of female-headed households. Using single-variable indicators eases interpretation of findings (Krieger, 2002) and allows for specification of plausible explanatory pathways and causal mechanisms (Braveman et al., 2005). Indices typically combine a variety of these measures to approximate these domains of contextual factors.

Given the absences of consensus on the use of appropriate indicator variables this study uses multiple predictors measured at the block-group level that were either: (1) previously examined in cited examples of a multi-level analysis of screening behavior or (2) examined in the Public Health Disparities Geocoding Project (Krieger, 2002; Krieger, Chen, et al., 2003). This project developed six domains related to area-level SES for which census-level data was readily available and that meaningfully summarize the socioeconomic conditions of a geographical area. The six domains included occupational class, income, poverty, wealth, education, and crowding. Only wealth was not measured in this study because it was not evaluated in any other single or multi-level model of cancer screening behavior to our knowledge.
For this analysis the effects of area-level material deprivation on Pap screening and cervical cancer knowledge used three measures to approximate neighborhood economic deprivation. These included: median household income, the proportion of residents aged ≥18 living in poverty, and the proportion of individual unemployed (percent individuals aged ≥ 16 that are unemployed). Social factors for analysis were conceptualized as broadly representative of ecosocial factors that represent collective social functioning and processes and included six measures: two measures of education (percent populations aged ≥ 25 with less than a high school education and percent population aged ≥ 25 with more than a college education), the percentage of female headed households with related children < 18 years old, the percent of non-citizen foreign born residents, the percent of homes whose primary language spoken was not English, and the percent crowding (percent of homes with > 1 occupant per room). A summary of the census definitions and calculation of these ABSMs is presented in Appendix A. Throughout analyses each factor was examined separately.

A composite deprivation index to represent both material and social factors was created by summing a standardized coefficient for each of the 9 selected indicator variables. Composite indexes may more accurately reflect the overall SES of a neighborhood (Robert, 1999). The composite index was modeled as a 1-point increase above the mean indicating an increasing level of socioeconomic deprivation. The composite index was calculated by first transforming each
component factor, $j$, into a standardized Z score. The Z score for area $i$ is calculated as

$$Z_{ij} = \frac{(X_{ij} - M_j)}{S_j}$$

where $X_{ij}$ is the value of component variable $j$ for area $i$, where $M_j$ is the mean of component $j$ across all areas and $S_j$ is the standard deviation of the component variable $j$ over all areas.

**Individual SES Correlates**

In multilevel analysis it is necessary to adjust models for individual measures of SES or other relevant social indicators (Diez Roux, 2001). Individual SES measures included household income and education; both of which have been associated with recent Pap smear screening in previous studies. Household income was measured by self-report and, where data was missing, by imputing values from the 2000 U.S. Census values for the block group of participant residence. Income was dichotomized; individuals with reporting earnings of ≤$15,000 were coded as the reference group and individuals earning ≥$15,000 were coded as 1. Education was defined as the highest level of education completed by the participant and was dichotomized to < High school education or ≥ High school diploma or more.

Other covariates measured at the individual level included demographic, healthcare access and acculturation related factors. Demographic variables include age and marital status. Age was measured as a categorical variable (18-30, 31-50, ≥ 51) as was marital status (Never been married, married/living with
partner, divorced/widowed/separated). Access to healthcare and the cultural competency of the care was assessed using four variables: Employment status was evaluated as employed or unemployed (including unemployed/student/homemaker/retired, reference category = “Employed”, coded as 0), having health insurance via employer, self, Medicaid/Medicare (reference category = “None”, coded as 0), having a regular place for medical care including private doctor, community health center and not including emergency room visits (reference category = “No”, coded as zero), and patient-provider English language compatibility. Women who spoke predominantly Haitian Kreyol with their healthcare provider were the reference group (coded as 0) and compared with women who stated they conversed in both Kreyol and English with their healthcare provider (coded as 1). Length of time spent in the U.S. was dichotomized to women who had been living in the U.S. for <10 years and ≥10 years and used to represent a measure of acculturation.

**Statistical Methods**

All analyses were completed using SAS v.9.2.3 (SAS Institute, Cary, NC). To examine the variation in proportions of outcomes by individual-level predictors descriptive analytic techniques were used including calculating proportions and frequencies, tests of statistical independence including Pearson’s Chi-square (for dichotomous predictors), Mantel-Haenszel Chi-square test (for categorical predictors with ≥ 3 levels) and the Cochran-Armitage Chi-square test for trend (for ordinal predictors with ≥ 3 levels). Odds ratios and 95% confidence intervals for either recent Pap screening and overall cervical cancer knowledge by
individual-level predictor variables was assessed using multivariate unconditional logistic regression models. Two separate models, one for recent Pap screening and one for overall cervical cancer knowledge were fit. All predictors where there was a statistically significant difference in the proportion of responses (p<.05) in descriptive analyses were included as predictors in each model. The Likelihood ratio test was used to examine the overall fit of the model. The Wald test statistics was used as an adjusted estimate of the statistical significance of each predictor adjusted for other covariates. After obtaining estimates for each individual-level predictor a hierarchical logistic regression model was used to examine the independent contribution of area-level factors in relation to each outcome.

The analytic approach utilized for nested data structures is to model outcomes using hierarchical model, also known as mixed, random-effects, covariance components, or random-coefficient regression models(Raudenbush et al., 2002). The random component refers to the proportion of the observed variation in the outcome that is attributable to between group differences in group-level factors (in this case neighborhood). The regression model that follows was used to examine the two outcomes of study: recent Pap screening (bivariate, “Yes” and ‘No”) and above average cervical cancer knowledge (bivariate, “Yes” and “No”) and the effects of group level measures of ABSMs. Regression equation (1) is the single-level model:

\[
\text{logit } Y_{ij} = \beta_{0j} + \beta_{Xj}X_{ij} + \epsilon_{ij}
\]

\[\epsilon_{ij} ~ N(0, \sigma^2)\]
\[ Y_{ij} = \text{log odds of outcome variable for } i^{th} \text{ individual in } j^{th} \text{ group} \]

\[ X_{ij} = \text{individual level variable for } i^{th} \text{ individual in } j^{th} \text{ group} \]

\[ B_{0j} = \text{group specific intercept, i.e. log odds of outcome for the } j^{th} \text{ neighborhood} \]

\[ B_{xj} = \text{group specific effect of the individual level variable(s)} \]

The individual level errors (\( \varepsilon_{ij} \)) are assumed to be independent and identically distributed with a mean of 0 and a variance \( \sigma^2 \). In the case of the multilevel model the term, \( \beta_{0j} \), the group-level intercept, becomes a random variable, by including the error term \( U_{0j} \). The resulting parameter estimates, \( \gamma_{01}G_j \), are the log odds of the likelihood of the bivariate outcome, adjusted for individual-level predictors as entered into model (1).

\[
(2) \quad \beta_{0j} = \gamma_{00} + \gamma_{01}G_j + U_{0j} \quad U_{0j} \sim N(0, \tau_{00})
\]

\( \gamma_{00} = \text{common intercept across groups} \)

\( \gamma_{01} = \text{effect of the group level predictor on the group specific intercepts} \)

In equation (2) the random error term, \( U_{0j} \), for the group-level estimate of the outcome makes the model distinct from a fixed effects model. \( \tau_{00} \) is the estimated between-neighborhood variation. The \( \gamma_{01} \) provides the parameter estimate for each ABSM entered separately into the model. In this study each ABSM was entered independently into models adjusted for the same individual-level factors. The covariance structure was modeled as compound symmetric.
Selection of the appropriate covariance structure is often overlooked in multilevel analysis. In these analyses there were severe limitations imposed by the small sample size and more appropriate matrices, such as conditional autoregressive models, which utilize Euclidean distances as a factor in the model, could not be employed. The compound symmetric structure states that there is a common covariance between each neighborhood. Other multilevel models of Pap screening have not explicitly referenced the structure selected.

