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Prevalence And Influence On Quality Of Life Of Symptoms Caused By Inhaled Odors,
Chemicals And Irritants: A Comparison Between Hispanics And Americans

by

Carmen Perez

A thesis submitted in partial fulfillment
of the requirements for the degree of
Master of Science in Public Health
Department of Environmental and Occupational Health
College of Public Health
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Dedication

*To my loving husband and wonderful son
for their love and support in my pursuit of professional enrichment.*

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Prevalence and Influence on Quality of Life of Symptoms Caused by Inhaled Odors,
Chemicals and Irritants: A Comparison between Hispanics and Americans.

Carmen Perez

ABSTRACT

Efforts to estimate the population prevalence of chemical sensitivities have been limited and have yielded different estimates of the prevalence of affected individuals. Researchers recognize that people differ in their biological susceptibility to environmental contaminants as well as the amount of contaminant to which they are potentially exposed.

Lack of information on the population prevalence of people, who report sensitivity to a chemical or many chemicals, as well as variables associated, has been recognized in previous studies (Kreutzer et al., 1999). In a more recent report, Berg et al., in 2007 reported the prevalence and consequences related to inhalation of chemicals in a Danish population. They concluded that the symptoms related to inhalation of airborne chemicals were common, especially among women. A small part of that population reported that these symptoms affected social life or occupational conditions.

Details in prevalence on severity of symptoms caused by inhaled odors, chemicals and irritants have not been investigated comparing populations based on ethnical differences. These differences could influence how individuals report their symptoms. This study evaluated the differences between Americans and Hispanics in sensitivity and symptoms related to inhalation of strong odors, chemical and irritants. We also evaluated

the differences between both ethnic groups on quality of life due to these symptoms. A cross-sectional descriptive study was conducted between December 2008 and March 2009. A self-administered questionnaire was distributed to a total of 290 adults and 205 were selected for the analysis. American and Hispanic individuals of 16 years old or more were included. The responses were cross-tabulated and comparisons between means were performed using t-test and ANOVA. 29.8% of study population reported being more sensitive than the average person and women reported more than men (75%). These findings were consistent with previous reported in the literature. The reaction more frequent reported was to cigarette smoke (60%). Statistically significant differences were identified between Americans and Hispanics regarding to sensitivity to chemicals, irritants, odors or strong fragrances and reaction to cigarette smoke when history of Allergy is present. Significant differences between both ethnic groups were detected with Lower Respiratory, Neuro-psychological and Non-specific symptoms; and Quality of life. These differences were disclosed when history of Allergy, smoking habit, used steroids or antibiotics within the last 4 weeks, and age were considered. Americans reported being more sensitive with exposure to recognized everyday irritants, react more to cigarette smoke and reported more Non-specific symptoms than Hispanics. Hispanic smokers tend to report Lower Respiratory symptoms more than the Americans. Hispanics between 50 to 59 years old reported more Neuro-psychological symptoms than Americans. Quality of life was more affected among Americans if they are exposed to common irritants, when Allergy history and use of steroids or antibiotics were considered.

Chapter I

Introduction

Some chemicals, routinely encountered in everyday life, produce strong odors and/or fumes that can further irritate already inflamed airways. They are sometimes referred to as irritants. Perfumes, hairsprays, cleaning solutions, air fresheners, cooking fumes, paints and varnishes are some of them.

People frequently complain that perfumes and fragrance products cause or contribute to health problems such as asthma, migraines, and upper respiratory irritation. Is this simply a reaction to the odor of these products or is it a serious concern?

It is well known that during pregnancy many odors that were perceived as pleasant or neutral before will cause nausea. After pregnancy the aversion to these odors usually disappears. When someone is ill, they are much more sensitive to odors. Again when the illness is over this sensitivity usually goes away. In both examples we have a physical change.

Individual and genetic factors also play an important role in sensitivity to chemicals (Dalton, 2003). Just as some people can tolerate more sun than others, some people can tolerate more chemical exposure than others. Individual body chemistry varies and so does tolerance to chemicals. Individual genetic susceptibilities are based on

differences in major histocompatibility complex, toxin metabolism, lifestyles, and exposure rates. As a consequence individuals will react differently to the same chemicals (Gebbers, 2001). If this statement is true, ethnic differences would be one determining factor in the way people respond to exposure to chemicals. Each ethnic group has its own lifestyle that characterizes and encompasses a range of exposures. This makes them more tolerable to those exposures, therefore, complain less about them. For example, Japanese believe that fragrance calms the spirit. They have created an olfactory cultural of producing incense. They like to burn incense or fragrant woods in their homes before guests arrive. This would be less tolerable by people from other cultures. Cultural-specific experience can evoke different patterns of cognitive and emotional experience of an odor, and play a role in one's odor perception. There is evidence for ethnical differences in sensitivity and preference for odors (Dalton & Beauchamp, 1999).

It often takes repeated exposures in order for sensitivities to develop. It may seem that things that have been tolerated for years suddenly causes problems. Often sensitivities develop takes long time before they are recognized. It is often difficult to pinpoint the cause of symptoms such as sinus problems, skin irritations, and triggers for asthma. This is especially true when the triggering substance is one that is common in the environment.

For the person who has asthma, migraines, or serious health problems from exposure to common fragrance materials, it is very difficult to function in public settings. This makes it very difficult to work, shop for groceries, and other necessary activities. For those with less serious health problems, such as sinus congestion and allergy symptoms such as runny noses and watering eyes, functioning is possible, but difficult.

Health and productivity can be seriously impacted. Costs of upper respiratory illnesses are high, both in terms of medical treatment and lost productivity at work.

Community residents, workers and patients frequently report physical symptoms in relationship to environmental odors. In 2001, Shusterman utilized three case studies in which an individual (or multiple individuals in a community) reported odor-associated physical symptoms. He made an analysis based upon the formal toxicological properties of the odorant(s) involved. He based this discussion in that environmental odors may play either a central or 'bystander' role in the genesis of acute air pollution-related symptoms. Finally, he concluded that an important first step in analyzing such situations is to catalog the chemical agent(s) involved and to consider its relative odorant and irritant potencies. When potent odorants alone are involved in the exposure, or when the toxicology of co-pollutants is insufficient to explain observed symptoms, it may be necessary to invoke non-toxicological explanations for odor-related symptoms. Some of these explanations involve attitudinal and/or behavioral responses to odors (Shusterman, 2001).

The experimental data on the effect of unpleasant odors on human health reviewed in a question-and-answer format suggests, according to a review of recent studies done by Schiffman, that the main complaints of health symptoms from odors are eye, nose, and throat irritation, headache, and drowsiness. Persons who report symptoms from odors generally find problems with a broad array of compounds. A study was conducted in which subjects were again asked how sensitive they were to odors. Then they were asked to fill out a single page "Odor Questionnaire" that did not mention the environment or length of exposure. Again, the sensitive subjects rated many items as problematic. However, the "less-sensitive" group rated only a few items as problematic

(mainly cigarette, cigar, and pipe smoke, ammonia, and diesel exhaust). No more than 32% of the “less-sensitive” individuals reported a problem with any item. This finding illustrated that the responses to surveys about odors can be affected by the perceived purpose of the questionnaire as well as the duration of exposure (Schiffman, 1998).

There are many factors that determine what will be tolerated without adverse effects and what will not. Those tolerances will vary from individual to individual. There may be variations in tolerance in the same individual depending on other factors involved. A healthy person can tolerate much more exposure than someone that is in poor health. Even a healthy person is more at risk when he or she is tired or stressed. Age also affects tolerance. The very young and the very old are more at risk. The young because many of the systems of the body are still developing and in the elderly health is often compromised. Children may be more susceptible to the effects of fragrances because of their smaller size, their higher respiratory rate, and their thinner skin. Skin in the elderly is usually thinner because of the loss of the fat layer beneath the skin, so substances are more easily absorbed through the skin.

Women are usually more prone to problems from fragranced products for various reasons. When compared to men, women are usually smaller in size. This means the same exposure would be a higher dose for women. Women have also a higher ratio of body fat than men. Many chemicals are stored in fat tissue. A substance stored in the fat tissue can remain in the body for a long time. Also women are generally exposed to fragranced products more than men. Most household products are fragranced. The fragrance materials are inhaled and they are absorbed through the skin. Along with this, women's personal care products are usually more perfumed than men's, although this

trend is quickly changing. Several studies have reported the high incidence of chemical sensitivity among women (Bell, 1993; Berg, 2008; Joffres, 2001; Johansson, 2005; Kreutzer, 1999; & Meggs, 1996).

Persons who are depressed may be more likely to make complaints about unpleasant odors. Doty et al reported that persons who claim that odors bother them had higher scores on the Beck Depression scale than control subjects (Doty et al., 1988).

Studies evaluating simultaneously chemical sensitivity to irritants and allergy in the general population have reported equivalent prevalence in both. Meggs et al., for example, found that both conditions present simultaneously were reported by 16.9% of the population, chemical sensitivity only by 18.2%, and allergy without chemical sensitivity by 16.0%. Based in these findings, they supported that the scientific investigation of chemical sensitivity is justified (Meggs et al., 1996).

Lack of information on the population prevalence of people who report sensitivity to chemicals, as well as demographic or other variables associated was recognized by Kreutzer et al. in 1999. They conducted a population based survey in California, and the report was published in 1999. They found that the ethnic groups studied (including Hispanics, 23.8%) had similar rates of doctor-diagnosed and perceived sensitivity to chemicals. However, later in the report, it was stated that Hispanic ethnicity was associated with physician-diagnosed multiple chemical sensitivity (OR 1.82). Based in these results of almost twice increased risk among Hispanics, it makes sense to provide additional test of these findings and look for possible differences among Hispanics and Americans in a sample in which both groups are equally represented. No other previous study has mentioned this distinction among Hispanics and Americans. Because of this, it

is imperative to support the credibility of these findings, through population samples based studies. Even more in communities where this ethnic group contribute is prevalent.

Although traditionally, it has been considered susceptible groups that include children, the elderly, and those with preexisting disease; the research has focused on evaluating the effects of socioeconomic status, race, ethnicity, gender, and other factors that may contribute to increased susceptibility. Researchers recognize that people differ in their biologic susceptibility to environmental contaminants. Furthermore, people also differ in the amount of contaminant to which they are potentially exposed. Despite recognition of these findings, available technology has limited the ability of researchers to evaluate the biological factors that make some people more vulnerable than others. Fortunately, recent advances in the ability to assess biological factors that influence risk have been made. We can now look at genetic factors, as well as the social and behavioral factors, that make people more vulnerable. Several studies indicate that age and pre-existing disease play a major role in susceptibility to the adverse effects of air pollution. Race has also been investigated as a possibly influential factor on heightened susceptibility, especially among those with preexisting disease (Berg, 2008; Fruin, 2003; & Meggs, 1996).

In a recent study, Berg et al. reported the prevalence and consequences related to inhalation of chemicals in a Danish population. They concluded that the symptoms related to inhalation of airborne chemicals were common, especially among women. A small percentage of participants reported that these symptoms affected social life or occupational conditions (Berg et al., 2008).

Efforts to estimate the population prevalence of chemical sensitivities have been limited and have yielded different estimates of the prevalence of affected individuals (Berg, 2008; Caress, 2003; Johansson, 2005; Meggs, 1996; & Steinemann, 2001).

Details in prevalence on severity of symptoms caused by inhaled odors, chemicals and irritants have not been investigated comparing specific populations based on ethnical differences. Most of the previous studies have evaluated the different races or ethnic groups among other socio-demographic variables. They agree that reports of sensitivity to chemicals are distributed homogeneously across racial/ethnic categories but they have not done in-depth analysis that allow identify possible ethnic disparities. (Caress, 2003; Kreutzer, 1999; Meggs, 1996; & Steinemann, 2001).

The U.S. Office of Management and Budget currently defines "Hispanic or Latino" as "a person of Mexican, Puerto Rican, Cuban, South or Central American, or other Spanish culture or origin, regardless of race. American is a citizen of or from the United States. Based on these definitions we established our own definitions of ethnicity based on where the parents (both) were born. We chose not to study individuals from different ethnicities independently if she or he reported that she/he was born in United States. Hispanic ethnicity is widely distributed across several states in Unites States, especially in Florida. This ethnic group is intermixing with other ones, and because of this; it is difficult sometimes identify one individual in one category or other. Exact definition for our study is given in the Method section.

Our study has the purpose of identifying possible ethnic differences between the major groups of the population of our community. Further research is required to fully

assess the health impact of odors, chemicals and irritants across specific ethnic groups with particular exposures. Based on the results from the California's study we could think about existing differences between Hispanics and Americans in our community in the way they report their symptoms. The minorities have different lifestyles or perform work differently from the majorities. They are usually exposed to different environmental issues in the workplaces with more exposures. This makes sense thinking about different patterns of complaints or more tolerance with exposure to irritants.

The results obtained could contribute to motivate researchers' interest and contribute to the development of exposure guidelines for occupational and residential environment.

Chapter II

Hypothesis and Specific Objectives

Hypothesis:

The prevalence and influence on quality of life of physical and psychological symptoms reported due to exposure to inhaled odors, chemicals and irritants differ between Hispanics and Americans.

