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The Association Between Lead Exposure and Respiratory Health in Children

Colleen Coleman
Virginia Commonwealth University

Master of Public Health Research Project

The Association between Lead Exposure and Respiratory Health in Children

By

Colleen Coleman

Advisor: Robert Leonard Vance, Ph.D., JD, PE, CIH, CSP, CHMM
Preceptor: Roy T. Sabo, Ph.D.

Department of Epidemiology and Community Health
Master of Public Health Program
MPH Research Project: EPID 691

Virginia Commonwealth University
Richmond, Virginia

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Submission Statement
Master of Public Health Research Project

This MPH Research Project report is submitted in partial fulfillment of the requirements for a Master of Public Health degree from Virginia Commonwealth University's School of Medicine. I agree that this research project report be made available for circulation in accordance with the program's policies and regulations pertaining to documents of this type. I also understand that I must receive approval from my Faculty Advisor in order to copy from or publish this document, or submit to a funding agency. I understand that any copying from or publication of this document for potential financial gain is not allowed unless permission is granted by my Faculty Advisor or (in the absence of my Faculty Advisor) the Director of the MPH Program.

____
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____
Date

Master of Public Health
Research Project Agreement Form
Department of Epidemiology and Community Health

Student name: Colleen Coleman E-mail address: colemancj@vcu.edu

Street address: 2345 Mosby Rd. Powhatan, VA 23139

Home phone: (540) 250-6715 Work phone: (   ) Fax:

Number of semester hours (3-6): 3 Semester: Fall Year: 2009

Please complete the following outline. **Do not exceed 2 pages (A-H)**.

A. PROJECT TITLE:

The Association Between Lead Exposure and Respiratory Health in Children

PURPOSE (state hypothesis/research question):

The objective of this study is to examine the extent to which children testing positive for blood lead exposure are at an increased risk for having poor respiratory.

C. SPECIFIC OBJECTIVES (list major aims of the study):

- To identify a possible need for a more multi-targeted approach when dealing with a child that is lead poisoned
- To determine if a relationship exists between lead exposure and respiratory health in children ages 1-6yrs
- To determine if there are demographic differences in both exposure and outcome groups

D. DESCRIPTION OF METHODS

D.1. Identify source(s) of data (eg, existing data set, data collection plans, etc):

- Existing data set: NHANES 2005-2006

D.2. State the type of study design (eg, cross-sectional, cohort, case-control, intervention, etc):

- Cross-sectional

D.3. Describe the study population and sample size:

- Sample size: 997 children
- Study population:
  - Children ages 1-6 years
  - Blood lead tested
  - Completed respiratory health questionnaire

D.4. List variables to be included (If a qualitative study, describe types of information to be collected)

- Exposure variable: Assessed at varying blood lead levels
  - Positive blood lead exposure: ≥1, 2,3, 4, 5, 10 ug/dL
  - Negative blood lead exposure: <1, 2, 3, 4, 5, 10 ug/dL

**Positive blood lead exposure level set at 1ug/dL due to recent findings that there is no safe blood lead level. Unable to choose a value of zero due to laboratory detection limit of 0.25ug/dL and small sample size (N=34) of study participants with levels <0.25ug/dL. **

- Outcome variable: Respiratory health status (questionnaire)
  - The following three questions from the respiratory health and disease questionnaire will be used to assess respiratory health status:
    - 1. In the past 12 months, has your child had wheezing or whistling in your chest?
    - 2. In the past 12 months, how many attacks of wheezing or whistling has your child had?
    - 3. In the past 12 months, how many times has your child gone to the doctor's office or the hospital emergency room for one or more of these attacks of wheezing or whistling?

  - I will dichotomize the outcome variable: poor vs. good respiratory health
    - Poor respiratory health will be defined as:
      - Answer Q1: Yes response, the child is wheezing
      - Answer Q2: >1 wheezing attacks
      - Answer Q3: ≥1 visit to the doctor for wheezing attack

    - Good respiratory health will be defined as:
      - Answer Q1: No response, the child is not wheezing
        OR
        Yes response, the child is wheezing
      - Answer Q2: 1 wheezing attack reported
      - Answer Q3: No visits to the doctor for wheezing attack

- Demographics:
  - Gender
  - Race
  - Age
  - Annual family income

D.5. Describe methods to be used for data analysis (If a qualitative study, describe general approach to compiling the information collected)

- Logistic regression

E. ANTICIPATED RESULTS:

I anticipate there is a positive association between lead exposure and poor respiratory health – as exposure to lead increases, the likelihood of poor respiratory health increases.

F. SIGNIFICANCE OF PROJECT TO PUBLIC HEALTH:

Addresses vulnerable populations

G. IRB Status:

1) Do you plan to collect data through direct intervention or interaction with human subjects? ___yes __x__no

2)Will you have access to any existing identifiable private information? ___yes __x__no

If you answered "no" to both of the questions above, IRB review is not required.
If you answered "yes" to either one of these questions, your proposed study must be reviewed by the VCU Institutional Review Board (IRB). Please contact Dr. Vance or Dr. Sridhar for assistance with this procedure.

Please indicate your IRB status:
___ to be submitted (____)
___ submitted (date of submission _____________; VCU IRB # ________)
___ IRB exempt review approved (date____________)
___ IRB expedited review approved (date____________)
___ IRB approval not required

H. PROPOSED SCHEDULE: Start Date: _September 2009
Anticipated End Date:_December 2009__

I. INDICATE WHICH OF THE FOLLOWING AREAS OF PUBLIC HEALTH KNOWLEDGE WILL BE DEMONSTRATED:

1. Biostatistics – collection, storage, retrieval, analysis and interpretation of health data; design and analysis of health-related surveys and experiments; and concepts and practice of statistical data analysis. _x_yes ___no (if yes, briefly describe): SAS

2. Epidemiology – distributions and determinants of disease, disabilities and death in human populations; the characteristics and dynamics of human populations; and the natural history of disease and the biologic basis of health. _x__yes ___no (if yes, briefly describe): examining relationship between lead exposure and respiratory health

3. Environmental Health Sciences – environmental factors including biological, physical and chemical factors which affect the health of a community. _x__yes ___no (if yes, briefly describe): lead exposure

4. Health Services Administration – planning, organization, administration, management, evaluation and policy analysis of health programs. ___yes __x_no (if yes, briefly describe): Evaluation of screening program

5. Social/Behavioral Sciences – concepts and methods of social and behavioral sciences relevant to the identification and the solution of public health problems. ___yes _x__no (if yes, briefly describe):

SIGNATURE PAGE
Master of Public Health Research Project

Student: Name: Colleen Coleman

Preceptor: Name: Roy Sabo, Ph.D Title: Assistant Professor

Address: Theatre Row 730 East Broad St. Rm. 3032 Richmond, VA 23298

E-mail: rsabo@vcu.edu Phone: 804-828-3047

Field of expertise: biostatistics

Faculty Advisor: Name: Robert Leonard Vance

E-mail: vance@vcu.edu Phone: 628-2513

SIGNATURES:

Student: ______________________ Date:: ______________________

Preceptor: ______________________ Date: ______________________

Faculty Advisor: ______________________ Date: ______________________

MPH Program Director: ______________________ Date: ______________________

MPH Program Coordinator: ______________________ Date: ______________________

MPH Research Project Approval Form

(Type TITLE of Project here)

Submitted to the Graduate Faculty of the
Department of Epidemiology and Community Health
Virginia Commonwealth University

In partial fulfillment of the requirements for the degree of
Master of Public Health

(by: Type STUDENT NAME here)

Comments:

Approval signatures:

Table of Contents

Acknowledgements

I would like to thank my advisor, Dr. Leonard Vance and my preceptor, Dr. Roy Sabo whose encouragement, guidance and statistical support allowed me to complete this project and enabled me to develop a stronger understanding of the subject.

Colleen Coleman

Abstract

Purpose: The substantial impact of indoor air quality and environmental hazards in the home on one's health has long been recognized in the field of public health. This cross-sectional study investigates the risk between home based hazards, specifically lead, and respiratory health in children. The objective of this study is to examine the extent to which children testing positive for blood lead exposure are at an increased risk for having poor respiratory health.

Methods: A nationally representative sample of 977 children ages 1- 6 years was obtained from the 2005-2006 National Health and Nutrition Examination Survey (NHANES). Information from the demographic, blood lead level, and respiratory health questionnaire databases were combined to assess the impact of lead exposure on respiratory health. Blood lead exposure (BLL) was assessed at the following cut-off values: 1, 2, 3, 4, 5 and 10ug/dL. Respiratory health status was dichotomized as good and poor respiratory health based on the study participant's answers to the questionnaire. Logistic regression was used to determine the relationship between blood lead levels and respiratory health status while controlling for the following potential confounders: race, age, sex, and annual family income.

Results: This study was unable to establish a relationship between lead exposure and poor respiratory health in children ages 1-6 years, and the lack of relationship held for increasing levels of lead exposure. However, this study did reveal the significant impact of low level lead exposure in children with approximately 77% exposed at BLL $\geq$ 1ug/dL and 39% at BLL $\geq$ 2ug/dL. It is important to note that this is only a snapshot of the amount of lead exposure within this population; it is very likely that the levels fluctuate.

