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TARGETING REDUCED ASTHMA HOSPITALIZATIONS THROUGH GEOSPATIAL STATISTICS: SECONDARY RESEARCH OF PREVENTABLE ASTHMA HOSPITALIZATIONS

A Thesis

Submitted to the Graduate Faculty of the

National University School of Business & Management

in partial fulfillment of the requirements for the degree of

Master of Science in Business Analytics

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May 2019

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I dedicate this first and foremost to Shannon: you picked up all the slack and took care of our family through numerous late-night studies and classes. I have always wanted to succeed in your eyes and make you proud that I am yours. Also, to Brendan, for telling me it was OK when I was not available to play. We will get the MGB running someday, Bug. Finally, to Lochlan, whose surprise addition to the family mandated a much-needed break from school before my final classes, even if you did not let me have much sleep. It's definitely well past time for us to get to know each other now.

Thank you and I love you all so very much.

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Acknowledgments

Thank you to Dr. David Andrews, President of National University; Dr. John Cicero, Vice Provost of Academic and Faculty Affairs at National University; and Patricia Cardozo, National University Associate Director of the NU Scholars Program and Center for Student Engagement and Activities. There are not words for my appreciation of both your invitation and acceptance of me into the NU Scholars Program; it propelled me to push harder and excel in every class. Your dedication to the entire National University student body is an inspiration for community excellence.

As the professors most responsible for my learning over the course of this program, I thank Dr. Tyler Smith, Professor and Chair of the National University School of Health and Human Services; Dr. Ebrahim Karimi-Tarshizi, National University Adjunct Professor of Data Science; and Dr. Jed Baker, National University Core Adjunct Economics Faculty. Your methodology and passion for teaching and focus on student learning through honest, constructive, and beneficial, feedback provided an immediate foundation for this program and, with each class, taught new and amazing skills that I was able to immediately apply at my office. Additional thanks to Dr. Smith, who wrote a letter of recommendation for me to the NU Scholars Program and who agreed to be an advisor for this capstone many months after our last class together, as well as Dr. Karimi-Tarshizi for building an analytics family from an extremely diverse group of Business Analytics and Data Science students.

None of this would have been possible without the support of the faculty, leadership, and staff, within the Department of Medicine at University of California San Diego School of Medicine. Thank you to Dr. Wolfgang H. Dillmann, Department Chair; Amir Schangali, Department Business Officer; and Cheryl Correia, previous Assistant Department Business Officer, for being understanding and supportive of my studies and research. Special thanks to Ericka Moore, Finance Manager, for your dedication and work, and especially for your understanding when lack of sleep left me more scattered than normal.

Incredibly special thanks to Dr. Praveen Akuthota, Associate Professor of Pulmonary, Critical Care, and Sleep Medicine, University of California San Diego, and his Staff Research Associate, Damaris Diaz, for advising me through this thesis and IRB. I cannot express in words my gratitude to you both for your support, advice, and wisdom. Additional thanks to Jennifer Johnson, Division Administrator for UCSD Division of Pulmonary, Critical Care, and Sleep Medicine, for introducing us.

Finally, thank you to my thesis classmates for accepting me when I transferred to the Data Science cohort, as well as ET's NU Analytics Geeks – I still cannot believe we won the *2019 Big Data Hackathon for San Diego* while in the middle of writing our theses!

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Abstract

This research investigated correlations of asthma and uncontrolled-asthma prevalence in California controlling for demographic, health, health insurance and access, and socioeconomic, factors, in order to develop a predictive model and apply it to the California population for creation of a targeted outreach identification tool. The study objectives were for the tool to enable health care providers to develop targeted outreach that would improve health care and reduce preventable hospitalizations, while the overall project would generate a population health framework that could be applied to other diseases and effectively scale to more granular health data. Adult California Health Interview Survey public-use data from 2011 through 2016 were utilized for model generation, with those models being applied to the 2017 five-year American Community Survey population estimates for California to predict disease prevalence. Generated models were statistically significant and resulted in identification of asthma prevalence binomial logistic regression coefficients for sex, race, citizenship, health insurance status, and income level. The uncontrolled-asthma binomial regression model resulted in identification of coefficients for sex, race, and income model. After application of the model against population data, the *Asthma Probability Model Dashboard* was published to Tableau® Public at https://mcvanderbilt.com/asthma-dashboard. In addition to providing the asthma dashboard, this study resulted in development of a framework that may be readily applied to other disease conditions and scaled to confidential health care data for more precise reporting.

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List of Abbreviations

API .....Asthma-Predictive Indices

AIC.....Akaike Information Criterion

BMI .....Body Mass Index

CDC .....United States Department of Health and Human Services Centers for Disease Control and Prevention

CHC .....Community Health Centers

CHIS .....California Health Interview Survey

CI.....Confidence Interval

EPA .....United States Environmental Protection Agency

ED .....Emergency Department

EMR.....Electronic Medical Record

FPL.....Federal Poverty Level

MLE .....Maximum Likelihood Estimates

NCD .....Non-Communicable Disease

NIH .....United States National Institute of Health

PHI .....Personal Health Information

PUF .....Public Use File(s)

PUMA .....Public Use Microdata Areas

San Diego....San Diego County, California, United States of America

UCLA.....University of California Los Angeles

UCSD.....University of California San Diego

UN.....United Nations

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Chapter 1: Introduction

Asthma is a complex condition afflicting hundreds of millions of children and adults worldwide. It is responsible for numerous premature deaths and tens of billions of dollars of incremental medical cost in the United States. Within San Diego County (San Diego), asthma is responsible for the death of approximately 35 adults and children each year (Community Epidemiology, 2009). This statistic is especially concerning when viewed in the context that the United States Department of Health and Human Services Centers for Disease Control and Prevention (CDC) states that asthma deaths are "largely preventable, particularly among children and young adults" (*AsthmaStats: Asthma as the Underlying Cause of Death*, 2018). Even hospitalizations for asthma are considered partially preventable, but targeting those at-risk individuals is a daunting prospect for government agencies and health care providers.

The CDC has provided a roadmap to assist with population outreach through its Asthma Surveillance Pyramid. As shown in Figure 1, the base of the pyramid includes every individual with asthma. The next two pyramid levels are the population of asthmatics that have scheduled healthcare visits for asthma management and those who require unscheduled office visits for asthma management. The patients of both levels have health insurance with regular access to quality medical care, as well as an understanding of their asthma management plans. Compared to those having scheduled healthcare visits, the asthmatics with unscheduled office visits have more severe asthma conditions or encounter greater asthma triggers, necessitating increased support from health care professionals. Beyond this level, the population has a distinct shift to patients having potentially preventable instances of escalated health care contact. As the severity

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of asthma encounters ascends the pyramid, there is generally a corresponding decrease in access to quality health care. This may be caused by personal financial factors or occupational factors as they relate to health insurance availability. The associated lack of health care insurance is significant, as asthmatics require regular monitoring at least bi-annually by a qualified health professional, in addition to more immediate access when conditions exacerbate (Meng, Babey, Malcolm, Brown, & Chawla, 2003). This also aligns with the need for greater patient education to ensure understanding of the chronic disease and required trigger avoidance, treatment, and symptom management (Fergeson, Patel, & Lockey, 2017, p. 438).

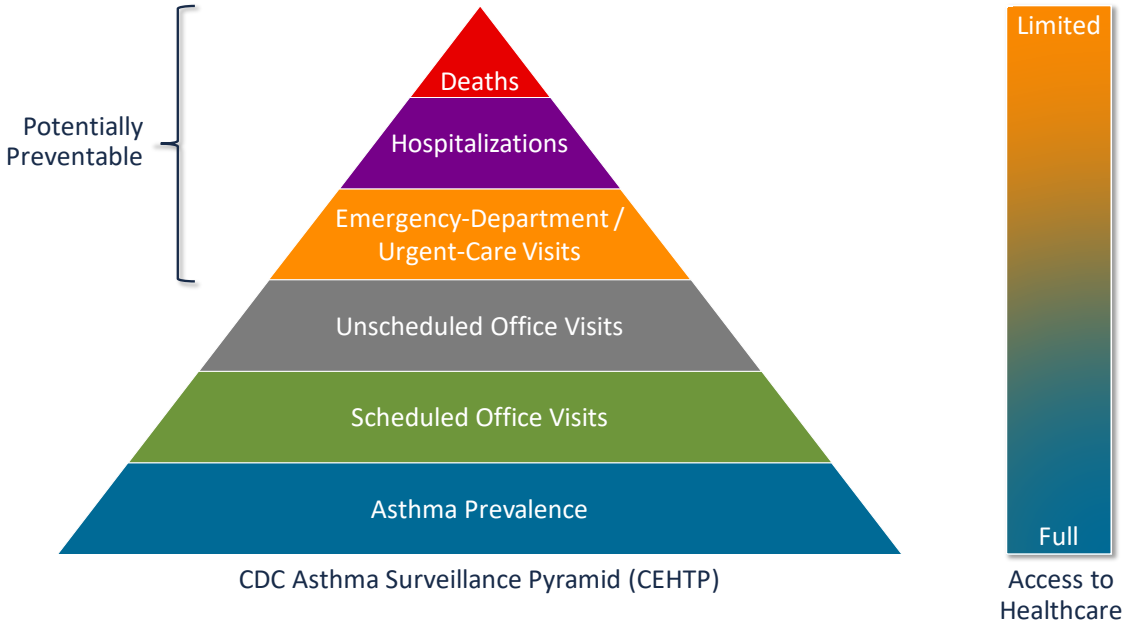

Figure 1: CDC Asthma Surveillance Pyramid, which provides a generalized, visual, reference of the relationship of asthma severity and health care access (adapted from "Asthma Surveillance," n.d.).

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While a beneficial roadmap, the CDC Asthma Surveillance Pyramid does not answer the question of how to target at-risk asthma populations for outreach. To be both generally effective, as well as cost effective, outreach must be targeted to the most at-risk, local, populations. This is possible at the juncture of health care data and visualized geospatial statistical analyses. Although health care has leveraged geospatial analysis since 1874 (Peterson, 2017, p. 1), health care geospatial analyses have primarily focused on generalized epidemiology and service-access concerns. Few published studies show utilization of geospatial visualization and local health information to identify specific areas and patients for outreach. Performance of such outreach in a cost-effective manner will enable health improvements and save lives within the local population, as well as improve financial performance and community perception for the health system leader in this area. This study aims to provide the tools for targeted asthma outreach in San Diego, as well as create a framework for health systems to leverage geospatial statistics and health data, such as federal and statewide surveys, as well as electronic medical records (EMR), for population improvements.

This unique study to create an outreach framework aligns well with Senate Bill 207 (SB-207) introduced in California in February 2019. Recognizing the need for improved health-care outreach and education services, passing of SB-207 will include asthma prevention service as a covered benefit under Medi-Cal, which provides health-care benefits for qualified, low-income, individuals in California. These services would include asthma education as well as in-home outreach for severe asthmatics (Hurtado, Chiu, & Reyes, 2019; RAMP staff, 2019).

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1.1 Note on Gender, Sex, and Sexual Identity References

Gender, genetic or biological sex, and sexual orientation represent politically charged topics that must be addressed to minimize implicit bias in both reading and reporting on topics, especially within a health care domain. New laws, such as Senate Bill 179 in California (SB179), are slowly beginning to recognize this through requirements that gender now be classified as male, female, or non-binary (Atkins & Wiener, 2017). Due to the recent implementation of SB179, however, such data are not yet available for study. Therefore, all references herein to sex are based upon the *APA Dictionary of Psychology* referring "especially to physical and biological traits" (VandenBos & American Psychological Association, 2015) limited to representing the assumed, binary, biological, sex of male (heterogametic sex; XY chromosomes) and female (homogametic sex; paired X chromosomes) identified in available data and reports.

This study additionally recognizes the numerous human sexualities. For the purpose of individual subclassifications, references will generally utilize the terms of straight or heterosexual as separate from LGBT+, representing the combination of all sexualities exclusive of heterosexual. Specific analyses of subsets of the LGBT+ population will utilize the generally accepted letter terminology for those classifications, such as LGB to represent lesbian, gay, and bisexual, persons.

1.2 Background

The "Expert Panel Report 3 (EPR-3): Guidelines for the Diagnosis and Management of Asthma-Summary Report 2007" ("EPR-3," 2007) defines asthma as an inflammatory condition of the bronchial tubes that presents as chronic or intermittent

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symptoms of airflow obstruction and hyperresponsiveness. Inflammation stimulates additional airflow constriction through bronchoconstriction, which is the tightening of the smooth muscles surrounding the bronchial tubes; airway edema, or swelling; and mucus hypersecretion that further narrows the airway ("EPR-3," 2007, p. S99). Asthma is not a singular disease, but rather a heterogeneous group of complex conditions with high variation of presentation and treatment (Lötvall et al., 2011, p. 355). Through the tenth revision by the World Health Organization of the *International Statistical Classification of Diseases and Related Health Problems* (ICD-10), the respiratory-system disease of asthma is clinically classified by severity, persistence, and complication (see Appendix A Table A1 for list of asthma ICD-10 codes). Recent studies are working to more strategically classify asthma into different phenotypes that are based on clinical similarities, and endotypes that are based on pathological similarities (Dean & Niven, 2017, p. 393). So complex are the asthma endotypes, which are believed to have varied physiological causes (Siddiqui et al., 2019, p. 4), that there are even research studies investigating how best to precisely target patients for appropriate clinical trials (Akuthota, Jain, & Vijayanand, 2017). Table A2 details the overlap of phenotypes and endotypes as proposed by Lötvall et al.

Asthma has varied symptoms far beyond the wheezing that is popularly associated with the disease. Unlike many other conditions for which definitive testing is possible, there are no definitive, confirmatory, tests to biologically determine a diagnosis of asthma (Kaiser Permanente, 2015, p. 2). It symptomatically presents as a cough; dyspnea, colloquially referred to as exercise-induced asthma; orthopnea, or breathing difficulties when lying flat; shortness of breath; stridor, which is a high-pitched sound

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made while inhaling and which may be caused by upper airway obstruction; and/or wheezing (Venes, 2017, pp. 743, 1703, 2251). In addition, asthma may present with chest pain; tachycardia, which is an abnormally rapid heartbeat (Venes, 2017, p. 2303); or anxiety, as reported in "Asthma and social anxiety in adolescents" (Bruzzese, Fisher, Lemp, & Warner, 2009).

Within the *Global Asthma Report 2018*, it is stated that 339-million people are affected by asthma globally, resulting in it being considered a common non-communicable disease (NCD) by the United Nations (UN). Further, it is listed as the 16th-highest condition resulting in individuals living their lives with disability (Addo-Yobo et al., 2018, p. 6). Of those with chronic asthma, a small percentage of at least 3% to 5% present with severe asthma, chronic symptoms, or reduced lung function not improved with inhaled medications (News Editors & Health/Medical Writers, 2002, pp. 1-2). These patients have significant, negative, impacts to their lives from the disease, as well as increased risk of hospitalization and mortality.

The *Asthma in California: Findings from the 2001 California Health Interview Survey* report on the California Health Interview Survey (CHIS) for 2001 indicated that 11.9% ($N = 3.9$ million) of the California population had a lifetime asthma prevalence, meaning they were diagnosed with asthma at some point in their lives irrespective to current presentation of asthma symptoms. This lifetime prevalence rate has increased over time to 13.1% of adults and 12.5% of children in CHIS 2010 (Milet, Lutzker, Flattery, & Wohl-Sanchez, 2013) and 13.8% of adults and 13.7% of children in CHIS 2014 (Milet, 2017). Based on data from 2014 through 2016, the overall rate in California

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is 14.8% as of 2015-2016, with a mortality rate for asthma of 9.6 per one-million residents (CDPH Environmental Health Investigations Branch, 2015-2016).

San Diego County (San Diego) has a 14.1% asthma prevalence rate, which is slightly below the 14.8% rate for the state (CDPH Environmental Health Investigations Branch, 2015-2016). Based upon the V2017 census population estimate of 3,337,685 residents (United States Census Bureau, 2017), this indicates that nearly one-half of one-million residents suffer from the disease. Improved from the state rate, San Diego has an asthma mortality of 6.5 per one million residents (CDPH Environmental Health Investigations Branch, 2015-2016). This means that approximately 22 adults and children in San Diego lose their lives to asthma annually. This is improved from the nearly 35-per-year average from 2003 through 2007 (Community Epidemiology, 2009), but remains an unacceptable and largely preventable loss of lives within the San Diego community.

San Diego contains one of the most sophisticated health care industries in the United States, boasting numerous academic medical centers and clinically focused hospitals. This $6.9 billion local industry includes 25 hospitals and greater than 26,000 health care and social-assistance facilities (San Diego Regional Economic Development Council, 2018). As a result, San Diego has historically trended well below the statewide average for preventable hospitalizations, with 962 per 100,000 people in 2016 relative to the state's 1,049, although this remains more than 32% above the target of 727 set by the State of California (Let's Get Healthy California, n.d.).

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1.3 Problem Statement

Asthma prevalence and its impact to quality of life continues to increase, with the most at-risk groups of patients not receiving regular condition-management assistance due to lack of quality health care access. No targeted outreach approach is currently available through which health care professionals may identify those individuals for symptom mitigation and hospitalization prevention.

1.4 Research Hypotheses

Geospatial analysis of asthma prevalence statistics adjusted for confounders, such as demographics, socioeconomic condition, and sexual orientation, will identify San Diego locations and sub-populations to target for asthma-control outreach to reduce preventable hospitalizations.

1.5 Objectives

This study leveraged CHIS Public Use File (PUF) data from 2011 through 2016. CHIS contains the greatest sample repository of state health information, containing a high number of cross-sectional samples with a broad variable set (Smith & Smith, 2017). Analytical accuracy of CHIS is increased through inclusion of weighting variables designed to compensate for bias in sample selection. Categorical analysis was applied to the dichotomous, nominal, and ordinal, data; no continuous variables were leveraged within the final analytical dataset. Testing for variable multicollinearity and confounders was performed along with logical examination of variables for expected linear connectivity. Multinomial and binomial univariate and multivariate regressions were performed in addition to executing decision-tree modeling in order to identify those variables most relevant for retrospective modeling of asthma prevalence. Pearson's chi-

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square test and the concordance statistic (C-Statistic) were utilized to test the null hypothesis of no difference in asthma outcomes between population subgroups.

CHIS PUF is deidentified and cannot be utilized for geocoding of results. Therefore, asthma and asthma-hospitalization models were developed for application against publicly available information from the United States Census Bureau Five-Year American Community Survey for 2017 (ACS). The ACS is a continuous survey performed randomly throughout the United States, including the District of Columbia and Puerto Rico, to provide more real-time population information to industry and government institutions than available from the ten-year census. Similar to CHIS, ACS includes variance replicate data to minimize bias and allow for extrapolation of the survey to the population. In addition, ACS is coded by Public Use Microdata Area (PUMA), which are non-overlapping geographic areas containing approximately 100,000 to 200,000 residents each.