Specific Objectives:

1. Evaluate the prevalence of symptoms reported due to exposure to inhaled odors, chemical and irritants, through socio-demographic and health variables, to identify differences between Hispanics and Americans.
2. Determine and contrast the variations on quality of life due to symptoms reported from exposure to inhaled odors, chemicals and irritants of both ethnic groups.

Chapter III

Methods

Study design and population

A cross-sectional descriptive study was conducted between December 2008 and March 2009. During this 4 months period, a self-administered questionnaire, created in a previous study (Williamson, 2007) to determine the frequency and severity of symptoms caused by inhaled odors, chemicals and irritants was distributed to adults. They voluntarily agreed to participate in the investigation. The total population part taken in the study was recruited in this period of time. The following criteria were considered to exclude subjects from the analysis: age less than 16 years and ethnicity other than American and Hispanic.

The original questionnaire on self-reported symptoms related to inhalation of odors, chemicals and irritants, with 59 separate items, consists of two sections. The first section included demographic, personal and health information (Appendix B). The second section contains questions regarding sensitivity to exposures from inhaled odors, chemicals, and irritants; as well as quality of life (Appendix C). Additional questions about socio-demographic information with 6 items were added in a separate sheet (Appendix D). The entire questionnaire takes about 15 minutes to complete. The

questionnaire has a cover letter to inform the participants about the research project and decision to complete the survey (Appendix A).

The socio-demographic information consisted of gender, age, ethnicity, if the individual and his or her parents were born in United States, information on educational level, and work location if employed was recorded. Representative items in personal and health information were answered as yes or no. These items included smoking habits, pregnancy status in women, history of: allergies, respiratory symptoms or diseases, psychiatric disorder, other specific organs/systems symptoms or diseases; and if the individual used antihistamines, steroids, antibiotics or heart medications. Questions regarding the sensitivity to inhaled odors, chemicals and irritants were based on symptoms and signs experienced by the individual as well as their interaction with social life when are exposed to cigarette smoke, automobile exhaust, strong smells, cologne, perfumes, scented candles and fresh paint vapors or fumes. The answers to sensitivity and quality of life questions were based on their experiences in the present and over the past year. The questionnaire format facilitated the participants' rating of their likelihood of agreement with the answers. Personally identifiable information was excluded. The questionnaires were translated to Spanish and were available in both languages.

Definition of variables

Ethnicity: defined as identity with a particular national or cultural group and observance of that group's customs, beliefs, and language. This variable was classified, on the investigator's interest, as:

American: individual from any race born in the United States, and descent from American parents born in U.S.

Hispanic: individual born in Central, South America or Caribbean Isles or born in the U.S as first generation descendents from parents born in these geographic areas, and Spanish speaking, regardless of race. This category included individuals from: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, Venezuela, and Puerto Rico.

In the questionnaire, the individuals regarded themselves within the ethnicity categories. During the data processing, the investigator assigned each participant within the adequate category, depending on the answers to the questions about where the parents were born, and based on previous definition of American or Hispanic.

In the analysis the individuals were divided into five age groups in age ranges of 10 years with the youngest being under 30 years of age and the oldest being over 59 years of age.

Educational level was evaluated as an ordinal variable with 4 categories: primary or elementary, high school, college or university, and graduate level.

Workplace location was divided into five different categories, based on possible common exposures to airborne odor and irritants in each category. For example, one category was indoor office where workers are more exposed to cigarette smoke, cologne, perfumes and scented candles. The other categories were enclosed vehicle, indoor plant or industry, outdoor, other location and unemployed. The individuals allocated themselves in a category based on if they staying in that location during 6 hours or more.

Health variables were defined from personal information of medical history included in the questionnaire and were categorized according to “Yes” or “No” answers.

These dichotomous variables were grouped during the data processing based on specific organ or system involved in the disease. This classification facilitated the analysis when medical history was considered. The health variables were:

Allergy history: This variable consisted on if the individual has history of allergy, hay fever, seasonal allergies, allergic rhinitis, eczema, hives or use of antihistamines medications.

Respiratory problems: If the individual reported history of respiratory problems, abnormal sense of smell, Asthma or daily cough.

Non-respiratory problems: If the individual has history of Hepatitis, Cirrhosis, Renal Failure, Arthritis or use heart medications.

Neuro-psychiatric disorder: If the individual has history of neurologic disorder, psychiatric disorder or use anti-depressant medications.

Physician diagnosis: If the individual has been diagnosed by a physician with Fibromyalgia, Chronic Fatigue Syndrome or Multiple Chemical Sensitivity.

Smoking habit: This individual characteristic was analyzed in two different variables, if the person is a current smoker and if has smoked in the last 10 years.

Pregnancy status: If the woman included in the study is pregnant.

Use of steroids or antibiotics: If the individual has used at least one of these two medications within the past 4 weeks.

We considered *exposure to inhaled odors, chemicals and irritants*, when the individual was exposed to cigarette smoke, automobile exhaust, strong smells, cologne, perfumes or scented candles, and fresh paint vapors or fumes. The reaction to each exposure was evaluated in an ordinal fashion (“nothing unusual”, a “mild reaction”,

“become somewhat ill” and “become very ill”). These categories were rated in the analysis using absolute values from 1 to 4 and more reaction resulted in higher score.

The statements about symptoms and quality of life were categorized according to the five-point likert scale and respondents specified their level of agreement to each statement (“strongly disagree”, “disagree”, “neutral”, “agree”, and “strongly agree”). The level of agreement or disagreement was scored in absolute values from 1 to 5, and more agreement resulted in higher statement score.

The symptoms reported due to exposures were grouped according to the body area or system affected, and new responses variables were created with the symptoms. The values of these variables were calculated with the mean of values of each symptom in the group. These quantitative variables created with the symptoms were:

Face and Upper airways symptoms (complaints related to the face, nose and throat), *Lower Respiratory symptoms* (complaints related to trachea and lungs like cough, difficult breathing, wheezing or chest discomfort), *Gastrointestinal symptoms* (nausea, indigestion, diarrhea or getting gas), *Neuro-psychological symptoms* (headache, anxiety, trouble concentrating and become emotional) and *Non-specific symptoms* (discomfort, becoming sick, aching joints, trouble sleeping, numbness or tingling in hands or feet, hot or cold body sensation, and relieve of symptoms when getting away).

Quality of life was defined from the last four statements included in the sensitivity questionnaire (missing work, missing social or business appointments, feeling stress at home or work, and difficulty to interacting with other people). The value of this variable was also calculated with the mean of values from the last statements.

Data collection

The main investigator distributed the questionnaires in Miami and Tampa. The locations selected were: libraries and food courts in Florida International University (FIU) in Miami and University of South Florida (USF) in Tampa, Publix food stores (one in Miami located directly across from FIU and other located in Tampa Palms area), and College of Public Health at USF. The questionnaires were completed by volunteers and returned to the investigator personally in these places the same day.

Statistical Analysis

We did a descriptive analysis of the statements about sensitivity, symptoms and quality of life, reported due to exposures. The prevalence was measured through the absolute frequency and percentage of individuals with symptoms and sensitivity reported from exposure to inhaled odors, chemicals and irritants. The responses were cross-tabulated with health variables and demographics including gender, age by groups and ethnicity. Comparisons between Americans and Hispanics about self reported sensitivity, symptoms and quality of life were examined in greater detail to evaluate possible differences between these ethnic groups.

Statistical analyses were performed using the software SPSS version 17.0. The comparisons in the prevalence of symptoms due to exposure to inhaled odors, chemical and irritants, and quality of life, between Hispanics and Americans, were done through two tailed t-test. Analysis of variance (ANOVA) was performed when socio-demographic and health variables were added to analysis. For all tests, the level of significance was $p < 0.05$ and the p-values were two sided.

Chapter IV

Results

Socio-demographic characteristics of the study population

Two hundred and ninety questionnaires were collected from volunteers and 205 were selected for the analysis based on exclusion criteria; 47 were answered in Spanish. One hundred individuals were Americans and one hundred and five were Hispanics. More women (64.9%) than men (35.1%) participated in the study although not by choice. The distribution of the population by gender was similar between Americans and Hispanics, 66% of participants were women among Americans and 63.8% among Hispanics. The mean of age in the sample was 33 years, ranging from 16 to 85 years. The 55% of participants were younger than 30 years old; this group of age constituted the 54% among Americans and 56% among Hispanics. The other groups of age constituted less than 20% each category and their distribution was different in both ethnic groups. The majority of the participants in the study were students or graduated from College or University (88.3%) and the 56.6 % reported work in office 6 hours or more a day. Figures 1, 2 and Table 1 show these results.

Figure 1: Distribution of the population by gender and ethnicity

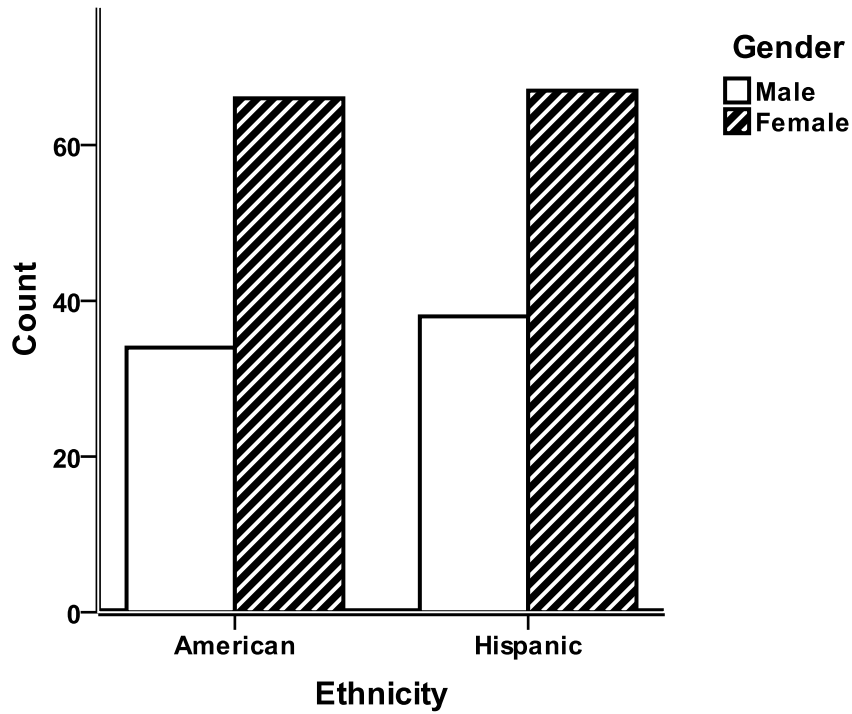


Figure 2: Distribution of the population by age and ethnicity

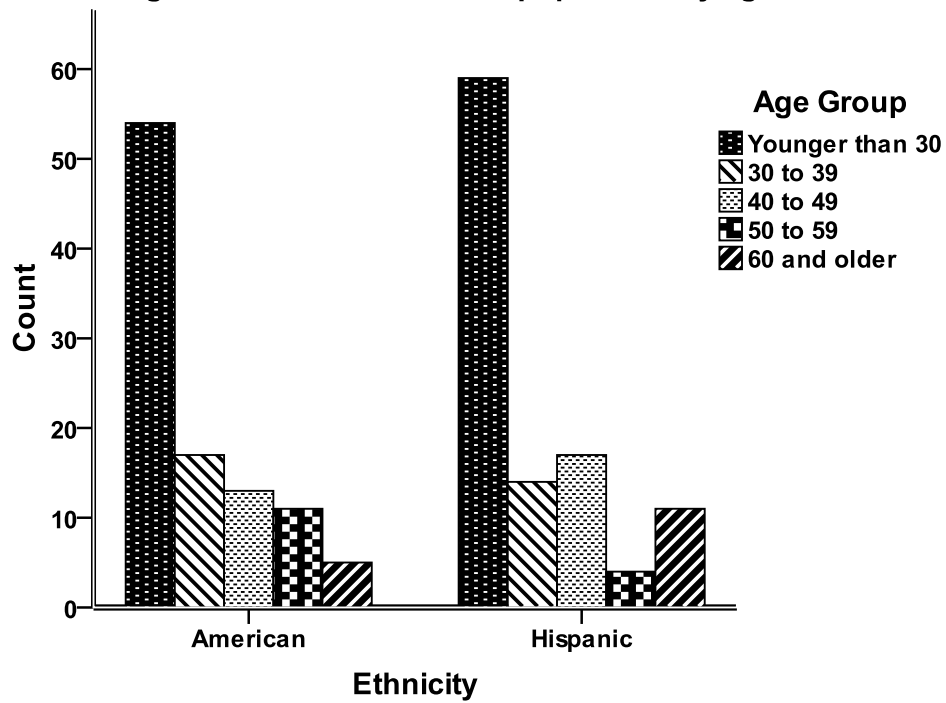


Table 1: Demographic characteristics of the study population

| Variable | Frequency | Percent |
|---------------------------|------------------|----------------|
| Ethnicity | | |
| Americans | 100 | 48.8 |
| Hispanics | 105 | 51.2 |
| Gender | | |
| Male | 72 | 35.1 |
| Female | 133 | 64.9 |
| Age by Group | | |
| Younger than 30 | 113 | 55.1 |
| 30 to 39 | 31 | 15.1 |
| 40 to 49 | 30 | 14.6 |
| 50 to 59 | 15 | 7.3 |
| 60 and older | 16 | 7.8 |
| Educational Level | | |
| High School | 24 | 11.7 |
| College or University | 138 | 67.3 |
| Graduate Level | 43 | 21.0 |
| Workplace Location | | |
| Enclosed vehicle | 1 | 0.5 |
| Indoor office | 116 | 56.6 |
| Indoor plant or industry | 3 | 1.5 |
| Outdoor | 7 | 3.4 |
| Other | 14 | 6.8 |
| Unemployed | 64 | 31.2 |

Medical history and smoking habit of the study population

Medical history and smoking habit of all study participants are shown in Table 2. Medical conditions more frequent reported among the individuals in this study were Allergy and Respiratory problems, 37.6% and 31.2% respectively. Only 6.8% of participants were current smoker, 22% reported smoking habit in the last 10 years and one woman was pregnant. The distribution of participants within each one of these health and socio-demographic variables was similar between Americans and Hispanics.