Conclusion: While the percentage of study population decreases as the lead exposure increases, it is still alarming at the number of children exposed to low levels of lead. A large and growing body of literature documents the adverse health effects associated with low levels of lead exposure in children. This finding further supports the need for continuing research in examining the true impact of low level lead exposure and in determining a threshold dose level. In addition, a stronger study with a larger sample size and a more clearly defined respiratory health variable would allow for the relationship to be more closely examined before a definitive "no association" result can be made.

INTRODUCTION

The substantial impact of indoor air quality and environmental hazards in the home on one's health has long been recognized in the field of public health. Florence Nightingale suggested the link between housing and health in the mid 1800's, noting that "the connection between health and the dwelling of the population is one of the most important that exists" (Jacobs et al. 2007). Research has shown that "the condition of an individual's home appears to serve as a marker for some important underlying factors beyond those of diet and heredity" (Krieger and Higgins, 2002) and the CDC recently adopted a "Healthy Housing" holistic approach to preventing illnesses in the home. Because young children spend nearly 90% of their time inside their home, they are among the most susceptible to indoor toxins (Cummins and Jackson, 2001; Jacobs et al. 2009). This study investigates the risk between home based hazards, specifically lead, and respiratory health in children ages 1-6 years old.

Lead poisoning is a serious environmental health hazard for U.S. children (Ryan et al. 1999; Joseph et al., 2005; Boreland et al. 2002, 2007). Two major sources of lead poisoning in children are caused by exposure to deteriorated lead-based paint and lead contamination of house dust and soil around the home. Children can ingest lead based paint or lead dust by putting their hands or other objects in their mouths, by eating paint chips or by playing in lead-contaminated soil. It is estimated that there are almost 4 million homes in the U.S. that have peeling or chipping lead-based paint or high levels of lead dust in the home. Lead based paint deterioration is exacerbated by the presence of moisture from plumbing leaks, condensation on surfaces, roof leaks, or high humidity in the home. The effects of lead poisoning include delayed cognitive development, permanent learning disabilities, and behavioral problems (Lanphear et al. 2002, 2005; Needleman 1998). Although federal guidelines recommend intervention at a blood lead level

(BLL) greater than or equal to 10ug/dL, adverse outcomes have been demonstrated at lower levels (Bernard and McGeehin, 2003; Brown and Meehan, 2004; Canfield et al. 2003).

The same moisture that exasperates the deterioration of lead based paints also has a significant effect on respiratory health by contributing to the growth of mold and mildew in the home. Asthma, a chronic respiratory disease characterized by attacks of difficulty breathing, currently affects more than 6 million children in the U.S. (Lanphear, 2001). According to the CDC, asthma annually leads to more than 3 million clinic visits, 550,000 emergency visits, 150,000 hospitalizations, and in excess of 150 deaths in children less than 15 years old (CDC MMWR, 2002). Asthma and other respiratory illnesses are frequently triggered and exacerbated by dusts and mold in the home (Martinez et al. 1995; IOM National Academies Press 2000, 2004). Molds are ubiquitous spore producing organisms, prevalent in warm, damp environments (American Academy of Pediatrics 1998; IOM 2004). According to the EPA, respirable dust particles, especially <10 microns in size, can pose health risks if inhaled, due to its ability to penetrate the nose and upper respiratory system and deep into the lungs. Despite advances in therapy and in our understanding of the pathophysiology of this disease, there has been an increase in the prevalence, morbidity and mortality of children with asthma during the past two decades (Lanphear 2001).

It has been shown that disparities exist in both poor respiratory health and lead poisoning in children (Joseph et al. 2005). Both are prevalent among minorities and subjects with low socio-economic status and certain elements in the environment are associated with increased risk for both conditions (Hartert and Peebles, 2000; Lanphear et al. 1998; Bernard and McGeehin, 2003; Joseph et al. 2005). Although other risk factors are also likely to be important, the large health differences among lower-income and minority families compared with other populations suggest housing conditions may contribute to chronic disease in some populations (Rosenbaug and Wilson 2001; Kawichi et al. 2005). In the U.S., children from low income families are eight times more likely to get lead poisoned and African-American children were found to have blood lead levels four times higher than Caucasians (Joseph et al. 2005). Previous research has shown that asthma rates are higher among children living in urban, low-income communities (Mannino et al. 2002; IOM 2004). Racial disparities also exist in respiratory illnesses. An Institute of Medicine report noted that African-American children living in low-income families tend to have more severe asthma and are at greater risk of death (IOM 2004).

Objective

The objective of this study was to examine the extent to which children testing positive for blood lead exposure are at an increased risk for having poor respiratory health. Three main goals of this study are to determine if a relationship exists between lead exposure and poor respiratory health in children ages 1-6 years of age, to determine if there are demographic differences between children with lead exposure and without lead exposure, and to identify a possible need for a more multi-targeted approach when dealing with a child that is lead poisoned. Secondary analyses examined if changes in the cut-off level that categorizes subjects with varying levels of lead exposure (2, 3, 4, 5, and 10ug/dL) change the relationship between lead exposure and respiratory health in children 1-6 years old.

METHODS

Study design

The National Health and Nutrition Examination Survey (NHANES) conducted in 2005-2006, was the source of data for this study. NHANES is a cross-sectional, random household survey of a civilian, non-institutionalized population that used a complex, multistage probability sampling design. Three NHANES datasets (demographics, blood lead levels, and respiratory health questionnaire) were merged into one dataset.

The population inclusion criteria for this study included children 1-6 years of age who were blood lead tested and who completed the respiratory health questionnaire. The following demographics and potential confounders were included in this cross-sectional study: age, race, gender, and annual family income. The analytic sample consisted of 997 children out of a sample of 10,348 study participants aged 1-85 years.

Since recent research findings suggest that there may not be a safe blood lead level, the blood lead exposure variable was dichotomized as children testing positive for blood lead (BLL ≥1ug/dL) and children without exposure to lead (BLL <1ug/dL). A BLL value of 0ug/dL was not used to represent no exposure because the blood lead testing detection limit was 0.25ug/dL. A value of 1ug/dL was chosen due to a small unexposed sample size using (<0.25ug/dL). Secondary analyses were performed which tested the relationship between lead exposure and respiratory health using higher lead exposure categorization levels. The following additional BLLs were tested: 2ug/dL, 3ug/dL, 4ug/dL, 5ug/dL and 10ug/dL. Blood samples were collected from each study participant via venipuncture and lead level analysis was performed using inductively coupled plasma mass spectrometry (ICP-MS). NHANES chose this multi-analytic technique because it enhances productivity by simultaneously detecting the presence of lead, mercury, and cadmium.

The outcome variable, respiratory health status was determined from data found in the Respiratory Disease Questionnaire which was collected as part of the NHANES Household Questionnaire Interview. The questions were asked in the home, prior to physical examination, using the Computer-Assisted Personal Interviewing (CAPI) system. The following three questions regarding a history of wheezing were administered to survey participants ages ≥1 years and was used as the criteria to assess respiratory health status:

- In the past 12 months, has your child had wheezing or whistling in his/her chest?
    - Yes or No
- In the past 12 months, how many attacks of wheezing or whistling has your child had?
    - Range of 1-12 attacks
- In the past 12 months, how many times has your child gone to the doctor's office or the hospital emergency room for one or more of these attacks of wheezing or whistling?
    - None or a range of 1-20+ visits

Based on the answers to these three questions, respiratory health was dichotomized as good and poor respiratory health. The following criteria define good respiratory health: Any child that has never had wheezing or whistling in their chest or may have had wheezing/whistling in their chest and had one wheezing attack within the past year but has had no visits to the doctor or ER due to a wheezing attack. The following criteria define poor respiratory health: Any child that has had wheezing/whistling in their chest, has had one or more wheezing attacks, and has gone to the doctor or ER at least once due to a wheezing attack (See Fig. 1).

Data Analysis

The Statistical Analysis System (SAS) 9.1 was used for data management and all analyses. SAS survey procedures were used to perform weighted analyses that adjusted for the design effects of the complex sampling used by NHANES. The percentages shown in Table 1 were computed using PROC SURVEYFREQ. The logistic regression models which provided both crude and adjusted estimates of the association between lead exposure and respiratory health status were computed using PROC SURVEYLOGISTIC. Potential confounders were retained in this model using 10% change-in-estimate strategy.