There were four tested models:

1. level-2 intercept only providing estimates of the individual-level covariates adjusted for the non-independent nature of the observations
2. regression of the level 2 (neighborhood) ABSM predictor adjusted for level-1 measures of SES,
3. regression of the level 2 (neighborhood) ABSM predictor adjusted for level-1 predictors, and
4. regression of the level 2 (neighborhood) ABSM predictor adjusted for level-1 predictors and SES.

Model 1 is used to estimate the variation in outcomes that is attributable to group-level variation. This is done by dividing the variance into level-1 and 2 components, where the sum of $\epsilon_{0ij}$ and $U_{0j}$ is the variance in $Y_{ij}$. The calculated statistic, the \textit{intra-class correlation coefficient} (ICC), is equal to the variance due to clustering divided by the sum of the variance due to clustering and the residual
variance. The range of values is 0-1, indicating complete independence of observations to complete dependence. An ICC value of greater than 0.1 can suggest clustering among observations (Cohen, 2003). For a bivariate outcome, such as recent Pap screening (“Yes” or “No”) a linear threshold model method is used to calculate the ICC. This calculation converts the individual level variance for the propensity of the outcome on the probability scale to the logistic scale (Snijders et al., 1999). The unobserved individual level variable follows a logistic distribution with individual level variance equal to $\pi^2/3$. On this basis the ICC is calculated as $V_A / (V_A+3.29)$ (Larsen et al., 2005; Merlo et al., 2006; Ridout et al., 1999). The use of the ICC in the linear case is explicit and easily understandable, however, for the logistic case its interpretation is limited and it is presented to illustrate the necessity of multi-level structure (Merlo et al., 2006; Ridout et al., 1999).

The estimation of odds ratios and 95% confidence intervals follow the similar convention of a single-level, unconditional logistic regression model. Because of the large number of predictor variables and the results of these analyses no adjustment was made for other second-level covariates in models 2-4. Moreover, the second level predictors (slopes) were modeled as fixed effects and not random, as the sampling of block groups was not a random sample but included all neighborhoods of primarily Haitian descent in Miami-Dade County.

**Results**

Participant characteristics have been described in the previous chapter of this dissertation and are presented in Table 1 (Study 1). Overall, 62.8% of the
population was between 31-50 years old, 52.5% were married or living with a partner, 52.5% spoke predominantly Kreyol with their healthcare provider, 60.3% had a recent Pap screening, 49.6% had a regular place for healthcare, and only 14.9% had health insurance.

Table 9 shows the results of the single-level descriptive and logistic regression analysis. A greater proportion of individuals who had a recent Pap were married (67.7% compared to 49.3% never married and 56.8% divorced/widowed/separated), had been in the U.S. for 10 years or more (67.6% compared to 54.7%), were employed (66.4% versus 52.8% unemployed), spoke both English and Kreyol with their healthcare provider (71.3% versus 50.4% predominantly Kreyol), had a regular place for medical care (69.2% versus 51.6 without a regular place for medical care), and had above average cervical cancer knowledge (67.6% versus 48.4% below average cervical cancer knowledge). In single-level multivariate analysis only patient-provider language compatibility, having a regular place for medical care, and cervical cancer knowledge remained significant predictors of recent Pap screening. Women speaking both Kreyol and English were 77% more likely (OR = 1.77, 95% CI: 0.99-3.16, p = 0.05) while those with above average cervical cancer knowledge were 83% more likely (OR = 1.83, 95% CI: 1.04-3.24, p=0.03) to have a recent Pap screening. Women without a regular place for medical care were nearly half as likely to have a recent Pap screening (OR = 0.53, 95% CI: 0.30-0.93, p = 0.02). For recent Pap screening, the ICC was 6.3, indicating that approximately 6% of the variation in
the outcome across census tracts was attributable to variation at the tract level
and not as a result of individual-level characteristics.

Table 10 presents the results of the single-level descriptive and multivariate
logistic regression analysis for cervical cancer knowledge. A greater proportion of
individuals with above average cervical cancer knowledge were younger (18-30,
75.0%, 31-50, 62.8%, ≥ 51, 48.2%), were high school graduates (75.6% versus
48.7% non-high school graduates), spoke both English and Kreyol with their
healthcare provider (74.8% versus 51.2% predominantly Kreyol), and did not live
in close proximity to any Haitian botanicas (70.3% versus 45.5% ≥ 1 within ½
mile). In single-level multivariate analysis all predictors but age remained
statistically significant (p<.05). Women with at least a high school education were
more than twice as likely have above average cervical cancer knowledge (OR =
2.16, 95% CI: 1.16-4.01). Similarly, those who spoke both Kreyol and English
were twice as likely (OR = 2.01, 95% CI: 1.10-3.67) to have above average
cervical cancer knowledge. Living near one or more Haitian botanicas decreased
the likelihood of having above average knowledge by 61% (OR = 0.39, 95% CI:
0.21-0.71). There was a significant interaction between educational attainment
and the proximity to Haitian botanicas; these results are presented in the
previous Chapter. Overall, for women living in areas within ½ mile of 1 or more
botanicas those with a high school education were more than 7 times as likely
(OR 7.26, 95% CI 2.41-21.8) to have above average knowledge compared to
those without a high school education. All ensuing multilevel models include this
interaction term. Fitting the model with random intercepts shows that the ICC was
1.9% and all predictors, including education, language compatibility, sociocultural exposure and the education-sociocultural exposure interaction, remained significant.

Table 11 presents a descriptive analysis of the distribution of ABSMs by neighborhood census groups. Maps illustrating the patterns in distribution for each of these factors individually across neighborhoods are presented in Appendix B. Overall, the neighborhoods where study participants resided were of low SES. On average, the neighborhood unemployment rate was 13.8%, the poverty rate 27.0%, the rate of foreign birth was almost half (48.1%) and the median income was 29,187 USD. There was significant variation in the socioeconomic characteristics between neighborhoods. A random intercept model predicting each contextual factor by individuals and neighborhoods found that the proportion of variation explained by between neighborhood variation ranged from 58.0% for female headed households to 79.9% for college education or greater.

The proportion of individuals per neighborhood who had above average cervical cancer knowledge and recent Pap screening is presented in Figure 8 and Figure 9, respectively. No census tracts within the neighborhood representing the historical boundaries of Little Haiti (7 census tracts, cultural and economic center for immigrant Haitian population) reached 75% in terms of either the proportion with above average cervical cancer knowledge or recent Pap screening. The highest proportions or participants with recent Pap screening or above average cervical cancer knowledge were seen in the eastern neighborhoods of the city,
along the US 1 corridor, with a visible decreasing gradient moving to the west towards Interstate 95.