Table 2: Medical history of the study population

| Variable | Frequency | Percent |
|--|------------------|----------------|
| History of Allergy | 77 | 37.6 |
| History of Respiratory problems | 64 | 31.2 |
| History of Non-Respiratory problems | 19 | 9.3 |
| History of Neuro-Psychiatric disorder | 14 | 6.8 |
| Physician diagnosis of Fibromyalgia, Chronic Fatigue Syndrome and Multiple Chemical Sensitivity | 5 | 2.4 |
| Use of steroids or antibiotics within the past 4 weeks | 23 | 11.2 |
| Smoker | 14 | 6.8 |
| Smoking habit in the last 10 years | 45 | 22.0 |

Sensitivity and reaction to specific irritants in the study population

The perception of being more sensitive than the average person and the reaction level experienced by individuals in the study when they are exposed to cigarette smoke, automobile exhaust, strong smells, cologne, perfumes, scented candles and fresh paint vapors or fumes, is represented in Table 3. Almost 30% (29.8%) of study population reported being more sensitive than the average person and women reported more than men (75%); the mean value to this statement was 2.95 when the ordinal variable was transformed and discontinuous values between 1 and 5 were assigned to the answers. This means that almost the majority of participants in the study are more impartial than disagree in confirm that they are more sensible than the average person.

The reaction more frequent reported was to cigarette smoke; more than a half of individuals (60%) experience any reaction when are exposed; and the mean for this exposure was almost 2 (1.80) that represent a mild reaction, when the variable is transformed in the analysis and discontinue values between 1 and 4 are assigned to the answers. The second more common reaction was to automobile exhaust; 57.1% of participants in the study reported any reaction to this exposure and the mean was 1.74; followed by fresh paint vapors or fumes with 55.6% of responders having any reaction and mean of responses of 1.77. As it is noticed, more than a half of persons have any reaction to these two exposures. However, less than 50% of participants in the study refer any reaction to strong smells, cologne, perfumes or scented candles (46.3%), and the mean for this exposure was 1.66 (Table 3).

Table 3: Sensitivity when exposure to inhaled chemicals, irritants, odors and strong fragrances and reaction to specific irritants

| Variable | Frequency | Percent |
|---|------------------|----------------|
| More sensitive to chemicals, irritants, odors and strong fragrances than the average person (Mean 2.95, SD 15.66) | | |
| Strongly Disagree | 25 | 12.2 |
| Disagree | 38 | 18.5 |
| Neutral | 81 | 39.5 |
| Agree | 44 | 21.5 |
| Strongly Agree | 17 | 8.3 |
| Reaction to cigarette smoke (Mean 1.80, SD 0.76) | | |
| Nothing unusual | 82 | 40.0 |
| A mild reaction | 84 | 41.0 |
| Become somewhat ill | 37 | 18.0 |
| Become very ill | 2 | 1.0 |
| Reaction to automobile exhaust (Mean 1.74, SD 0.73) | | |
| Nothing unusual | 88 | 42.9 |
| A mild reaction | 83 | 40.5 |
| Become somewhat ill | 33 | 16.1 |
| Become very ill | 1 | 0.5 |
| Reaction to strong smells, perfumes or candles (Mean 1.66, SD 0.84) | | |
| Nothing unusual | 110 | 53.7 |
| A mild reaction | 64 | 31.2 |
| Become somewhat ill | 22 | 10.7 |
| Become very ill | 9 | 4.4 |
| Reaction to fresh paint vapors or fumes (Mean 1.66, SD 0.84) | | |
| Nothing unusual | 91 | 44.4 |
| A mild reaction | 77 | 37.6 |
| Become somewhat ill | 30 | 14.6 |
| Become very ill | 7 | 3.4 |

Symptoms and Quality of Life due to exposure to irritants in the study population

The symptoms due to exposure to cigarette smoke, automobile exhaust, strong smells, perfumes or fresh paint vapors were classified by body area or system affected. Participants in the study reported their level of agreement or disagreement with the different complaints and aspects related to quality of life. The answers were rated and the mean of values within each group of symptoms and quality of life are shown in Table 4.

The mean of scores ranged from 1.73 to 2.38, this indicate that the majority of people in the study had any level of disagreement with the different symptoms or statements related to quality of life. The highest mean value detected (2.38) was with lower respiratory symptoms (cough, difficulty of breathing, wheezing, and tightness or pressure in the chest) that represent disagreement. Most people reported strong disagreement with gastrointestinal symptoms and complaints that affect the quality of life, when they are exposed to irritants.

Table 4: Symptoms and quality of life due to exposure to cigarette smoke, automobile exhaust, strong smells, perfumes or fresh paint vapors

| Variable | N | Minimum | Maximum | Mean | (±SD) |
|--|----------|----------------|----------------|-------------|--------------|
| Face and Upper Respiratory symptoms | 205 | 1.00 | 5.00 | 2.23 | .983 |
| Lower Respiratory symptoms | 205 | 1.00 | 5.00 | 2.38 | .913 |
| Gastrointestinal symptoms | 205 | 1.00 | 5.00 | 1.88 | .732 |
| Neuro-Psychological symptoms | 205 | 1.00 | 5.00 | 2.22 | .947 |
| Non-Specific symptoms | 205 | 1.00 | 5.00 | 2.25 | .758 |
| Quality of Life | 205 | 1.00 | 5.00 | 1.73 | .797 |

Sensitivity and reaction to specific irritants by ethnicity

The level of agreement to the statement if the individual is more sensitive to inhaled chemicals, irritants, odors and strong fragrances than the average person, and level of reaction to each irritant was compared between Americans and Hispanics, these results are shown in Table 5.

There were not statistically significant differences between the means in both ethnics groups for any variable analyzed, p values were more than 0.05 in all tests. Most answers to reaction caused by different irritants were nothing unusual (mean less than 2 in each group). In both ethnic groups, the mean of the responses about the question if the individual is more sensitive than the average person was close to 3 (2.97 in Americans and 2.93 in Hispanics), which correspond to almost impartiality with the answer.

Table 5: Sensitivity with exposure to inhaled chemicals, irritants, odors and strong fragrances and reaction to specific irritants by ethnicity

| Variable | Ethnicity | N | Mean | (±SD) | t | p-value |
|---|------------------|----------|-------------|--------------|----------|----------------|
| More sensitive to chemicals, irritants, odors or strong fragrances than average person | American | 100 | 2.97 | 1.096 | .237 | .813 |
| | Hispanic | 105 | 2.93 | 1.120 | | |
| Reaction to cigarette smoke | American | 100 | 1.84 | .762 | .732 | .465 |
| | Hispanic | 105 | 1.76 | .766 | | |
| Reaction to automobile exhaust | American | 100 | 1.79 | .743 | .918 | .360 |
| | Hispanic | 105 | 1.70 | .735 | | |
| Reaction to strong smells, perfumes or scented candles | American | 100 | 1.68 | .875 | .356 | .722 |
| | Hispanic | 105 | 1.64 | .810 | | |
| Reaction to fresh paint vapors or fumes | American | 100 | 1.72 | .805 | .861 | .390 |
| | Hispanic | 105 | 1.82 | .841 | | |

Symptoms and Quality of Life due to exposure to irritants by ethnicity

Symptoms reported and quality of life when the individuals are exposed to cigarette smoke, automobile exhaust, strong smells, fragrances or fresh paint vapors were also compared between Americans and Hispanics; the results are shown in Table 6. There were not statistically significant differences between both groups, in any variable analyzed ($p > 0.05$). In all variables most responses had values around 2 which mean that the individuals are disagree with the question.

Table 6: Symptoms and quality of life with exposure to cigarette smoke, automobile exhaust, strong smells, fragrances or fresh paint vapors by ethnicity

| Variable | Ethnicity | N | Mean | (±SD) | t | p-value |
|--|------------------|----------|-------------|--------------|----------|----------------|
| Face/Upper Respiratory Symptoms | American | 100 | 2.294 | .981 | .894 | .372 |
| | Hispanic | 105 | 2.171 | .985 | | |
| Lower Respiratory Symptoms | American | 100 | 2.348 | .943 | -.615 | .539 |
| | Hispanic | 105 | 2.426 | .886 | | |
| Gastrointestinal Symptoms | American | 100 | 1.887 | .713 | .017 | .986 |
| | Hispanic | 105 | 1.885 | .753 | | |
| Neuro-Psychological Symptoms | American | 100 | 2.275 | .933 | .799 | .425 |
| | Hispanic | 105 | 2.169 | .962 | | |
| Non Specific Symptoms | American | 100 | 2.242 | .737 | -.263 | .793 |
| | Hispanic | 105 | 2.270 | .781 | | |
| Quality of Life | American | 100 | 1.742 | .754 | .167 | .867 |
| | Hispanic | 105 | 1.723 | .839 | | |

Ethnic differences on self-reported symptoms and quality of life controlling health and socio-demographic variables

When the sensitivity with exposure to inhaled chemicals, irritants, odors and strong fragrances and reaction to specific irritants was compared between Americans and Hispanics, but having in consideration the history of health problems and socio-demographic characteristics, statistically significant differences between both ethnic groups were detected in several analyses.

If history of Allergy was considered together with ethnicity (Table 7), differences between Americans and Hispanics were statistically significant ($p = 0.028$) when the participants in the study were asked if they are more sensitive to chemicals, irritants, odors or strong fragrances than the average person. Americans with history of Allergy tended to be more agree with the question about the sensitivity; the mean in this group of individuals was 3.47 (around neutral category) versus 3.05 among Hispanics; however, when the history of Allergy is not present, the Hispanics tended to be more agree (mean 2.87) than the Americans (mean 2.60). Figure 3 show the results without consider the history of Allergy, which differs from the analysis shown in Figure 4 where the Allergy modified the answers and disclosed the differences based in ethnicity.

Figure 3: Sensitivity to inhaled chemicals, irritants, odors and fragrances by ethnicity