RESULTS

Table 1 shows the characteristics of the study population by low exposures to lead (BLL 1ug/dL). Overall, nearly 77% of 997 children surveyed tested positive for blood lead exposure at a level ≥ 1ug/dL. It is very interesting to see that a significant portion of the population is exposed to low levels of lead. This number represents only a "snapshot" of lead exposure within a population; it is very likely that these levels fluctuate. To examine the impact of lead exposure more closely, Table 2 compares lead exposure at levels 1, 2, and 3ug/dL. While the percentage of study population decreases as lead exposure increases, it is still alarming at the number of children exposed to low levels of lead. Almost 32% of the study population has a lead exposure of at least 2ug/dL and 13% at least 3ug/dL. Males and females are equally likely to be exposed to lead (see Table 1). Looking at the study population, 2 year olds are the most likely to be exposed: 84% of all 2 year olds tested were exposed to at least 1 ug/dL, 39% at least 2ug/dL, and 15% at least 3ug/dL. This is pertinent with the literature which has shown this age group is most likely to be exposed because they tend to put objects and their hands in their mouths. As age increases, the percentage of subjects highly exposed declines. Except in this study population, an equal percentage (80%) of both 1 year olds and 4 year olds were exposed at 1ug/dL. Across all levels of lead exposure, African American children were more likely to be exposed (92% of all African American exposed at 1ug/dL) than compared to Caucasian children (74% of all Caucasian exposed at 1ug/dL). Looking at Table 1, lower socio-economic families experienced an increase in lead exposure. Almost 85% of families with an annual family income of <$24,999 and nearly

80% of families with an annual family income of $25,000-$54,999 were exposed to lead as compared to only 37% of families with an annual family income of >$55,000. Both of these observations have been previously reported in literature.

Table 2 shows both crude and adjusted odds ratios examining the association between several lead exposure levels and respiratory health. Based on the results of the 10% change-in-estimate, all analyses were adjusted for race, age, gender and annual family income. It appears that no relationship exists in both crude and adjusted OR analyses for lead exposure at ≥1ug/dL (Crude OR= 1.179 (0.563, 2.466) and Adjusted OR=1.011 (0.439, 2.327)). To examine if any relationship exists among increasing lead exposure levels, additional logistic regression analyses were performed (Table 2). However, no relationship continues to exist as the lead exposure level is increased. Cut-off values greater than 3ug/dL were considered for high lead exposure, but there were no subjects with poor respiratory health in the high exposure groups with this categorization; thus they were not included in this analysis.

DISCUSSION

Lead exposure and respiratory diseases were found to jeopardize the health and quality of life of urban minority children in the United States (Bernard and McGeehin, 2003; Lanphear et al. 2002). This study sought to evaluate the strength of association between low level lead exposure and uni-dimensional scaling of respiratory health in children ages 1-6 years.

This study was unable to establish a relationship between lead exposure and poor respiratory health in children ages 1-6 years, and the lack of relationship held for various definitions of "high" lead exposure. However, these findings may not be completely accurate possibly due to the small sample size and/or the calculated respiratory health variable may not be accurately representative. According to the CDC and other sources, African Americans and lower socio-economic children in the U.S. are at a higher risk of lead poisoning when compared with Caucasian and affluent children (Bernard and McGeehin 2003). This same association was seen within this study population.

Certain limitations of this analysis should be acknowledged. Respiratory health status was based on interviewer responses from the Respiratory Health Questionnaire which is not as accurate as a medical examination by a physician. The 2005-2006 NHANES did assess respiratory health by medical examinations utilizing pulmonary function tests but these were not performed on children less than 13 years of age. Self-reported data is subject to validity concerns, recall bias and misclassification is likely to occur when conducting interviews. This study did not assess the impacts of other confounders associated with respiratory diseases such as pets, allergens, environmental tobacco smoke or heredity. The small sample size was a major limitation because although NHANES has the capacity of providing large sample sizes, this study restricted the study population to 1-6 year olds. Also, NHANES 2005-2006 cannot be merged with other NHANES samples to increase the study population size because 4-year population weights are not currently available.

A major strength of this study is the use of NHANES data due its representativeness to the U.S. population. The CAPI system allows for a standardized, unbiased interviewing system. Lead levels in the NHANES laboratory database are obtained by venipuncture which is considered more reliable than other methods (e.g. finger or heel stick). This was a major strength in that it permitted assessment of all levels of lead exposure.

CONCLUSION

A large and growing body of literature documents the adverse health effects associated with low levels of lead exposure in children (Brown and Meehan 2004). Additionally, a growing number of studies have linked respiratory diseases with the condition of the home (Lanphear et al. 2001). This study attempts to provide additional impetus to the development of holistic strategies to reduce health hazards in the home.

Although the results of this cross-sectional study depicted no association between varying levels of lead exposure and respiratory health; this study did reveal the significant impact of low level lead exposure in children - approximately 77% of children ages 1-6 years exposed at BLL ≥ 1ug/dL and 39% at BLL ≥ 2ug/dL. It is also important to note that this is only a snapshot of the amount of lead exposure within this population; it is very likely that the levels fluctuate which may overestimate or underestimate the true exposure in children. This finding further supports the need for continuing research in examining the true impact of low level lead exposure and in determining a threshold dose level. Coherence exists with previous research when comparing study population demographics between children exposed and unexposed to lead, the same disparities can be seen.

A stronger study with a larger sample size and a more clearly defined respiratory health variable would allow for the relationship to be more closely examined before a definitive “no association” result can be made.

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Tables

Table 1. Population Characteristics of Lead Exposure & No Lead Exposure

	Lead exposure (≥1ug/dL)		No lead exposure (<1ug/dL)	
	N = 767 Wt. N = 11128583		N = 230 Wt. N = 4459365	
	N	% (Wt. %)	N	% (Wt. %)
Potential Confounders				
Gender				
Male	375	48.9% (51.8%)	114	49.6% (50.9%)
Female	392	51.1% (48.2%)	116	50.4% (49.1%)
Age				
1 year	158	21.0% (16.6%)	39	17.0% (11.3%)
2 years	174	22.7% (18.8%)	33	14.3% (9.6%)
3 years	112	14.6% (15.8%)	36	15.7% (20.8%)
4 years	126	16.4% (17.7%)	32	13.9% (12.7%)
5 years	106	13.4% (14.8%)	37	16.1% (16.7%)
6 years	91	11.9% (16.2%)	53	23% (28.9%)
Race				
Mexican	250	32.6% (15.4%)	109	47.4% (18.3%)
Other Hispanic	40	5.2% (5.8%)	12	5.2% (4.9%)
Caucasian	209	27.2% (55.9%)	72	31.3% (64.6%)
African American	228	29.8% (16.1%)	19	8.3% (3.9%)
Other/multi-racial	40	5.2% (6.7%)	18	7.8% (8.3%)
Annual family income				
$24,999	333	43.4% (30.8%)	59	25.7% (14.7%)
$25,000 - $54,999	260	33.9% (34.0%)	67	29.1% (27.7%)
≥ $55,000	104	22.7% (35.2%)	174	45.2% (57.7%)