The application of the CHIS models to the ACS data will enable geostatistical mapping by PUMA throughout California. The final result of this effort was creation of an interactive heat map of San Diego that may be filtered by identified subpopulation. By leveraging mass, public, data, this study proves the population health framework for leveraging geospatial statistics to improve health care outcomes and research targeting procedures.

Equation 1 details the planned, initial, modeling algorithm for asthma based on binomial logistic regression and subject to change through descriptive analysis of correlative factors. It is anticipated based on available research review that the probability of being an asthmatic, grouped by PUMA, is the combination of race and

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ethnicity classification, which is based on the 2001 Department of Finance definition of Latino, non-Latino other single race, non-Latino American Indian or Alaskan Native, non-Latino Asian, non-Latino African American, non-Latino White, non-Latino multiracial; binary, genetic, sex; nominal body mass index (BMI) classification; ordinal sexuality variable; classified occupation; type of health care insurance; classification group for partner or marriage status; primary language spoken as a proxy for home country of origin (nativity); and nominal age group classification. Equation 2 shows the similar modeling planned to determine hospitalization risk factors for current asthmatics.

$$Logit(CA) = \beta_0 + \sum_{i=1}^{n} \beta_i X_i + \epsilon \quad (1)$$

where $Logit(CA)$: inverse of the logistic transform of the occurrence probability for the dependent and dichotomous variable, current asthmatic

β_0: interception at y-axis

β_i: regression coefficient of X_n

X_n: predictor variables including nominal race and ethnicity classification; binary, genetic, sex; nominal body mass index categorization; ordinal sexuality variable; classified occupation; type of health care insurance; partnership/marriage classification; primary language spoken; and nominal age group

ϵ: error factor of the model

$$Logit(HCA) = \beta_0 + \sum_{i=1}^{n} \beta_i X_i + \epsilon \quad (2)$$

where $Logit(HCA)$: inverse of the logistic transform of the occurrence probability for the dependent and dichotomous variable, hospitalized current asthmatic

β_0: interception at y-axis

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β_i: regression coefficient of X_n

X_n: predictor variables including nominal race and ethnicity classification; binary, genetic, sex; nominal body mass index categorization; ordinal sexuality variable; classified occupation; type of health care insurance; partnership/marriage classification; primary language spoken; and nominal age group

ϵ: error factor of the model

After performing the quantitative analysis to identify statistically significant, dependent, variables, this information will be converted to geospatial polygons for visualization through application of the model against census data by PUMA. Indicators and additional layers will be utilized to differentiate between disparate sub-populations. Upon completion, these heat maps of San Diego may be utilized to identify at-risk sub-populations for targeted outreach to reduce asthma morbidity and mortality, improve quality of life for affected patients, and mitigate preventable hospitalizations in a cost-effective manner.

A secondary objective of this project is to provide information and analytical outreach framework for the San Diego Team Asthma Management using Phenotypes (STAMP) project. STAMP is a University of California San Diego (UCSD) project sponsored by the National Institute of Health (NIH) and intended to create a San Diego clinical center that better matches asthma patients to clinical trials based on the specific endotypes and phenotypes investigated (Akuthota et al., 2017, para. 1).

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1.6 Limitations of the Study

A significant limitation of this study is the use of state-level results to develop a model for application by PUMA. While providing a solid framework and the only available analytical tool of this type, phenotypic asthma differences across the state will not be sufficiently mapped. An initial compensatory plan was to leverage University of California San Diego (UCSD) Health Electronic Medical Record (EMR) data. Given the coverage of Personal Health Information (PHI) under the Health Insurance Portability and Accountability Act of 1996 (HIPAA), necessary research certification was obtained, and a project plan was approved by the UCSD Institutional Review Board (IRB). Due to several limitations with availability of EMR data, partially due to variables not yet made available for research pending a planned EMR upgrade, this approach was discarded in lieu of the larger CHIS analysis. The framework developed through this study will benefit future EMR modeling with more refined analysis.

Available data does not contain nativity information for subjects, nor does it include details regarding the first-, second-, or third-world status of that country. As identified through the hygiene hypothesis and farming effect on asthma, this is a known factor in prevalence of asthma conditions. Citizenship information within data shall be utilized as a proxy for nativity. This will add bias error to the study, as naturalized and non-citizens may be from first-, second-, and third-world countries, while the assumption is essentially that such individuals are primarily from third-world countries. Use of language as a proxy for, or additional indicator of, this information was investigated, but sufficient information granularity was not available.

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A key factor for this study involves identification of asthmatics, which necessitates an individual having had a medical diagnosis of asthma, as well as symptoms and conditions sufficient to warrant medical attention. Due to the association of health care access and medical insurance, this creates inherent bias against the under-insured and uninsured population. This creates significant analytical risk especially in an area such as San Diego, for which both the city and county were ranked fourth highest in the U.S. for homeless in 2018 (Henry et al., 2015, p. 20). Targeting that most at-risk population requires survey data more closely aligned with symptoms of asthma than diagnosis. Such customized data was not feasible within the confines of this study.

Much of the data being reviewed involves human interaction for the recording and modification of data. This manual process inherently includes the expectation of data-entry errors, miscoding, and missing information. Especially as pertains to location information, data will not be connected to a secondary source for validation or interpolation. However, the use of large and public datasets from which many studies are annually performed does increase the perceived validity of utilized information.

Specific to the geospatial analysis, home location for patients is only accurate when reported, with the error factor from change increasing significantly thereafter. Individuals are constantly moving and this migration between PUMAs will create compounded error factors the further in time results are reported from the data entry point. Study results will present a roadmap for patient outreach, but the developed framework to identify patients requires incorporation into an automated update algorithm to assure continued validity.

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For a thorough analysis of the asthmatic population, air quality information should be included in any geospatial analysis due to its effect on asthma prevalence and severity. As identified by Vanderbilt et al. in "Smart city improvements for environmental health in San Diego," only six EPA air quality monitors exist in San Diego and recorded environmental variables vary drastically by monitor (2019). In order to incorporate such analysis in future studies, a near-real-time and cost-effective platform for localized environmental factors will need to be implemented (Vanderbilt et al., 2019).

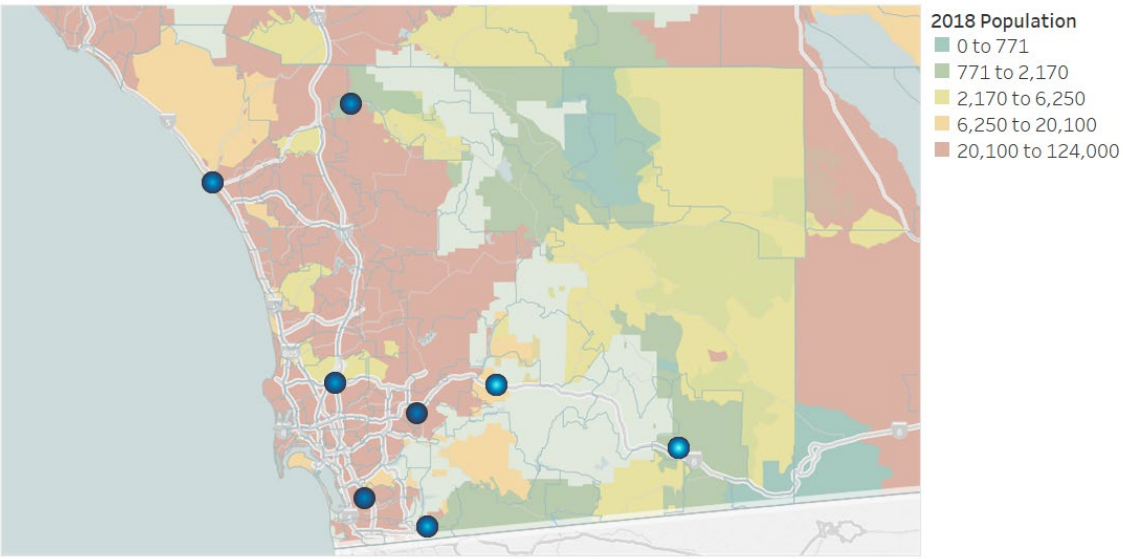

Figure 2: San Diego EPA monitoring sites relative to 2018 population levels. Adapted from "Smart city improvements for environmental health in San Diego" (Vanderbilt et al., 2019).

1.7 Summary

Asthma is a complex disease affecting millions of individuals worldwide and nearly one-half of one-million individuals within San Diego. Individuals require regular access to quality health care in order to partially prevent hospitalizations and largely

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prevent deaths from the disease. By performing statistical analyses to identify correlating factors with asthma and geospatially presenting such information, local subpopulations may be specifically targeted for health care outreach. The next chapter will discuss current research surrounding asthma, as well as the basis for identification of asthma-influencing factors.

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Chapter 2: Literature Review

Asthma is not a new medical discovery and references to it date back thousands of years. Thought to be one of the earliest references to asthma is the *Huang Ti Nei Ching Su Wên* (The Yellow Emperor's Classic on Internal Medicine), which was published between 3000 and 250 BC with some question as to whether by multiple authors or the mythical father of Chinese herbal medicine. Translated, this text notes what are now recognized as multiple symptomatic presentations of asthma:

> Man is afflicted when he cannot rest and when his breathing has a sound (is noisy) – or when he cannot rest and his breathing is without any sound. He may rise and rest (his habits of life may be) as of old and his breathing is noisy; he may have his rest and his exercise and his breathing is troubled (wheezing, panting); or he may not get any rest and be unable to walk about and his breathing is troubled. There are those who do not get a rest and those who rest and yet have troubled breathing. (Veith & Barnes, 2015, p. 252)

In the article "History of Asthma (Part One)- In the Beginning" (2017), Cannizzaro notes other early texts of asthma include the Georg Ebers papyrus from circa 1550 BC in Egypt that noted use of a device to aid in restricted breathing, as well as the Babylonian *Code of Hammurabi*, which documented asthmatic symptoms in 1792 BC. Hippocrates, however, is considered to have first used the term "asthma" (Greek: *aazein*) to describe a respiratory symptom associated with the environment and certain occupations (Cannizzaro, 2017, para. 3-5). In "A brief history of asthma" (2018), Felman notes various other reports of asthma and possible treatments throughout the ages, but that it was not until 1892 that Sir William Osler, one of the John Hopkins Medical School

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founders, developed a clinical diagnosis of asthma and the use of over-the-counter bronchodilators to treat airway spasms. Sadly, bronchodilators provided only short-term mitigation of asthma symptoms, not long-term control, and as asthma prevalence continued to increase, an epidemic of asthma mortality started in the 1960s. Clinical trials into the use of corticosteroids for treatment of asthma were initiated in the 1970s, leading to understanding of the inflammatory nature of the disease and subsequent prescription of daily treatment medications in the 1980s. It is only over the past decade that the connection of asthma to the immune system has begun to be researched, as well as the identified need for regular and on-going asthma management by health care professionals (Felman & Sullivan, 2018).

Although humanity has had an awareness of the respiratory symptoms and condition of asthma for nearly the breadth of known civilization, much about the disease and improved treatment of asthma remains elusive. Significant medical research into asthma is performed annually within the United States, with the National Institute of Health (NIH) alone issuing grants estimated to total $1.6 billion from 2014 through 2019 ("Estimating of Funding for Various RCDC," 2018). Many of these studies focus on risk prevalence of disadvantaged individuals, proper classification of disease subtypes, and, more specifically, genetic variations affecting disease outcomes. However, there has been limited research published regarding methods by which local subpopulations of at-risk individuals may be identified and targeted for health care outreach to reduce impacts to quality-of-life and mortality, as well as decrease preventable hospitalizations that drain limited medical resources. Investigation of existing literature identifies generalized research groupings, such as the prevalence and impact of asthma; key factors affecting

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the disease, such as the environment and climate change, demographics and socioeconomic conditions, obesity, and sexual orientation; and population-level geospatial analysis. Figure 3 provides visualization of the categories and publication years of reviewed literature.

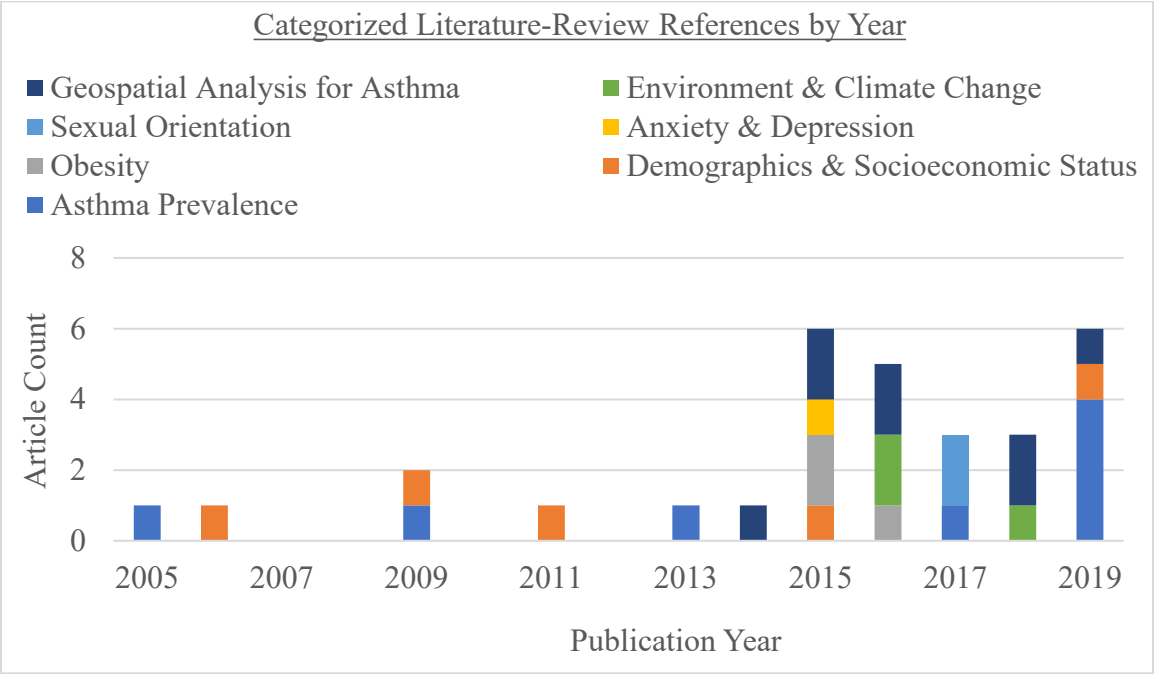

Figure 3: Categorized chart of literature-review references by publication date.

2.1 Asthma Prevalence and Environment

The hygiene hypothesis is a causative factor partially attributed to asthma prevalence and its disproportionate increase in the first world. Its antithesis, the farming effect on asthma, is the theory that childhood farming exposure reduces asthma prevalence due to greater microbial exposure at an early age (Timm et al., 2019, p. 1). Timm et al., investigated the farming effect on asthma through a three-generation study observing the migration of individuals between metropolitan and rural environments depending upon their personal asthma history. Relative risks were estimated through

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binary regression models after controlling for other, causative, factors (Timm et al., 2019, p. 2). The study determine that additional research was need regarding the subject, but interestingly discovered that parents with asthma were statistically more likely to migrate between environments, especially prior to having children, than those without asthma (Timm et al., 2019).

These concepts of childhood exposure effects on asthma prevalence were previously investigated in "Generational patterns of asthma incidence among immigrants to Canada over two decades: A population-based cohort study" (Radhakrishnan et al., 2019), which found increased asthma risk among children of immigrants than either their immigrant parents or other children born outside Canada. The study analyzed 11.7-million health records from Ontario, Canada, to identify asthmatics and connected the dataset with the Canadian immigration database to classify immigrants and descendants of immigrants. Controlling for age and sex, the correlation between asthma incidence and nativity was statistically investigated. The asthma incidence rate ratio (IRR) was determined to be significantly higher for Canadian-born children of immigrants than their parents or immigrant children (Radhakrishnan et al., 2019).

A review of recent studies by Katsoulis, Ismailos, Kipourou, and Kostikas, "Microbiota and asthma: Clinical implications" (2019), sought to investigate the pathogenic source for asthma. Inspired by effective treatments of chronic asthma with antibiotics and the identification of early-life exposures on asthma, they looked to link existing research into the subject. They found that the microbial colonization of the airways related to both inhalation of such microbes, as well as transfer of gut microbes through gastric reflux. Further evidence was found to show that many phenotypes and

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endotypes of asthma appear connected to specific bacterial species. The review concluded that a pathogenic connection exists for asthma, but that additional research is needed to clarify the microbial roles, as well as develop clinical trials to leverage this understanding and generate additional control and treatment protocols (Katsoulis et al., 2019).

Lovinsky-Desir et al. (2019), recently modeled the interaction between air pollution and urgent childhood asthma events controlling for neighborhood classification and socioeconomic status, and confirmed increased asthma prevalence in higher-pollution areas. Contradictory to expectations, however, their study "Air pollution, urgent asthma medical visits and the modifying effect of neighborhood asthma prevalence" (2019) found that additional air pollutants were only associated with asthma severity increases in lower asthma prevalence neighborhoods (LAPN). The active-participant study of asthmatics examined children from middle-income families through an associated insurance provider within New York City. Based on ZIP, pollution data was additionally incorporated from the New York City Community Air Survey, and census data was applied from the 2000 United States census. Chi-square tests and T-tests examined demographics and asthma events between LAPN and higher asthma prevalence neighborhoods (HAPN). Increased levels of street-level nitrogen dioxide (NO_2), atmospheric particulate matter with diameter less than 2.5 micrometers ($PM_{2.5}$), and elemental carbon (EC), were found to result in statistically significant increases of urgent asthma events. However, after adjusting for the dichotomous LAPN or HAPN variable, the statistically significant increase in urgent asthma events was only confirmed in children within LAPN neighborhoods. Overall results confirmed the link between air

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pollution and urgent asthma events, but additionally identified comorbidity from socioeconomic status creating a limiting factor in doctors' visits for urgent asthma events until a certain severity threshold was achieved. This study not only confirms the need for pollution control and severe increase in risk for respiratory-compromised patients, but also the need to eliminate income disparities for health care in order to properly treat patients and reduce preventable hospitalizations and symptom exacerbations (Lovinsky-Desir et al., 2019).