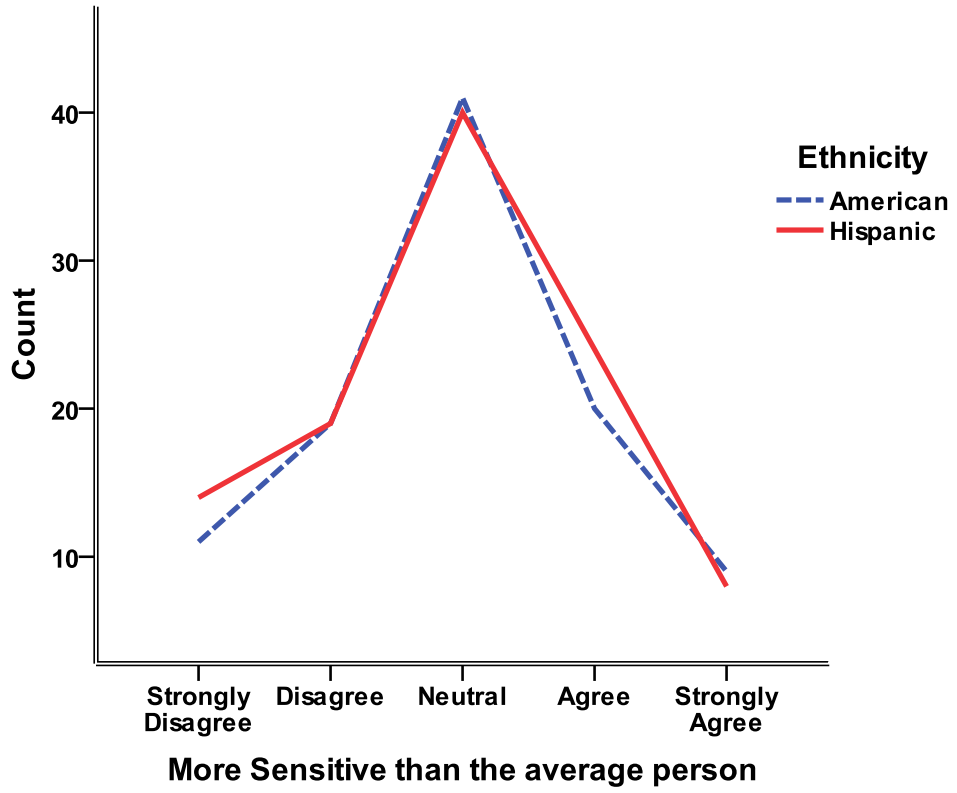
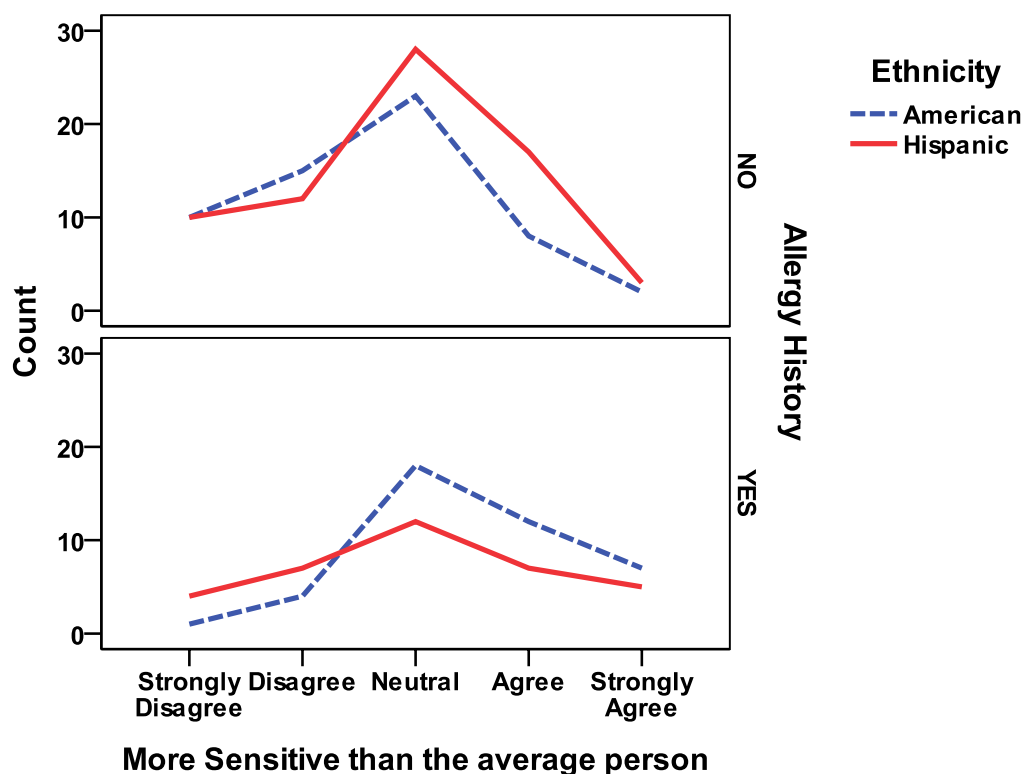


Figure 4: Sensitivity to inhaled chemicals, irritants, odors and fragrances by ethnicity and history of Allergy



Similar findings were detected with the reaction to cigarette smoke (Table 7) where the differences between Americans and Hispanics were statistically significant ($p=0.012$) depending on history of Allergy. A mild reaction was the average of the answers (mean 2.14) among Americans versus nothing unusual (mean 1.74) among Hispanics with history of Allergy, however among individuals without Allergy, the mean was higher in Hispanics and nothing unusual was the average of the answers in this group (mean 1.77 versus 1.62 in Americans). Figure 5 show the results without consider the history of Allergy and Figure 6 the analysis where the Allergy disclosed differences between Americans and Hispanics.

Figure 5: Reaction to cigarette smoke by ethnicity

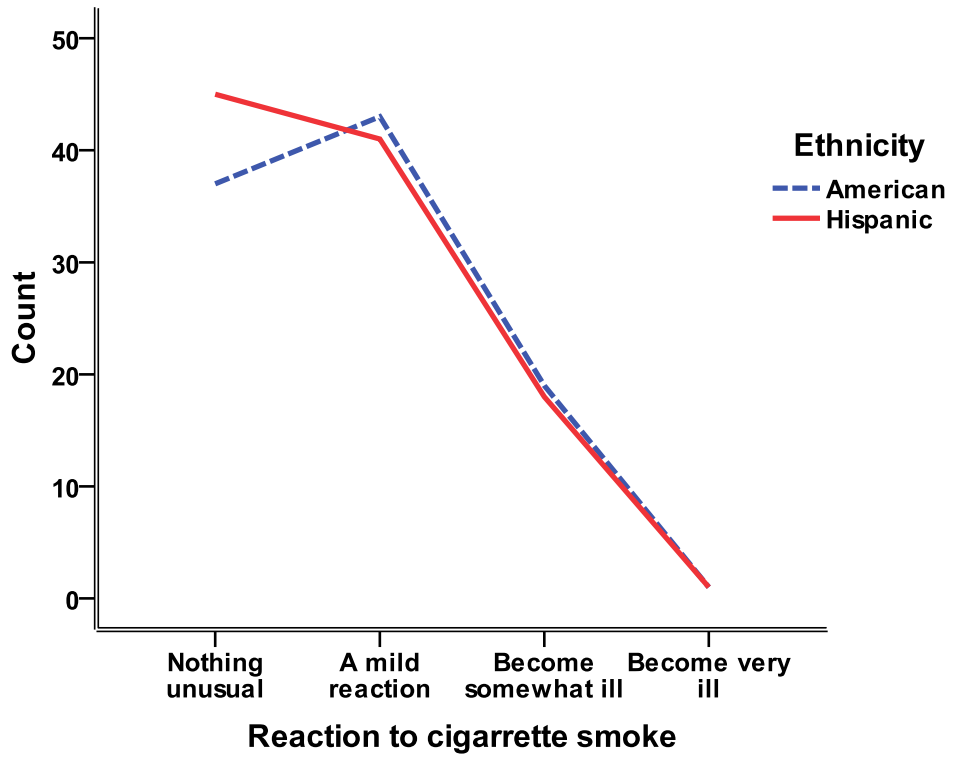
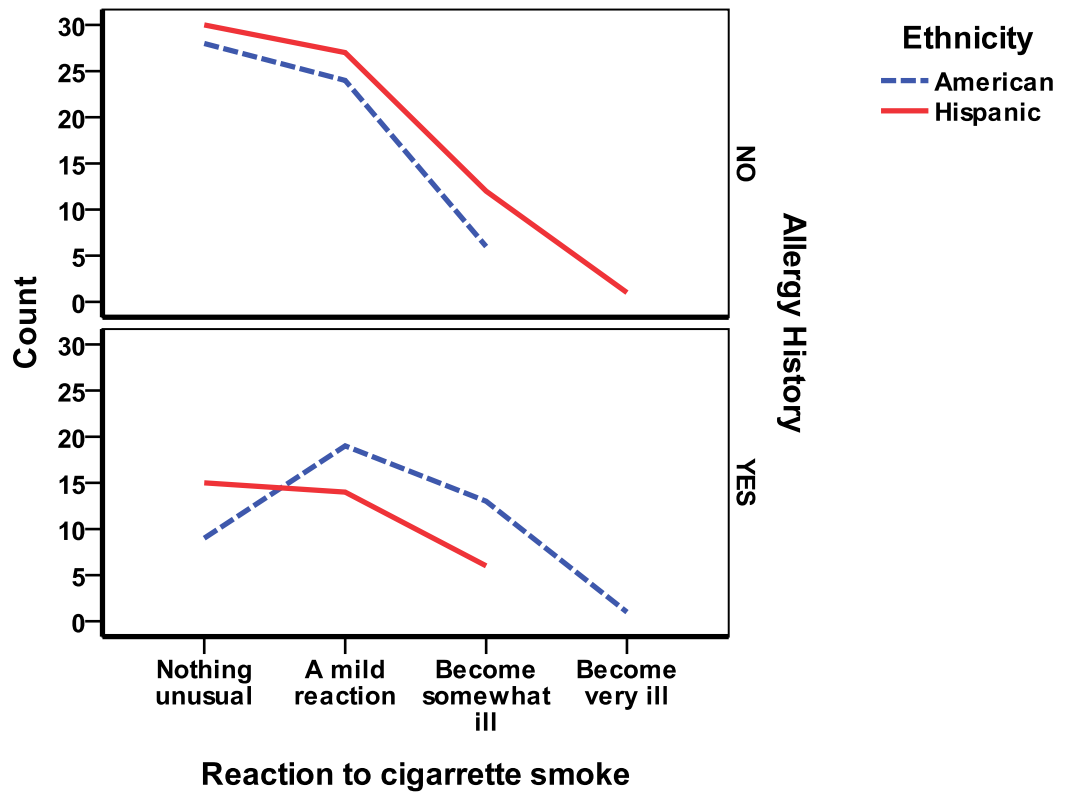


Figure 6: Reaction to cigarette smoke by ethnicity and history of Allergy



Ethnicity did not interact with allergy history in predicting participants' reaction to automobile exhaust, strong smells, perfumes, scented candles, and fresh pain vapor or fumes. These results from ANOVA analysis are summarized in Table 7.

Table 7: Sensitivity with exposure to inhaled chemicals, irritants, odors and strong fragrances and reaction to specific irritants by ethnicity and history of Allergy

| Variable | Ethnicity | Allergy History | | Mean | F | p – Value |
|--|------------------|------------------------|----|-------------|----------|------------------|
| More Sensitive to chemicals irritants, odors or strong fragrances than the average person | American | No | 58 | 2.603 | 4.914 | .028 |
| | | Yes | 42 | 3.476 | | |
| | Hispanic | No | 70 | 2.871 | | |
| | | Yes | 35 | 3.057 | | |
| Reaction to cigarette smoke | American | No | 58 | 1.621 | 6.497 | .012 |
| | | Yes | 42 | 2.143 | | |
| | Hispanic | No | 70 | 1.771 | | |
| | | Yes | 35 | 1.743 | | |
| Reaction to automobile exhaust | American | No | 58 | 1.586 | 3.145 | .078 |
| | | Yes | 42 | 2.071 | | |
| | Hispanic | No | 70 | 1.657 | | |
| | | Yes | 35 | 1.771 | | |
| Reaction to strong smells, colognes, perfumes or scented candles | American | No | 58 | 1.431 | 3.371 | .068 |
| | | Yes | 42 | 2.024 | | |
| | Hispanic | No | 70 | 1.586 | | |
| | | Yes | 35 | 1.743 | | |
| Reaction to fresh paint vapors or fumes | American | No | 58 | 1.534 | .298 | .586 |
| | | Yes | 42 | 1.976 | | |
| | Hispanic | No | 70 | 1.714 | | |
| | | Yes | 35 | 2.029 | | |

When analyses were done with the symptoms classified by body area or system affected and quality of life but considering health and socio-demographic variables, notable differences were detected between Americans and Hispanics in several analyses.

History of Allergy, smoking habit, used steroids or antibiotics within the last 4 weeks, and age interacted with ethnicity in predicting non-specific symptoms reported and quality of life.

History of Allergy interacted with ethnicity in predicting non-specific symptoms ($p = 0.046$). Americans had higher values than Hispanics when they reported these symptoms due to exposure to irritants and the mean of the responses was 2.59 when reported history of Allergy versus 2.39 in Hispanics. However, among individuals without history of Allergy, the Hispanics tended to report more agreement with non-specific symptoms when are exposed, the mean was 2.21 versus 1.98 in Americans. These findings are shown in Table 8; Figure 7 represents the comparison without consider history of Allergy and Figure 8 with the Allergy considered.