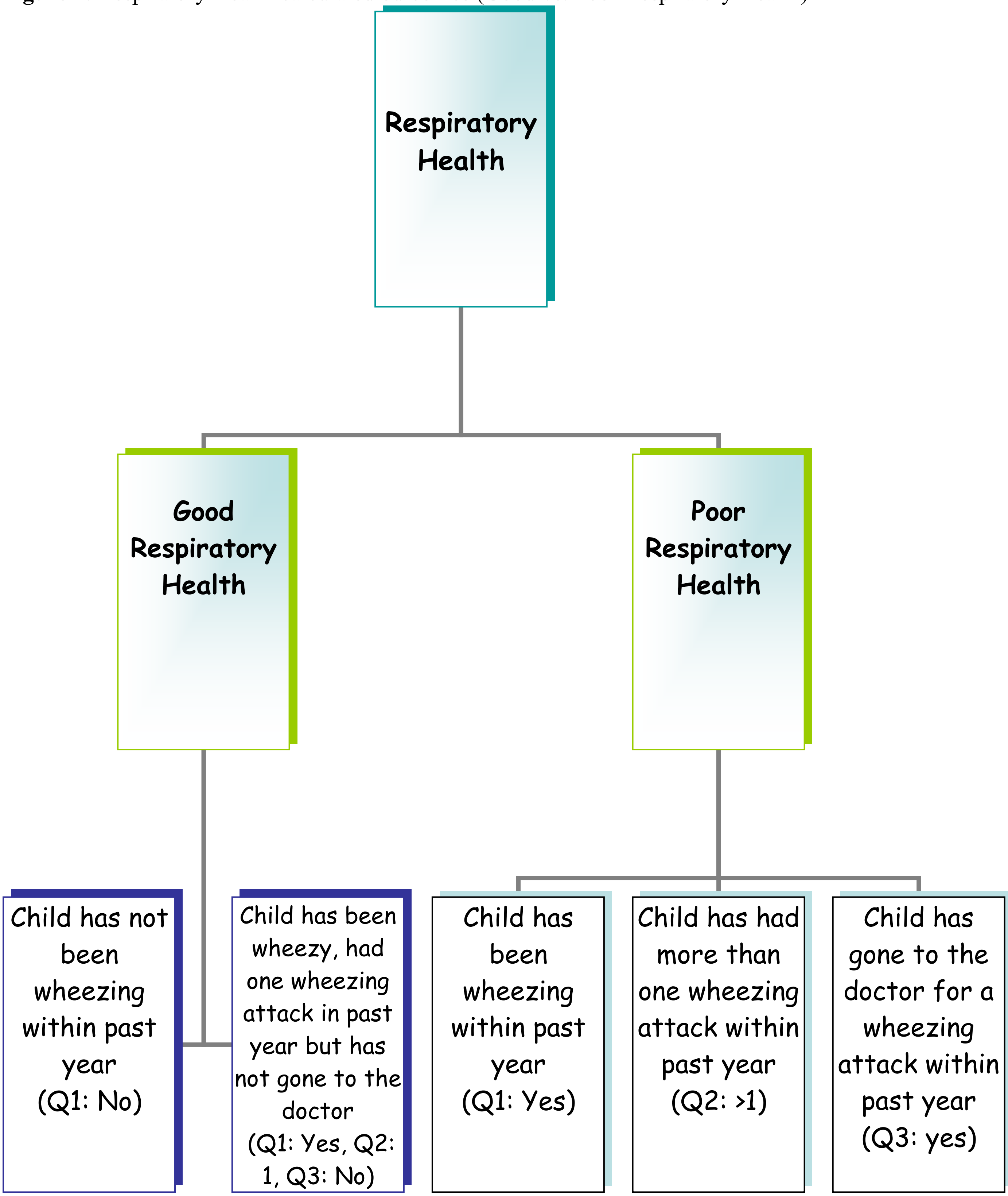
Table 2. Crude and Adjusted Analyses

	Good Respiratory Health N = 924 Wt. N =14396960 N % (Wt. %)		Poor Respiratory Health N = 73 Wt. N =1190989 N % (Wt. %)		Crude OR (95% CI)	Adjusted OR* (95% CI)
Lead Exposure						
BLL ≥ 1ug/dL	713	77.2% (71.1%)	54	74.0% (74.4%)	1.179 (0.56, 2.47)	1.011 (0.44, 2.33)
BLL < 1ug/dL	211	22.8% (28.6%)	19	26.0% (25.6%)	1.00	1.00
BLL ≥ 2ug/dL	293	31.7% (91.5%)	24	32.9% (8.5%)	1.164 (0.59, 2.30)	1.032 (0.49, 2.16)
BLL < 2ug/dL	631	68.3% (92.6%)	49	67.1% (7.4%)	1.00	1.00
BLL ≥ 3ug/dL	121	13.1% (95.5%)	5	6.8% (4.5%)	0.544 (0.17, 1.70)	0.436 (0.14, 1.37)
BLL < 3ug/dL	803	86.9% (92.0%)	68	93.2% (8.0%)	1.00	1.00

* Adjusted for race, income, age, gender

Figures

Figure 1: Respiratory Health calculated outcomes (Good vs. Poor Respiratory Health)



Appendix

NHANES Respiratory Health Questionnaire

(modified to include only questions selected for use in this study)

RDQ.070 In the **past 12 months**, {have you/has SP} had wheezing or whistling in {your/his/her} chest?

YES 1
NO.. 2
(RDQ.140)
REFUSED 7
(RDQ.140)
DON'T KNOW 9
(RDQ.140)

RDQ.080 In the **past 12 months,** how many attacks of wheezing or whistling {have you/has SP} had? IF 12 OR MORE EPISODES ENTER 12

CAPI INSTRUCTION: HARD EDIT: RANGE EQUALS 1 TO 12

__________ ENTER NUMBER OF EPISODES

REFUSED…………………..77
DON'T KNOW……………..99

RDQ.120 (In the **past 12 months**), how many times {have you/has SP} gone to the doctor's office or the hospital emergency room for one or more of these attacks of wheezing or whistling?

IF NEVER, ENTER 0

____________ (ENTER NUMBER)

CAPI INSTRUCTION:
SOFT EDIT: IF RESPONSE >20, THEN DISPLAY "UNLIKELY RESPONSE. PLEASE VERIFY. (RDQ. 150)."
HARD EDIT: CHECK: RDQ.120 – RANGE ERROR, THE VALID RANGE IS 0-50.

REFUSED……………………..77
DON'T KNOW………………..99

10% change-in-estimate model

Potential Confounders	Crude OR = 1.179	Crude weighted OR	% change
age		1.121	15.71428571
gender		1.174	11.72932331
race		1.136	14.58646617
income		1.154	13.23308271

**Calculate % change = (crude - adj) / crude

If the % change is greater than 10% than it is a confounder and will need to be adjusted for

Crude OR = 1.179
Full Model OR = 1.011

% change (crude OR vs. full model OR)

(1.179-1.011)/1.179 = 0.14*100=14%

SAS Output

Potential confounders weighted Ns

The SURVEYFREQ Procedure

Data Summary	
Number of Observations	997
Sum of Weights	15587948.6

Table of age by lead								
age	**lead**	**Frequency**	**Weighted Frequency**	**Std Dev of Wgt Freq**	**Percent**	**Std Err of Percent**	**Row Percent**	**Std Err of Row Percent**
1 - Target population age, 1yr	**0 - Negative lead exposure (<1ug/dL)**	39	505169	102207	3.2408	0.6566	21.4478	3.8701
	1 - Postive lead exposure (>=1ug/dL)	158	1850175	183397	11.8693	1.1918	78.5522	3.8701
	Total	197	2355344	205436	15.1100	1.3373	100.000	
2 - Target population age, 2yrs	**0 - Negative lead exposure (<1ug/dL)**	33	427167	96633	2.7404	0.6197	16.9184	3.4921
	1 - Postive lead exposure (>=1ug/dL)	174	2097705	193865	13.4572	1.2624	83.0816	3.4921
	Total	207	2524872	212420	16.1976	1.3828	100.000	
3 -Target population age, 3yrs	**0 - Negative lead exposure (<1ug/dL)**	36	926119	186775	5.9412	1.1665	34.4844	5.4327
	1 - Postive lead exposure (>=1ug/dL)	112	1759497	216510	11.2875	1.3510	65.5156	5.4327
	Total	148	2685616	280160	17.2288	1.6893	100.000	
4 - Target population age, 4yrs	**0 - Negative lead exposure (<1ug/dL)**	32	568232	132004	3.6453	0.8375	22.3694	4.5651
	1 - Postive lead exposure (>=1ug/dL)	126	1971987	225987	12.6507	1.4078	77.6306	4.5651
	Total	158	2540218	257381	16.2960	1.5817	100.000	
5 - Target population age, 5yrs	**0 - Negative lead exposure (<1ug/dL)**	37	744859	164911	4.7784	1.0367	31.1253	5.5474
	1 - Postive lead exposure (>=1ug/dL)	106	1648243	208073	10.5738	1.3028	68.8747	5.5474

Table of age by lead								
age	lead	Frequency	Weighted Frequency	Std Dev of Wgt Freq	Percent	Std Err of Percent	Row Percent	Std Err of Row Percent
	Total	143	2393102	260816	15.3523	1.5918	100.000	
6 - Target population age, 6yrs	0 - Negative lead exposure (<1ug/dL)	53	1287820	223034	8.2616	1.3750	41.6933	5.4125
	1 - Postive lead exposure (>=1ug/dL)	91	1800976	238714	11.5536	1.4662	58.3067	5.4125
	Total	144	3088797	319486	19.8153	1.8682	100.000	
Total	0 - Negative lead exposure (<1ug/dL)	230	4459365	364575	28.6078	2.0456		
	1 - Postive lead exposure (>=1ug/dL)	767	11128583	407373	71.3922	2.0456		
	Total	997	15587949	446337	100.000			

Table of age by lead			
age	lead	Column Percent	Std Err of Col Percent
1 - Target population age, 1yr	0 - Negative lead exposure (<1ug/dL)	11.3283	2.2692
	1 - Positive lead exposure (>=1ug/dL)	16.6254	1.6266
	Total		
2 - Target population age, 2yrs	0 - Negative lead exposure (<1ug/dL)	9.5791	2.1392
	1 - Positive lead exposure (>=1ug/dL)	18.8497	1.7163
	Total		
3 -Target population age, 3yrs	0 - Negative lead exposure (<1ug/dL)	20.7679	3.7182
	1 - Positive lead exposure (>=1ug/dL)	15.8106	1.8291
	Total		
4 - Target population age, 4yrs	0 - Negative lead exposure (<1ug/dL)	12.7424	2.8105
	1 - Positive lead exposure (>=1ug/dL)	17.7200	1.8978
	Total		
5 - Target population age, 5yrs	0 - Negative lead exposure (<1ug/dL)	16.7033	3.3821
	1 - Positive lead exposure (>=1ug/dL)	14.8109	1.7690
	Total		
6 - Target population age, 6yrs	0 - Negative lead exposure (<1ug/dL)	28.8790	4.1632
	1 - Positive lead exposure (>=1ug/dL)	16.1833	1.9758
	Total		
Total	0 - Negative lead exposure (<1ug/dL)	100.000	
	1 - Positive lead exposure (>=1ug/dL)	100.000	
	Total		