To examine this correlation the results of the multilevel modeling analysis are presented in Table 12. In model 1 each ABSM was regressed separately on both outcomes controlling for individual SES (as measured by income and education level). For cervical cancer knowledge, only increasing area-level income and the proportion of individuals with a college education or greater were positively associated, although the association with increased income was not statistically significant. For every 5% increase in the proportion of individuals with a college education or greater women were 51% more likely (OR = 1.51, 95% CI: 1.17-1.92) to have above average cervical cancer knowledge (p <.01). Similarly, for every 5% increase in the proportion of individuals with less than a high school education women were 18% less likely to have above average cervical cancer knowledge (OR = 0.82, 95% CI: 0.71-0.96, p<.05). While increasing proportions of all other indicators, unemployment, crowding, foreign born, language isolation, female headed households and the composite index were negatively associated (indicating that increasing levels decreased the likelihood of outcome) with individual level cervical cancer knowledge no associations were statistically significant (p<.05). In model 2, which adjusted for other individual-level covariates (including patient-provider language compatibility and the education-sociocultural environment interaction term) the association with area level high school educational attainment (OR = 0.89, 95% CI: 0.75-1.06, p<.10) and area-level college attainment (OR = 1.24, 95% CI: 0.94-1.63, p > 0.10) were attenuated and
were not statistically significant. The fully adjusted model (Model 3), which included all covariates from models 2 and 3, gave the same point estimates and slightly wider confidence intervals.

Only the area-level measure of college educational attainment was associated with recent Pap screening in model 1 (adjusted for individual-level SES). For every 5% increase in the proportion of individuals with a college education or greater within the participants neighborhood of residence there was a 28% increase in the likelihood of recent Pap screening (OR = 1.28, 95% CI: 1.02-1.61, p<.05). This association was attenuated in both model two and three, and, like with cervical cancer knowledge, the contribution of individual-level covariates was much more important than individual-level SES (Model 2 [AOR individual covariates = 1.18, 95% CI: 0.93-1.49], Model 3 [AOR individual SES + covariates = 1.18, 95% CI: 0.93-1.50]).

There was a positive trend (increasing levels increased the likelihood of outcome) with area-level unemployment, income, and immigration and recent Pap screening, however none of these associations were statistically significant at p<.05. For all other predictors increasing area-levels were negatively associated with the likelihood of recent Pap screening, although again, no association approached statistical significant (p <.05). There was no association between the deprivation index and recent Pap screening (OR = 1.01, 95% CI: 0.93-1.10).
Discussion

The current study is the first multilevel examination of recent Pap screening and cervical cancer knowledge in an ethnic minority population residing in an urban area using census groups as the secondary level of analysis. This study demonstrated that neighborhood factors related to educational attainment may be associated with both outcomes, adjusted for individual-level SES. However, upon adjustment for other important individual-level covariates including access to medical cares, having health insurance, a usual source of medical care and patient-provider language compatibility these findings were not statistically significant. Only one other study has found area-level education to be an important predictor of recent Pap screening (Coughlin et al., 2006), while two others found a similar result with area-level poverty. Both latter studies found area-level poverty was not associated with Pap screening when entered into fully parameterized models adjusting for similar individual-level covariates (Datta et al., 2006; Schootman et al., 2006). No studies have investigated cervical or Pap screening knowledge in a multilevel framework.

The non-significant findings may be related to data limitations (small samples size per neighborhood) and are not associated with variability in outcomes or indictors. There was evidence showing variation in both outcomes across neighborhoods. The ICC for recent Pap screening was 6.3% and 1.9% for above average cervical cancer knowledge. However, when modeling this variation based on the selected contextual indicators of area-level SES no association was seen between area-based material deprivation (as indicated by employment,
poverty, or the composite index) and screening contrary to the findings of some multilevel studies. Only area-level educational attainment was associated with both screening (Model 1, proportion of individual with a college degree or greater, AOR = 1.8, 95% CI: 1.02-1.61) and knowledge (Model 1, proportion of individuals with a college degree or greater, AOR = 1.51, 95% CI: 1.17-1.93 and, proportion of individual with less than a high school education, AOR = 0.82, 95% CI: 0.71-0.96), adjusted for individual level measures of SES. The attenuation of these results after adjustment for other important individual-level covariates indicates that socioeconomic context may matter, but that individual characteristics may be more important factors for both knowledge and screening behavior in this ethnic minority population, as demonstrated in many multilevel studies (Pickett et al., 2001).

Given the small association between area-level education and both outcomes it is important to provide a theoretical rationale for these findings given the lack of sufficient explication in the literature and the stated need for developing mechanistic theory. Area-based measures of SES may be related to cervical cancer knowledge and screening in several ways. First, these factors may affect access, both to knowledge and services. The ability to access services may depend on such factors as cost, proximity to, and cultural acceptability of services, the presence of public transportation, or public clinics (Coughlin et al., 2010; Coughlin et al., 2008; Woltman et al., 2007). In areas of lower educational attainment there may be fewer of these services available (Berk et al., 1997;
Coughlin et al., 2006) thus providing less structural opportunity to engage in a Pap screening behavior for individuals who felt it necessary.

Cervical cancer knowledge reflects an individual’s capacity to obtain, process, and understand disease etiology and preventive measures and reflects their level of health literacy (Nielsen-Bohlman et al., 2004). It may include factors such as level of reading comprehension, knowing when and where to go for screening, the understanding of public health messages about the importance of screening (Meade et al., 2007). In ethnic minority populations there is lower educational attainment and correspondingly lower health literacy. Studies show individuals with low health literacy are unable to meet the educational demands imposed by the structures of the current U.S. healthcare system (National Cancer Institute, 2005). Furthermore, studies show that persons with lower health literacy are less likely to undergo Pap screening (D. W. Baker et al., 1997; Lindau et al., 2001a, 2001b). This study supports those conclusions suggesting that cervical cancer screening can be increased by prioritizing the allocation of resources to areas with lower educational attainment. Knowledge interventions can be more cost-effective and disseminated more widely than screening itself. In the Haitian immigrant community future research could seek to identify the individuals and community resources available, such as religious institutions or radio stations, both known to influence Haitian health beliefs and which reach a wide-swath of the population, to increase knowledge.

This study has several important limitations. First, the sampling of participants was not conducted in a systematic, random manner based on neighborhood of
residence. This limits the internal validity of the measurements of ABSMs. Approximately 10% of study participants were related or shared a close connection (were neighbors) to other participants. Therefore, a selection bias may result which makes the population more similar in regards to both outcomes and predictors. However, this type of bias may in general lead to an underestimation of effect size as the variation between individuals and areas was smaller. Second, because of the small sample size and low number of participants per neighborhood (only one participant in 16 different neighborhoods, 32.6%) the study was not adequately powered to detect these neighborhood effects. As discussed, the goal of this research was to provide cervical self-sampling intervention to the community. Often this type of CBPR investigation is at odds with epidemiologic considerations regarding validity and effect size estimation. Therefore, these findings should be regarded as exploratory, indicating that there potentially exists many levels of influence beyond individual covariates that affect Pap screening utilization.