Published in 2017, Feng and Astell-Burt confirmed the protective association of green space in high-traffic areas relative to asthma prevalence. A stratified sample of 4,983 children across Australia was studied, with home address linked to classification of asthma diagnoses, green space as a percentage of land, and parental perception of traffic volumes as a proxy for negative air quality. The study controlled for age, sex, maternal education, socioeconomic status by area, and geographic remoteness. Descriptive analyses and multi-level logistic regressions were performed to investigate interaction of the dependent variables. The study concluded interactive effects of green space in high-traffic areas on asthma prevalence, and did not find the green space affected asthma prevalence in low-traffic areas (Feng & Astell-Burt, 2017).

Zhang, Morrison-Carpenter, Holt, and Callahan published "Trends in adult current asthma prevalence and contributing risk factors in the United States by state: 2000-2009" (2013) to explore state-specific risk factors affecting asthma prevalence. CDC Behavioral Risk Factor Surveillance System (BRFSS) data from 2000 through 2009 was utilized to perform logistic regression to confirm any statistically significant asthma prevalence changes by state over time. BRFSS is a nationwide telephone survey

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covering health-related variables and included more than 3.2-milion respondents over the subject period. The dichotomous variable of current asthma status was investigated as the dependent variable, with demographic and socioeconomic information representing the independent variables. A nearly 20% increase in asthma prevalence was identified over the sample period, with variations in increases across demographic categories and most states. In addition to the contributions of demographics and socioeconomics, behavior factors such as obesity were also identified as causing the statistically significant increases in asthma prevalence within the U.S.

In "Contributions of race/ethnicity and country of origin to variations in lifetime reported asthma: Evidence for a nativity advantage," Subramanian, Jun, Kawachi, and Wright (2009), took a different approach to early-life exposure effects on asthma, investigating how country of origin impacted asthma prevalence amongst Hispanic mothers and children. A localized study was performed, whereby the analysis used data from the Project on Human Development in Chicago Neighborhoods. After categorizing asthma outcomes based on the International Study of Asthma and Allergies in Childhood survey, maternal race/ethnicity was then classified into non-reported, Hispanic, and three, non-Hispanic, groups. The Hispanic group was then further classified into those individuals born in Mexican and those born elsewhere. Maternal birth country was classified into those individuals born in the United States versus outside the United States. Adjusted odds ratios of the various ethnic and nativity groups of mothers and children were compared to non-Hispanic white individuals born in the United States. Results indicated disparities in asthma prevalence amongst races/ethnicities, but focused

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on identification of prevalence difference between those born in the United States versus immigrant populations (Subramanian et al., 2009).

An earlier doctoral thesis by R. Govea Ramos identified contradictory results, as that study failed to confirm the farming effect on asthma (Ramos, 2005, p. 44). Adults hospitalized for asthma within six Pennsylvania counties over the period from 1999 through 2001 were analyzed relative to daily traffic while controlling for classified degree of urbanization. Effects of socioeconomic status appeared more impactful on asthma prevalence than the degree of area urbanization (Ramos, 2005).

2.2 Demographics and Socioeconomic Status

Although environmental variables have a significant effect on asthma prevalence, obesity, demographics, and socioeconomic status, have all additionally been found to correlate with prevalence. Numerous studies have investigated these issues to determine if there is a causative or associative effect.

A novel research approach by Seibert et al., "Health literacy and income mediate racial/ethnic asthma disparities" (2019), identified that socioeconomic status and health literacy provided a level of mitigation to the effect of race and ethnicity on asthma. Their study investigated Chicago Initiative to Raise Asthma Health Equity (CHIRAH) data from 2004 through 2007 and covered more than 5,000 potential asthmatics for further interview. Those interviews gathered significant details regarding demographics; socioeconomic status; health literacy; asthma, based upon the Mini Asthma Quality of Life questionnaire (mAQOL); and other variables identified as potentially relevant factors. The study leveraged imputation of CHIRAH data to fill in missing information. It does not appear that a similar approach was used to validate self-reported data. Chi-

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squared tests, analysis of continuous-variable variance, structural equation models, and time-series analysis, were utilized to develop a best-fit model of asthma. Interestingly, the models confirmed the relationship of lower socioeconomic status and health literacy to escalated asthma events but did not show a direct association between asthma events and race and ethnicity. However, lower health literacy and socioeconomic status were correlated with race and ethnicity in these models, indicating the indirect relationship of race and ethnicity with escalated asthma events. Due to the localized nature of this study, the effects of race and ethnicity on asthma outcomes may not be representative of the entire country, thus creating the slightly contradictory analysis. However, the study does show the need for addressing health literacy and income disparities in order to eliminate difference in health care outcomes and reduce asthma severity and preventable hospitalizations (Seibert et al., 2019).

Bhan, et al., (2015) concluded that racial disparities relative to asthma prevalence have been increasing, and that further research was needed to identify causative factors in order to mitigate bias in asthma mitigation research and treatment plans (Bhan et al., 2015, pp. 1274-1275). BRFSS data from 1999 through 2011 was utilized for the analysis in order to provide a large sample for analytical results representative of the entire country. The entire dataset was pooled, with about 10% (n=442,817) excluded due to key variables having missing data and the data limitation relative to non-Hispanic white, non-Hispanic black, and Hispanic ethnic groups. Categorical groups were added for current household income, education, health insurance, and region. A bivariate analysis of prevalence and the categorical predictors was performed, with various regression models then applied to identify the most statistically significant correlation. Results

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identified the most statistically-significant risk increases in asthma prevalence for non-Hispanic Black and Hispanic minority populations (Bhan et al., 2015, p. 1274).

A CDC-sponsored report, "Current asthma prevalence -- United States, 2006–2008" (Moorman, Zahran, Truman, & Molla, 2011, p. 84), found that statistically-significant difference in current asthma prevalence between demographic and socioeconomic populations. Using National Health Interview Survey (NHIS) data from 2006 through 2008, a sample of individuals with current asthma symptoms were extracted. Algorithms were controlled by a quaternary classification of race, two age groups (adult vs child), socioeconomic status, and education, with age-adjusted weightings. Findings indicated that the combination of income level and race and ethnicity provided results that significantly differed from univariate analysis of the categories. The study did not identify causative factors, but it did find asthma-prevalence disparities between demographic and socioeconomic groups. Specifically, low-income individuals, females, children, Hispanics of Puerto Rican descent, and Blacks. Authors speculated multicollinearity between the demographic and socioeconomic groups, such as increased environment trigger exposure, such as tobacco smoke, pollutants, and allergens. Potential genetic differences were also speculated, but such effort was out of project scope. Additional research into these factors was recommended, but providing regular access to quality health care, coupled with financial and social support, were identified as being necessary to ensure disease management and reduction of adverse events and preventable hospitalizations (Moorman et al., 2011, pp. 84, 86). These results aligned with previous work in this area.

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In 2009, Forno and Celedón identified a correlation between socioeconomic status and both asthma prevalence and severity in "Asthma and ethnic minorities: Socioeconomic status and beyond," which was a review of existing literature covering 72 articles and reports from 1996 through 2008. They posited that socioeconomic status was not causative, but created variation in environmental and behavioral exposures, in addition health care-access differences resulting from income disparities. Specifically, their study noted differences in environmental exposures to indoor allergens, cigarette smoke, air pollution. It also noted causative behavioral exposures from stress and violence, obesity, and depression and anxiety. The study concluded by noting the importance of understanding and addressing risk factors, but cautioned that asthma-risk-related genetic differences between ethnicities could not be ignored (Forno & Celedón, 2009).

A 2006 study of United States military personnel, "Asthma hospitalizations among US military personnel, 1994 to 2004" (Hansen et al., 2007, p. 36), added occupational analysis to an expanded demographic review, noting increased risk of asthma hospitalizations among females, married, and older, individuals, as well as enlisted and US Army personnel. This study was undertaken subsequent to identification of the prevalence of asthma and concern by the United States Department of Defense that such a condition could impact battle readiness of personnel, especially across the changing landscape of war. Demographic and hospitalization data for 4.7 million active-duty personnel across military branches from 1994 through 2004. Those details were classified into standard categories for comparison with hospitalization details leveraging asthma diagnoses under the *International Classification of Disease, Ninth Revision,*

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Clinical Modification. Significance correlations between demographic and occupational variables were investigated for those individuals experiencing asthma hospitalizations through application of univariate statistical modeling. Regression analysis and "Cox proportional hazards time-to-event modeling" (Hansen et al., 2007, p. 38) were then utilized to normalize time-series effects within the data. End results indicated the increased prevalence risk for various personnel classifications. Additionally, certain occupational classes were identified with increased prevalence risk, although potential causative effects of such were not investigated (Hansen et al., 2007).

2.3 Obesity

In "Interacting effects of obesity, race, ethnicity and sex on the incidence and control of adult-onset asthma," Koebnick et al. (2016) identified a direct, exponential, relationship between BMI and adult-onset asthma. As compared to those classified as normal or underweight, asthma prevalence increased 12% for those classified as overweight, to 250% for those with a BMI above 50 kilograms per meter-squared (kg/m^2). The study investigated patients with adult-onset asthma from throughout the United States utilizing data from multiple health care organizations. The retrospective study investigated interactions between asthma-exacerbation factors, such as categorized obesity ratings, race, socioeconomic status, gender, and age. A strong and statistically-significant correlation was found between adult-onset asthma and the categorized BMI, with stronger risk for women than men (Koebnick et al., 2016, pp. 1-2,5,14).

A "Prospective study on the relationship of obesity to asthma impairment and risk" (Schatz et al., 2015) confirmed the relationship of BMI and poor asthma control to identify the need for weight management in overweight and obese asthma patients. More

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than ten-thousand adult patients were studied based on a review of Kaiser Permanente records from 2006 to identify adult patients with persistent asthma who continued health plan enrollment through 2007 and 2008 and had BMI measurements. Bivariate and multivariable analyses were then performed to determine the statistical relationship of asthma control outcomes and BMI after controlling for age, sex, asthma-exacerbation event, medication usage, smoking, gastroesophageal reflux disease (GERD), and depression. The study concluded a statistically significant association between worsened asthma outcomes and both high BMI categories and increased mean BMI. More specifically, the study identified a 26% to 40% increase in negative asthma outcome risk for overweight patients, increasing to a 36% to 57% risk for those classified as obese (Schatz et al., 2015).

Yawn, Rank, Bertram, and Wollan, also studied the effect of obesity and other factors on asthma outcomes in " Obesity, low levels of physical activity and smoking present opportunities for primary care asthma interventions: an analysis of baseline data from The Asthma Tools Study" (2015). Using data from the Asthma Tools Study, a five-year asthmatic trial, activity levels, smoking exposure, and obesity, were compared to asthma status and exacerbations. The study found increased health care needs and uncontrolled asthma instances were associated with these factors.

2.4 Anxiety and Depression

Comorbidity of asthma with anxiety and depression has been previously identified, with a 2015 study by Yong-hua et al. uniquely investigating the predictive factor of one disease on the other through metadata analysis and literature review. Several textual search terms related to depression and asthma were utilized to identify studies

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published prior to January 2015 for potential inclusion in the analysis. Published studies were then analyzed to determine those where asthma may predict depression or where depression may predict asthma. Six of 1,390 published studies were utilized for the final analysis, which involved comparison of relative risk ratios identified between study cohorts. Based on these details, authors concluded that asthma does not increase depression risk, but that depression does result in a 43% increase in risk of asthma occurrence in adults (Yong-hua et al., 2015).

2.5 Sexual Orientation

Interestingly, new research is beginning to identify sexual orientation as a factor in asthma prevalence, although this factor is thought to be correlative and not causative. In "Environmental injustice and sexual minority health disparities: A national study of inequitable health risks from air pollution among same-sex partners" (2017), Collins, Grineski, and Morales, identified significantly increased respiratory risks for the lesbian, gay, and bisexual, population (LGB), relative to the heterosexual population. This research differed significantly from most asthma-related research that focuses on disparities of asthma prevalence across ethnic, racial, and socioeconomic, groups. By analyzing Environmental Protection Agency (EPA) data across the country and sexuality data derived from the 2010 Decennial Census, Collins, et al., were able to correlate households with hazardous air pollution. After adjusting for racial, ethnic, and socioeconomic disparities, an increased respiratory risk was found within the LGB population relative to both the heterosexual population with the least risk and the total population with centralized, relative, risk (Collins et al., 2017, p. 42).

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Asthma Prevalence in California: A Surveillance Report (2017) also indicated that LGB males and females have an asthma prevalence increase of 40-60% as compared to their heterosexual counterparts. The study utilized California Health Interview Survey (CHIS) 2013/2014 data from the University of California Los Angeles (UCLA) Center for Health Policy Research (CHPR) filtered for those individuals ever diagnose with asthma by a health care provider. Weighted point estimates utilized the 95% confidence level for associated calculation. The increased lifetime asthma prevalence for both the gay/lesbian and bisexual populations relative to the straight population was found to be statistically significant, as presented in Figure 4. Interestingly, the study found no statistically-significant differences in current asthma prevalence across the three populations (Milet, 2017, pp. 2,13,18-19).

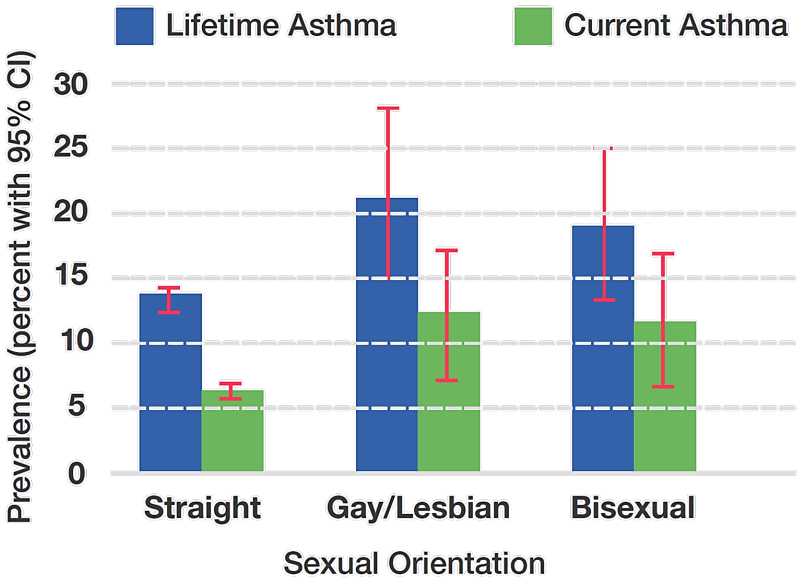

Figure 4: Graph of lifetime and current asthma prevalence with confidence interval across the heterosexual, gay and lesbian, and bisexual, populations within California. From *Asthma Prevalence in California: A Surveillance Report* (Milet, 2017, p. 13).

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2.6 Climate Change

No analysis of asthma may ignore the impact of the environment and climate change, as they are definitively linked to increased prevalence and severity of asthma. Research has proven both direct and indirect impacts to asthmatics due to air pollution and air quality, temperature changes and the associated impact to plant life, and the instances of wildfires and extreme weather events.

"The San Diego 2007 wildfires and Medi-Cal emergency department presentations, inpatient hospitalizations, and outpatient visits" (Hutchinson et al., 2018) investigated the causative factor of wildfires on asthma hospitalizations and determined that asthmatic instances continue many days beyond initial exposure to resultant airborne particulates. (Hutchinson et al., 2018, p. 17).

This study is extremely relevant, as the impact of climate change cannot be intelligently dismissed, and there is high confidence that "climate change is projected to increase the number and severity of naturally occurring wildfires in parts of the United States" (Fann et al., 2016, p. 85). As reported in *The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment*, these extreme events will compound climate concerns and increase respiratory issues through increased particulate matter and ozone. Exponentially, climate change will raise premature mortality and severe cardiovascular and respiratory events (Fann et al., 2016, p. 70).

Along a similar vein, "United Nations climate change conferences: COP21 a lost opportunity for asthma and allergies and preparing for COP22" (Annesi-Maesano, 2016, p. 57) noted that causes of asthma and allergies are significantly, and both directly and indirectly exacerbated by climate change. This literature review identified existing

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research providing how biological-contaminant pollution and plant migration due to climate change results in changes to mold and pollen distributions, as well as duration and timing of changes in seasons. Even humidity, which further exacerbates mold and pollen conditions, is changing due to differences in flood and other extreme weather event patterns. These weather changes are even responsible for a new asthma reference of thunderstorm asthma, which is attributed to thunderstorms causing changes in the release of submicron particulates of allergy triggers into the environment (Annesi-Maesano, 2016).

2.7 Geospatial Analysis for Asthma

The analysis of health care factors affecting asthma and exacerbating severity of asthma outcomes and hospitalizations is an important step in the determination of methods by which health care providers may determine mitigation options. Such mitigation requires contact with patients, however, and differences in access to quality health care will limit this potential. For the most at-risk individuals, targeted outreach will be necessary to actively create those patient interactions. While limited research has been discovered to do this for asthma, health care research has leveraged geospatial analysis for reviews of this topic. Reviewing this literature enables a precision approach for this research that builds upon past work.

Lovinsky-Desir et al., who's article "Air pollution, urgent asthma medical visits and the modifying effect of neighborhood asthma prevalence" (2019) was previously discussed (see section 2.6 Climate Change), leveraged geospatial analysis by ZIP to identify childhood asthma prevalence, as well as the distribution of study subjects. This level of analysis allowed for correlations between participant home location and

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measured air pollution indicators and rural versus urban density. Although not leveraged for patient outreach, the resultant heatmap readily identified those areas within New York City at increased prevalence risk for asthma (Lovinsky-Desir et al., 2019, pp. 37-38). This confirms the next step need to target sub-populations within ZIP areas for outreach and cost-effective medical intervention to prevent unnecessarily severe health outcomes related to asthma.

A study by Ouédraogo et al., "Exploration of the spatial patterns and determinants of asthma prevalence and health services use in Ontario using a Bayesian approach" (2018), utilized Bayesian spatial analysis to investigate geographic correlations between asthma outcomes and the physical environment, socioeconomic conditions, and health care access, while controlling for age and sex. Data covered more than 1.8-million asthmatic individuals, 682.3-thousand physician and ED visits, and 13.6-thousand hospitalizations in Ontario, Canada, from 2003 through 2013. Inclusion of environmental data by Canadian postal code provided the geographical correlation of outcome results. Socioeconomic data from the 2006 census was also included by geographic area. Geospatial analysis methods were utilized to correlate asthma conditions with geographic factors and the study performed model testing using Monte Carlo simulation. The study confirmed lower asthma prevalence in rural areas relative to urban but noted higher instance of asthma ED visits and hospitalizations in rural areas. Results concluded that the hygiene hypothesis explained the decreased prevalence, but that decreased access to quality health care in rural areas prevented mitigation of asthma events prior to required ED or hospitalization escalation. Interestingly, of all air pollutants, only NO_2, which is expected to relate more to urban areas, showed strong correlation with physician visits,

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although it did not correlate to instance escalations. Granularity of air-quality data limited the analysis, however, resulting in the study notation that improved granularity and volume of air-pollution measurement and their effects required additional research (Ouédraogo et al., 2018).