Table of race by lead								
race	**lead**	**Frequency**	**Weighted Frequency**	**Std Dev of Wgt Freq**	**Percent**	**Std Err of Percent**	**Row Percent**	**Std Err of Row Percent**
1 - Mexican Americans	**0 - Negative lead exposure (<1ug/dL)**	109	817143	76696	5.2421	0.5399	32.2738	2.5990
	1 - Positive lead exposure (>=1ug/dL)	250	1714769	98817	11.0006	0.7931	67.7262	2.5990
	Total	359	2531912	113285	16.2428	1.0083	100.000	
2 - other Hispanic	**0 - Negative lead exposure (<1ug/dL)**	12	217045	72191	1.3924	0.4625	25.0129	7.1281
	1 - Positive lead exposure (>=1ug/dL)	40	650684	116015	4.1743	0.7453	74.9871	7.1281
	Total	52	867729	135600	5.5667	0.8699	100.000	
3 - non-Hispanic white	**0 - Negative lead exposure (<1ug/dL)**	72	2882432	346202	18.4914	1.9871	31.6505	3.1535
	1 - Positive lead exposure (>=1ug/dL)	209	6224628	431983	39.9323	2.1857	68.3495	3.1535
	Total	281	9107060	520035	58.4237	1.9424	100.000	
4 - non-Hispanic black	**0 - Negative lead exposure (<1ug/dL)**	19	173840	40284	1.1152	0.2623	8.8586	1.9684
	1 - Positive lead exposure (>=1ug/dL)	228	1788559	109228	11.4740	0.8487	91.1414	1.9684
	Total	247	1962400	113707	12.5892	0.8979	100.000	
5 - other, multi-racial	**0 - Negative lead exposure (<1ug/dL)**	18	368905	105272	2.3666	0.6709	32.9719	7.7636
	1 - Positive lead exposure (>=1ug/dL)	40	749943	149919	4.8110	0.9483	67.0281	7.7636
	Total	58	1118848	181666	7.1776	1.1408	100.000	

Table of race by lead								
race	**lead**	**Frequency**	**Weighted Frequency**	**Std Dev of Wgt Freq**	**Percent**	**Std Err of Percent**	**Row Percent**	**Std Err of Row Percent**
Total	**0 - Negative lead exposure (<1ug/dL)**	230	4459365	364575	28.6078	2.0456		
	1 - Positive lead exposure (>=1ug/dL)	767	11128583	407373	71.3922	2.0456		
	Total	997	15587949	446337	100.000			

Table of race by lead			
race	**lead**	**Column Percent**	**Std Err of Col Percent**
1 - Mexican Americans	**0 - Negative lead exposure (<1ug/dL)**	18.3242	2.1608
	1 - Positive lead exposure (>=1ug/dL)	15.4087	1.1256
	Total		
2 - other Hispanic	**0 - Negative lead exposure (<1ug/dL)**	4.8672	1.6029
	1 - Positive lead exposure (>=1ug/dL)	5.8470	1.0345
	Total		
3 - non-Hispanic white	**0 - Negative lead exposure (<1ug/dL)**	64.6377	3.6397
	1 - Positive lead exposure (>=1ug/dL)	55.9337	2.2743
	Total		
4 - non-Hispanic black	**0 - Negative lead exposure (<1ug/dL)**	3.8983	0.9399
	1 - Positive lead exposure (>=1ug/dL)	16.0718	1.1980
	Total		

Table of race by lead			
race	**lead**	**Column Percent**	**Std Err of Col Percent**
5 - other, multi-racial	**0 - Negative lead exposure (<1ug/dL)**	8.2726	2.2879
	1 - Positive lead exposure (>=1ug/dL)	6.7389	1.3100
	Total		
Total	**0 - Negative lead exposure (<1ug/dL)**	100.000	
	1 - Positive lead exposure (>=1ug/dL)	100.000	
	Total		

Table of gender by lead								
gender	**lead**	**Frequency**	**Weighted Frequency**	**Std Dev of Wgt Freq**	**Percent**	**Std Err of Percent**	**Row Percent**	**Std Err of Row Percent**
1 - male	**0 - Negative lead exposure (<1ug/dL)**	114	2267813	271262	14.5485	1.6383	28.2431	2.8623
	1 - Positive lead exposure (>=1ug/dL)	375	5761806	347219	36.9632	2.0355	71.7569	2.8623
	Total	489	8029619	409763	51.5117	2.1331	100.000	
2- female	**0 - Negative lead exposure (<1ug/dL)**	116	2191552	263272	14.0593	1.5980	28.9952	2.9240
	1 - Positive lead exposure (>=1ug/dL)	392	5366777	327849	34.4290	1.9774	71.0048	2.9240
	Total	508	7558329	391381	48.4883	2.1331	100.000	
Total	**0 - Negative lead exposure (<1ug/dL)**	230	4459365	364575	28.6078	2.0456		
	1 - Positive lead exposure (>=1ug/dL)	767	11128583	407373	71.3922	2.0456		
	Total	997	15587949	446337	100.000			

Table of gender by lead			
gender	**lead**	**Column Percent**	**Std Err of Col Percent**
1 - male	**0 - Negative lead exposure (<1ug/dL)**	50.8551	4.3824
	1 - Positive lead exposure (>=1ug/dL)	51.7748	2.4171
	Total		
2- female	**0 - Negative lead exposure (<1ug/dL)**	49.1449	4.3824
	1 - Positive lead exposure (>=1ug/dL)	48.2252	2.4171
	Total		
Total	**0 - Negative lead exposure (<1ug/dL)**	100.000	

Table of gender by lead			
gender	lead	Column Percent	Std Err of Col Percent
	1 - Positive lead exposure (>=1ug/dL)	100.000	
	Total		

Table of income by lead								
income	lead	Frequency	Weighted Frequency	Std Dev of Wgt Freq	Percent	Std Err of Percent	Row Percent	Std Err of Row Percent
1 - Annual family income of less than $24,999	0 - Negative lead exposure (<1ug/dL)	59	653669	98479	4.1934	0.6433	16.0254	2.2628
	1 - Positive lead exposure (>=1ug/dL)	333	3425282	204608	21.9739	1.4554	83.9746	2.2628
	Total	392	4078952	216949	26.1673	1.5811	100.000	
2 - Annual family income between $25,000 and $54,999	0 - Negative lead exposure (<1ug/dL)	67	1234047	205284	7.9167	1.2755	24.5681	3.5007
	1 - Positive lead exposure (>=1ug/dL)	260	3788912	293539	24.3067	1.7901	75.4319	3.5007
	Total	327	5022959	344844	32.2233	2.0011	100.000	
3 - Annual family income of greater than $55,000	0 - Negative lead exposure (<1ug/dL)	104	2571650	304045	16.4977	1.7969	39.6490	3.6964
	1 - Positive lead exposure (>=1ug/dL)	174	3914389	347403	25.1116	1.9844	60.3510	3.6964
	Total	278	6486038	439225	41.6093	2.1867	100.000	
Total	0 - Negative lead exposure (<1ug/dL)	230	4459365	364575	28.6078	2.0456		
	1 - Positive lead exposure (>=1ug/dL)	767	11128583	407373	71.3922	2.0456		
	Total	997	15587949	446337	100.000			

Table of income by lead			
income	lead	Column Percent	Std Err of Col Percent
1 - Annual family income of less than $24,999	0 - Negative lead exposure (<1ug/dL)	14.6583	2.2916
	1 - Positive lead exposure (>=1ug/dL)	30.7791	1.9712
	Total		
2 - Annual family income between $25,000 and $54,999	0 - Negative lead exposure (<1ug/dL)	27.6731	3.9615
	1 - Positive lead exposure (>=1ug/dL)	34.0467	2.3040
	Total		
3 - Annual family income of greater than $55,000	0 - Negative lead exposure (<1ug/dL)	57.6685	4.2339
	1 - Positive lead exposure (>=1ug/dL)	35.1742	2.4815
	Total		
Total	0 - Negative lead exposure (<1ug/dL)	100.000	
	1 - Positive lead exposure (>=1ug/dL)	100.000	
	Total		

Table of RH by lead								
RH	**lead**	**Frequency**	**Weighted Frequency**	**Std Dev of Wgt Freq**	**Percent**	**Std Err of Percent**	**Row Percent**	**Std Err of Row Percent**
0 - Good respiratory health	**0 - Negative lead exposure (<1ug/dL)**	211	4154472	356089	26.6518	2.0163	28.8566	2.1377
	1 - Positive lead exposure (>=1ug/dL)	713	10242488	395144	65.7077	2.1199	71.1434	2.1377
	Total	924	14396960	444401	92.3596	1.1903	100.000	
1 - Poor respiratory health	**0 - Negative lead exposure (<1ug/dL)**	19	304894	93053	1.9560	0.5942	25.6000	6.8901
	1 - Positive lead exposure (>=1ug/dL)	54	886095	167448	5.6845	1.0538	74.4000	6.8901
	Total	73	1190989	190145	7.6404	1.1903	100.000	
Total	**0 - Negative lead exposure (<1ug/dL)**	230	4459365	364575	28.6078	2.0456		
	1 - Positive lead exposure (>=1ug/dL)	767	11128583	407373	71.3922	2.0456		
	Total	997	15587949	446337	100.000			

Table of RH by lead			
RH	lead	Column Percent	Std Err of Col Percent
0 - Good respiratory health	0 - Negative lead exposure (<1ug/dL)	93.1628	2.0393
	1 - Positive lead exposure (>=1ug/dL)	92.0377	1.4511
	Total		
1 - Poor respiratory health	0 - Negative lead exposure (<1ug/dL)	6.8372	2.0393
	1 - Positive lead exposure (>=1ug/dL)	7.9623	1.4511
	Total		
Total	0 - Negative lead exposure (<1ug/dL)	100.000	
	1 - Positive lead exposure (>=1ug/dL)	100.000	
	Total		

Crude Weighted OR for the E-D relationship

The SURVEYLOGISTIC Procedure

Model Information		
Data Set	WORK.CLEANDATA	
Response Variable	RH	Respiratory health status
Number of Response Levels	2	
Weight Variable	WTINT2YR	Full Sample 2 Year Interview Weight
Model	Binary Logit	
Optimization Technique	Fisher's Scoring	
Variance Adjustment	Degrees of Freedom (DF)	

Number of Observations Read	997
Number of Observations Used	997
Sum of Weights Read	15587949
Sum of Weights Used	15587949

Response Profile			
Ordered Value	**RH**	**Total Frequency**	**Total Weight**
1	1 - Poor respiratory health	73	1190989
2	0 - Good respiratory health	924	14396960

Probability modeled is RH='1 - Poor respiratory health'.