A further methodological limitation was the use of census-based areas as a proxy for neighborhood. This unit of geography is an artificial representation of the neighborhood that uses statistical areas rather than a meaningful spatial cluster. This phenomenon, known in the literature as the *Modifiable Areal Unit Problem* (MAUP), introduces error as a result of aggregating continuous spatial phenomena to areas of arbitrary shapes and sizes (Holt, Steel, & Tranmer, 1996; Holt, Steel, Tranmer, et al., 1996). Future research may use spatial analytic techniques, where distances between individuals and resources are included to
overcome this methodological problem (Chaix, Merlo, & Chauvin, 2005; Chaix, Merlo, Subramanian, et al., 2005). Finally, this research used a cross-sectional design and there may be a temporal mismatch in the exposure-outcome relationship. There are no studies of Pap screening behavioral changes over time in relation to contextual exposure. This exposure is bound to be dynamic as individuals move throughout the urban environment and as the environment itself changes over time. By using census data representing the neighborhood seven years in advance of the current study one cannot assume that the contextual exposure was the same over time nor necessarily represented the true value of the contextual factors. Therefore, there may be significant measurement error of the actual exposure itself leading to the mis-estimation of effect size.

Other factors to consider include the specification of the theoretical model and the measured variables chosen. Several other competing theories include Andersen’s Theory of Healthcare utilization, which prioritizes individual-level choice as a driver of behavior. In this framework the lived environment is a completely external factor inconsequential to the mechanism of behavior adoption (Andersen, 1995). Others, such as Bandura’s conceptualization of collective efficacy, characterizes choice as a group-level construct (Bandura, 2000). Collective efficacy is the groups’ belief in their shared ability to achieve social action. Area-level educational attainment may be one mechanism by which collective efficacy for Pap screening and knowledge is shaped. If one posits that engagement in preventive medicine in an ethnic minority community is a product of the psychocultural or sociocultural environment it will be necessary to use a
measure of collective efficacy as an outcome and explore the moderating effects of contextual factors such as education. In future research it will be necessary to untangle how the Haitian immigrant community itself regards Pap screening and knowledge to see if this theoretical orientation is better suited to explaining differences and should guide research into mechanism of individual-action based on the characteristics of the groups, or neighborhoods.

The primary strength of this research was that it applied a theory-based model (Social Ecology) to explore the influence of neighborhood characteristics as opposed to the standard convention of using race, income, and education of individuals as confounders of the predictor-behavior (or knowledge outcome) relationship. If place does matter for health mis-specified models that do not address this spatial variation leave out important upstream factors that should be addressed in order to achieve sustainable health behavioral change. Therefore, future research should include a review of these spatial distributions in order to achieve increased accuracy in measuring effect size estimates.
Table 9. Proportion of women with recent Pap smear screening and participant characteristics.

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<td>≥ Highschool</td>
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</tr>
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<td>0.03</td>
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<td>50.4</td>
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<td>REF</td>
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<td>Speak both Kreyol and English</td>
<td>71.3</td>
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<td>1.77</td>
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<td><strong>Regular place for medical care</strong></td>
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<td>No</td>
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<td>0.53</td>
<td>0.30-0.93</td>
<td><strong>0.02</strong></td>
<td>0.52</td>
<td>0.30-0.93</td>
<td><strong>0.03</strong></td>
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<td><strong>Cervical cancer knowledge</strong></td>
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<td>Below average</td>
<td>48.4</td>
<td>&lt;.01</td>
<td>REF</td>
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</tr>
<tr>
<td>Above average</td>
<td>67.6</td>
<td></td>
<td>1.83</td>
<td>1.04-3.24</td>
<td><strong>0.03</strong></td>
<td>2.08</td>
<td>1.00-3.27</td>
<td><strong>0.05</strong></td>
<td></td>
</tr>
</tbody>
</table>

† Pearson Chi-Square statistic p-value (dichotomous, categorical); ‡ Cochran-Armitage trend test statistic p-value (ordinal).

* Adjusted model includes all significantly different proportions from univariate analysis. Those terms found not significant in this multivariate model were subsequently dropped from the multi-level model of random intercepts.
### Table 10. Proportion of women with above average cervical cancer knowledge and participant characteristics.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Proportion (%)</th>
<th>$\chi^2$</th>
<th>OR (95% CI)</th>
<th>p-value</th>
<th>Proportion (%)</th>
<th>OR (95% CI)</th>
<th>p-value</th>
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<tbody>
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<td><strong>Age</strong></td>
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<tr>
<td>18-30</td>
<td>75.0</td>
<td>0.03</td>
<td>REF</td>
<td>-</td>
<td>75.0</td>
<td>REF</td>
<td>-</td>
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<td>31-50</td>
<td>64.5</td>
<td>0.73</td>
<td>0.30-1.78</td>
<td>-</td>
<td>64.5</td>
<td>0.61</td>
<td>0.21-1.73</td>
</tr>
<tr>
<td>$\geq$ 51</td>
<td>48.2</td>
<td>0.61</td>
<td>0.21-1.73</td>
<td>-</td>
<td>48.2</td>
<td>0.61</td>
<td>0.21-1.73</td>
</tr>
<tr>
<td><strong>Education§</strong></td>
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<td></td>
</tr>
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<td>$&lt;$ Highschool</td>
<td>48.7</td>
<td>&lt;.001</td>
<td>REF</td>
<td>-</td>
<td>48.7</td>
<td>REF</td>
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</tr>
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<td>$\geq$ Highschool</td>
<td>75.6</td>
<td>2.16</td>
<td>1.16-4.01</td>
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<td>75.6</td>
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<td>1.29-4.29</td>
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<td>Never been married</td>
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<td>-</td>
<td>56.3</td>
<td>0.45</td>
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<tr>
<td>Married/living with partner</td>
<td>65.4</td>
<td>0.47</td>
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<td></td>
</tr>
<tr>
<td>Divorced/widowed/separated</td>
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<td>0.48</td>
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<td><strong>Time in U.S.</strong></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>$&lt;$ 10 years in the U.S.</td>
<td>62.0</td>
<td>0.90</td>
<td>-</td>
<td>-</td>
<td>62.0</td>
<td>0.90</td>
<td>-</td>
</tr>
<tr>
<td>$\geq$ 10 years in the U.S.</td>
<td>62.9</td>
<td>0.07</td>
<td>-</td>
<td>-</td>
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<tr>
<td><strong>Employment status</strong></td>
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<tr>
<td>Employed</td>
<td>64.9</td>
<td>0.37</td>
<td>-</td>
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<td>Unemployed</td>
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<td>0.45</td>
<td>-</td>
<td>-</td>
<td>-</td>
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</tr>
<tr>
<td><strong>Language used with healthcare provider</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Speak predominantly Kreyol</td>
<td>51.2</td>
<td>&lt;.001</td>
<td>REF</td>
<td>-</td>
<td>51.2</td>
<td>REF</td>
<td>-</td>
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<tr>
<td>Speak both Kreyol and English</td>
<td>74.8</td>
<td>2.01</td>
<td>1.10-3.67</td>
<td>0.02</td>
<td>74.8</td>
<td>2.14</td>
<td>1.17-3.91</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
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<td>$&lt;$ 15K</td>
<td>58.6</td>
<td>0.20</td>
<td>-</td>
<td>-</td>
<td>58.6</td>
<td>2.01</td>
<td>1.10-3.67</td>
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<tr>
<td>$\geq$ 15K</td>
<td>66.7</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>66.7</td>
<td>0.54</td>
<td>-</td>
</tr>
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<td><strong>Health Insurance</strong></td>
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<td>Yes</td>
<td>63.9</td>
<td>0.84</td>
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<td>63.9</td>
<td>0.64</td>
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<td>62.1</td>
<td>0.67</td>
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</tr>
<tr>
<td><strong>Regular place for medical care</strong></td>
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<tr>
<td>Yes</td>
<td>66.7</td>
<td>0.17</td>
<td>-</td>
<td>-</td>
<td>66.7</td>
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<td>0.21-0.71</td>
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<td>-</td>
<td>-</td>
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<td>0.40</td>
<td>0.22-0.72</td>
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<td><strong>Botanica§</strong></td>
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<tr>
<td>None</td>
<td>70.3</td>
<td>&lt;.001</td>
<td>REF</td>
<td>-</td>
<td>70.3</td>
<td>REF</td>
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<td>$\geq$ 1 within 1/2 mile</td>
<td>45.5</td>
<td>0.39</td>
<td>0.21-0.71</td>
<td>&lt;.01</td>
<td>45.5</td>
<td>0.40</td>
<td>0.22-0.72</td>
</tr>
</tbody>
</table>

---

* Pearson Chi-Square statistic p-value (dichotomous, categorical); † Cochran-Armitage trend test statistic p-value (ordinal).