In "Exploratory analysis in mapping of asthma risk in Western Australia" (2018), Febriawan and Sodre leveraged exploratory data analysis (EDA) and confirmatory data analysis (CDA) to investigate the association of asthma and humidity, annual rainfall, the enhanced vegetation index, and the socio-economic indexes, in Western Australia. Both approaches identified statistically significant, negative, correlation between asthma prevalence and the socio-economic indexes. EDA additionally resulted in an association between asthma and humidity, rainfall, and the enhanced vegetation index. The use of EDA represented a novel technique unique from traditional statistical analyses of asthma (Febriawan & Sodre, 2018).

While not specifically relevant to geospatial analysis for asthma outreach in San Diego, a 2016 article in London identified key points that should be included in any analysis to target decreases in preventable asthma events. Through their study published as "The barriers to accessing primary care resulting in hospital presentation for exacerbation of asthma or chronic obstructive pulmonary disease in a large teaching hospital in London" (2016), Naqvi and Khachi had ED and inpatients interviewed over a one-year period, although limited to only certain hours of the day due to resource availability. Researchers gathered asthma background, health care, demographic, and socioeconomic data during the interviews. The team performed subsequent analysis of the data, although confidence intervals and goodness-of-fit results were not provided.

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Both time of day and day of week were identified as having increased occurrence rates for asthma ED and inpatient visits. Research concluded that access to quality health care increased preventable ED visits and hospitalizations, noting that many patients did not have general-practitioner visits when escalated asthma conditions initially presented (Naqvi & Khachi, 2016). Given the presence of these issues in a country with a nationalized health care system, the potential for such impacts in the United States may be significantly compounded.

In the master's thesis, "Examining air pollution and asthma in metropolitan communities using spatial and statistical analyses" (2016), Fyfe leveraged geospatial statistics to identify the impact of airborne pollutants on asthma prevalence specifically to investigate disparities in low-income areas predominantly inhabited by high percentages of ethnic and racial minorities.(Fyfe, 2016{Hossain, 2015 #219) Due to relative equivalencies in demographics, the U.S. cities of St. Louis, Missouri; Kansas City, Kansas; and Charlotte, North Caroline, were selected for study. The study geocoded publicly available data from the Toxics Release Inventory (TRI) by the EPA to present sources of air pollution and utilized ZIP-grouped ANOVA tests to analyze those sources with downwind dispersion. Both summarized and de-identified public-use data on ED encounters for asthma, as well as non-public, ZIP-identified data were leveraged(Fyfe, 2016). Results confirmed long-held understanding of environmental and socioeconomic impacts on asthma, as well as further highlight the importance of education and income in decreasing escalated health care visits for asthma support (Fyfe, 2016).

A 2015 study, "The effect of community health center (CHC) density on preventable hospital admissions in Medicaid and uninsured patients" (Evans, Smith,

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Kobayashi, & Chang, 2015, p. 839), identified that community health centers (CHC) partially reduce preventable hospitalizations for the surrounding community. Data from the 2010 California Office of Statement Health Planning and Development was utilized to identify adult, Medicaid and uninsured, patients, filtered for preventable hospitalization, such as asthma. Geospatial analysis classified the type of hospital to which patients were admitted based upon the number of CHCs within a five-mile radius. Logistic regressions grouped by insurance type controlling for demographics, county, socioeconomic status, and comorbidities, was performed by ZIP. The study determined that CHCs correlated with statistically-significant decreases in preventable hospitalizations due to the availability of alternative health care (Evans et al., 2015; Hossain, Laditka, & Gardiner, 2015).

"Refining of Asthma Prevalence Spatial Distribution and Visualization of Outdoor Environment Factors Using GIS and its Application for Identification of Mutual Associations" (Skarková et al., 2015) focused on the association of childhood asthma prevalence and concentrations of airborne pollutants. Asthma prevalence across 18 municipalities was separately extracted from the National Institute of Public Health (NIPH) and the Institute of Health Information and Statistics of the Czech Republic (IHIS). Municipal polygons were converted to one-square-kilometer grids to align with air-pollution data. Logistic regression was performed using NIPH data based on the address of each child studied, as well as the address of their pediatrician. For IHIS data, multivariate linear regression was performed based only on the pediatrician's address. The logistic-regression models using NIPH data resulted in a statistically significant association ($p < 0.001$), while the multivariate linear regression with IHIS data did not

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show statistical significance ($p = 0.197$). Based on these results, the study concluded positive, statistically significant, associations between asthma prevalence and both air pollution and the rate of agricultural land use. A negative association was found between asthma prevalence and natural forests (Skarková et al., 2015). Although no outreach or mitigation plans were contemplated within the study, it identified a framework by which geospatial analysis of health information could be used to correlate environmental factors with health instances.

Lemke et al., (2014) performed a unique analysis of the association between acute asthma events and air pollutants across international boundaries. The noted significant limitations in data precision and comparisons between populations and health systems. Their results identified a correlation between acute asthma events and nitrogen dioxide (NO_2) concentrations across the border. This differed from a 2007 study noted from San Diego that showed no statistically significant relationship between asthma and NO_2. Part of the difference may be explained by the San Diego study being more focused on personal exposures than this international analysis (Lemke et al., 2014).

2.8 Conclusion

Since nearly the dawn of what is currently recognized as human civilization, significant research into asthma and its causes and comorbidities has occurred within the context of both medical and environmental research. Numerous studies have shown correlations of asthma prevalence and severity to such correlates and confounders as race and ethnicity, country of origin, demographics, socioeconomic condition, obesity, lifestyle, and both in-home and neighborhood environments. More recent studies are beginning to show additional, although most likely not causative, correlations with sexual

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orientation. Many of these studies have utilized geospatial analysis to allow for correlation of environmental conditions to patient locations. However, no published studies have leveraged geospatial statistics of asthma correlates to allow for determination of cost-effective outreach for health care professionals to directly target most-at risk subpopulations by area. This study is unique in creation of a framework to allow for the connection of data science, business analytics, and geospatial statistics, to target individual patients for quality-of-life and mortality-risk improvements. The next chapter leverages information from the literature review to discuss study execution.

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Chapter 3: Methodology

This project is a retrospective, secondary, analysis of a statewide, California, sample. Statewide data are from CHIS PUF adult data files, while geolocational information was generated through use of the 2017 five-year ACS and associated polygons. The statewide sample enabled generalized analysis of both the target and non-target populations, allowing for creation of a model applied to the ACS for mapping purposes. CHIS PUF data were mined for identification of potential correlates to asthma to be leveraged for development of multinomial logistic regression models and resultant odds ratio calculations.

3.1 California Health Information Survey

Dutwin, Sherr, Goyle, Langdale, and Best, describe in *Report 1: Sample Design* (2018) how CHIS is a cellphone and landline telephone health survey randomly sampling residents of California excluding institutionalized individuals. It is the largest state health survey in the United States, allowing one adult and one miner in each household sampling eligibility. The survey was originally conducted every odd year beginning 2001 but has been an annual survey since 2011. The sample design is such that data are representative of the entire California population across major racial and ethnic groups as well as differently sized county populations, with over-sampling utilized for San Diego, Imperial County, and certain ethnic groups identified as requiring increased precision. In order to maximize response rates, the telephone survey was performed in six different languages (Dutwin et al., 2018, pp. 1.1-1.6).

CHIS data includes weighting information to minimize sampling bias resulting from survey administration, participant response declination, and selection probability.

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For missing variables related to key factors utilized in the weighting methodology, the study utilizes three imputation techniques: (1) if only a small number of values was missing, random variable selection was used; (2) more commonly, values were obtained from a pool of donor records based on matched response characteristics; and (3) external assignment of geolocation values when locational information provided was inconsistent. For other missing variables, which comprised less than 1% of the sample, the study leveraged relational imputation to identify similar sample respondents (Dutwin et al., 2018, pp. 1.13-11.15). Weighted observation tables regarding the CHIS analytical sample are presented in tabular format in Appendix B.

3.1.1 Creation of Six-Year CHIS PUF Data

CHIS PUF adult data files from 2011 through 2016 were downloaded from the UCLA Center for Health Policy Research California Health Interview Survey website as compressed archive files containing SAS®-formatted data, labelling, and format, tables. Manual review of the respective data dictionaries identified annual changes in survey variables. For each year from 2011 through 2016, total variables were 490, 456, 480, 421, 432, and 403, respectively, inclusive of 81 annual replicate weight variables. Of those variables, 224 survey and the 81 weighting variables matched across all six years. Using SAS Enterprise Guide™ 64-bit version 7.15 HF7 on a Lenovo® ThinkPad® P1 with Xeon processor running Windows 10 Pro, the CHIS adult PUF files were imported along with the accompanying SAS format and label files. Based on "Sample Code to Pool Multiple Cycles" (California Health Interview Survey, 2019), tables were combined into a single data table, with year, weighting index, and 161 new weighting variables added. The import and combination code included formatting of variable values to provide more

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meaningful output during direct analysis. Data were then reduced to include only those 224 matched variables, the 161 new weighting variables and counter index, the CHIS file year, and several recoded variables. Table 1 provides the variable and observation counts from the annual CHIS, combined, and final tables, showing the number of observations and variables that were maintained.

Table 1

CHIS Pre- and Post- Combination Variable and Observation Counts

Variable	**Variables** ***N*** **(%)** **(N=811)**	**Observations** ***N*** **(%)** **(N=125,264)**
CHIS2016.ADULT	490 (60.4%)	21,055 (16.8%)
CHIS2015.ADULT	456 (56.2%)	21,034 (16.8%)
CHIS2014.ADULT	480 (59.2%)	19,516 (15.6%)
CHIS2013.ADULT	421 (51.9%)	20,724 (16.5%)
CHIS2012.ADULT	432 (53.3%)	20,355 (16.2%)
CHIS2011.ADULT	403 (49.7%)	22,580 (18.0%)
CHIS.CHIS_DATA_RAW	811 (100.0%)	125,264 (100.0%)
CHIS.CHIS_DATA_INTRM	474 (58.4%)	124,521 (99.4%)
CHIS.CHIS_DATA_FINAL	253 (31.2%)	124,521 (99.4%)

Note: Pre- and post- combination counts of variables and observations from CHIS PUF.

3.1.2 Optimization of Sample to Key Variables

From the 224 matched, non-weighting, variables, manual review was performed to remove those variables related to spouses and children, as well as duplicative variables associated with otherwise-reported information, such as race and ethnicity. Measurement variables duplicated across different units, such as those for height, weight, and BMI, were also removed. This manual review reduced the analysis variable list to 90,

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excluding year and 161 updated weighting variables. All variables were categorical, with 47 dichotomous variables of which 32 included invalid-response codes, 23 nominal variables having three to nine categories and up to three invalid-response codes, and 21 ordinal variables having three to nine categories and up to two invalid-response codes. Running of SAS *PROC FREQ* for each variable confirmed there was no missing data, with results instead leveraging the invalid-response codes. However, 743 observations contained a "proxy skipped" code that provided no value to further analytics. Given that these observations represented only 0.6% of the total (0.4% of the weighted population), they were removed from study.

Recoding of several variables was performed to reduce categories, correct for survey difference across periods, and collapse lesser categories, such as "proxy skipped," to the standard "inapplicable" category. Specific actions included recoding:

- marital status from a four-category field indicating married, living with a partner, widowed or separated or divorced, and single or never married, to a three-category field indicating married or living with a partner, widowed or separated or divorced, and single or never married;
- age from 14 categories, including 18 through 25, 26 through 29, five-year increments from 30 through 84, and 85 and older, to three categories indicating young adults from 18 through 39, middle-aged adults from 40 through 64, and later adults from 65 and older;
- English as a second language proficiency to collapse non-response categories to *inapplicable*;

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- years of service in the U.S. armed forces to collapse non-response categories to inapplicable;
- method of telephone use to collapse non-response categories to inapplicable;
- highest level of education attained to align 2013 coding with other years;
- name of health plan, covered by Medicare, and covered by Medi-Cal, to a combined field providing broader insurance information through a single, nominal, variable;
- primary language spoken in the home to a new field collapsing those who speak English with or without another language into a single category;
- family type to a new field in order to collapse three single-without-children categories into one;

Specific to asthma, seven target variables were maintained through the table creation process. These variables, for which identified inapplicable values represented non-asthmatic individuals, are detailed in the *CHIS 2016 Data Dictionary* (2018a) and include

- *ab17*, a dichotomous variable showing whether a doctor has ever diagnosed the individual with asthma (i.e. lifetime asthma prevalence);
- *ab40*, a dichotomous variable that shows whether an individual diagnosed with asthma still has the disease;
- *ab41*, a dichotomous variable that shows whether an individual diagnosed with asthma has had an attack during the last year;
- *astcur*, which is a dichotomous variable that shows whether an individual currently has asthma;

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- *asts*, a dichotomous variable indicating individuals diagnosed with asthma who have suffered from symptoms over the last year;
- *astyr*, a dichotomous variable indicating individuals who currently have asthma and who have suffered from symptoms over the last year;
- *ab18*, a dichotomous variable showing individuals who use asthma-control medications daily;
- *ab19*, a five-level, ordinal, variable identifying instances over the past year that an individual suffered from asthma symptoms;
- *ah13a*, a dichotomous variable detailing whether a current asthmatic required emergency-department or urgent health care during the past year;
- *ab43*, a dichotomous variable that shows whether an individual with asthma was provided an asthma management plan by their health care professional;
- *ab98*, a dichotomous variable that shows whether an asthmatic individual has a written copy of their asthma management plan; and
- *ab108_p1*, an ordinal variable indicating an individual's confidence to manage and control their disease (California Health Interview Survey, 2018a).

In order to provide for improved classification of asthmatics, the asthma variables were all utilized to create a new variable labeled *asthmastatus*, which indicated whether an individual was a current asthmatic, meaning they have suffered symptoms or sought medical attention or remediation during the last 12 months; previous asthmatic, meaning they have been diagnosed with asthma but have not suffered symptoms or required remediation within the last 12 months; and non-asthmatics. From this variable, a separate, dichotomous, variable was created to differentiate between current asthmatics

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and non-asthmatics, inclusive of individuals previously diagnosed with asthma but who have had no symptoms or treatment for at least one year. Previous asthmatics were separated from analyses when utilizing this variable.

Asthmatics may suffer a wide range of disease severity and associated utilization of health care resources. Unfortunately, CHIS does not contain a measure of asthma control, although it does contain an indicator of confidence in asthma management. In order to identify a proxy for asthma control, a nominal variable was created to differentiate between uncontrolled asthma, defined as those current asthmatics who visited the ED or urgent care for their symptoms within the prior 12 months; controlled asthmatics, who are current asthmatics that did not visit the ED or urgent care; and non-asthmatics. Non-asthmatics again includes previous asthmatics, although these observations were separated from analyses of this variable. An unfortunate limitation of this asthma control variable is that it will be directly impacted by health insurance and health care access issues for those uncontrolled asthmatics who are unable to seek medical attention for their disease. The entire data creation process is summarized in Figure 5.

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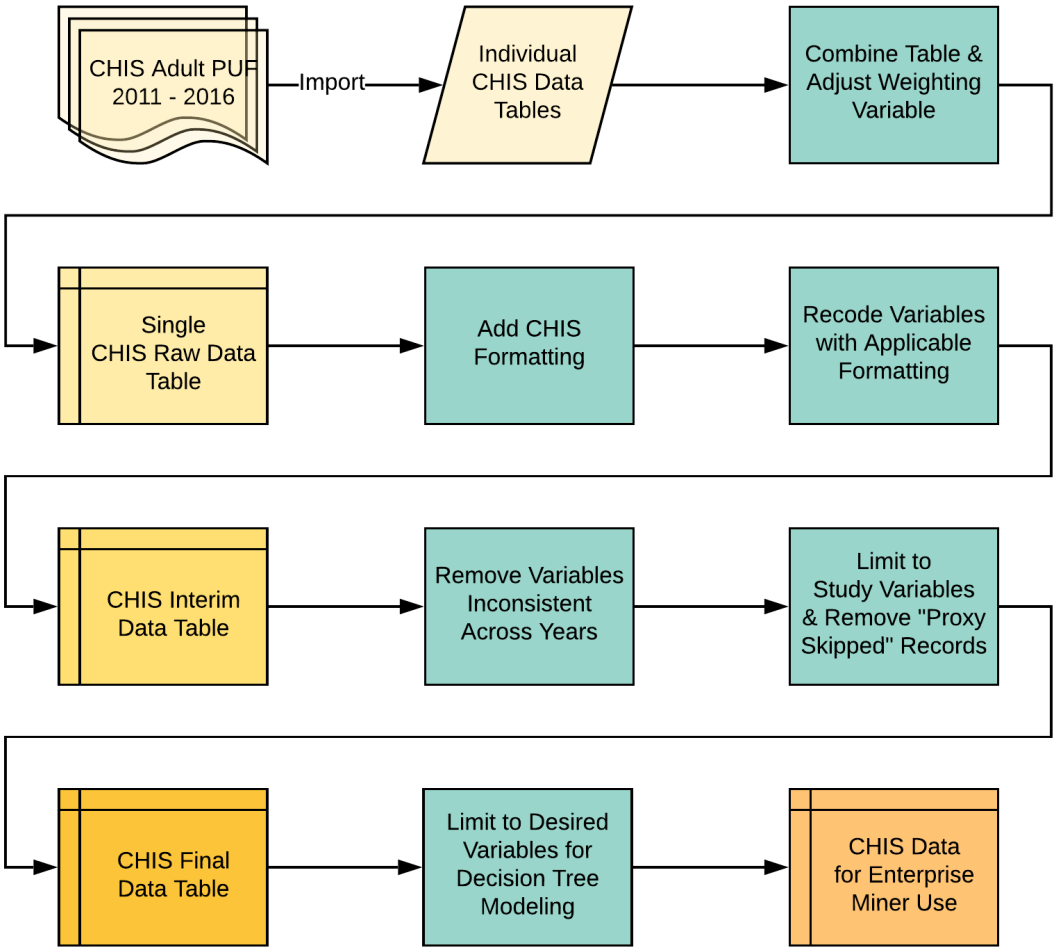

Figure 5: Summary of process to convert individual CHIS adult PUF files into a combined data table for study analysis.