Class Level Information		
Class	**Value**	**Design Variables**
lead	**1 - Positive lead exposure (>=1ug/dL)**	1
	0 - Negative lead exposure (<1ug/dL)	-1

Crude Weighted OR for the E-D relationship

The SURVEYLOGISTIC Procedure

Model Convergence Status
Convergence criterion (GCONV=1E-8) satisfied.

Model Fit Statistics		
Criterion	**Intercept Only**	**Intercept and Covariates**
AIC	8414339.4	8408511.7
SC	8414344.3	8408521.5
-2 Log L	8414337.4	8408507.7

Testing Global Null Hypothesis: BETA=0			
Test	**Chi-Square**	**DF**	**Pr > ChiSq**
Likelihood Ratio	5829.6764	1	<.0001
Score	5711.7896	1	<.0001
Wald	0.1907	1	0.6623

Type 3 Analysis of Effects			
Effect	**DF**	**Wald Chi-Square**	**Pr > ChiSq**
lead	1	0.1907	0.6623

Analysis of Maximum Likelihood Estimates						
Parameter		**DF**	**Estimate**	**Standard Error**	**Wald Chi-Square**	**Pr > ChiSq**
Intercept		1	-2.5297	0.1883	180.4600	<.0001
lead	**1 - Positive lead exposure (>=1ug/dL)**	1	0.0822	0.1883	0.1907	0.6623

Crude Weighted OR for the E-D relationship

The SURVEYLOGISTIC Procedure

Odds Ratio Estimates			
Effect	**Point Estimate**	**95% Wald Confidence Limits**	
lead 1 - Positive lead exposure (>=1ug/dL) vs 0 - Negative lead exposure (<1ug/dL)	1.179	0.563	2.466

Association of Predicted Probabilities and Observed Responses			
Percent Concordant	16.9	**Somers' D**	-.032
Percent Discordant	20.1	**Gamma**	-.086
Percent Tied	63.0	**Tau-a**	-.004
Pairs	67452	**c**	0.484

Age, gender, race, and income adjusted OR

The SURVEYLOGISTIC Procedure

Model Information		
Data Set	WORK.CLEANDATA	
Response Variable	RH	Respiratory health status
Number of Response Levels	2	
Weight Variable	WTINT2YR	Full Sample 2 Year Interview Weight
Model	Binary Logit	
Optimization Technique	Fisher's Scoring	
Variance Adjustment	Degrees of Freedom (DF)	

Number of Observations Read	997
Number of Observations Used	997
Sum of Weights Read	15587949
Sum of Weights Used	15587949

Response Profile			
Ordered Value	**RH**	**Total Frequency**	**Total Weight**
1	1 - Poor respiratory health	73	1190989
2	0 - Good respiratory health	924	14396960

Probability modeled is RH='1 - Poor respiratory health'.

Age, gender, race, and income adjusted OR

The SURVEYLOGISTIC Procedure

Class Level Information						
Class	**Value**	**Design Variables**				
lead	**1 - Positive lead exposure (>=1ug/dL)**	1				
	0 - Negative lead exposure (<1ug/dL)	-1				
age	**6 - Target population age, 6yrs**	1	0	0	0	0
	5 - Target population age, 5yrs	0	1	0	0	0
	4 - Target population age, 4yrs	0	0	1	0	0
	3 -Target population age, 3yrs	0	0	0	1	0
	2 - Target population age, 2yrs	0	0	0	0	1
	1 - Target population age, 1yr	-1	-1	-1	-1	-1
race	**5 - other, multi-racial**	1	0	0	0	
	4 - non-Hispanic black	0	1	0	0	
	3 - non-Hispanic white	0	0	1	0	
	2 - other Hispanic	0	0	0	1	
	1 - Mexican Americans	-1	-1	-1	-1	
income	**3 - Annual family income of greater than $55,000**	1	0			
	2 - Annual family income between $25,000 and $54,999	0	1			
	1 - Annual family income of less than $24,999	-1	-1			
gender	**2- female**	1				
	1 - male	-1				

Model Convergence Status
Convergence criterion (GCONV=1E-8) satisfied.

Age, gender, race, and income adjusted OR

The SURVEYLOGISTIC Procedure

Model Fit Statistics		
Criterion	**Intercept Only**	**Intercept and Covariates**
AIC	8414339.4	8058959.4
SC	8414344.3	8059028.1
-2 Log L	8414337.4	8058931.4

Testing Global Null Hypothesis: BETA=0			
Test	**Chi-Square**	**DF**	**Pr > ChiSq**
Likelihood Ratio	355405.932	13	<.0001
Score	332892.224	13	<.0001
Wald	27.1024	13	0.0120

Type 3 Analysis of Effects			
Effect	**DF**	**Wald Chi-Square**	**Pr > ChiSq**
lead	1	0.0006	0.9798
age	5	9.3228	0.0969
race	4	6.8070	0.1464
income	2	0.1890	0.9098
gender	1	3.1616	0.0754

Age, gender, race, and income adjusted OR

The SURVEYLOGISTIC Procedure

Analysis of Maximum Likelihood Estimates						
Parameter		**DF**	**Estimate**	**Standard Error**	**Wald Chi-Square**	**Pr > ChiSq**
Intercept		1	-2.6079	0.2521	107.0514	<.0001
lead	**1 - Positive lead exposure (>=1ug/dL)**	1	0.00538	0.2127	0.0006	0.9798
age	**6 - Target population age, 6yrs**	1	0.0693	0.4717	0.0216	0.8832
age	**5 - Target population age, 5yrs**	1	0.2676	0.4071	0.4320	0.5110
age	**4 - Target population age, 4yrs**	1	-0.4149	0.3742	1.2289	0.2676
age	**3 -Target population age, 3yrs**	1	-0.8238	0.4263	3.7342	0.0533
age	**2 - Target population age, 2yrs**	1	0.2942	0.3364	0.7646	0.3819
race	**5 - other, multi-racial**	1	0.3770	0.4778	0.6225	0.4301
race	**4 - non-Hispanic black**	1	0.2713	0.2838	0.9141	0.3390
race	**3 - non-Hispanic white**	1	0.0293	0.2936	0.0100	0.9205
race	**2 - other Hispanic**	1	-0.0713	0.6054	0.0139	0.9063
income	**3 - Annual family income of greater than $55,000**	1	-0.0987	0.2566	0.1480	0.7005
income	**2 - Annual family income between $25,000 and $54,999**	1	0.0933	0.2359	0.1565	0.6924
gender	**2- female**	1	-0.3069	0.1726	3.1616	0.0754

Odds Ratio Estimates			
Effect	**Point Estimate**	**95% Wald Confidence Limits**	
lead 1 - Positive lead exposure (>=1ug/dL) vs 0 - Negative lead exposure (<1ug/dL)	1.011	0.439	2.327
age 6 - Target population age, 6yrs vs 1 - Target population age, 1yr	0.584	0.177	1.922
age 5 - Target population age, 5yrs vs 1 - Target population age, 1yr	0.712	0.245	2.065
age 4 - Target population age, 4yrs vs 1 - Target population age, 1yr	0.360	0.135	0.956
age 3 -Target population age, 3yrs vs 1 - Target population age, 1yr	0.239	0.081	0.709
age 2 - Target population age, 2yrs vs 1 - Target population age, 1yr	0.731	0.307	1.742
race 5 - other, multi-racial vs 1 - Mexican Americans	2.673	0.798	8.951
race 4 - non-Hispanic black vs 1 - Mexican Americans	2.405	1.180	4.901
race 3 - non-Hispanic white vs 1 - Mexican Americans	1.888	0.928	3.843

Age, gender, race, and income adjusted OR

The SURVEYLOGISTIC Procedure

Odds Ratio Estimates			
Effect	**Point Estimate**	**95% Wald Confidence Limits**	
race 2 - other Hispanic vs 1 - Mexican Americans	1.708	0.377	7.743
income 3 - Annual family income of greater than $55,000 vs 1 - Annual family income of less than $24,999	0.901	0.401	2.026
income 2 - Annual family income between $25,000 and $54,999 vs 1 - Annual family income of less than $24,999	1.092	0.524	2.275
gender 2- female vs 1 - male	0.541	0.275	1.065

Association of Predicted Probabilities and Observed Responses			
Percent Concordant	64.5	**Somers' D**	0.306
Percent Discordant	33.9	**Gamma**	0.311
Percent Tied	1.5	**Tau-a**	0.042
Pairs	67452	**c**	0.653

Crude Weighted OR for the E-D relationship

The SURVEYLOGISTIC Procedure

Model Information		
Data Set	WORK.CLEANDATA	
Response Variable	RH	Respiratory health status
Number of Response Levels	2	
Weight Variable	WTINT2YR	Full Sample 2 Year Interview Weight
Model	Binary Logit	
Optimization Technique	Fisher's Scoring	
Variance Adjustment	Degrees of Freedom (DF)	

Number of Observations Read	997
Number of Observations Used	997
Sum of Weights Read	15587949
Sum of Weights Used	15587949

Response Profile			
Ordered Value	**RH**	**Total Frequency**	**Total Weight**
1	1 - Poor respiratory health	73	1190989
2	0 - Good respiratory health	924	14396960

Probability modeled is RH='1 - Poor respiratory health'.