* Adjusted model includes all significantly different proportions from univariate analysis. Those terms found not significant in this multivariate model were subsequently dropped from the multi-level model of random intercepts.

* Interaction between education level and environmental botanica exposure was statistically significant (p<.01). See previous chapter for discussion. For all subsequent multi-level models the interaction term was included.
Table 11. Variation of area-level measures across census tracts.

<table>
<thead>
<tr>
<th>Census tracts</th>
<th>Mean (SD)</th>
<th>Range</th>
<th>ICC †</th>
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<tr>
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<td>Neighborhood Economics</td>
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<tr>
<td>median income‡</td>
<td>$29,187 S10,589</td>
<td>$8,477-66,413</td>
<td>75.5</td>
</tr>
<tr>
<td>below poverty</td>
<td>27.0 12.8</td>
<td>1.7-58.3</td>
<td>79.6</td>
</tr>
<tr>
<td>unemployed</td>
<td>13.8 6.3</td>
<td>2.6-33.6</td>
<td>61.6</td>
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<tr>
<td>Social Factors</td>
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</tr>
<tr>
<td>&lt; HS</td>
<td>18.7 9.6</td>
<td>2.5-50.9</td>
<td>76.6</td>
</tr>
<tr>
<td>≥ College</td>
<td>10.2 6.9</td>
<td>0-41.0</td>
<td>79.9</td>
</tr>
<tr>
<td>Female headed</td>
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<td>Education households</td>
<td>14.3 5.7</td>
<td>3.0-31.8</td>
<td>58.0</td>
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<tr>
<td>Foreign born</td>
<td>48.1 10.1</td>
<td>8.6-62.3</td>
<td>70.9</td>
</tr>
<tr>
<td>Linguistically isolated</td>
<td>17.9 9.4</td>
<td>0.0-43.7</td>
<td>59.2</td>
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<tr>
<td>&gt; 1 person per room</td>
<td>28.5 9.5</td>
<td>5.6-47.4</td>
<td>60.2</td>
</tr>
</tbody>
</table>

† ICC - Interclass correlation coefficient. The percent of variation between the grand mean and tract-level mean that is explained by between tract variation.
‡ Income is reported in USD.
Table 12. Multilevel model predicting recent Pap and above average cervical cancer knowledge by selected ABSMs.

<table>
<thead>
<tr>
<th>ABSM</th>
<th>Mean %</th>
<th>Recent Pap Model 1</th>
<th>Recent Pap Model 2</th>
<th>Recent Pap Model 3</th>
<th>Above average cervical cancer knowledge Model 1</th>
<th>Above average cervical cancer knowledge Model 2</th>
<th>Above average cervical cancer knowledge Model 3</th>
</tr>
</thead>
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<tr>
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<td></td>
</tr>
<tr>
<td>% Unemployed</td>
<td>14.8</td>
<td>1.01 (0.96-1.06)</td>
<td>1.07 (0.85-1.36)</td>
<td>1.05 (0.83-1.34)</td>
<td>0.97 (0.77-1.23)</td>
<td>0.99 (0.78-1.28)</td>
<td>1.00 (0.78-1.29)</td>
</tr>
<tr>
<td>Income</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean Income</td>
<td>$29,187</td>
<td>1.11 (0.85-1.46)</td>
<td>1.07 (0.81-1.41)</td>
<td>1.11 (0.83-1.47)</td>
<td>1.17 (0.88-1.54)</td>
<td>0.95 (0.69-1.30)</td>
<td>0.94 (0.69-1.30)</td>
</tr>
<tr>
<td>Poverty</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Below poverty</td>
<td>27.0</td>
<td>0.96 (0.86-1.07)</td>
<td>0.98 (0.88-1.10)</td>
<td>0.97 (0.86-1.09)</td>
<td>0.91 (0.81-1.02)</td>
<td>0.98 (0.86-1.11)</td>
<td>0.98 (0.86-1.12)</td>
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<td>Education</td>
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</tr>
<tr>
<td>&lt; HS</td>
<td>18.7</td>
<td>0.94 (0.81-1.09)</td>
<td>0.99 (0.84-1.15)</td>
<td>0.97 (0.83-1.14)</td>
<td>0.82 (0.71-0.96)*</td>
<td>0.89 (0.75-1.06)</td>
<td>0.89 (0.75-1.07)</td>
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<tr>
<td>≥College</td>
<td>10.2</td>
<td>1.28 (1.02-1.61)*</td>
<td>1.18 (0.93-1.49)</td>
<td>1.18 (0.93-1.50)</td>
<td>1.51 (1.17-1.93)**</td>
<td>1.24 (0.94-1.63)</td>
<td>1.24 (0.94-1.63)</td>
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<td>Crowding</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>&gt;1 person per room</td>
<td>28.5</td>
<td>0.94 (0.81-1.09)</td>
<td>0.98 (0.84-1.15)</td>
<td>0.98 (0.84-1.15)</td>
<td>0.92 (0.80-1.08)</td>
<td>1.00 (0.85-1.19)</td>
<td>1.00 (0.85-1.19)</td>
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<td>Immigrants</td>
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</tr>
<tr>
<td>Foreign born</td>
<td>48.1</td>
<td>1.02 (0.89-1.18)</td>
<td>1.03 (0.89-1.19)</td>
<td>1.04 (0.90-1.20)</td>
<td>0.89 (0.77-1.03)</td>
<td>0.90 (0.77-1.05)</td>
<td>0.90 (0.77-1.05)</td>
</tr>
<tr>
<td>Language</td>
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<tr>
<td>Linguistically isolated</td>
<td>18.9</td>
<td>0.99 (0.86-1.15)</td>
<td>1.04 (0.89-1.21)</td>
<td>1.03 (0.88-1.20)</td>
<td>0.91 (0.79-1.06)</td>
<td>0.97 (0.82-1.14)</td>
<td>0.97 (0.82-1.15)</td>
</tr>
<tr>
<td>Social disorder</td>
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<td></td>
<td></td>
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<td></td>
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<tr>
<td>Female-headed households</td>
<td>14.3</td>
<td>0.94 (0.73-1.21)</td>
<td>0.96 (0.74-1.24)</td>
<td>0.93 (0.72-1.21)</td>
<td>0.97 (0.75-1.25)</td>
<td>0.97 (0.74-1.27)</td>
<td>0.98 (0.74-1.29)</td>
</tr>
<tr>
<td>Deprivation Index</td>
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<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Z-standardize score</td>
<td>-1.41</td>
<td>1.01 (0.93-1.10)</td>
<td>1.03 (0.94-1.13)</td>
<td>1.02 (0.94-1.12)</td>
<td>0.95 (0.87-1.03)</td>
<td>0.97 (0.88-1.06)</td>
<td>0.97 (0.88-1.07)</td>
</tr>
</tbody>
</table>

All ABMS measures were evaluated as a 5% increase from the mean, except median income ($10,000 increase) and deprivation index (1-point increase from mean).