3.1.3 Subject Demographics

The combined CHIS data library consisted of 124,521 sampled individuals from the 2011 through 2016 survey years. Characteristics of this data are shown in Table B1. Through the application of CHIS weighting methodologies for bias reduction, figures were grossed up to a population of 28,246,634. To account for this adjustment, statistical figures within this study are generally reported in terms of the weighted population (*wN*),

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rather than the sample frequency (*n*). Tables B1 through B4 provide a complete breakdown of the study respondent characteristics by demographics, health condition and behavior, health care insurance and access, and socioeconomic status.

Weighted-population sex was split 51.2% female (*wN* = 14,462,534) and 48.8% male (*wN* = 13,784,100); CHIS contains no non-binary coding for sex. Majority of respondents were considered middle aged from 40 to 64 (42.7%, *wN* = 12,049,216), followed closely by young adults between the ages of 18 and 39 (41.0%, *wN* = 11,571,994), and finally later adults at least 65 years of age (16.4%, *n* = 4,625,423). Figure 6 provides the breakdown of respondents' educational attainment, with high school graduates (23.4%; *wN* = 6,619,205) and those with bachelor's degrees (22.9%; *wN* = 6,470,239) comprising the majority of the population. More than one half of respondents reported as married or living with a partner (57.4%, *wN* = 16,204,700), while more than one quarter reported never having been married (26.5%, *n* = 7,491,722), and less than one sixth reported as being widowed or separated (16.1%, *n* = 4,550,212). Of those who reported as being married, which represents a subset of those were married or living with a partner, less than half indicated having children (48.5%; *wN* = 7,027,498), with the remainder not having children (51.5%; *wN* = 7,451,383). A significant majority of single individuals reported not having children (87.0%; *wN* = 11,981,749), with the remainder having children (13.0%; *wN* = 1,786,003). More than half of respondents indicated home ownership (57.2%; *wN* = 16,150,351), while the remainder either rented or had a different living situation (42.8%; *wN* = 12,096,283). The majority of the weighted population reside in urban settings (52.0%; *wN* = 14,675,331).

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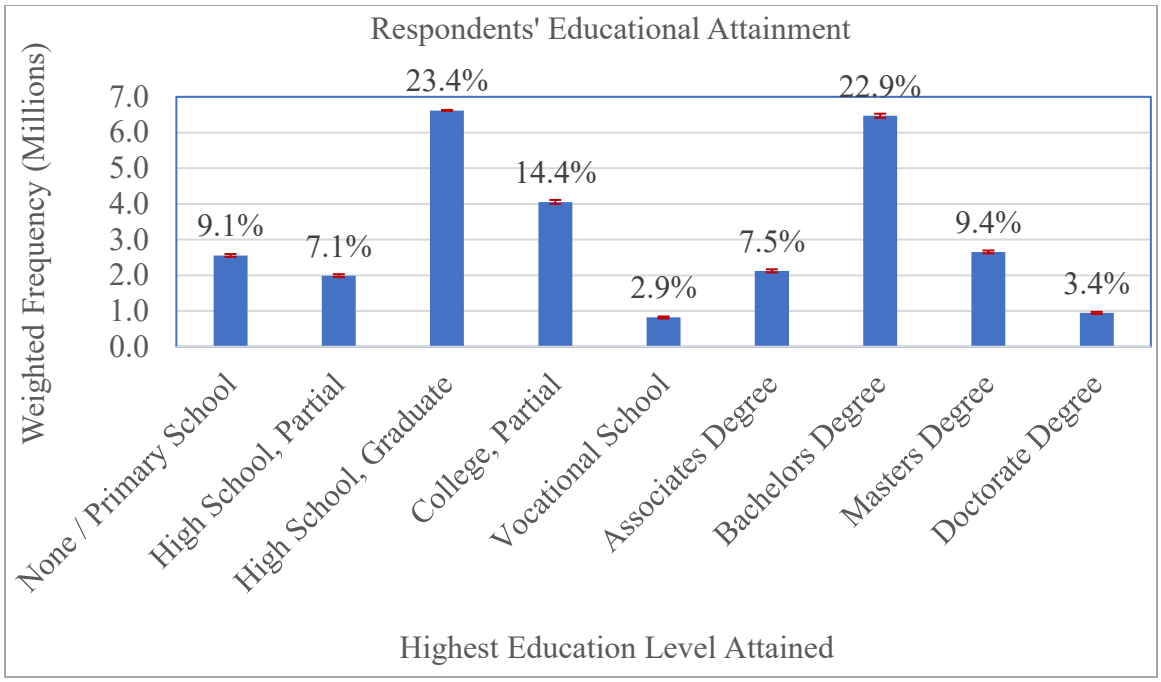

Figure 6: Weighted respondent frequency with standard error regarding respondents' highest level of education attained.

Based on the State of California Department of Finance (CA DOF) race and ethnicity categories, the racial composition of the weighted population was predominantly White (42.8%, *wN* = 12,092,661). Latino (34.7%, *wN* = 9,806,044), Asian (13.9%, *wN* = 3,924,430), and African American (5.6%, *wN* = 1,581,649) respondents comprised the next three largest racial categories. Multiracial (1.9%, *wN* = 549,824) respondents, other races (0.6%, *wN* = 156,121), and American Indians and Alaska Natives (0.5%, *wN* = 135,904), comprised the remainder of the sample. Figure 7 provides a visual breakdown of these characteristics.

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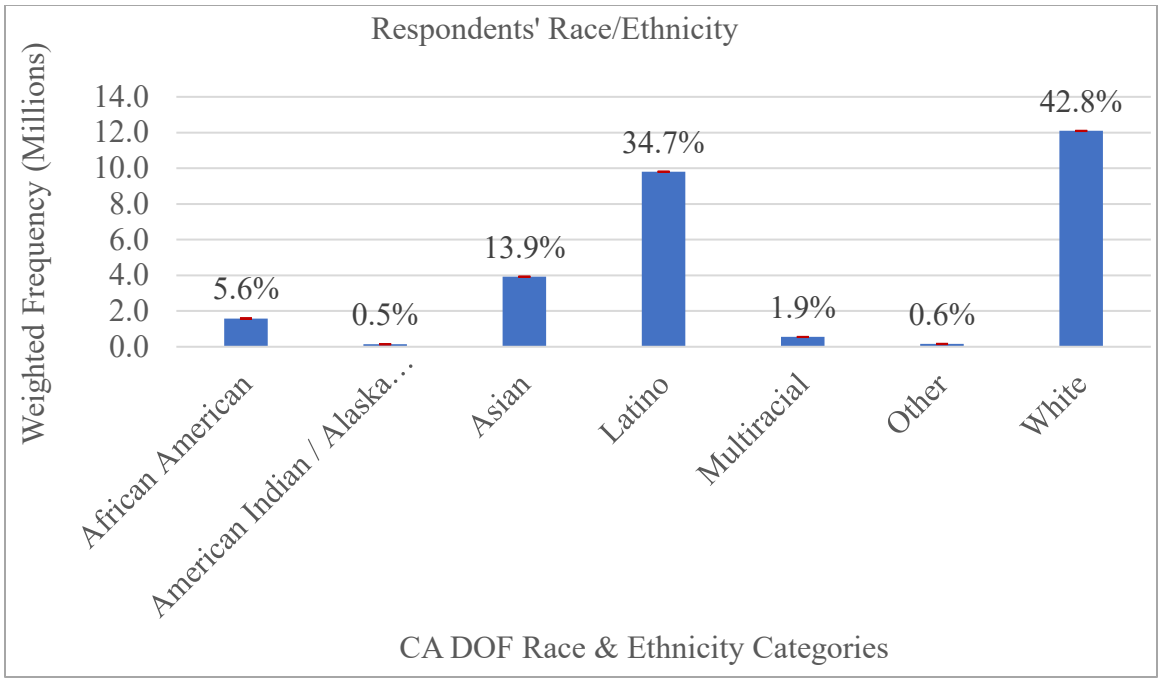

Figure 7: Weighted respondent frequency with standard error regarding respondents' race and ethnicity based on CA DOF categorization.

Nearly two-thirds of the weighted population was comprised of US-born citizens (66.2%; wN = 18,689,704), with naturalized citizens (17.6%; *wN* = 4,973,380) and non-citizens (16.2%; *wN* = 4,583,550) each comprising approximately one-sixth. Of the naturalized- and non-citizens, 70.3% had lived in the U.S. for 15 to 19 years (*wN* = 6,718,712), while those living in the U.S. for 10 to 14 years comprised only 13.7% (*wN* = 1,312,040) of the weighted population. Those living in the U.S. for less than ten years comprised only 16.0% of the weighted population (*wN* = 1,526,177). Figure 8 provides a visual breakdown of the primary spoken languages for the weighted population, with those speaking English or English and another language comprising the majority (84.;4%; *wN* = 23,849,238).

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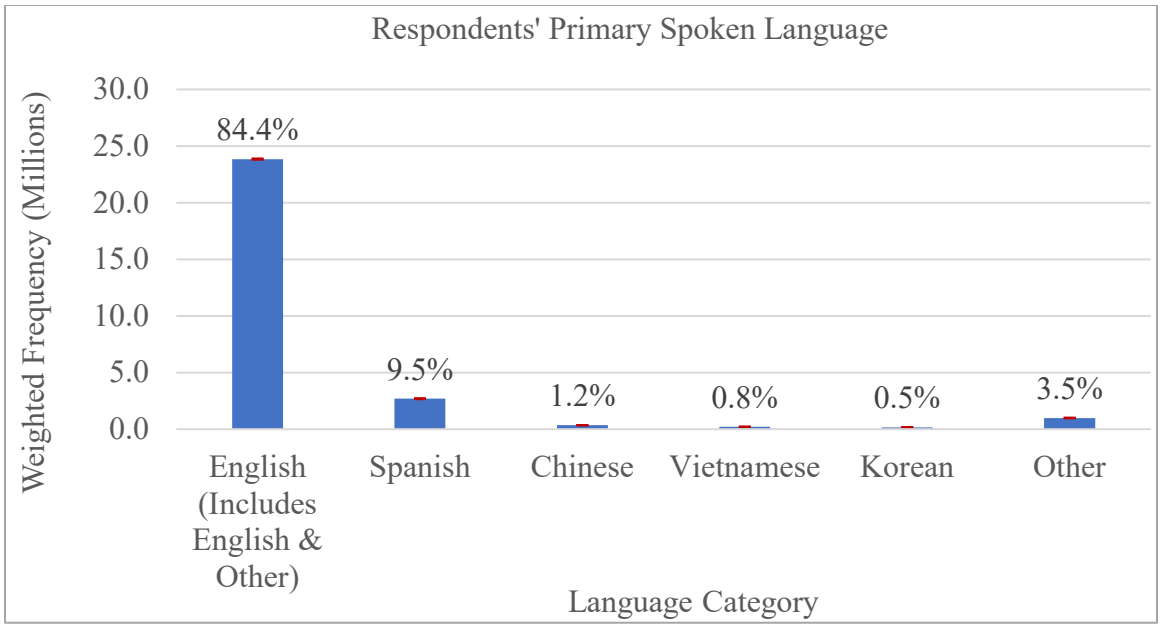

Figure 8: Weighted respondent frequency with standard error regarding respondents' primary spoken language.

3.1.4 Non-Asthma Health and Health Care Access and Insurance

The health condition and behavior characteristics of the CHIS PUF data are detailed in Table B2. Health care insurance and access characteristics are provided in Table B3. Figure 9 provides a visual breakdown of the weighted frequency of general health categories chose by respondents when answering, "Would you say that in general your health is excellent, very good, good, fair, or poor?" (California Health Interview Survey, 2017a). This is a key factor in determining the overall condition of an individual, as well as the emotional toll on them from any identified disease. The majority of respondents rated themselves in very good (30.7%, *wN* = 38,298, *SEM* = 0.268) or good condition (30.5%, *wN* = 8,622,494). Similar numbers reported either excellent (18.6%, 5,250,635) or fair (16.1%, *wN* = 4,545,146) condition, while a relative minority indicated

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poor health (4.1%, *wN* = 1,167,273).

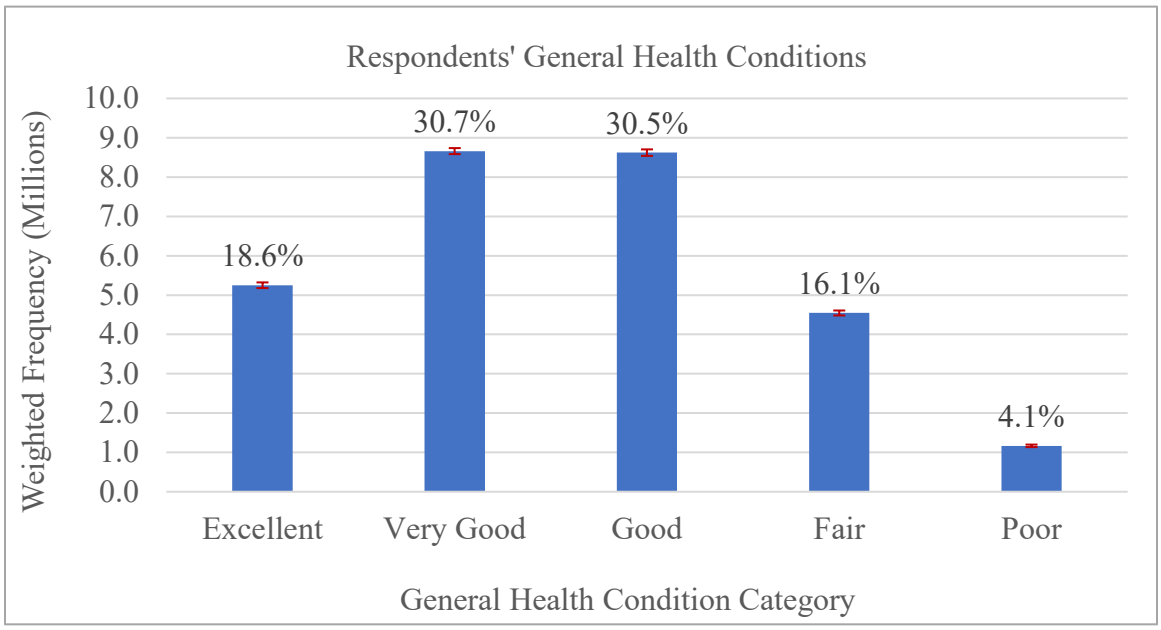

Figure 9: Weighted respondent frequency with standard error regarding respondents' general health conditions.

More than one half of respondents walk for at least ten minutes for transportation (53.5%, *wN* = 15,110,572) or leisure (65.3%, *wN* = 18,432,648). A small portion of respondents are unable to walk (0.4%, *wN* = 121,913). The remainder of participants do not walk at least ten minutes for transportation (46.1%, *wN* = 13,014,149) or leisure (34.3%, *wN* = 9,692,162). Along this vein of healthy lifestyle, it is important, especially for review of lung performance, to look at the smoking habits of respondents. Slightly less than two thirds of individuals have never smoked cigarettes regularly (64.7%, *wN* = 18,283,189), with nearly one quarter more having quit smoking (22.4%, *wN* = 6,322,746). Only a small portion of the weighted California population (12.9%, *wN* = 3,640,698) continues to have the habit of smoking cigarettes.

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Statistically significant associations between BMI both asthma prevalence and severity have been identified through numerous medical studies. Figure 10 provides a visual summary of respondents' descriptive BMI categories, as calculated by the CHIS survey based on individuals' heights and weights, with the significant skew towards the obese and overweight population readily identifiable. A slight majority of the weighted population does have normal BMI between 18.50 and 24.99 (36.9%, *wN* = 10,426,170), although they are closely followed by the overweight population with BMI between 25.00 and 29.99 (35.2%, *wN* = 9,951,359). More than one-quarter of the weighted population is classified as obese with BMI above 30.00 (26.2%, *wN* = 7,401,546). Few of the weighted population are classified as underweight with BMI below 18.5 (1.7%, *wN* = 467,558). Associations were also found with diabetes and heart disease, but these are most likely comorbid relationships resultant from BMI, rather than causative factors.

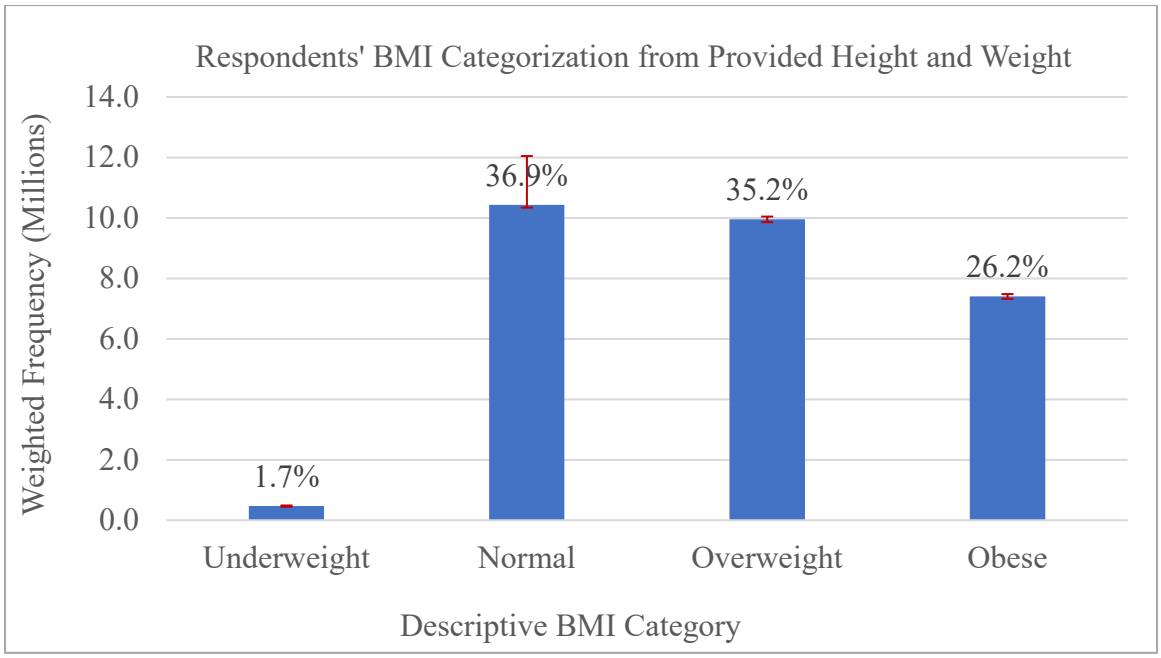

Figure 10: Weighted respondent frequency with standard error regarding respondents' descriptive BMI category.