Class Level Information		
Class	**Value**	**Design Variables**
lead	**1 - Positive lead exposure (>=2ug/dL)**	1
	0 - Negative lead exposure (<2ug/dL)	-1

Crude Weighted OR for the E-D relationship

The SURVEYLOGISTIC Procedure

Model Convergence Status
Convergence criterion (GCONV=1E-8) satisfied.

Model Fit Statistics		
Criterion	Intercept Only	Intercept and Covariates
AIC	8414339.4	8409459.7
SC	8414344.3	8409469.5
-2 Log L	8414337.4	8409455.7

Testing Global Null Hypothesis: BETA=0			
Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	4881.6712	1	<.0001
Score	4987.2871	1	<.0001
Wald	0.1914	1	0.6618

Type 3 Analysis of Effects			
Effect	DF	Wald Chi-Square	Pr > ChiSq
lead	1	0.1914	0.6618

Analysis of Maximum Likelihood Estimates						
Parameter		DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept		1	-2.4554	0.1733	200.6545	<.0001
lead	1 - Positive lead exposure (>=2ug/dL)	1	0.0758	0.1733	0.1914	0.6618

Crude Weighted OR for the E-D relationship

The SURVEYLOGISTIC Procedure

Odds Ratio Estimates			
Effect	Point Estimate	95% Wald Confidence Limits	
lead 1 - Positive lead exposure (>=2ug/dL) vs 0 - Negative lead exposure (<2ug/dL)	1.164	0.590	2.296

Association of Predicted Probabilities and Observed Responses			
Percent Concordant	22.5	Somers' D	0.012
Percent Discordant	21.3	Gamma	0.027
Percent Tied	56.3	Tau-a	0.002
Pairs	67452	c	0.506

Age, race, gender and income adjusted OR

The SURVEYLOGISTIC Procedure

Model Information		
Data Set	WORK.CLEANDATA	
Response Variable	RH	Respiratory health status
Number of Response Levels	2	
Weight Variable	WTINT2YR	Full Sample 2 Year Interview Weight
Model	Binary Logit	
Optimization Technique	Fisher's Scoring	
Variance Adjustment	Degrees of Freedom (DF)	

Number of Observations Read	997
Number of Observations Used	997
Sum of Weights Read	15587949
Sum of Weights Used	15587949

Response Profile			
Ordered Value	**RH**	**Total Frequency**	**Total Weight**
1	1 - Poor respiratory health	73	1190989
2	0 - Good respiratory health	924	14396960

Probability modeled is RH='1 - Poor respiratory health'.

Age, race, gender and income adjusted OR

The SURVEYLOGISTIC Procedure

Class Level Information						
Class	**Value**	**Design Variables**				
lead	**1 - Positive lead exposure (>=2ug/dL)**	1				
	0 - Negative lead exposure (<2ug/dL)	-1				
age	**6 - Target population age, 6yrs**	1	0	0	0	0
	5 - Target population age, 5yrs	0	1	0	0	0
	4 - Target population age, 4yrs	0	0	1	0	0
	3 -Target population age, 3yrs	0	0	0	1	0
	2 - Target population age, 2yrs	0	0	0	0	1
	1 - Target population age, 1yr	-1	-1	-1	-1	-1
race	**5 - other, multi-racial**	1	0	0	0	
	4 - non-Hispanic black	0	1	0	0	
	3 - non-Hispanic white	0	0	1	0	
	2 - other Hispanic	0	0	0	1	
	1 - Mexican Americans	-1	-1	-1	-1	
income	**3 - Annual family income of greater than $55,000**	1	0			
	2 - Annual family income between $25,000 and $54,999	0	1			
	1 - Annual family income of less than $24,999	-1	-1			
gender	**2- female**	1				
	1 - male	-1				

Model Convergence Status
Convergence criterion (GCONV=1E-8) satisfied.

Age, race, gender and income adjusted OR

The SURVEYLOGISTIC Procedure

Model Fit Statistics		
Criterion	**Intercept Only**	**Intercept and Covariates**
AIC	8414339.4	8058799.0
SC	8414344.3	8058867.7
-2 Log L	8414337.4	8058771.0

Testing Global Null Hypothesis: BETA=0			
Test	**Chi-Square**	**DF**	**Pr > ChiSq**
Likelihood Ratio	355566.334	13	<.0001
Score	333028.099	13	<.0001
Wald	27.5003	13	0.0106

Type 3 Analysis of Effects			
Effect	**DF**	**Wald Chi-Square**	**Pr > ChiSq**
lead	1	0.0069	0.9337
age	5	8.9710	0.1102
race	4	6.8243	0.1455
income	2	0.1842	0.9120
gender	1	3.1530	0.0758

Age, race, gender and income adjusted OR

The SURVEYLOGISTIC Procedure

Analysis of Maximum Likelihood Estimates						
Parameter		**DF**	**Estimate**	**Standard Error**	**Wald Chi-Square**	**Pr > ChiSq**
Intercept		1	-2.5988	0.2325	124.9265	<.0001
lead	**1 - Positive lead exposure (>=2ug/dL)**	1	0.0156	0.1880	0.0069	0.9337
age	**6 - Target population age, 6yrs**	1	0.0708	0.4539	0.0243	0.8761
age	**5 - Target population age, 5yrs**	1	0.2694	0.3978	0.4588	0.4982
age	**4 - Target population age, 4yrs**	1	-0.4134	0.3759	1.2091	0.2715
age	**3 -Target population age, 3yrs**	1	-0.8235	0.4328	3.6200	0.0571
age	**2 - Target population age, 2yrs**	1	0.2904	0.3314	0.7677	0.3809
race	**5 - other, multi-racial**	1	0.3806	0.4863	0.6127	0.4338
race	**4 - non-Hispanic black**	1	0.2676	0.2809	0.9080	0.3407
race	**3 - non-Hispanic white**	1	0.0313	0.2962	0.0112	0.9158
race	**2 - other Hispanic**	1	-0.0746	0.6128	0.0148	0.9032
income	**3 - Annual family income of greater than $55,000**	1	-0.0986	0.2593	0.1446	0.7038
income	**2 - Annual family income between $25,000 and $54,999**	1	0.0950	0.2401	0.1565	0.6924
gender	**2- female**	1	-0.3067	0.1727	3.1530	0.0758

Odds Ratio Estimates			
Effect	**Point Estimate**	**95% Wald Confidence Limits**	
lead 1 - Positive lead exposure (>=2ug/dL) vs 0 - Negative lead exposure (<2ug/dL)	1.032	0.494	2.156
age 6 - Target population age, 6yrs vs 1 - Target population age, 1yr	0.585	0.189	1.817
age 5 - Target population age, 5yrs vs 1 - Target population age, 1yr	0.714	0.257	1.981
age 4 - Target population age, 4yrs vs 1 - Target population age, 1yr	0.361	0.134	0.968
age 3 -Target population age, 3yrs vs 1 - Target population age, 1yr	0.239	0.080	0.717
age 2 - Target population age, 2yrs vs 1 - Target population age, 1yr	0.729	0.304	1.749
race 5 - other, multi-racial vs 1 - Mexican Americans	2.680	0.806	8.907
race 4 - non-Hispanic black vs 1 - Mexican Americans	2.393	1.169	4.899
race 3 - non-Hispanic white vs 1 - Mexican Americans	1.889	0.915	3.903
race 2 - other Hispanic vs 1 - Mexican Americans	1.700	0.363	7.955

Age, race, gender and income adjusted OR

The SURVEYLOGISTIC Procedure

Odds Ratio Estimates			
Effect	Point Estimate	95% Wald Confidence Limits	
income 3 - Annual family income of greater than $55,000 vs 1 - Annual family income of less than $24,999	0.903	0.404	2.016
income 2 - Annual family income between $25,000 and $54,999 vs 1 - Annual family income of less than $24,999	1.096	0.527	2.276
gender 2- female vs 1 - male	0.542	0.275	1.066

Association of Predicted Probabilities and Observed Responses			
Percent Concordant	64.6	Somers' D	0.308
Percent Discordant	33.8	Gamma	0.313
Percent Tied	1.6	Tau-a	0.042
Pairs	67452	c	0.654

Crude Weighted OR for the E-D relationship

The SURVEYLOGISTIC Procedure

Model Information		
Data Set	WORK.CLEANDATA	
Response Variable	RH	Respiratory health status
Number of Response Levels	2	
Weight Variable	WTINT2YR	Full Sample 2 Year Interview Weight
Model	Binary Logit	
Optimization Technique	Fisher's Scoring	
Variance Adjustment	Degrees of Freedom (DF)	

Number of Observations Read	997
Number of Observations Used	997
Sum of Weights Read	15587949
Sum of Weights Used	15587949

Response Profile			
Ordered Value	**RH**	**Total Frequency**	**Total Weight**
1	1 - Poor respiratory health	73	1190989
2	0 - Good respiratory health	924	14396960

Probability modeled is RH='1 - Poor respiratory health'.