* p < .05, ** p < .01.
† Adjusted for income and education.
‡ Adjusted for language spoken with healthcare provider, usual source of care, and cervical cancer knowledge.
§ Model adjusted for both individual SES measures and other significant individual-level covariates.
¥ Model adjusted for both individual SES measures and other significant individual-level covariates.
§ Adjusted for language spoken with healthcare provider and education by environmental botanica exposure interaction.
Figure 8. Proportion of study participants with above average cervical cancer knowledge by neighborhood.
Figure 9. Proportion of study participants with recent Pap screening by neighborhood.
CHAPTER 5. SYNTHESIS OF FINDINGS

Summary

The two papers of this dissertation address the potential role of culture and neighborhood socioeconomic context in explaining Haitian immigrants’ understanding of cervical cancer and their Pap screening behaviors. In the first paper, using the framework of the Health Belief Model (HBM) as conceptualized by Mailman and Becker (Becker et al., 1975), psychocultural and sociocultural factors were tested as predictors of above average cervical cancer knowledge and the likelihood of having a recent Pap screening (within the past 3 years). In this study having above average cervical cancer knowledge was significantly associated with recent Pap screening. Psychocultural factors, such as having a humoral orientation towards health, a fatalistic view towards screening, and other Haitian-specific beliefs were not associated with knowledge or screening while living in closer proximity to a greater number of Haitian botanicas was associated with knowledge. While previous research has demonstrated that holding non-Western conceptualizations of disease etiology and beliefs regarding the value of preventive medicine are barriers to Pap screening (Johnson et al., 2008) this finding was not substantiated in this study possibly as a result of there being little variation in the proportion of women holding these beliefs.

There was a significant interaction between the sociocultural environment, individual-level education and cervical cancer knowledge. Women with less than
a high school education and living within ½ mile of a Haitian botanica were significantly less likely to correctly answer a series of cervical cancer knowledge questions. These findings suggest that certain exo-system features reflecting the sociocultural identity of a neighborhood may be more indicative of the level of one’s cultural identification, exposure to cultural values, or a proxy for limited resource access and impact on individual behaviors. Sociocultural factors may serve as barrier to obtaining appropriate cervical cancer knowledge and thereby indirectly affecting screening.

Measuring the cultural context for a population is important because it could also be a more precise marker of neighborhood SES. Women who live in a “more Haitian” context may do so as a result of the historic patterns of immigration to the U.S. and Miami or because of the reduced social and material capital available to immigrants. The Haitian community in Miami is of lower SES than surrounding immigrant populations. Furthermore, there is little movement up the socioeconomic ladder for the majority of this population. This continual material deprivation and the lack of opportunities, owing to lower educational attainment and historic marginalization of the community itself, means that individuals remain in the same socioeconomic status throughout their experience in the U.S. Women may be unable or choose not to move into neighborhoods that are “less Haitian”, or more acculturated, where there may be greater access to health knowledge and services. The “more Haitian” neighborhoods may offer reduced opportunity for residents to be exposed to Western conceptions of health and illness and the value of preventive medicine (I.G. Ellen et al., 1997; Jencks et al.,
Therefore, women may, as a result, tend to believe in and have more readily available access to traditional, culturally based forms of medical care. They may only seek care that is incongruous with their cultural orientation to healthcare when afflicted by physiological illness that cannot be treated through traditional means which in the case of cervical cancer is too late. This conceptualization of the role of Haitian botanicas could then be a better community-specific metric to identify segments of the population at higher risk for cervical cancer. By allocating resources to these areas specifically it could lead to a reduction in the overall cervical cancer disparity faced in the community.

The second paper of this dissertation applied the framework of Social-ecology (SE) theory to examine how the external, contextual characteristics of a neighborhood operate to influence a Haitian woman’s cervical cancer knowledge and resultant Pap screening behavior. This study found a small amount of evidence to support that neighborhood socioeconomic conditions influence these outcomes. SE theory states that individual-level outcomes are nested within a set of higher level processes. These processes, which may be political, economic, or social, construct the opportunity and material resources available to access both health knowledge and utilize preventive medicine. This theory was empirically tested using a multilevel model where the socioeconomic attributes of neighborhoods were regressed on both outcomes, adjusted for individual-level measures of SES and other important covariates including health insurance status, having a usual source of medical care, and patient-provider language compatibility. Women living in areas of lower educational attainment were less
likely to undergo screening, adjusted for individual-level SES but not when including the latter three covariates. Several other studies have used this multi-level framework and found similar SES-adjusted estimates (Coughlin et al., 2006; Datta et al., 2006; Fukuda et al., 2005), but the results are inconsistent and the results do not clarify if the effects are a result of direct, indirect, or interactive neighborhood influences.

There was a significant association between educational attainment and the likelihood of having above average cervical cancer knowledge. For every 5% increase in the proportion of individuals with less than a high school education, women were 18% less likely to have answered 3 or more (scale of 5) cervical cancer etiologic and screening knowledge questions. Conversely as to be expected, for every 5% increase in the proportion of individuals with a college degree or greater there was 51% increase in the likelihood of having above average cervical cancer knowledge. No previous research has evaluated the relationship between neighborhood characteristics and individual-level beliefs, or knowledge, regarding preventive health behavior (Robert, 1999). This study provides an initial exploration of the possible mechanisms that drive on the construction of cervical cancer knowledge at the community level which in turn influences screening behavior.

Overall, it will be important to further our understanding of how beliefs and attitudes interact with neighborhood and cultural characteristics to effect health outcomes in order to design and deliver interventions that are culturally and community acceptable alternatives (Pickett et al., 2001). For example,
developing community-based health education interventions that target areas of low educational attainment and with a higher proportion of sociocultural resources may promote sustainable behavior change for Pap screening. These interventions could be focused on increasing health literacy regarding cervical cancer specifically. Furthermore, it may prove beneficial to include proprietors of Haitian botanicas to facilitate the development of critical consciousness regarding women's health within the community. As one of the fundamental tenets of CBPR methodology this is important not only for individual health but also promoting sustainable, community-wide social change.

Strengths

The major strength of this dissertation comes from its origins as a CBPR partnership in the Haitian immigrant community. This partnership provided access to a population that has been historically difficult to reach for public health intervention and research and still bears a great burden of cancer, and specifically cervical cancer-related mortality and morbidity, in the region. Furthermore, by using CHWs as the primary community front-line partners to generate data this study was able to identify features, Haitian botanicas, which could not have been studied using traditional risk-factor, population based methodology.