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Figure 11 provides visualization of the weighted population frequency regarding availability and affordability of fresh fruits and vegetables based on a Likert scale of agreement. Results showed that more than three-quarters of the weighted population have fresh fruits and vegetables available within their neighborhood (76.0%, *wN* = 21,478,856) while less than half of the weighted population can afford to purchase them (46.5%, *wN* = 13,129,925). At the opposite end, 3.5% (*wN* = 991,455) of the weighted population state that fresh fruits and vegetables are never available within their neighborhood, while 1.3% (*wN* = 374,663) are never able to afford them.

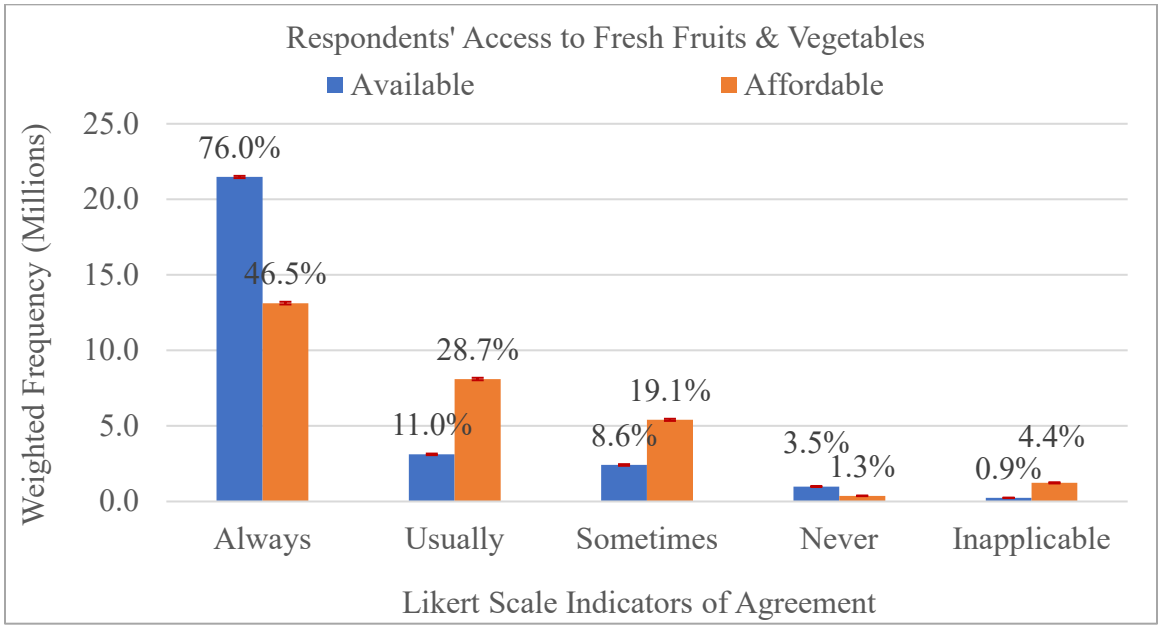

Figure 11: Weighted respondent frequency with standard error regarding respondents' access to fresh fruits and vegetables.

Clinical studies have additionally identified associations between asthma prevalence and psychological conditions such as depression and anxiety, necessitating a review of mental-health indicators. CHIS data includes a Boolean field screening for

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severe mental illness based on the Kessler K6 nonspecific distress scale captured through six unique survey questions. The raw output along the entirety of the Kessler K6 nonspecific distress scale prior to Boolean conversion is provided in Figure C1. While research has questioned the clinical validity of this scale for identifying moderate mental distress, it continues to remain an important diagnostic tool for severe mental conditions (Prochaska, Sung, Max, Shi, & Ong, 2012). Most of the weighted population is not classified as having severe mental distress (91.9%, *wN* = 25,964,669), with a minority showing severe mental conditions based upon the screening scale (3.8%, *wN* = 2,281,964).

With any chronic health condition, it is important to have regular access to quality health care, and insurance is a key driver to enabling that access. Troublingly, 14.4% (*wN* = 4,077,541) of the weighted population do not have health insurance. This significantly impair their treatment abilities for severe conditions. Of those who have health insurance, 56.8% (*wN* = 13,725,422) utilize an HMO, while 43.2% (*wN* = 10,443,671) do not. While most insured individuals have prescription drug coverage (78.5%, *wN* = 22,161,335), just under one-quarter respond either that they do not have such coverage or that such coverage is inapplicable (21.5%, *wN* = 2,007,758). Most uninsured individuals also indicate that they do not have prescription drug coverage or that such coverage is inapplicable (95.5%, *wN* = 3,930,790), 0.5% (*wN* = 146,751) indicate having coverage. While counterintuitive to have prescription drug coverage without health care insurance, there are many pharmaceutical companies who provide prescription-drug programs that register with pharmacies as prescription-drug-only insurance coverage. Even with these programs, 5.3% of the weighted population

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(*wN* = 1,614,793) delayed obtaining prescription drugs due to cost, although this is at least below the 7.4% (*wN* = 2,102,002) who delayed obtaining needed medical care due to cost. Figure C2 provides a mosaic plot of dichotomous health insurance (yes, no) by the nominal variable have prescription drug coverage (inapplicable, yes, no).

For those who are insured, more than one-third (38.9%, *wN* = 9,194,952) of the weighted population are covered by Medi-Care or Medicaid, which are the California and Federal medical assistance programs for low-income individuals, seniors, children, and disabled individuals. Kaiser Permanente services the next-highest segment of the insured at 17.4% (*wN* = 4,117,495) of the weighted population, followed by Blue Cross at 13.9% (*wN* = 3,291,847). The remaining 29.8% of the weighted population (*wN* = 7,053,384) leverage a different health care insurance. The complete list of health plans with weighted population is provided in Figure 12.

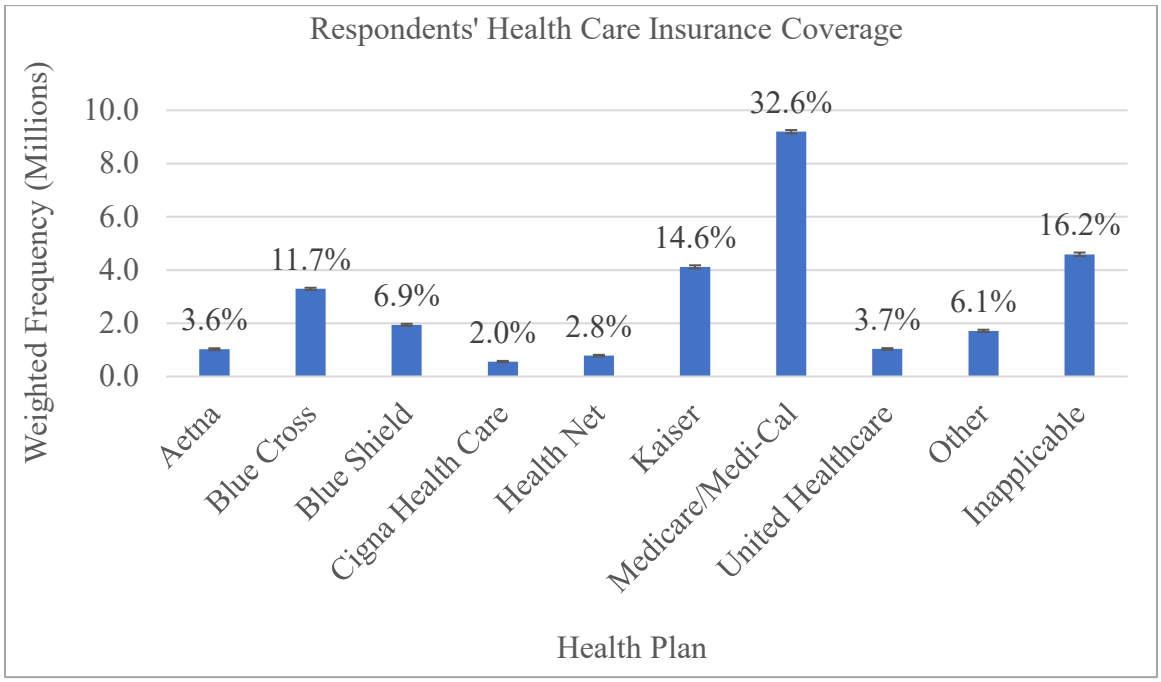

Figure 12: Weighted respondent frequency with standard error regarding respondents' health care insurance plan.

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3.1.5 Employment and Food Security

The socioeconomic characteristics found within the CHIS PUF data are detailed in Table B4. Full-time employment was reported by a majority of respondents (54.6%, *wN* = 15,423,269), followed by those who were unemployed and not looking for work (29.4%, *wN* = 8,307,234), those with part-time employment (8.8%, *wN* = 2,487,583), those unemployed and looking for work (6.9%, *wN* = 1,947,924), and those with other employment situations (0.3%, *wN* = 80,623). Individuals who served within the U.S. Armed Forces comprised a minority of respondents (7.4%, *wN* = 2,083,549), while those who had not served comprised the remainder (92.6%, *wN* = 26,163,085). Nearly half the weighted population were employed by private companies and non-profit organizations (42.6%, *wN* = 12,025,511), followed by the more than one-third of individuals who were retired or unemployed (35.6%, *wN* = 10,051,046). Self-employed individuals comprised 10.7% (*wN* = 3,020,842) of the weighted population, with government workers comprising 9.9% (*wN* = 2,790,005), and those employed within a family business or on a form being the remainder at 1.3% (*wN* = 359,229). More than half the weighted population do not volunteer or perform community service (59.2%, *wN* = 16,736,114), while 40.8% (*wN* = 11,510,519) do volunteer or community-service work.

More than one half of respondents self-reported home ownership (56.5%, *wN* = 15,966,479), while the remainder self-reported renting or having a different living situation (43.5%, *wN* = 12,280,155). As shown in Figure 13, nearly one half of individuals (49.7%, *wN* = 14,037,805) have household incomes at least three times the federal poverty level (FPL). Those with income more than twice, but less than three times, the FPL comprise nearly one seventh of individuals (14.1%, *wN* = 3,973,723),

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while those above but less than twice the FPL number nearly one fifth (19.6%, *wN* = 5,528,155). Less than one fifth of households (16.7%, *wN* = 4,706,950) have incomes below the FPL.

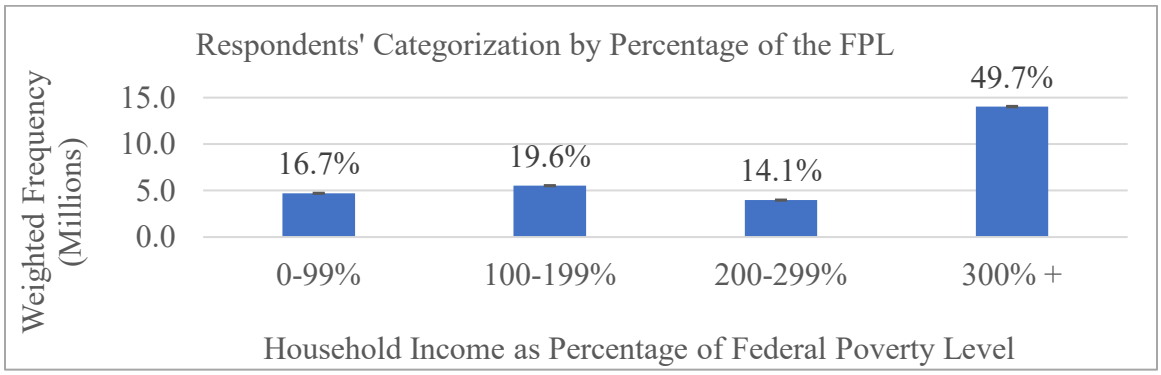

Figure 13: Weighted respondent frequency with standard error regarding respondents' household income relative to FPL. Values shown as weighted percentage of total.

More than four-million individuals within the weighted respondent population experience food insecurity, with 9.9% (*wN* = 2,799,403) not facing hunger and 5.5% (*wN* = 1,542,618) going hungry. The remaining 84.6% of the weighted population (*wN* = 23,904,612) have food security or earn at least 200% of the federal poverty level (FPL).

3.1.6 Asthmatic Subject Characteristics

The asthma characteristics of the CHIS PUF data are provided within the health conditions shown in Table B2. Consistent with information calculated by the CDPH Environmental Health Investigations Branch (2015-2016), only a minority of Californians have ever been diagnosed with asthma (14.3%, *wN* = 4,027,914); the majority have never been diagnosed with the disease (85.7%, *wN* = 24,218,720). Not all diagnosed with asthma continue to experience the disease, however. Current asthmatics

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comprise 9.8% of the weighted population (*wN* = 2,765,889) while previous asthmatics comprise 4.5% (*wN* = 1,262,024). Only 52.9% (*wN* = 2,129,829) of asthmatics were ever provided an asthma management plan, with only 24.6% (*wN* = 522,998) having a written copy of the plan. As shown in Figure 14, 78.8% of those that have ever been diagnosed with asthma are very confident in their ability to control the disease (*wN* = 3,175,594). Those that have only some confidence in disease control comprise only 17.4% of the asthmatic population (*wN* = 699,907), while 0.5% have limited to no confidence in their asthma management (*wN* = 152,412). Figure C3 provides a visual breakdown of asthma-control confidence based on whether individuals represent current or previous asthmatics. Nearly three-quarters (72.2%, *wN* = 1,997,216) of current asthmatics are very confident in disease control, while 23.3% (*wN* = 644,905) are somewhat confident and 4.5% (*wN* = 123,760) have limited to no confidence. While results are improved for previous asthmatics, only 93.4% (*wN* = 1,178,378) are very confident while 4.4% (*wN* = 55,002) are somewhat confidence and 2.3% (*wN* = 28,644) have limited to no confidence.

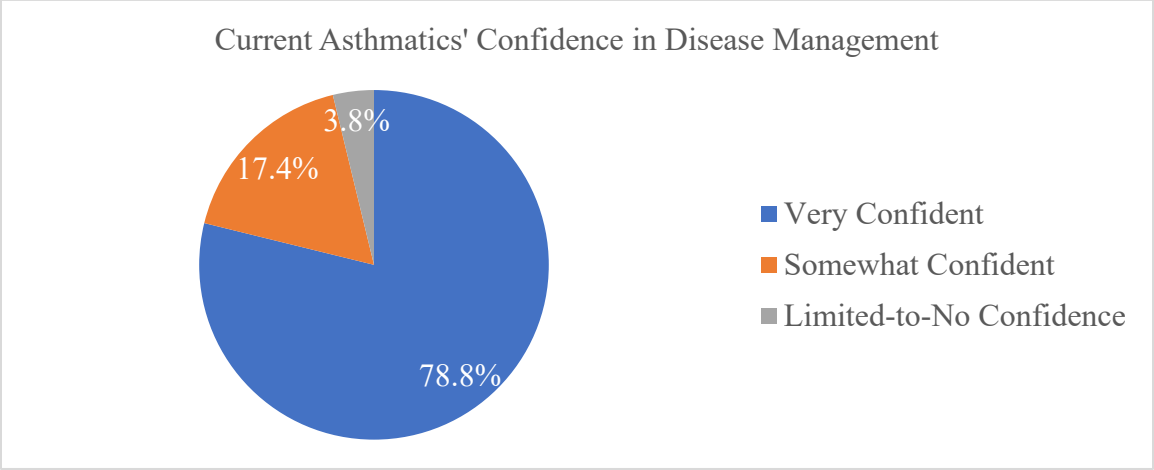

Figure 14: Weighted respondent frequency regarding confidence in asthma management amongst those respondents classified as ever having been diagnosed with asthma.

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Of those ever diagnosed with asthma, more than one quarter of weighted respondents take daily asthma medications (27.3%, *wN* = 1,101,625) while just under three quarters do not (72.7%, *wN* = 2,926,288). As shown in Figure 15, frequency of symptoms for asthmatics ranges from every day (6.5%, *wN* = 261,257) to not at all (49.0%, *wN* = 224,646 after conversion of diagnosed asthmatics who responded "inapplicable" to the survey question to "not at all"). The vast majority of asthmatics have not gone to the ED or urgent care for their asthma symptoms (94.1%, *wN* = 3,790,654 after conversion of diagnosed asthmatics who responded "inapplicable" to the survey question to "not at all"), while 5.9% (*wN* = 237,259) have had to seek asthma medical attention from the ED or urgent care.

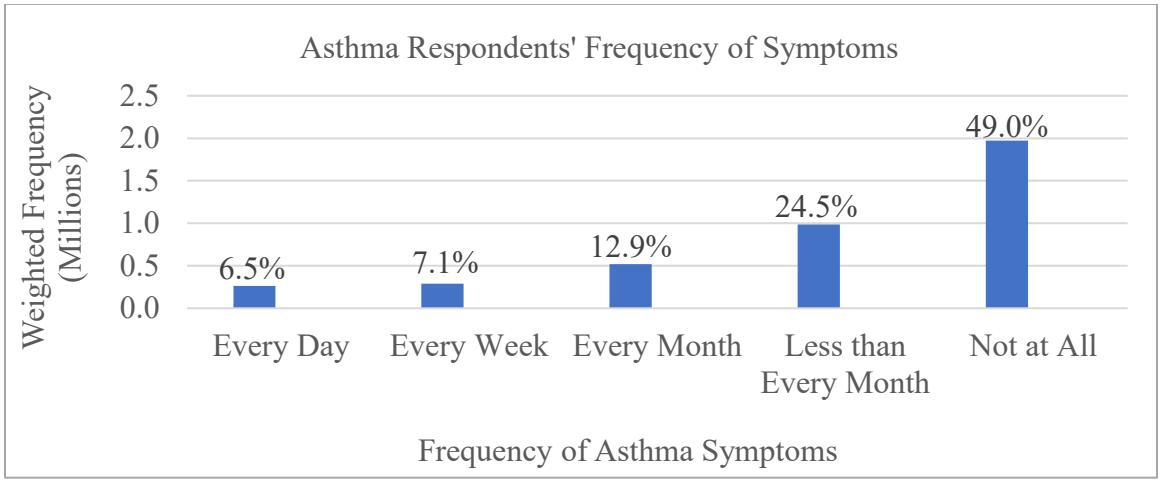

Figure 15: Weighted asthma respondent frequency regarding frequency of disease symptoms. Values shown as weighted percentage of total.

3.2 American Community Survey

A decennial census is mandated by the Constitution of the United States of America in order to provide an accurate count of state residents for the apportionment of government representation and taxes. The census covers numerous subjects, including

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demographics and socioeconomic details from each household. As noted by Torrieri and SEHSD Program Staff in *American Community Survey Design and Methodology (January 2014)*, the U.S. Bureau of the Census (Census Bureau) began developing ACS in 1994, with full implementation in 2005, in order to provide more real-time census information for analysis. Rather than cover the entire population, ACS samples population areas to provide statistical estimates regarding variables measured. One-year and five-year estimate datasets are created from this information, with one-year data being the most current but least reliable and only available for areas with populations above 65,000 individuals, and five-year data being the least current but most reliable with coverage for all population areas (Torrieri & SEHSD Program Staff, 2014). The five-year ACS was selected for use in this study due to the improved reliability of information and population coverage.