Class Level Information		
Class	**Value**	**Design Variables**
lead	**1 - Positive lead exposure (>=3ug/dL)**	1
	0 - Negative lead exposure (<3ug/dL)	-1

Crude Weighted OR for the E-D relationship

The SURVEYLOGISTIC Procedure

Model Convergence Status
Convergence criterion (GCONV=1E-8) satisfied.

Model Fit Statistics		
Criterion	Intercept Only	Intercept and Covariates
AIC	8414339.4	8388719.9
SC	8414344.3	8388729.7
-2 Log L	8414337.4	8388715.9

Testing Global Null Hypothesis: BETA=0			
Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	25621.4661	1	<.0001
Score	22381.0234	1	<.0001
Wald	1.0913	1	0.2962

Type 3 Analysis of Effects			
Effect	DF	Wald Chi-Square	Pr > ChiSq
lead	1	1.0913	0.2962

Analysis of Maximum Likelihood Estimates						
Parameter		DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept		1	-2.7517	0.2913	89.2351	<.0001
lead	1 - Positive lead exposure (>=3ug/dL)	1	-0.3043	0.2913	1.0913	0.2962

Crude Weighted OR for the E-D relationship

The SURVEYLOGISTIC Procedure

Odds Ratio Estimates			
Effect	**Point Estimate**	**95% Wald Confidence Limits**	
lead 1 - Positive lead exposure (>=3ug/dL) vs 0 - Negative lead exposure (<3ug/dL)	0.544	0.174	1.704

Association of Predicted Probabilities and Observed Responses			
Percent Concordant	12.2	**Somers' D**	0.062
Percent Discordant	6.0	**Gamma**	0.344
Percent Tied	81.8	**Tau-a**	0.008
Pairs	67452	**c**	0.531

Age, race, gender and income adjusted OR

The SURVEYLOGISTIC Procedure

Model Information		
Data Set	WORK.CLEANDATA	
Number of Response Levels	2	
Weight Variable	WTINT2YR	Full Sample 2 Year Interview Weight
Model	Binary Logit	
Optimization Technique	Fisher's Scoring	
Variance Adjustment	Degrees of Freedom (DF)	

Number of Observations Read	997
Number of Observations Used	997
Sum of Weights Read	15587949
Sum of Weights Used	15587949

Response Profile			
Ordered Value	**RH**	**Total Frequency**	**Total Weight**
1	1 - Poor respiratory health	73	1190989
2	0 - Good respiratory health	924	14396960

Probability modeled is RH='1 - Poor respiratory health'.

Class Level Information						
Class	**Value**	**Design Variables**				
lead	**1 - Positive lead exposure (>=3ug/dL)**	1				
	0 - Negative lead exposure (<3ug/dL)	-1				
age	**6 - Target population age, 6yrs**	1	0	0	0	0

Age, race, gender and income adjusted OR

The SURVEYLOGISTIC Procedure

Class Level Information						
Class	**Value**	**Design Variables**				
	5 - Target population age, 5yrs	0	1	0	0	0
	4 - Target population age, 4yrs	0	0	1	0	0
	3 -Target population age, 3yrs	0	0	0	1	0
	2 - Target population age, 2yrs	0	0	0	0	1
	1 - Target population age, 1yr	-1	-1	-1	-1	-1
race	**5 - other, multi-racial**	1	0	0	0	
	4 - non-Hispanic black	0	1	0	0	
	3 - non-Hispanic white	0	0	1	0	
	2 - other Hispanic	0	0	0	1	
	1 - Mexican Americans	-1	-1	-1	-1	
income	**3 - Annual family income of greater than $55,000**	1	0			
	2 - Annual family income between $25,000 and $54,999	0	1			
	1 - Annual family income of less than $24,999	-1	-1			
gender	**2- female**	1				
	1 - male	-1				

Model Convergence Status
Convergence criterion (GCONV=1E-8) satisfied.

Age, race, gender and income adjusted OR

The SURVEYLOGISTIC Procedure

Model Fit Statistics		
Criterion	Intercept Only	Intercept and Covariates
AIC	8414339.4	8011899.3
SC	8414344.3	8011967.9
-2 Log L	8414337.4	8011871.3

Testing Global Null Hypothesis: BETA=0			
Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	402466.100	13	<.0001
Score	376072.582	13	<.0001
Wald	31.2562	13	0.0031

Type 3 Analysis of Effects			
Effect	DF	Wald Chi-Square	Pr > ChiSq
lead	1	2.0237	0.1549
age	5	9.6387	0.0861
race	4	8.0351	0.0903
income	2	0.2317	0.8906
gender	1	3.4437	0.0635

Age, race, gender and income adjusted OR

The SURVEYLOGISTIC Procedure

Analysis of Maximum Likelihood Estimates						
Parameter		DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept		1	-2.9455	0.3354	77.1129	<.0001
lead	1 - Positive lead exposure (>=3ug/dL)	1	-0.4150	0.2918	2.0237	0.1549
age	6 - Target population age, 6yrs	1	0.0675	0.4576	0.0218	0.8827
age	5 - Target population age, 5yrs	1	0.2502	0.4036	0.3842	0.5354
age	4 - Target population age, 4yrs	1	-0.4233	0.3742	1.2799	0.2579
age	3 -Target population age, 3yrs	1	-0.8361	0.4352	3.6913	0.0547
age	2 - Target population age, 2yrs	1	0.3117	0.3250	0.9199	0.3375
race	5 - other, multi-racial	1	0.3596	0.4977	0.5219	0.4700
race	4 - non-Hispanic black	1	0.3071	0.2795	1.2071	0.2719
race	3 - non-Hispanic white	1	0.00948	0.2956	0.0010	0.9744
race	2 - other Hispanic	1	-0.0241	0.6085	0.0016	0.9684
income	3 - Annual family income of greater than $55,000	1	-0.1254	0.2605	0.2316	0.6303
income	2 - Annual family income between $25,000 and $54,999	1	0.0728	0.2390	0.0929	0.7606
gender	2- female	1	-0.3222	0.1736	3.4437	0.0635

Odds Ratio Estimates			
Effect	Point Estimate	95% Wald Confidence Limits	
lead 1 - Positive lead exposure (>=3ug/dL) vs 0 - Negative lead exposure (<3ug/dL)	0.436	0.139	1.368
age 6 - Target population age, 6yrs vs 1 - Target population age, 1yr	0.570	0.180	1.802
age 5 - Target population age, 5yrs vs 1 - Target population age, 1yr	0.684	0.242	1.934
age 4 - Target population age, 4yrs vs 1 - Target population age, 1yr	0.349	0.131	0.929
age 3 -Target population age, 3yrs vs 1 - Target population age, 1yr	0.231	0.077	0.693
age 2 - Target population age, 2yrs vs 1 - Target population age, 1yr	0.727	0.305	1.735
race 5 - other, multi-racial vs 1 - Mexican Americans	2.750	0.809	9.345
race 4 - non-Hispanic black vs 1 - Mexican Americans	2.610	1.289	5.282
race 3 - non-Hispanic white vs 1 - Mexican Americans	1.938	0.933	4.026
race 2 - other Hispanic vs 1 - Mexican Americans	1.874	0.407	8.638

Age, race, gender and income adjusted OR

The SURVEYLOGISTIC Procedure

Odds Ratio Estimates			
Effect	Point Estimate	95% Wald Confidence Limits	
income 3 - Annual family income of greater than $55,000 vs 1 - Annual family income of less than $24,999	0.837	0.376	1.864
income 2 - Annual family income between $25,000 and $54,999 vs 1 - Annual family income of less than $24,999	1.020	0.497	2.094
gender 2- female vs 1 - male	0.525	0.266	1.037

Association of Predicted Probabilities and Observed Responses			
Percent Concordant	66.3	Somers' D	0.345
Percent Discordant	31.8	Gamma	0.352
Percent Tied	1.9	Tau-a	0.047
Pairs	67452	c	0.672