From an epidemiological/behavioral health perspective this research applied individual-level theory, the HBM, as a rationale for the observed patterns in behavior. Furthermore, information on the often-overlooked, and less studied, moderating factors of the “external environment” including both cultural and
socioeconomic factors were included based on multilevel theories and analysis techniques which often are subsumed into analyses as individual-level confounders. It is especially necessary to include these orientations to examine health patterns when they are thought to be attributable to the differences in social factors, as is the case in studying cancer disparities among ethnic minority populations.

Theoretical orientations, such as Bordieu’s concept of the *habitus*, provide a framework for how higher-level social, economic, political, and physical forces may influence patterns of health disparities. Causal pathways between these factors and health outcomes are often not explored because of the difficulty in operationalizing and measuring them. However, many current scholars of public health have argued that a fundamental flaw of epidemiologic inquiry is the lack of using such sociological thought to understand disease distribution in populations (Krieger, 1994). Throughout much public research over the last half century there has been a focus on “lifestyle” factors and far less attention paid to the social causes of disease. This is not to say that a focus on genes and behaviors is not important. Social context is an adjunct, upstream marker of the potential and realized disparities in disease burden. Only by understanding how they interact with the environment that we can make social changes which have a sustainable impact on disease rates.

To increase the literature on this subject these two studies examined two components of the *habitus*: culture and context. The former is most often studied using qualitative methods which provide a substantial and important theory and
first look at how culture operates to influence knowledge and behavior. The next step, as carried out in this dissertation, was to apply these theories to create a set of variables that approximate the cultural factors and to test the association between these factors using quantitative methods. By framing cultural factors as both an individual-system of beliefs and as an environmental exposure, this study adopts a sociocultural view of behavior utilization rather than the typical study of socioeconomic differences between groups as the drivers of behavior (L. C. Baker et al., 2004; Benjamins et al., 2004; Siahpush et al., 2002; Wells et al., 1998).

It was important and the results suggested that socioeconomic differences are important determinants of knowledge and screening. However, traditionally, they are evaluated using only individual-level data which may not reflect the distinct influence exerted by processes occurring at the group-level, as posited by Durkheim (Durkheim, 1982). The synthesis of Durkheim’s theory is that the characteristics of the group as a whole are conceptually different and exert a distinct influence on an individual separate from characteristics of compositional elements, which form the group. This theory, of multiple levels of influence above the individual, can be tested using the multilevel analytic tools provided in any number of statistical programming packages (GLIMMIX procedure in SAS in this case). This modeling procedure controls for the clustering of individuals within the same group by formally representing each level of influence in its own sub-model. Only four studies have used a multilevel model, and the necessary multilevel modeling algorithms, to explore contextual effects on Pap screening
and none have done so in evaluation of cervical cancer knowledge. Moreover, in contextual analysis studies have routinely employed only one or two area-based socioeconomic measures. This study explored nine ABSMs including one composite index and while the results showed minimal evidence to support the theory it illustrates:

(1) These tools are applicable in small area studies of both knowledge and behavior

(2) Studies of this type could provide important information for the allocation of resources and baseline data regarding the fundamental social issues that drive health disparities in ethnic minority populations.

Limitations

The strength of this dissertation come from its roots in the University of Miami-Little Haiti CBPR partnership but this fact also underlies its fundamental, methodological weaknesses. The study itself was designed to provide a cervical self-sampling intervention, assess its acceptability and efficacy, and to investigate the Haitian women’s feminine hygiene practices as a risk factor for HR HPV infection. Because of this the design, it was difficult to reconcile this applied public health research orientation to study the abstract nature of cultural and contextual influences. To that end I have identified five main limitations to this research: (1) cultural and knowledge scale development, (2) sampling frame, (3) sample size, (4) geographic representation of neighborhoods, and (5)
interpretation of mechanisms for the influence of socioeconomic area-based indicators.

The first limitation is that the scales developed and tested were abstracted from the data that was available and may not appropriately represent either the predictors of interest, such as the cultural belief scale, nor the outcome, cervical cancer knowledge. Across studies of cultural barriers to Pap screening there are a diverse set of questions considered and scales formulated. There is no one unifying construct to measure cultural beliefs even though there are strong similarities across ethnic groups in the themes that are identified as barriers to Pap screening (Johnson et al., 2008). Initially, using principle component analysis, a method for identifying the factors related to a latent construct, all variables from both the knowledge and pyschocultural beliefs scale were simultaneously entered. The results of this analysis showed four distinct factors, one set of which included the pyschocultural scale and three others that had various loading for each of the cervical cancer knowledge questions.

The pyschocultural belief items were consistent (loaded on one factor) but similarly suffered from low internal reliability of a representative scale was low ($\alpha = 0.36$). Typically, $\alpha$ levels of at least 0.40 are meaningful when considering the reliability of scales representative of underlying constructs (Cronbach, 1951). There was also little variability in the responses to these questions. In total, at least 85% of participants answered that they agreed with each of the questions selected. This lack of variation made it difficult to evaluate whether differences in
the level of identification with psycho-cultural beliefs were associated with either cervical cancer knowledge or Pap screening behavior.

In a similar fashion there was very low internal reliability of cervical cancer scale (\(\alpha = 0.28\)). In another principle component analysis including all of the questions related to knowledge from the questionnaire resulted in at least four separate factors to be considered. Question by question addition of selected components after including only those factors that showed a significant loading on the primary factor (Rotated factor loading score of at least 0.3) in all cases reduced internal reliability further, to approximately 0.20. There was also the need to dichotomize responses to both scales because of the small sample size which obscures the true ordinal character of each scale.

Second, the selection of participants themselves was not conducted using a random sampling framework, either at the individual or group level and evaluation of outcomes and sociodemographic characteristics were not longitudinal. By using a convenient, or snow-ball sampling approach, we were not able to make any population based estimates of either outcome. Using a systematic random sampling approach would be necessary to make causal inference (Rothman et al., 2008). While there was good coverage (49 census tracts) of the neighborhoods of Miami-Dade County over the primary neighborhoods of Haitian residence it cannot be assumed that all areas where Haitians reside were sampled. Furthermore, we make no claims that the block groups selected were representative of the neighborhood context for all Haitians. The selection process may have compromised the internal variability of the
selected ABSMs because it did not represent a random sample of all neighborhoods where Haitians reside. Furthermore, given the cross-sectional nature of the study it was not possible to whether women resided in different neighborhoods over time and how their contextual exposure might have changed.

A selection bias may have been introduced as participants were chosen from the social networks available to the community health workers. While CHWs made attempts to canvas a random selection of culturally appropriate venues it is presumable that the women who participated in this study were of lower SES than those who did not participate. No data was collected on those participants that either refused or dropped out of the study before completing its requirements. Similarly, there were a number of participants (approximately 10%) who were referred to the study by family and friends. These individuals are more likely to have similar characteristics of predictors and outcomes thus compromising the external generalizability of the study results to other subpopulations of Haitian immigrants.

Third, the sample size was small and this reduced the power to conduct post-hoc analyses on both individual and area-level factors. Typically, for each individual covariate included in a simple logistic regression model there needs to be at least 5 individuals per cell in the stratified analysis (Greenland, 1989). Using this logic we could at most hope to investigate approximately five covariates simultaneously. This limits the ability to test for both additive and multiplicative effects in single-level models. In the multilevel context simulation studies have
shown that a large number of groups (approximately 50) is more important than a large number of individuals per group (at least five) (Moineddin et al., 2007). In analyses with this number of level-1 and level-2 units the estimates of the fixed regression coefficients are unbiased but that the standard errors and the variance components tend to be biased downward (underestimated) (Hox, 2002; Maas et al., 2004, 2005). While intercepts were treated as random, slopes were treated as fixed, other area-level covariates could be included in the model, and no cross-level interactions were evaluated because of the small sample size per group. Therefore, after careful consideration it is necessary to label this study as more exploratory in nature.