Figure 7: Non-Specific Symptoms due to exposures by ethnicity

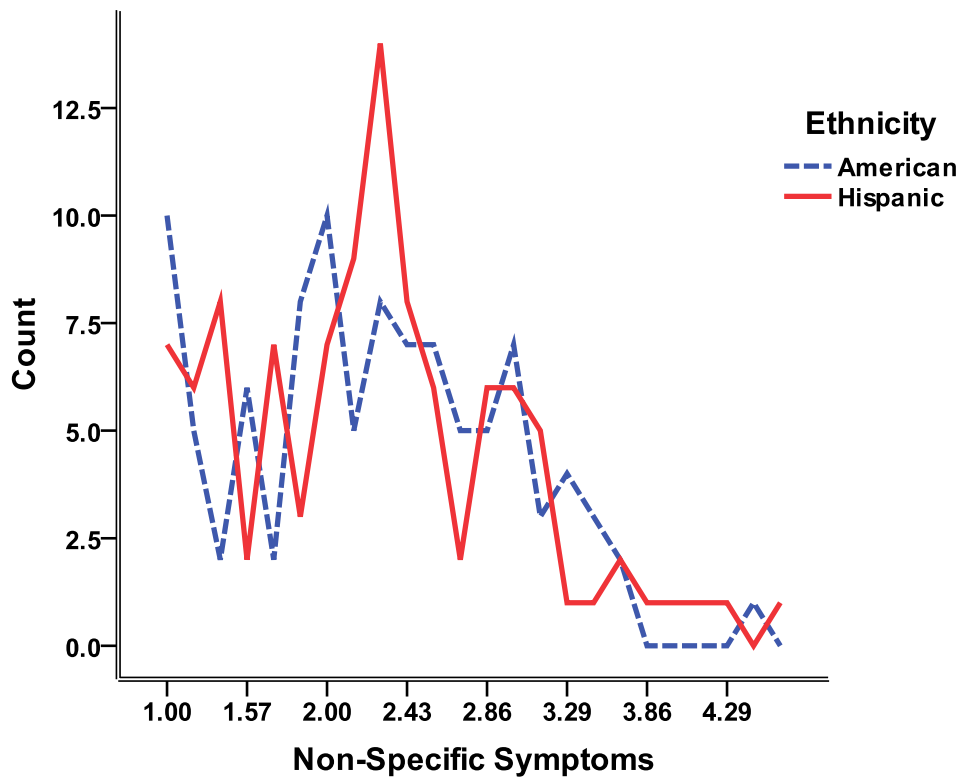
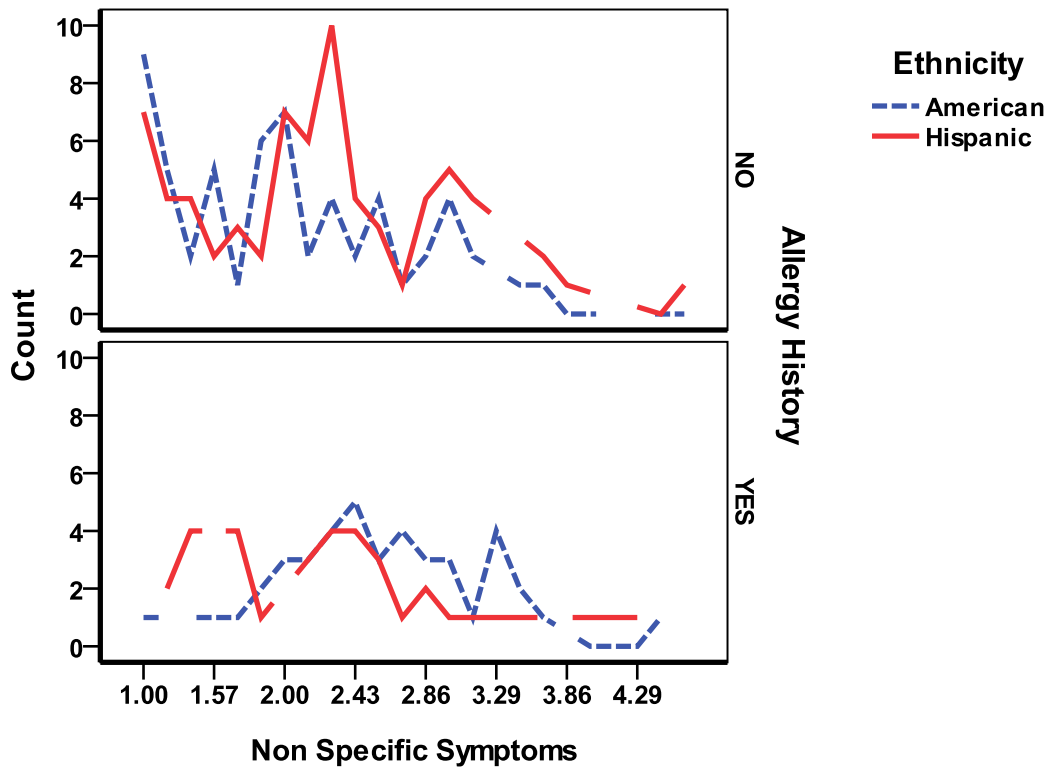


Figure 8: Non-Specific Symptoms due to exposures by ethnicity and history of Allergy



No significant differences were detected with the other types of symptoms (Table 8).

The analysis about quality of life revealed statistically significant interaction between ethnicity and history of Allergy ($p = 0.32$). The mean among Americans was 2.09; most of them were disagree with the statements related to quality of life; however in Hispanics, the tendency was to strongly disagreement (mean 1.80). Among individuals without history of Allergy, in contrast with those who had history, the Hispanics tended to less disagreement when they were asked about the interference with aspects related to quality of life. These results are presented in Table 8; Figure 9 shows the comparison

between Americans and Hispanics in quality of life without consider the history of Allergy and Figure 10 considering the Allergy.

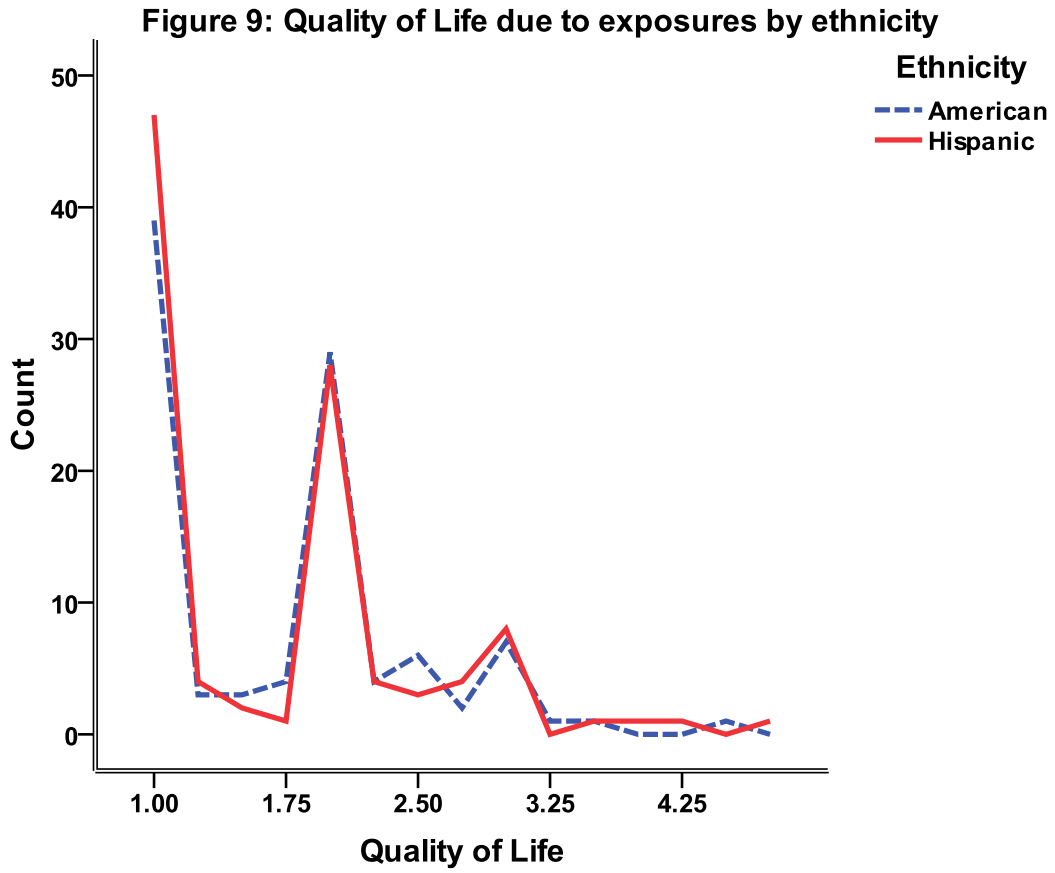


Figure 10: Quality of Life due to exposures by ethnicity and history of Allergy

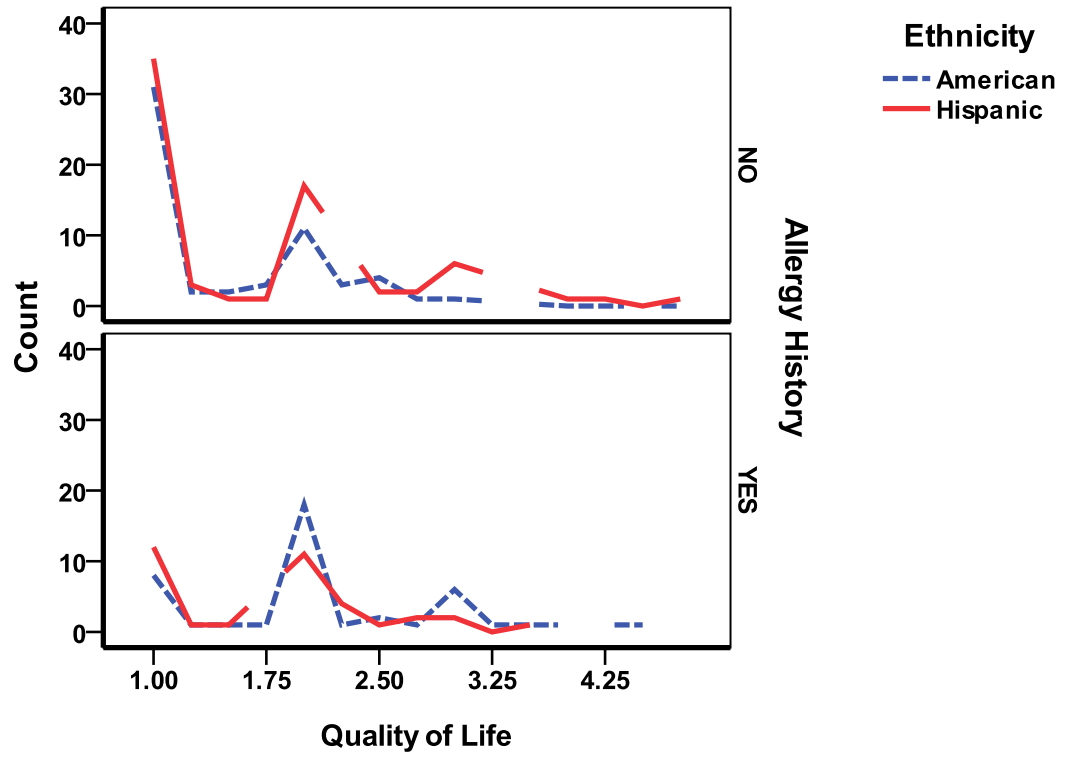


Table 8: Symptoms and quality of life with exposure to cigarette smoke, automobile exhaust, strong smells, fragrances or fresh pain vapors by ethnicity and history of Allergy

| Variable | Ethnicity | Allergy History | | Mean | F | p – Value |
|--|------------------|------------------------|----|-------------|----------|------------------|
| Face and Upper Respiratory Symptoms | American | No | 58 | 1.980 | 2.444 | .120 |
| | | Yes | 42 | 2.727 | | |
| | Hispanic | No | 70 | 2.065 | | |
| | | Yes | 35 | 2.383 | | |
| Lower Respiratory Symptoms | American | No | 58 | 2.079 | 1.638 | .202 |
| | | Yes | 42 | 2.719 | | |
| | Hispanic | No | 70 | 2.323 | | |
| | | Yes | 35 | 2.634 | | |
| Gastrointestinal Symptoms | American | No | 58 | 1.703 | 3.056 | .082 |
| | | Yes | 42 | 2.143 | | |
| | Hispanic | No | 70 | 1.861 | | |
| | | Yes | 35 | 1.936 | | |
| Neuro-Psychological Symptoms | American | No | 58 | 1.961 | 3.533 | .062 |
| | | Yes | 42 | 2.708 | | |
| | Hispanic | No | 70 | 2.086 | | |
| | | Yes | 35 | 2.336 | | |
| Non-Specific Symptoms | American | No | 58 | 1.988 | 4.039 | .046 |
| | | Yes | 42 | 2.595 | | |
| | Hispanic | No | 70 | 2.210 | | |
| | | Yes | 35 | 2.392 | | |
| Quality of Life | American | No | 58 | 1.487 | 4.649 | .032 |
| | | Yes | 42 | 2.095 | | |
| | Hispanic | No | 70 | 1.682 | | |
| | | Yes | 35 | 1.807 | | |

When current smoking habit was analyzed, statistically significant interaction effect ($p=0.021$) between ethnicity and smoking habit was found for lower respiratory symptoms (cough, difficult of breathing, wheezing and chest tightness or pressure). This analysis disclosed that Hispanic smokers tend to report these symptoms more than the Americans; the mean was 3.23 (impartiality with the answers was the average). However, among non-smokers, the answers were almost the same between Americans and Hispanics, the mean values in this category of individuals were 2.37 (corresponds to disagreement with the response). Table 9 shows these results; Figure 11 shows lower respiratory symptoms reported without consider smoking habit and Figure 12 with smoking in the analysis.