The 2017 ACS five-year estimate data was obtained from the Census Bureau in SAS format through their American Fact Finder website. For alignment with CHIS, only California population records were obtained. Data included 1,872,509 observations across 286 variables, inclusive of 18 replicate weights to provide improved standard error estimates and decrease sampling bias. ACS first attempts to derive missing data from other information within the observation. When data could not be derived, it was imputed from the household or nearest neighbor matrices Missing data leveraged a tiered imputation approach where results were first attempted to be derived based on other responses for that observation and, second, imputed from within the household or "nearest neighbor matrices populated by donors" ("Item Allocation Rates Definition," n.d.). Rates of imputation are shown by key data characteristic in Table 2.

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Table 2

ACS Imputation Rates by Characteristic

Sample Characteristic	2017	2016	2015	2014	2013
Population	11%	10%	10%	9%	9%
Age	2%	2%	2%	2%	2%
Sex	0%	0%	0%	0%	0%
Citizenship	8%	8%	7%	7%	6%
Race	2%	2%	2%	2%	3%
Wages/salary income	20%	20%	20%	19%	19%
Health Insurance through Employer	12%	12%	11%	10%	9%
Health insurance through Medicare	11%	11%	10%	9%	8%
Health insurance through Medicaid	13%	13%	12%	11%	10%

Note: Adapted from "Item Allocation Rates: California" (n.d.).

After download, ACS data was imported into SAS Enterprise Guide for analysis. Data was then recoded to align with key variables from the CHIS model. Respondent age was recoded into a dichotomous variable indicating children below 18 years of age and adults 18 years of age and older. Sex was also recoded into a dichotomous variable aligned with CHIS models. Citizenship was collapsed from five nominal categories to only three, with those born within the U.S. or its protectorates, as well as those "born abroad of American parent(s)" (American Community Survey Office, 2019b), being categorized as U.S. citizens. The remaining two categories, naturalized citizens and non-citizens, were aligned between data. Two ACS variables were utilized to recode race in alignment with CHIS. The first past aligned the ACS race variable with non-Latino categories utilized in CHIS. All combinations of American Indian and Alaska Native were collapsed together into a single category, and Asian, Native Hawaiian, and Other Pacific Islander, were collapsed into a single category for Asians. A second pass utilized

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the variable indicating individuals of Hispanic origin to recode race as Latino. The income-to-poverty ratio was recoded to the dichotomous variable indicating those earning below FPL and those earning at least 100% FPL. Finally, the dichotomous variable indicating whether or not an individual was covered by health insurance was recoded for alignment with the CHIS model.

Table 3

Key Characteristics of ACS Observations

Variable	Frequency *N* (%) (N=1,872,509)	Wtd. Population *Wtd. N* (%) (N=38,982,847)	Standard Error of Wtd. *f*	Percent
Age Category				
Adult (18+)	1,468,146 (78.4%)	29,870,875 (76.6%)	1,408	0.0%
Minor (< 18)	404,363 (21.6%)	9,111,972 (23.4%)	1,330	0.0%
Gender				
Male	923,697 (49.3%)	19,364,308 (49.7%)	2,471	0.0%
Female	948,812 (50.7%)	19,618,539 (50.3%)	2,406	0.0%
Citizenship				
US-Born Citizen	1,380,003 (73.7%)	28,445,236 (73.0%)	18,365	0.0%
Naturalized Citizen	266,542 (14.2%)	5,266,468 (13.5%)	12,669	0.0%
Non-Citizen	225,964 (12.1%)	5,271,143 (13.5%)	16,081	0.0%
Race				
African American	91,190 (4.9%)	2,157,451 (5.5%)	5,493	0.0%
American Indian / Alaska Native	10,024 (0.5%)	137,642 (0.4%)	1,772	0.0%
Asian	281,403 (15.0%)	5,571,121 (14.3%)	6,579	0.0%
Latino	652,810 (34.9%)	15,104,837 (38.7%)	2,438	0.0%
White	777,900 (41.5%)	14,778,030 (37.9%)	3,598	0.0%
Multiracial / Other	59,182 (3.2%)	1,233,766 (3.2%)	8,545	0.0%
Income as Percentage of FPL				
0-99% FPL	315,687 (16.9%)	6,543,048 (16.8%)	23,900	0.1%
100% FPL and Above	1,556,822 (83.1%)	32,439,799 (83.2%)	23,922	0.1%
Health Insurance Coverage				
Yes	1,695,549 (90.5%)	34,828,504 (89.3%)	16,665	0.0%
No	176,960 (9.5%)	4,154,343 (10.7%)	16,663	0.0%

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ACS data is sampled by Public Use Microdata Sample (PUMS) that are geographically associated into PUMA representing approximately 100,000 to 200,000 people each. This system is designed to sufficiently deidentify data to maintain respondent confidentiality, while providing necessary aggregate granularity to allow for meaningful analyses. 2018 *TIGER/Line® Shapefiles* for California PUMA were downloaded from the Geography Division of the U.S. Census Bureau. Shapefiles were imported into Tableau indexed by PUMA for relational joining with ACS results. Appendix G provide maps of the PUMA polygons for California color-coded by county and the 22 PUMA polygons by area within San Diego.

3.3 Procedures

After importing CHIS and developing a final dataset, the table was imported into a SAS Enterprise Miner™ 15.1 (EM) project. Asthma-related variables for current asthmatics, previous asthmatics, and those needing to visit an ED or urgent care for asthma symptoms within the last 12 months, were coded as target, or independent, variables, while all other fields were coded as input, or independent, variables. After manual review of field data, all variables were classified as either binary, nominal, or ordinal. Based upon the work of deVille and Neville (2013), decision trees were created in order to facilitate identification of potential inputs for the regression equation. Trees were created with the target variable of asthma status (current, previous, or non-asthmatic). A secondary tree using the target of individuals that went to the ED or urgent care for asthma from a subset dataset of those individuals identified as current asthmatics. All other asthma variables were excluded from the tree for each root node. Asthma-related variables, such as how the variable of having gone to the ED or urgent care within

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the past year aligns with having gone to the ED or urgent care for asthma symptoms within the past year, were also excluded from the analysis. EM trees were designed for a maximum of three branches per node with a depth up to six nodes.

Subsequent to the decision-tree analysis, final variables were manually reviewed relative to research identified within the literature review. Specifically, those variables related to demographics and socioeconomic status, obesity, and anxiety and depression, were determined for further review. Although the original study intent was to enable statistical control based on sexual orientation, which recent studies have identified to be associated with asthma, this variable was not made available within the CHIS PUF.

As previously indicated, CHIS PUF contained weighting variables, also known as replicate weights. Replicates allow for improved standard error estimates and decreased sampling bias through inflation of the sample data to the expected population. Use of the replicates in statistical procedures effectively increases data tests for application across the diverse population. The initial step in analyzing CHIS involved the creation of data characteristic tables detailing the observed frequency across specified variables, the replicate or weighted-population frequency, and the standard error. The characteristics are detailed for demographics variables in Table B1, health variables in Table B2, health insurance and access variables in Table B3, and socioeconomic variables in Table B4.

Using Pearson's chi-square test of categorical data, Table B5, Table B6, Table B7, and Table B8 were created to describe the univariate analyses of multinomial asthma status and, respectively, demographics, health, health insurance and access, and socioeconomic variables. Table B9, Table B10, Table B11, and Table B12 provide similar information for models specific to uncontrolled asthmatics, who are those current

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asthmatics that visit the ED or urgent care for treatment of symptoms. Pearson's chi-square test shown in these tables provided insight into the *goodness of fit* through an indication of how the actual distribution of data compared to the expected distribution of independent variables. Thus, this tested the null hypotheses that the variables reviewed were independent of one another. The associated p values at a 95% confidence level, or significance level (α) of .05, allowed for conclusion regarding the statistical significance of identified variable associations and subsequent rejection or acceptance of the null hypotheses.

After identifying desired variables for further analysis, multinomial logistic regression off asthma status was performed relative to key variables indicated through literature review, statistical significance from the univariate analysis, decision trees, and judgmental analysis of those factors that could be leveraged for subpopulation targeting and for which data may be available by geospatial polygon. Results of this model are presented through the odds ratio estimates presented in Table D7, which was indexed to variable factors as shown in Table 4. The odds ratio estimate provided the log odds of the alternative to the indexed outcome factor within the model. All other factors remaining constant across the linear combination of independent variables, the log-odds of a positive outcome increases by the specified odds-ratio coefficient (UCLA Institute for Digital Research and Education, n.d.). The associated 95% confidence limits (CI) provided the range within which the actual or true odds ratio for the population was expected. The null hypothesis that there is no statistically significant difference between the occurrence odds for each variable factor fails to be rejected for those instances where the 95% CI includes one.

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Table 4

Initial Multinomial Logistic Regression Odds Ratio Indexing

Variable	**Indexed Factor**
Asthma status (*outcome*)	Current asthmatics
Sex	Male
Age group	Young adults (18 – 39)
Citizenship	U.S. born citizens
Family type	Married with children
Descriptive BMI	Normal (18.50 – 24.99)
Smoking status	Non-smokers
Psychological distress	None
Health care insurance	Uninsured
Income level	At least 300% FPL
Food security status	Inapplicable due to income level
Employer type	Government

Subsequent to investigation of the multinomial logistic regression into asthma status, continued use of previous asthmatics was further investigated. As stated previously, this indicates those individuals who were once diagnosed with asthma but who have been asymptomatic for more than one year. This could indicate such confounders as adults with childhood asthma who outgrew the disease or instances of asthma secondary to other health conditions that are no longer an ongoing concern. Use of replicate weights prevented direct exclusion of these observations from the sample, so a dummy variable was created to indicate those observations to be included or excluded from further study. This process enabled binomial logistic regressions to be performed using the dummy variable as a domain divider, thus enabling modeling of the binary outcome of current asthmatics and non-asthmatics. Initial modeling leveraged the same

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indexing as shown in Table 4, with results presented tabularly within Table D2 and visually within Figure D1.

In addition to detailing the odds ratios and 95% CIs, Table D2 includes Maximum Likelihood Estimates (MLE). For the desired logit probability model, the estimated value of the y-axis interception (β_0) is provided, as are the regression coefficient estimates ($\beta_{1\ldots n}$) for each variable ($X_{1\ldots n}$). Standard errors are provided to show the expected variability of the point estimate from the true population value. The p value is again provided at a significance level of .05. This shows the statistical significance of the variable and tests the null hypothesis of the regression coefficient being zero. For those variables where $p < .05$, the null hypothesis is rejected, resulting in acceptance of the alternative that the regression coefficient is as stated within the standard error range.

Table D3, Table D4, Table D6, and Table D8, provide similar information, but with ever-refining models building upon each other and aligning closer to available geospatial variables. These tables are inverted in that model outcome indexing is to the probability of individuals being asthmatic, rather than non-asthmatic. Predictor variable indexing was also shifted as shown in each table. The odds ratio results for each of these models are visualized in Figure D2, Figure D3, Figure D4, and Figure D5. To provide for an measure of the overall effect of each variable factor on outcome results, MLE sorted descending by the absolute value of the standard estimates are provided in Table D5, Table D7, and Table D9.

Modeled variables were strategically targeted based upon research to minimize the risk of multicollinearity, where multiple predictor variables have shared associations that conflate to overstate the statistical significance of the variables and result in unstable

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models. To further mitigate the risk of multicollinearity with the final binomial regression models, linear regression was also performed with these models for review of the variance inflation factors (VIF). All VIF values were lower than two and well below the expected range of multicollinearity indication.

Subsequent to completion of modeling for asthma probability, binomial regression models were created for the dichotomous outcome variable indicating asthmatics who required ED and urgent care visits for asthma symptoms. As with the asthma prevalence models, univariate statistics, logistic regression odds ratio results, MLE sorted by standard estimate, and visualization of odds ratios are provided.

In order to align asthma models with the ACS replicated-weighted population estimates by PUMA, associated variables within ACS were recoded for CHIS alignment. Replicate weights were then leveraged to generate a table of weighted population by PUMA and key modeling variable: sex, citizenship, race, income as a percentage of FPL, and health insurance coverage. The output SAS table and geospatial polygon by PUMA were imported into Tableau 2019.1 for creation of an interactive dashboard for California, with asthma logistic regression algorithms being applied to ACS data to provide probabilities by PUMA. This dashboard was uploaded to Tableau Public for use by interested parties. Figure 16 provides a summary overview of the analytics process leveraged to target the asthma sub-population within San Diego. The next chapter summarizes the results of this analysis.

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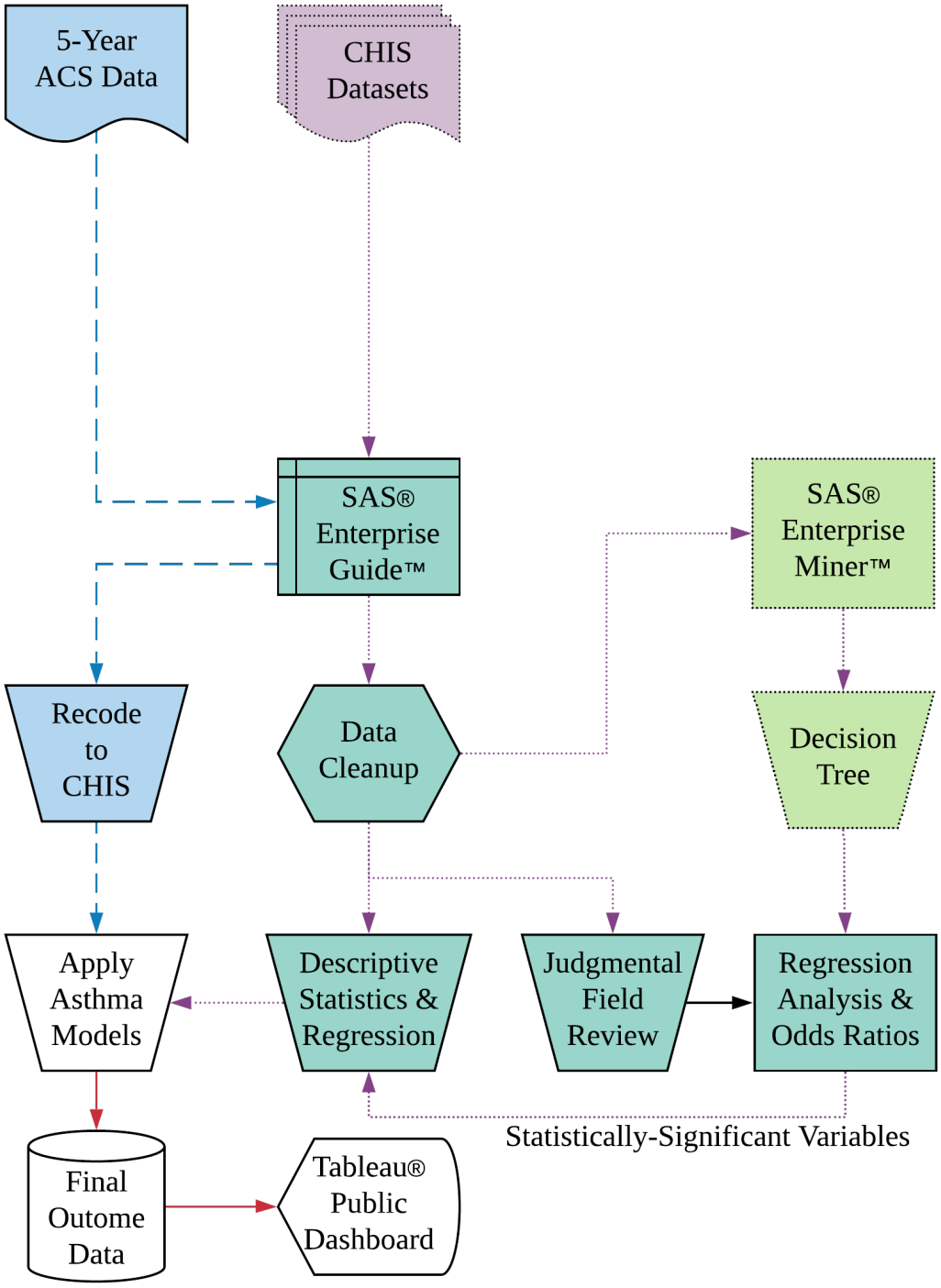

Figure 16: Analytics process summary overview.

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Chapter 4: Results

4.1 Asthma Status Univariate Associations

Complete results of univariate analyses of asthma status are shown in Table B5 for demographics, Table B6 for health conditions and behaviors, Table B7 for health care insurance and access, and Table B8 for socioeconomic status and conditions. All variables except for residency type, active duty service years, working status of respondent, housing category, and home rental or ownership, showed statistically significant associations with asthma status. Focus of univariate review is on those variables that may be useful in combining with available data for mapping hot spots and targeting individuals for outreach and that have expected associations based on literature review or for which results were unexpected and potentially representative of additional research needs.

As shown in Figure 17, the overall weighted respondent population is split 51.2% female (wN = 14,462,534) and 48.8% male (wN = 13,784,100). At a significance level of .05, the univariate association of asthma status to sex is statistically significant ($p < .001$). The proportion of current female asthmatics shows as higher at 62% (wn = 1,723,991) than the overall weighted respondent population (51%, wN = 14,462,534). Conversely, the proportion of current male asthmatics is lower at 37% (wn = 1,041,898) than the overall weighted respondent population (49%, wN = 13,784,100). This reverses with previous asthmatics, where males are proportionately higher at 57% (wn = 719,775) and females are proportionately lower at 43% (wN = 542,249) than the overall weighted respondent population. Non-asthmatics are split similar to the overall weighted

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respondent population at 50% female (*wn* = 12,196,294) and 50% male (*wn* = 12,022,426).