Next, the representation of neighborhoods through administratively defined geographic areas is a topic of continued debate in the literature and presents another methodological weakness. First, immigrant Haitians, and study participants, may define the boundaries of their “neighborhood” very differently than would an outside researcher. What they perceive as their neighborhood environment is important because it will reflect which factors could exert an influence on the outcomes under study (Bond Huie, 2001). Second, units of census-based geography are artificial; they are created as statistical areas by the U.S. census (Holt, Steel, & Tranmer, 1996; Holt, Steel, Tranmer, et al., 1996). When using census tracts the level of heterogeneity within the neighborhood may be great and, consequently, between area variation low. The reverse is true for block groups, the areas may be too homogenous limiting our ability to investigate important social factors. (O’Campo, 2003) The modifiable areal unit problem as
conceived by Openshaw (Openshaw, 1983) states that by changing the geographical area of study one can alter the observed spatial patterns of outcomes and predictors. This problem has two implications: (1) that the observed and modeled variability in the outcomes does not accurately reflect the distribution of health across space and (2) that any observed effect of ABSMs on the outcomes may not represent the effect of a neighborhood per se but the result of the artificially imposed geographical structure. There is also the problem posed by the extreme contextual variability that can occur within an area and no metric of distance or proximity has been created to measure at what level contextual attributes cease to exert an influence on individuals.

In the city of Miami the segregation of poor, ethnic minorities from the more affluent areas is never more than 1-2 miles away. Often, individuals are in close proximity to the resources of these areas including the healthcare infrastructure. In the first study of this work it was hypothesized that exposure to the sociocultural environment was a function of distance and density. The same argument could be made for contextual features. Distance and density of healthcare resources were not examined specifically as a contextual feature. However, the study by Coughlin et al. (2008) illustrated that there is an association between healthcare provider-related factors, such as proximity to OBGYN clinics and Pap screening. It may be important for future research to examine these factors directly rather through approximation by sociodemographic characteristics of neighborhoods themselves.
This leads the final limitation of this work. Mechanistic causal frameworks that define how contextual attributes of an environment impact health are still in their infancy. While theories have been proposed (Diez Roux, 2002; Kawachi et al., 2003; Macintyre, 1999; Pickett et al., 2001; Robert, 1999) understanding these mechanisms will be necessary to meaningfully inform research geared at attenuating health disparities by affecting social change. In studies of other disease-based outcomes it is easier to propose mechanisms of neighborhood effects. For example, it is completely conceivable that living in an area of lower SES may lead to reduced infrastructure, such as viable sidewalks, bike lanes, and green space, for exercise. These types of features are known to reduce cardiovascular morbidity and mortality (Diez-Roux et al., 1997). This type of causal model has not been proposed in the literature on health behaviors, let alone knowledge and health literacy (Robert, 1999). Social factors that describe the interaction between neighbors and the environment, such as trust, reciprocity, and civic engagement, provides one mechanism that interacts with the economic, political, cultural and institutional processes of areas to influence health. As another component of Bourdieu’s *habitus* the social environment may affect variation in outcomes when they are considered as a part of a nested, epidemiologic triangle. While the current research investigated two of these factors, culture and socioeconomic context, it remains that other intrinsic components were left out of the models as a result of data limitations and less fully conceived theoretical orientations towards preventive healthcare utilization.
Conclusions and Future Directions

This dissertation begins to fill several important gaps in the literature on the cultural and contextual influences on one cancer prevention tool in one minority population. While the results are limited to the extent of the methodological limitations cited it provides a rationale for further, more rigorous, investigation. First, future could develop theory-based approaches for the role of social, economic, and cultural factors on behaviors and knowledge as opposed to only reporting the relationship between predictors of cervical cancer screening. This could be applied across studies among diverse ethnic minority populations to further our understanding of the role of sociocultural factors on screening, as opposed to only examining socioeconomic. Third, studies can, and should where appropriate, make use of the new analysis toolbox that is widely available including multilevel frameworks and analysis. Health disparities will continue to afflict those who are marginalized from the formal healthcare institutions and who, by no fault of their own, are faced with socioeconomic disadvantage. In this age focused on efficiency and cost reduction in the healthcare system it is an absolute necessity that resources are focused on those who continue to shoulder the greatest burden of disease. Only by incorporating the study of upstream determinants with individual, lifestyle-related factors can the community-based work that began decades ago and continues today throughout the U.S. and the world lead to truly sustainable social change and improved health for all.
APPENDIX A

ABSMs FOR STUDY 2

**Area poverty:** Neighborhood poverty was determined using the proportion of total individuals within a block group living below the federally designated poverty line as defined by the US Census in 2000. This line varies according to the number of individuals supported by a family’s annual household income. If a family’s total income is less than the family’s threshold, then that family and every individual in it is considered in poverty. For example, in 2000 for a family of four people with two children the poverty line was $16,895.

**Area unemployment:** Neighborhood unemployment was measured using 2000 Census SF3 estimates of the proportion of block group residents 16 years of age and older who were unemployed at the time of 2000 Census. The US Census defines unemployed individuals as those without any employment, including part-time work, for the past six months.

**Area education:** Two measures of neighborhood educational attainment were evaluated: the proportion of individuals with less than a highschool education and the proportion of individuals with a college education or better. For the latter, attainment was determined using the proportion of neighborhood residents 25 years and older reporting less than high school as the highest level of education attained. For the former, attainment was determined using the proportion of
neighborhood residents 25 years and older reporting they completed college or secondary education beyond college.

**Area female-headed households:** The proportion of female-headed households in a neighborhood was determined by dividing the number of female-headed households in a census block group by the total number of households for that block group.

**Area foreign born:** The proportion of individuals residing within the area who is not a U.S. citizen at birth. This includes naturalized U.S. citizen, lawful permanent residents, temporary migrants, humanitarian migrants, and persons illegally present in the U.S. In 2007, 13% of the entire U.S. population was foreign born.

**Area ethnic isolation:** Neighborhood ethnic isolation was determined using the proportion of all neighborhood residents who were foreign born and is directly calculated by the U.S. Census.

**Area linguistic isolation:** Neighborhood linguistic isolation was determined using the proportion of residents whose primarily language spoken at home was not English.

**Area crowding:** The proportion of household with $\geq 1$ person per room.

**Median income:** The median household income in year prior to the decennial census based on all reported incomes for the household, and not separately for individuals (for the U.S. in 1999 = $42,000.00$)
APPENDIX B – MAPS OF DISTRIBUTION OF CONTEXTUAL FACTORS

Average proportion of individuals unemployed by census tract.
Average mean income by census tract.
Average proportion of individual living below the federal poverty line by census tract.
Average proportion of individual with less than a highschool education by census tract.
Average proportion of individuals with a college degree or greater by census tract.
Average proportion of living in crowded conditions by census tract.
Average proportion of individuals who are foreign born by census tract.
Average proportion of individuals living in linguistic isolation by census tract.
Average contextual proportion of female headed households by census tract.
Average proportion of individual living in deprived conditions by census tract.
Works Cited