Table 9: Lower Respiratory symptoms by ethnicity and current smoker status

| Lower Respiratory symptoms (F= 5.421 p = 0.021) | | | | |
|--|---------------|----------|-------------|-------------|
| Ethnicity | Smoker | N | Mean | ± SD |
| American | No | 92 | 2.374 | .965 |
| | Yes | 8 | 2.050 | .611 |
| Hispanic | No | 99 | 2.378 | .882 |
| | Yes | 6 | 3.233 | .496 |

Figure 11: Lower Respiratory symptoms due to exposures by ethnicity

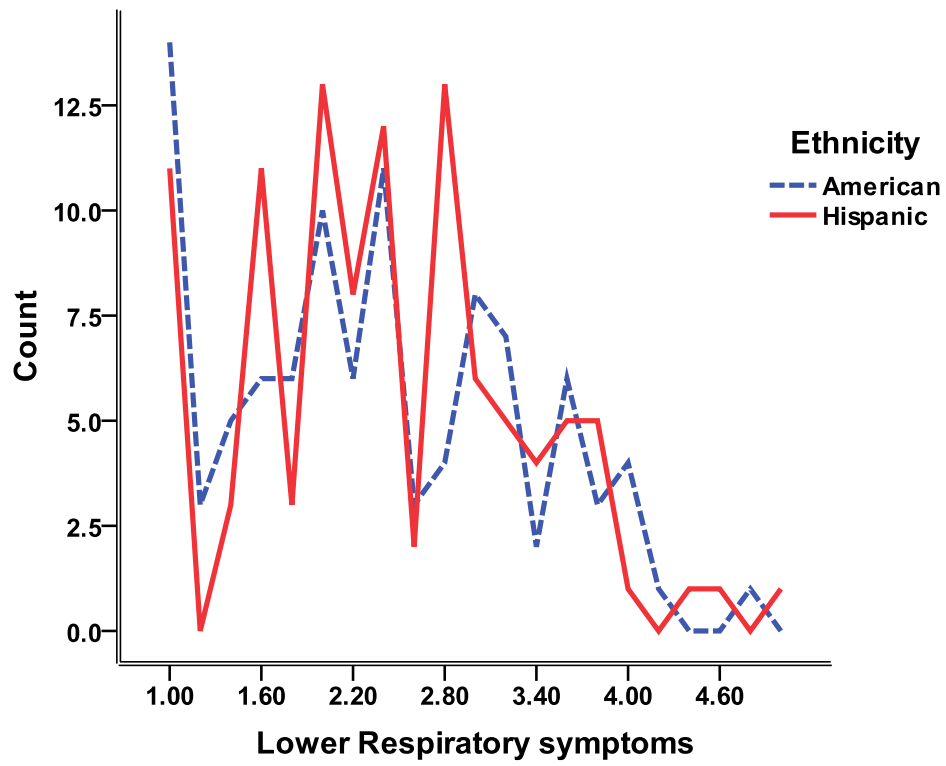
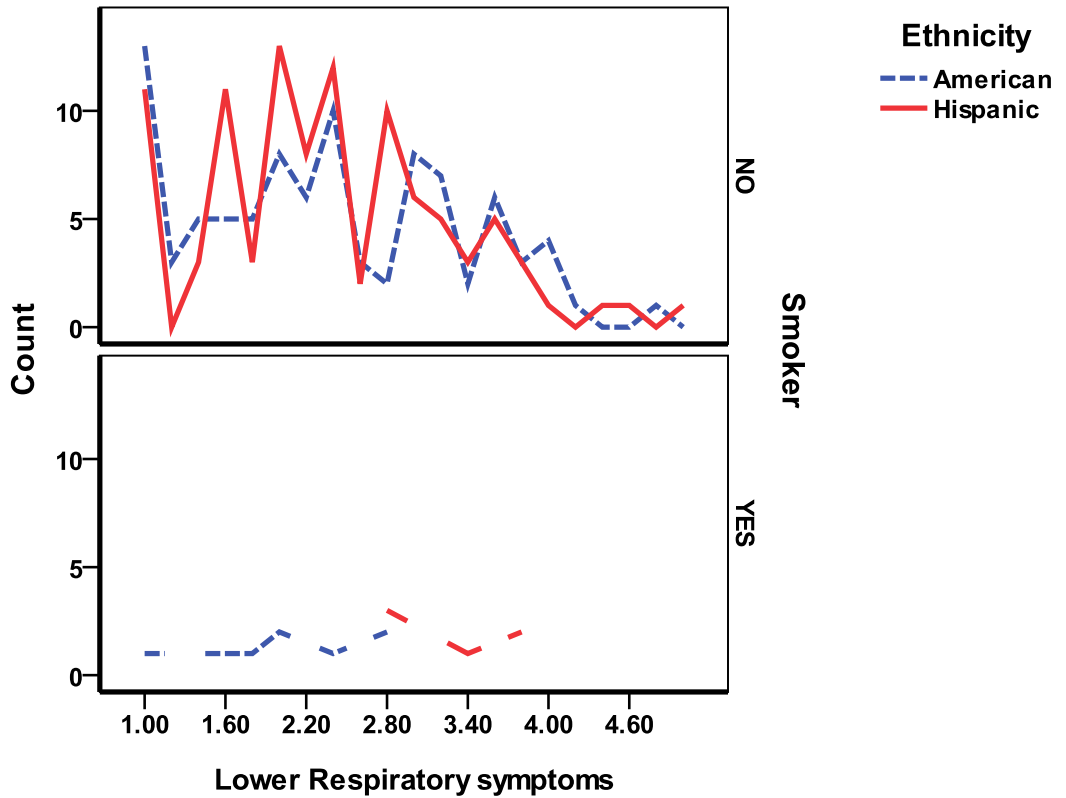


Figure 12: Lower Respiratory symptoms due to exposures by ethnicity and current smoker status



The report of neuro-psychological symptoms by participants in the study disclosed statistically significant interaction between ethnicity and age ($p = 0.012$). Among Americans the means of the answers ranged around 2 or disagree with the complaints. The groups of 30 to 39 years old and 60 and older had the highest mean (2.67 and 2.60 respectively); however among Hispanics, the group with the highest mean value was 50 to 59 years old, with a mean 3.56 that correspond to impartiality when complaining of this kind of symptoms. The values of the mean were more variable among the groups of age in Hispanics, from 1.78 (strongly disagree) to 3.56 (neutral). Table 10 summarizes these results.

Table 10: Neuro-psychological Symptoms by ethnicity and age

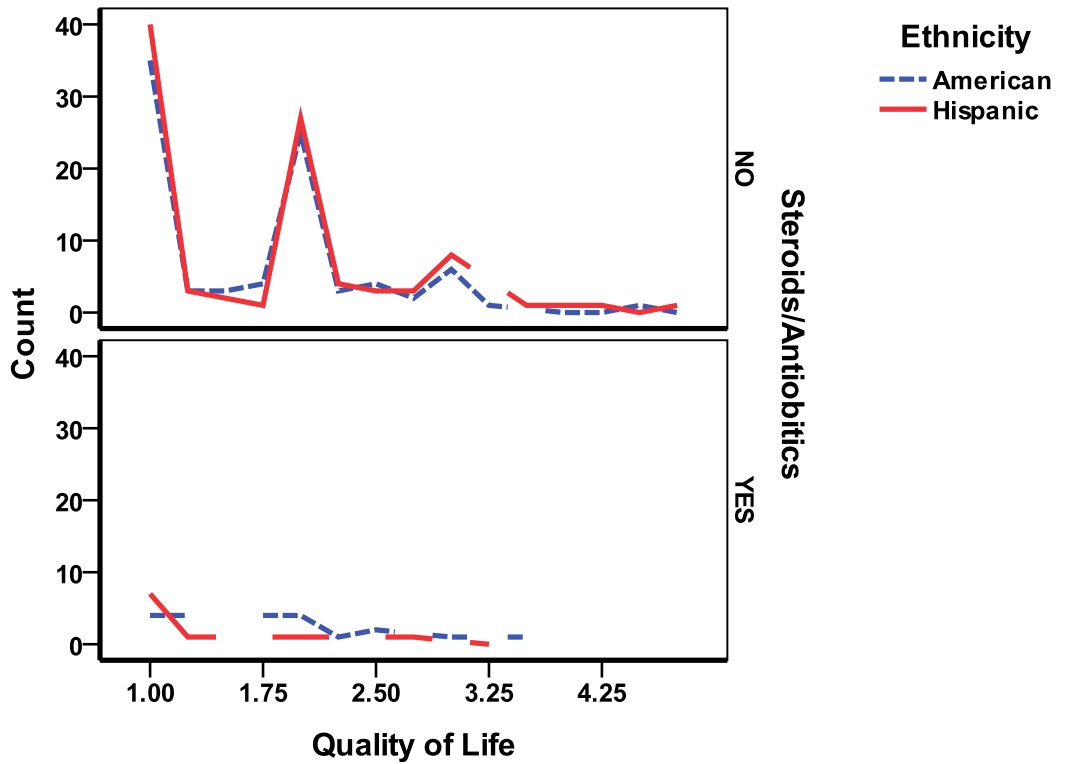
| Neuro-Psychological Symptoms (F= 3.311 p = 0.012) | | | | |
|--|-----------------|----------|-------------|-------------|
| Ethnicity | Age | N | Mean | ± SD |
| American | Younger than 30 | 54 | 2.180 | .866 |
| | 30 to 39 | 17 | 2.676 | 1.120 |
| | 40 to 49 | 13 | 1.961 | .782 |
| | 50 to 59 | 11 | 2.340 | .903 |
| | 60 and older | 5 | 2.600 | 1.206 |
| Hispanic | Younger than 30 | 59 | 2.144 | .865 |
| | 30 to 39 | 14 | 1.785 | .783 |
| | 40 to 49 | 17 | 2.235 | 1.210 |
| | 50 to 59 | 4 | 3.562 | .426 |
| | 60 and older | 11 | 2.181 | 1.049 |

Other health variable that revealed differences among Hispanics and Americans regarding to quality of life when the individuals are exposed to irritants was recent use of steroids or antibiotics. When the use of these medications was considered together with ethnicity statistically significant interaction was found ($p=0.037$). The majority of the means values were close to disagreement with the answers. Americans who used antibiotics or steroids within the last 4 weeks had a mean value of 1.98; however among those who didn't use steroids or antibiotics, the Hispanics had the higher mean value, 1.76 versus 1.70 in Americans. In both groups, the questions that define quality of life, although different, were answered in the range of disagreement. The results are shown in Table 11; Figures 9 represent the comparison without consider medications in the analysis and Figure 13 the use of steroids or antibiotics are included.

Table 11: Quality of life by ethnicity and use of steroids or antibiotics within the past 4 weeks

| Quality of life (F= 4.389 p = 0.037) | | | | |
|--------------------------------------|--------------------------------|----|-------|-------|
| Ethnicity | Use of steroids or antibiotics | N | Mean | ± SD |
| | American | No | 87 | 1.706 |
| Yes | | 13 | 1.980 | .806 |
| Hispanic | No | 95 | 1.768 | .851 |
| | Yes | 10 | 1.300 | .598 |

Figure 13: Quality of Life due to exposures by ethnicity and steroids or antibiotics use



Results in Table 12 show no differences statistically significant between Americans and Hispanic in quality of life when gender was considered in the analysis.

Table 12: Quality of life by ethnicity and gender

| Quality of life (F= 1.402 p = 0.238) | | | | |
|---|---------------|----------|-------------|-------------|
| Ethnicity | Gender | N | Mean | ± SD |
| American | Male | 34 | 1.654 | .648 |
| | Female | 66 | 1.787 | .804 |
| Hispanic | Male | 38 | 1.815 | .999 |
| | Female | 67 | 1.671 | .737 |

Chapter V

Discussion

Our results showed that there is not any statistically significant differences between Americans and Hispanics when we compare both groups regarding to if the individual sensitivity to inhaled chemicals, irritants, odors or strong fragrances than the average person. Similar results were obtained when they were asked about reaction to specific irritants like cigarette smoke, automobile exhaust, strong smells, colognes, perfumes, scented candles and fresh paint vapors or fumes.

Symptoms (by organ or system involved) reported when the individuals are exposed to cigarette smoke, automobile exhaust, strong smells, fragrances or fresh paint vapors were also evaluated and there was no statistically significant difference between Americans and Hispanics.

Interaction between ethnicity and other socio-demographic and health variables were also tested. Results from these analyses showed statistically significant interaction between ethnicity and Allergy history. The effect of ethnicity on sensitivity to chemicals, irritants, odors or strong fragrances changed depending on participants' Allergy history. The same finding was detected when we analyzed the reaction of the individual to cigarette smoke, which was also statistically significant. In both situations, Americans with Allergy history reacted more strongly to mentioned exposures.

When we compared symptoms reported when the participants are exposed to cigarette smoke, automobile exhaust, strong smells, fragrances or fresh paint vapors, statistically significant interaction effects were detected between ethnicity and Allergy history. This occurred with non-specific symptoms. Once again, the effect of the ethnicity on non-specific symptoms changed depending on participant's Allergy history. Americans with Allergy history reacted more strongly to the exposures.

Interaction between ethnicity and smoking habit was found for predicting lower respiratory symptoms. In this case Hispanics who were current smoker reacted more strongly to irritants. However this finding should be interpreted with caution because there was low frequency of individuals who were smokers in the study population. In similar analysis, Age and ethnicity interacted in predicting neuro-psychological symptoms. These results should also be interpreted with caution because the distribution of age in the study population was not homogeneous. There were few participants in the groups of 50 to 59 and 60 and more years old.

When Quality of Life was analyzed, we found statistically significant interactions between ethnicity and Allergy history or use of steroids and antibiotics. Americans reported being more affected than Hispanics when reported history of Allergy and use of these medications. However with the use of the medications the results should be interpreted with caution because few participants reported the use of them.

Sensitivity to common environmental irritants is a frequent concern for the population. Several studies have been published about self-reported symptoms or sensitivity to chemicals. Each study corroborates the influence of socio-demographic

variables, when individuals report their symptoms and how it has affected their quality of life.

Studies evaluating the prevalence rate of affected individuals when they are exposed to inhaled airborne chemicals, odors or irritants have reported estimates between 9% and 33%. Results of our study fell within this range, if we consider that 30% of individuals reported that they are more sensitive to inhaled chemicals, irritants, odors or strong fragrances than the average person.

The increased prevalence of chemical sensitivity among women is recognized in most studies (Bell, 1993; Berg, 2008; Joffres, 2001; Johansson, 2005; Kreutzer, 1999; & Meggs, 1996). Our results concurred with the findings of the above mentioned reports, where the highest percentage of individuals reporting more sensitivity than the average person was women (75%).

Socio-demographic and personal health characteristics have been evaluated in most of the literature describing reports from sensitivity to chemicals and irritants, including ethnicity as a variable within several in the analyses. However no one has selected specific ethnic groups to establishing comparisons, or confirm previously mentioned findings.

Some investigations, like that one from the California population-based sample, indicated that multiple chemical sensitivity and self-assessed unusual sensitivity to chemicals are distributed homogeneously across racial or ethnic groups. The authors justified that this homogeneous distribution might be explained by a physiological mechanism more than shared cultural or sociologic characteristics. Although the researchers suggested that cultural homogenizing effects of the media, the economy and

the educational system, which are the commonly shared psychosocial mechanisms could account for these findings.

The aim of our study was to determine if there are differences between Americans and Hispanics in the prevalence of self-reported sensitivity to common irritants found in the everyday environment, specific symptoms frequently reported and the interference with quality of life.

The format of our questionnaire facilitated the comparison between Americans and Hispanics considering other socio-demographic and health variables that could influence in the report from participants. This allowed us to identify, differences between Americans and Hispanic that initially were not detected in simpler analysis.

The fact that the main investigator was present and witnessed the participation of volunteers, added credibility and formality to the completion and returning of the questionnaires. The questionnaire was easy to complete, and no participant had complaints about its length or had any difficulties with the completion the questions.

The characteristics of study population were fairly similar between Americans and Hispanics regarding the health variables. Although the distribution of some variables (history of non-respiratory problem, neuro-psychiatric disorder, physician diagnosis of Fibromyalgia, Chronic Fatigue Syndrome and Multiple Chemical and current smoking habit) was fairly uneven. There was a small number of participants in some categories could affect the results when we interpreting the interaction effects between the variables. Therefore the results would be treated with caution.

One result that called our attention was the reaction to the cigarette smoke and automobile exhaust, both common environmental contaminants. They were the most

frequent exposures that generated negative reactions reported participants in this study. 60% of participants reported some kind of reaction to cigarette and 57.1% to automobile exhaust. These results were consistent with previous studies; tobacco smoke was the exposure scenario most likely to made respondents very sick in the California study (Kreutzer et al., 1999), and automobile exhaust was the second most prevalent exposure among all responders and the first among men in the study from Berg et al. in 2008. Reaction to strong smells, perfumes or candles was the least reported reaction in this study, in contrast with the Berg's report where it was the most prevalent exposure among all responders and women.

When Americans were compared with Hispanics about their sensitivity to chemicals, irritants and fragrances and reaction to specific irritants initially, these comparisons did not demonstrate any significant difference between two ethnic groups. However, Americans reported being more sensitive than the average person. They were also more reactive to cigarette smoke, automobile exhaust and strong smell, perfumes or candles than Hispanics. Hispanics react more to fresh paint vapors. Cigarette smoke, a common environmental contaminant, was the most reported exposure agent.

On more in-depth analyses, when it was added the history of Allergy, significant differences were identified between Americans and Hispanics regarding sensitivity. It happened when they reported being more sensitive than the average person. A similar significant finding was detected when dealing with reaction to cigarette smoke. As initially disclosed in bivariate analysis, Americans were more sensitive with exposure to recognized everyday irritants and react more to cigarette smoke than Hispanics. These results clearly demonstrated that Allergy history played an important role in the way

people reported their sensitivity. The pivotal role of Allergy has such an impact that brings about ethnic differences, otherwise obliterated. It is important indicate that we didn't included Asthma as part of Allergy history. Asthma was classified within Respiratory problems.

The symptoms categorized by organs or systems, due to exposure to common irritants were also evaluated initially without taking into consideration the influence of other variables. Important differences were not detected between Americans and Hispanics in these first analyses. When Allergy history was added in subsequent analyses, statistically significant differences between Americans and Hispanics were detected. These important ethnic differences were noted when individual reported Non-specific symptoms. Americans with Allergy history reported more these unspecified complaints. A study in Germany about self-reported chemical sensitivity, the most common complaints reported were headache, fatigue, sleep disturbances, joint pain, mood changes and nervousness (Hausteiner et al., 2005). Some of these symptoms were includes in our classification of non-specific symptoms.

Both types of analyses disclosed that lower and upper respiratory symptoms were the most frequent symptoms reported. These results confirms previous findings that airways symptoms are the most commonly reported when sensitivity to odors or irritants are evaluated (Johansson, 2005; Kreutzer, 1999; Meggs, 1996). Significant prevalence of lower lung complaints among individuals reporting Asthma, hay fever and chemical odor intolerance were detected by Baldwin et al. in a community-based sample.

Although there were identified important differences between Americans and Hispanics related to lower respiratory symptoms when Allergy history was considered,

significant differences were also found when smoking status was taken into consideration. In this particular scenario, it was demonstrated that smoking could really influence the way people reported symptoms related to trachea, bronchus and lung. Significant differences between both ethnic groups were found. In this situation, Hispanics with current smoking habit reported more these symptoms than Americans. Among non-smokers the reports were fairly homogeneous.

Age, also disclosed significant differences between Americans and Hispanics when individuals reported neuro-psychological symptoms. Reports from these symptoms were not homogeneously distributed between both groups. Among Americans, the individuals between 30 to 39 years old and the oldest (60 and older) reported headache, anxiety, trouble with concentrating and becoming emotional more frequently. Among Hispanics, people between 40 and 59 more complaints were reported.

Sensitivity and response to chemicals is known to be caused from multiple factors, which alter an individual's sensitivity, one of them is age. Because of this the influence of the age in the sensitivity has been evaluated in several studies. Most of them state that older individuals reported fewer symptoms caused by chemicals inhaled and this finding accounts for the fact that it may be easier to control one's exposures to chemicals or irritants after retirement. Berg et al. found in their study that when the oldest group is excluded from the analysis, it is not detected any effect of age (Meggs, 1996; Berg, 2008).

The age in our group was not distributed homogeneously. The majority of our participants were younger than 30 years old, and the group more prevalent in reporting sensitivity to irritants or chemicals was not well represented.

Quality of life was analyzed in this study, through the interference of exposure to common irritants with social and occupational life. The majority of respondents disagreed that such exposures interfere with their quality of life. An initial comparison between Americans and Hispanics was done where the results revealed that there were not significant differences between both groups. Subsequent and more detailed analyses proved that important differences can distinguish Americans from Hispanics. This fact was confirmed when Allergy history and previous use of steroids or antibiotics was considered in the analyses. Under these two conditions, Americans were the most affected in their social or occupational life when they state that they are exposed to common environmental contaminants. When gender, age and other health variables were controlled in our analyses, differences between Americans and Hispanics were not disclosed.

It is known that quality of life is affected in any dimension when the individuals are exposed to everyday environmental contaminants. Furthermore the presence of odor can cause people to suspect exposures to be harmful to their health. Previous studies have recognized the association of exposure to airborne chemicals with loss of occupation and adjustment in social life. Estimations of the frequency on specific activities affected have been identified (Berg, 2008; Caress, 2003; Johansson, 2005; Kreutzer, 1999). Multiple chemical sensitivity is an established diagnosis characterized by an increased sensitivity to chemicals. This diagnosis has achieved credibility in worker's compensation claims, tort liability, and regulatory actions for its repercussion in the workplace (Gots, 1995). These studies have been exhaustive in their reports but have not evaluated if exposures that affect the quality of life, differ across ethnic groups. Their comparative analyses have

been concentrated more in uncovering age or gender differences in this matter. Our questionnaire allowed us to evaluate the quality of life between Hispanics and Americans, as well as the influence of socio-demographic and health variables.

When writing our work's results, an interesting finding came to light, which was not different between Americans and Hispanics. All mean values obtained with ANOVA analysis, compared with those in the initial bivariate analysis, resulted higher when history of Allergy was considered in the analyses of sensitivity, reaction to specific exposures, symptoms and quality of life. This means a greater tendency to agree with the statements when the individual have a history of Allergy. This confirm that if the individuals have a preexisting Allergy history, he or she can be more sensitive, reacts more, and reports more interference with their social or work life when they are exposed to common irritants. Meggs et al. in his study about allergy and chemical sensitivity found that the prevalence of sensitivity to chemical irritants is equivalent to that of allergy. Suffice it to say that this study is consistent with our results.

Theoretical and research implication

Future investigation is required to extend our findings. Studies may focus on other ethnic groups that are also exposed to specific chemicals or irritants in their environments, particularly under represented communities. Specific and detailed analyses about their sensitivity to their common irritants are needed. The results could explain the role of the tolerance in the way people report or react when are exposed. Also would help to explain more serious health problems that starting with simple symptoms after dangerous exposures in the environment.

Workplaces could be a target for this kind of research. Exposure limits are based on objective measures of irritation onset as well as subjective complaints. The current instrument used as part of the process for determining exposure limits to chemicals or irritants in the workplace. The results from studies that evaluate population responses to environmental exposure could be solid basis for development policies and guidelines for occupational and residential environment.

Limitations

It was noted that during the data input, several participants responded all the questions about symptoms or sensitivity to specific irritants with the same answers. It could reflect that they were not motivated. As a consequence, the absence of variability in some of the participants' answers is one of the weaknesses of this study. This could have affected the results.

Other limitation is the lack of variability in the study population regarding to some important socio-demographic variables such as age, educational level and workplace location. This could have masked any significant difference between Americans and Hispanics.

The majority of the participants were recruited from the Universities sites. There was not variability in the population studied regarding to workplace location and educational level. Most people reported working in an office, being unemployed, and having college or university educational level. This could be a weak part of this study, because the prevalence or the differences detected between these two ethnic groups could not be generalized to other sectors of the population. People employed in sectors like industrial, construction and agriculture, or with lower education are exposed to different

environmental issues with other exposures. Their tolerance to irritants could be different, and therefore the probability of agreement or disagreement with the answers would change.

Investigators have mentioned that Age and educational level are factors that alter an' individual sensibility. Young age, for example, was associated with non-response, and individuals over 60 years old reported fewer symptoms and adjustment of behavior in the Danish's population study (Berg et al., 2007). Previous studies suggested that hypersensitivity is more common in individuals of high level of education, because educated individuals are more probable to seek treatment and be diagnosed (Caress, & Steinemann, 2003)

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Appendices

Appendix A: Cover Letter

To the volunteer:

I am inviting you to participate in a research project to study symptoms that one develops after exposure to inhaled odors, chemicals and airborne irritants. Along with this letter, there is a questionnaire that asks a variety of questions about this. It should take about 15 minutes to complete. I hope you will take the time to complete the survey and return it to me personally. Your participation is voluntary, and there is not penalty if you do not participate.

The development and results of this study will be used as the subject of my Thesis in the College of Public Health. It is not know of any risk to you if you decide to participate in this survey, and it is guaranteed that your responses will not be identified with you. I promise not to share any information that identifies you with anyone. You should not volunteer to put your name or any other information on the questionnaire other than that which is requested. If you do not feel comfortable completing the survey, discard it.

Regardless of whether you choose to participate, the results will be on file at the University of South Florida Shimberg Health Sciences Library after June 30, 2009.

If you have any questions or concerns about completing the questionnaire or about being in this study, you may contact me at (305) 283-4579. If you have questions about your rights, general questions, complaints, or issues as a person taking part in this study, you may also call the Division of Research Integrity and Compliance of the University of South Florida at (813) 974-9343.

Sincerely, and thank you,

signature

Carmen Perez, M.D.
Chief Investigator

Appendix B: Additional Questionnaire

Please, place an "X" in the appropriate box below

| | | | | | | | |
|----|--|-----------------------|-------------------|-----------------------|-----------------------|-------|----------------|
| 1 | Ethnicity | American | Hispanic (Latino) | | Asian | | Other |
| | | | | | | | |
| 2 | Was your father born in the Unites States? | | | | YES | NO | |
| | | | | | | | |
| 2a | If not, where was he born? | | | | | | |
| 3 | Was your mother born in the United States? | | | | YES | NO | |
| | | | | | | | |
| 3a | If not, where was she born? | | | | | | |
| 4 | Were you born in the Unites States? | | | | YES | NO | |
| | | | | | | | |
| 5 | Educational level | Primary or Elementary | High School | | College or University | | Graduate level |
| | | | | | | | |
| 6 | Workplace Location (6 hours or more a day) | Enclosed vehicle | Indoor office | Indoor plant/industry | Outdoor | Other | Unemployed |
| | | | | | | | |

If you are not American or Hispanic, please disregard the remaining questions.

Appendix C: Demographic and Medical Information Questionnaire

| | | | |
|---|--------|------|--------|
| 1 | Gender | Male | Female |
| | | | |
| 2 | Age | | |

Please, place an "X" in the appropriate box below

| | | YES | NO |
|----|--|-----|----|
| 3 | Do you take antihistamines? | | |
| 4 | Do you get hay fever, seasonal allergies, or allergic rhinitis? | | |
| 5 | Do you cough every day? | | |
| 6 | Do you suffer from respiratory problems? | | |
| 7 | Do you have asthma? | | |
| 8 | Do you have a normal sense of smell? | | |
| 9 | Are you a smoker? | | |
| 10 | Have you smoked in the last 10 years? | | |
| 11 | Have you received systemic steroids or antibiotics within the past 4 weeks? | | |
| 12 | Are you taking heart medication? | | |
| 13 | Do you have hepatitis or cirrhosis? | | |
| 14 | Do you suffer from renal failure? | | |
| 15 | Do you suffer from any neurologic disorder? | | |
| 16 | Do you suffer from any psychiatric disorder? | | |
| 17 | Do you take medication for depression? | | |
| 18 | Are you pregnant or think you might be? | | |
| 19 | Do you have eczema or hives? | | |
| 20 | Do you have arthritis? | | |
| 21 | Has a doctor ever told you that you have Fibromyalgia, Chronic Fatigue Syndrome, or Multiple Chemical Sensitivity? | | |

Appendix D: Chemical, Odorant and Irritant Sensitivity Questionnaire

This questionnaire asks about how you feel now and over the past year.
Please, check the box that most closely describes how you feel.

| | | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|----|--|-------------------|----------|---------|-------|----------------|
| 22 | I am more sensitive to inhaled chemicals, irritants, odors, or strong fragrances than the average person | | | | | |

| If I am around the following, I get this reaction: | | Nothing unusual | A mild reaction | Become somewhat ill | Become very ill |
|--|---|-----------------|-----------------|---------------------|-----------------|
| 23 | Cigarette smoke | | | | |
| 24 | Automobile exhaust | | | | |
| 25 | Strong smells, cologne, perfumes or scented candles | | | | |
| 26 | Fresh paint vapors or fumes | | | | |

| If I am exposed to cigarette smoke, automobile exhaust, strong smells, perfumes or colognes, or fresh paint vapors: | | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|---|--|-------------------|----------|---------|-------|----------------|
| 27 | I suffer discomfort | | | | | |
| 28 | I become sick | | | | | |
| 29 | I develop burning in the skin of my face | | | | | |
| 30 | I develop a funny sensation of the skin of my face | | | | | |
| 31 | I develop eye irritation | | | | | |
| 32 | I develop eye pain | | | | | |
| 33 | I develop eye itching | | | | | |
| 34 | I develop sore or burning in my nasal passages | | | | | |
| 35 | I develop a sore throat | | | | | |
| 36 | I feel nauseated | | | | | |
| 37 | I develop indigestion | | | | | |
| 38 | I develop diarrhea | | | | | |

| If I am exposed to cigarette smoke, automobile exhaust, strong smells, perfumes or colognes, or fresh paint vapors: | | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|---|--|-------------------|----------|---------|-------|----------------|
| 39 | I get gas | | | | | |
| 40 | I may cough without phlegm | | | | | |
| 41 | I may cough with phlegm up | | | | | |
| 42 | I feel like I can't get my breath | | | | | |
| 43 | I start wheezing | | | | | |
| 44 | I feel tightness or pressure in my chest | | | | | |
| 45 | I develop aching joints | | | | | |
| 46 | I develop trouble sleeping | | | | | |
| 47 | I develop numbness or tingling in my hands or feet | | | | | |
| 48 | My body feels hot or cold | | | | | |
| 49 | My symptoms ease if I can get away | | | | | |
| 50 | I become emotional | | | | | |
| 51 | I get a headache | | | | | |
| 52 | I become anxious | | | | | |
| 53 | I have trouble concentrating | | | | | |
| 54 | I miss work | | | | | |
| 55 | I miss social or business appointments | | | | | |
| 56 | I feel stress at home or work | | | | | |
| 57 | I find it hard to interact with other persons | | | | | |

Appendix E: Cover Letter and Questionnaires translated to Spanish

Carta de Presentación

Al voluntario:

Yo lo estoy invitando a participar en un proyecto de investigación para estudiar los síntomas que uno desarrolla después de la exposición a olores, químicos e irritantes transportados por el aire. Junto con esta carta, hay un cuestionario con una variedad de preguntas acerca de esto. Debe tomar alrededor de 15 minutos para completarlo. Yo espero que usted tomara el tiempo para completar la encuesta y retornarla a mí personalmente. Su participación es voluntaria, y no hay penalidad si usted no participa.

El desarrollo y resultados de este estudio serán usados como el tema de mi Tesis en el Colegio de Salud Pública. No se conoce de algún riesgo para usted si se decide a participar en esta encuesta y se le garantiza que sus respuestas no serán identificadas con usted. Se le promete no compartir alguna información que le identifique con alguien. Usted no debe voluntariamente poner su nombre o alguna otra información en el cuestionario que la requerida. Si usted no se siente cómodo completando la encuesta, ignórela.

Independientemente de si usted seleccione o no participar, los resultados estarán en un archivo en la Biblioteca de Ciencias de Salud Shimberg de la Universidad del Sur de la Florida (USF) después del 30 de Junio del 2009.

Si usted tiene alguna pregunta o preocupación acerca de completar el cuestionario o de estar en este estudio, usted puede contactarme al (305) 283-4579. Si usted tiene preguntas acerca de sus derechos, preguntas generales, quejas, o preocupación como una persona tomando parte en este estudio, usted puede también llamar a la División de Cumplimiento e Integridad de Investigaciones de la Universidad de South Florida al (813) 974-9343.

Sinceramente y muchas gracias,

firma

Carmen Perez, M.D.
Investigador Principal

Appendix E (Continued)

Cuestionario Adicional

Por favor, coloque una "X" en la casilla apropiada debajo

| | | | | | | | |
|----|---|------------------|--------------------|---------------------------|----------------------------------|------|-------------------------|
| 1 | Etnicidad | Americano | Hispánico (Latino) | | Asiático | | Otra |
| | | | | | | | |
| 2 | ¿Su padre nació en los Estados Unidos? | | | | SI | NO | |
| | | | | | | | |
| 2a | Si no, ¿donde él nació? | | | | | | |
| 3 | ¿Su madre nació en los Estados Unidos? | | | | SI | NO | |
| | | | | | | | |
| 3a | Si no, ¿donde ella nació? | | | | | | |
| 4 | ¿Usted nació en los Estados Unidos? | | | | SI | NO | |
| | | | | | | | |
| 5 | Nivel de escolaridad | Primaria | Secundaria | | Preuniversitario o Universitario | | Graduado de Universidad |
| | | | | | | | |
| 6 | Localización del área de trabajo (6 horas o más al día) | Vehículo cerrado | Oficina cerrada | Planta interior/industria | Al aire libre | Otro | Desempleado |
| | | | | | | | |

Si usted no es Americano o Hispánico (Latino), por favor, no conteste las demás preguntas.

Appendix E (Continued)

Información Médica y Demográfica

| | | | |
|---|------|-----------|----------|
| 1 | Sexo | Masculino | Femenino |
| | | | |
| 2 | Edad | | |

Por favor, coloque una "X" en la casilla apropiada debajo

| | | SI | NO |
|----|--|----|----|
| 3 | ¿Usted toma antihistamínicos? | | |
| 4 | ¿Usted sufre de fiebre del heno, alergias, o rinitis alérgica? | | |
| 5 | ¿Usted tiene tos todos los días? | | |
| 6 | ¿Usted sufre de problemas respiratorios? | | |
| 7 | ¿Usted padece de Asma? | | |
| 8 | ¿Usted tiene un sentido del olfato que es normal? | | |
| 9 | ¿Usted es un fumador? | | |
| 10 | ¿Usted ha fumado en los últimos 10 años? | | |
| 11 | ¿Usted ha recibido esteroides o antibióticos dentro de las últimas 4 semanas? | | |
| 12 | ¿Usted está tomando medicinas para el corazón? | | |
| 13 | ¿Usted tiene hepatitis o cirrosis del hígado? | | |
| 14 | ¿Usted sufre de fallo renal? | | |
| 15 | ¿Usted sufre de algún problema neurológico? | | |
| 16 | ¿Usted sufre de algún problema psiquiátrico? | | |
| 17 | ¿Usted toma medicinas para la depresión? | | |
| 18 | ¿Usted está embarazada o piensa que podría estarlo? | | |
| 19 | ¿Usted sufre de eczema o urticaria? | | |
| 20 | ¿Usted tiene artritis? | | |
| 21 | ¿Algún doctor le ha dicho que usted tiene Fibromialgia, Síndrome de Fatiga Crónica o Sensibilidad a Múltiple Químicos? | | |

Appendix E (Continued): Cuestionario sobre sensibilidad a químicos, olores e irritantes.

Este cuestionario le pregunta como usted se siente ahora y como se sintió el año pasado. Por favor, marque la casilla que mejor describe como usted se siente.

| | | Totalmente desacuerdo | Desacuerdo | Neutral | De acuerdo | Totalmente de acuerdo |
|----|--|--------------------------|------------|---------|---------------|--------------------------|
| 22 | Yo soy más sensible a inhalados químicos, irritantes, olores, o fuertes fragancias que el promedio de las personas | | | | | |

| Si estoy alrededor de lo siguiente, me ocurre esta reacción: | | Nada Inusual | Una ligera reacción | Algo enfermo | Muy enfermo |
|--|---|-----------------|------------------------|-----------------|----------------|
| 23 | Humo de cigarro | | | | |
| 24 | Gases de automóvil | | | | |
| 25 | Olores fuertes, colonias, perfumes o esencia de velas | | | | |
| 26 | Vapores de pintura fresca o humo | | | | |

| Si me expongo al humo del cigarro, gases de automóvil, olores fuertes, perfumes, colonias o vapores de pintura fresca: | | Totalmente desacuerdo | Desacuerdo | Neutral | De acuerdo | Totalmente de acuerdo |
|--|--|--------------------------|------------|---------|---------------|--------------------------|
| 27 | Sufro de molestias | | | | | |
| 28 | Llego a enfermarme | | | | | |
| 29 | Desarrollo quemazón en la piel de la cara | | | | | |
| 30 | Desarrollo una sensación extraña en la piel de la cara | | | | | |
| 31 | Desarrollo irritación en los ojos | | | | | |
| 32 | Desarrollo dolor en los ojos | | | | | |
| 33 | Desarrollo picazón en los ojos | | | | | |

| Si me expongo al humo del cigarro, gases de automóvil, olores fuertes, perfumes, colonias o vapores de pintura fresca: | | Totalmente desacuerdo | Desacuerdo | Neutral | De acuerdo | Totalmente de acuerdo |
|--|---|-----------------------|------------|---------|------------|-----------------------|
| 34 | Desarrollo dolor o quemazón en la nariz | | | | | |
| 35 | Desarrollo dolor de garganta | | | | | |
| 36 | Siento nauseas | | | | | |
| 37 | Desarrollo indigestión | | | | | |
| 38 | Desarrollo diarreas | | | | | |
| 39 | Me dan gases | | | | | |
| 40 | Podría toser sin flemas | | | | | |
| 41 | Podría toser con flemas | | | | | |
| 42 | Siento que no puedo respirar | | | | | |
| 43 | Empiezo a estornudar | | | | | |
| 44 | Siento opresión o apretazón en el pecho | | | | | |
| 45 | Desarrollo dolor en las articulaciones | | | | | |
| 46 | Desarrollo problemas para dormir | | | | | |
| 47 | Desarrollo entumecimiento, cosquilleo en las manos o pies | | | | | |
| 48 | Mi cuerpo lo siento caliente o frio | | | | | |
| 49 | Mis síntomas mejoran si puedo salir del lugar | | | | | |
| 50 | Me pongo emocional | | | | | |
| 51 | Me da dolor de cabeza | | | | | |
| 52 | Me pongo ansioso | | | | | |
| 53 | Tengo problemas para concentrarme | | | | | |
| 54 | Dejo de trabajar | | | | | |
| 55 | Pierdo citas sociales o de negocio | | | | | |
| 56 | Siento nerviosismo en la casa o el trabajo | | | | | |
| 57 | Encuentro difícil interactuar con otras personas | | | | | |