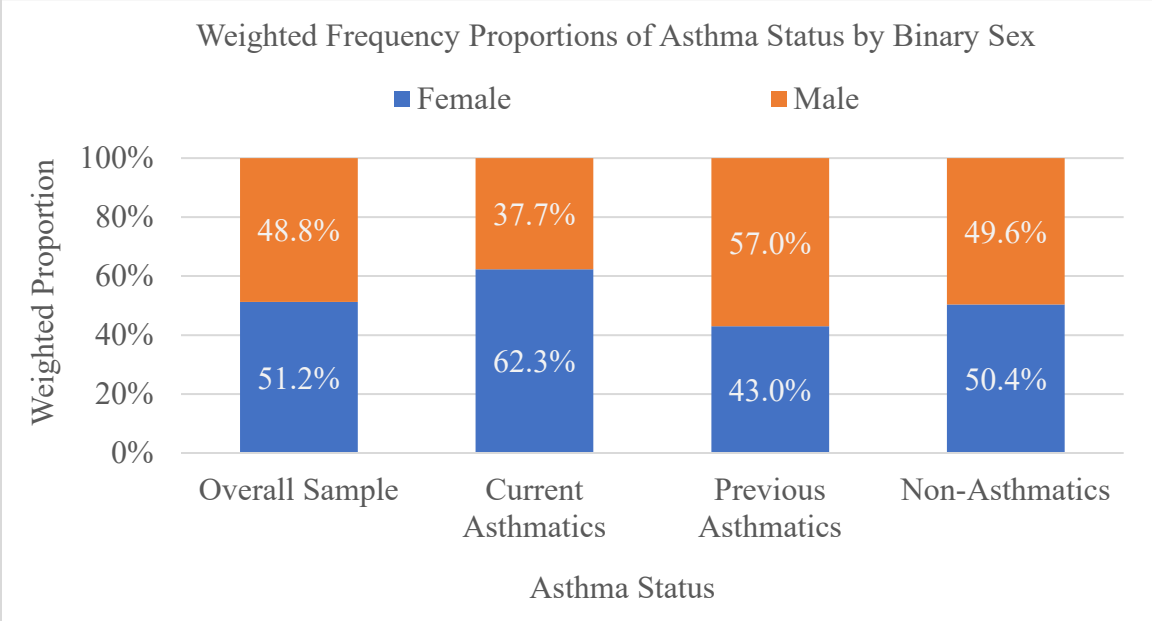

Figure 17: Weighted frequency proportion of asthma status by binary sex.

Although the differences were found to be statistically significant at a .05 significance level ($p < .001$), both current asthmatics and non-asthmatics appeared to be distributed by age group relatively in line with the overall population, as shown in Figure 18. While the overall population was grouped 41% young adults from 18 to 39 (*wN* = 11,571,994), 43% middle-aged individuals from 40 to 64 (*wN* = 12,049,216), and 16% later adults of at least 65 years of age (*wN* = 4,625,423), current asthmatics were respectively grouped 42% (*wn* = 1,150,310), 42% (*wn* = 1,150,939), and 16% (*wn* = 464,640); and non-asthmatics were respectively grouped 40% (*wn* = 9,723,964), 43% (*wn* = 10,476,480), and 17% (*wn* = 4,018,276). Previous asthmatics obviously differed, however, with young adults having a higher proportion than the total population (55%, *wn* = 697,720). Middle-aged (33%, *wn* = 421,798) and later adults (11%,

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wn = 142,507) classified as previous asthmatics were both lower proportioned than the overall population.

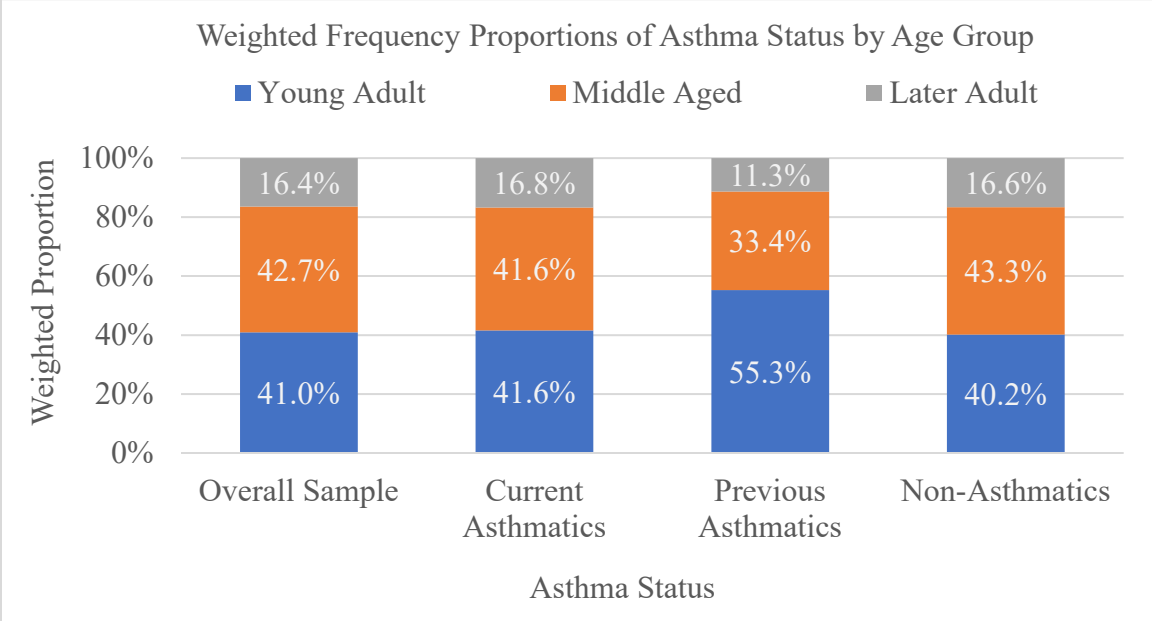

Figure 18: Weighted frequency proportion of asthma status by age group.

As shown in Figure 19, weighted proportions across races are relatively in alignment, although current-asthmatic associations were found to be statistically significant with 95% confidence ($\alpha = .05$, $p < .0001$). Asians (10%, *wn* = 176,128) and Latinos (28%, *wn* = 762,675) readily show lower proportions of current asthmatics than the overall weighted respondent population (Asians 14%, *wN* = 3,924,430; Latinos 35%, *wN* = 9,806,044). The proportion of previous Latino asthmatics (31%, *wn* = 393,295) is also lower than the overall population, although previous Asian asthmatics are in line with the overall population. White individuals (49%, *wn* = 1,361,955) show higher current-asthmatic proportion than seen in the overall population (43%, *wN* = 12,092,661).

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African Americans (8%, *wN* = 229,044) also show this higher proportion of current asthmatics than found within the overall population (6%, *wN* = 1,581,649).

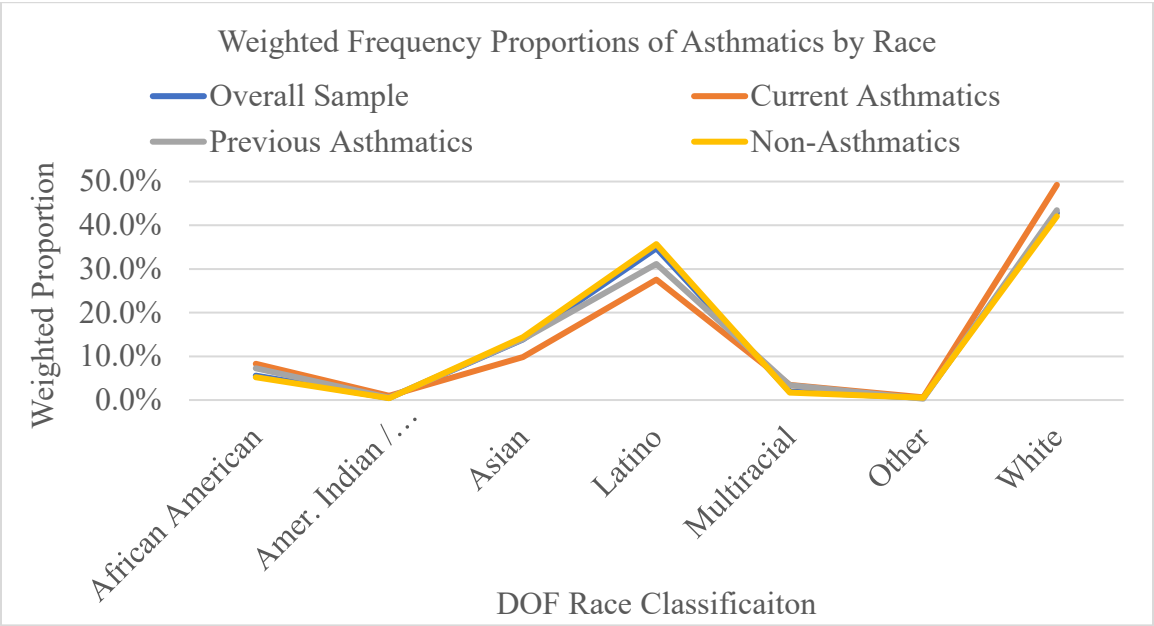

Figure 19: Weighted frequency proportion of asthmatic status by race.

As anticipated from reviewed research into the hygiene hypothesis and farming effect on asthma, US-born individuals have significantly higher proportion of current asthmatics (81%, *wn* = 2,239,461) and previous asthmatics (80%, *wn* = 1,013,137) than the overall weighted population (66%, *wN* = 18,689,704). The weighted frequency proportions of asthma status by nativity are shown in Figure 20. Similarly, US-born citizens have significantly higher proportion of current asthmatics (81%, *wn* = 2,239,461) and previous asthmatics (80%, *wn* = 1,013,137) than the overall weighted population (66%, *wN* = 18,689,704). As shown in Figure 21, these relative asthma proportions for naturalized and non-citizens are reduced. The association between each variable and asthma status were found to be statistically significant at a significance level of .05 ($p < .001$).

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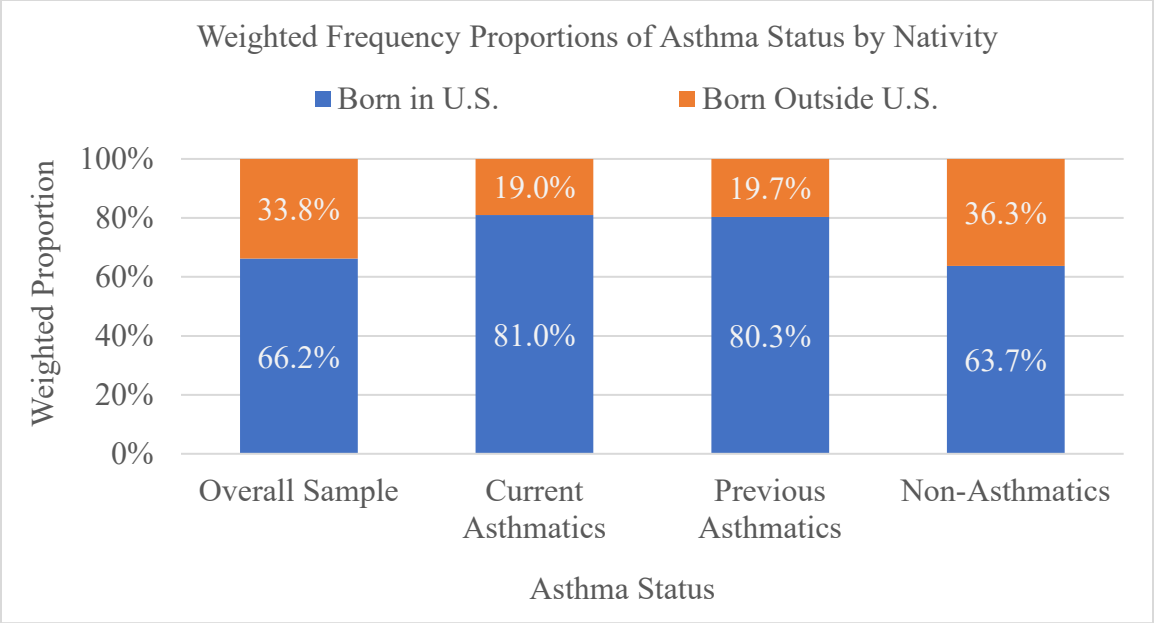

Figure 20: Weighted frequency proportion of asthma status by nativity.

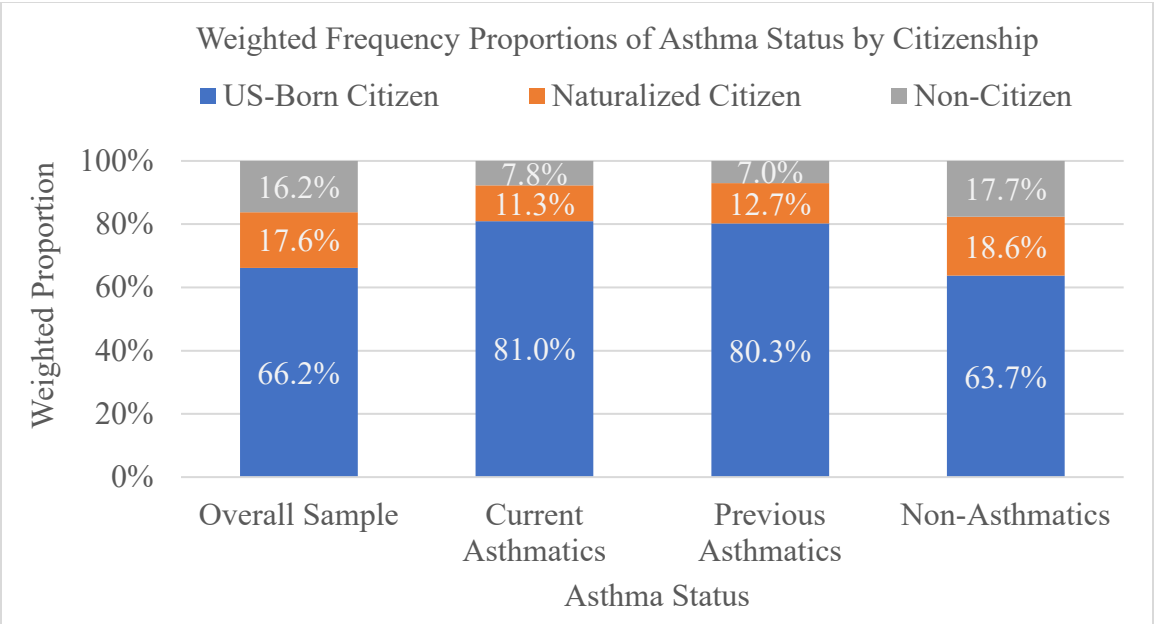

Figure 21: Weighted frequency proportion of asthma status by citizenship category.

Investigating asthma status by primary spoken language yields the visual summary provided in Figure 22. As shown, the English-speaking population, which

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includes those that primarily speak English or English and another language within the home, has proportionately more current asthmatics (91%, *wn* = 2,527,590) and previous asthmatics (92%, *wn* = 1,157,982) relative to their overall weighted respondent population (84%, *wN* = 23,849,238). Other figures are relatively in line with the overall population or proportionately insignificant, although the association between primary spoken language and asthma status is significant at a statistical significance level of .05 ($p < .001$).

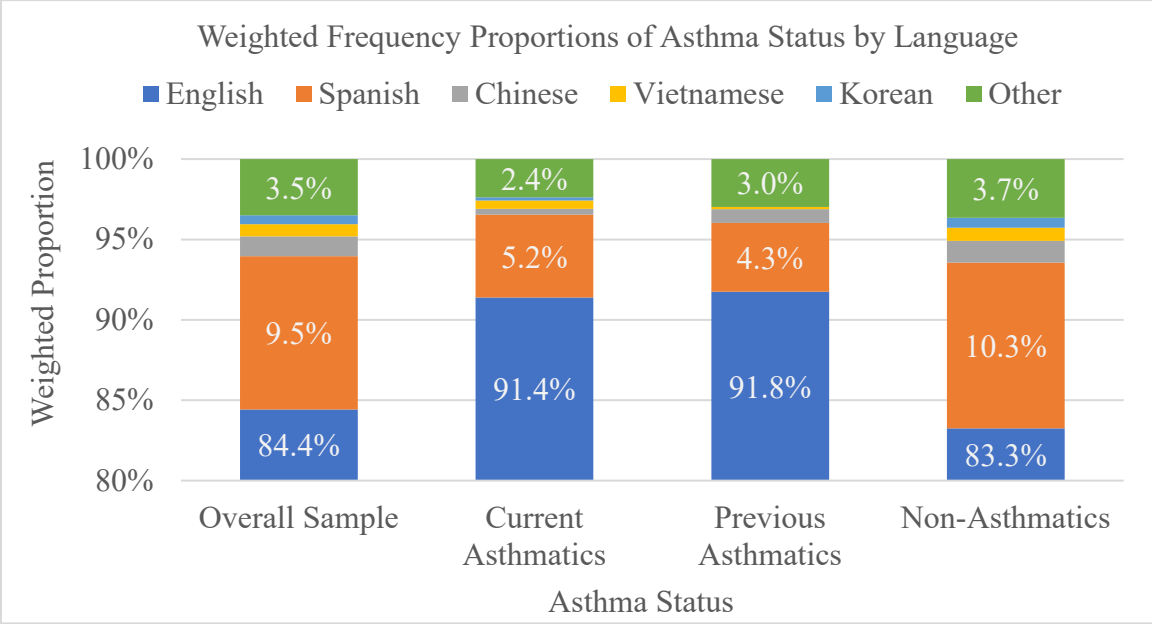

Figure 22: Weighted frequency proportion of asthmatic status by primary language. Values shown only for those factors with a proportion above two points. Zero-axis adjusted to begin at 80% in order to provide improved visual comparison across factors.

The breakdown of asthma status proportions by urban or rural Claritas code is provided in Figure 23 based on a statistical significance level of .05 ($p < .001$). Results are not as expected based upon the hygiene hypothesis, although this may be a factor of the limited differences between zip codes within San Diego. The urban population lives

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within those areas with population densities between 85% and 99% (Claritas, 2017). While expected to have the highest asthmatic prevalence, the proportion of current (49%, *wn* = 1,341,843) and previous (50%, *wn* = 628,509) were both below the population level (52%, *wN* = 14,675,331). Those in second cities, which represent urban areas of decreased population densities between 40% and 85% (Claritas, 2017), showed an increased proportion of current asthmatics (24%, *wn* = 23.6%) and previous asthmatics (22%, *wn* = 272,227) relative to the population (21%, *wN* = 5926,684). Suburban areas, which are outside urban centers and have population densities between 40% and 90% (Claritas, 2017), had decreased proportions of current asthmatics (17%, *wn* = 463,750) yet increased proportions of previous asthmatics (19%, *wn* = 239,635) relative to the weighted respondent population (17%, *wN* = 4,835,966). Contradicting expectations of the farming effect on asthma, those within towns and rural areas, which include farms and have population densities below 40% (Claritas, 2017), had an increased proportion of current asthmatics (11%, *wn* = 308,017) and decreased proportion of previous asthmatics (10%, *wn* = 121,653) relative to the weighted respondent population (10%, *wN* = 2,808,653).

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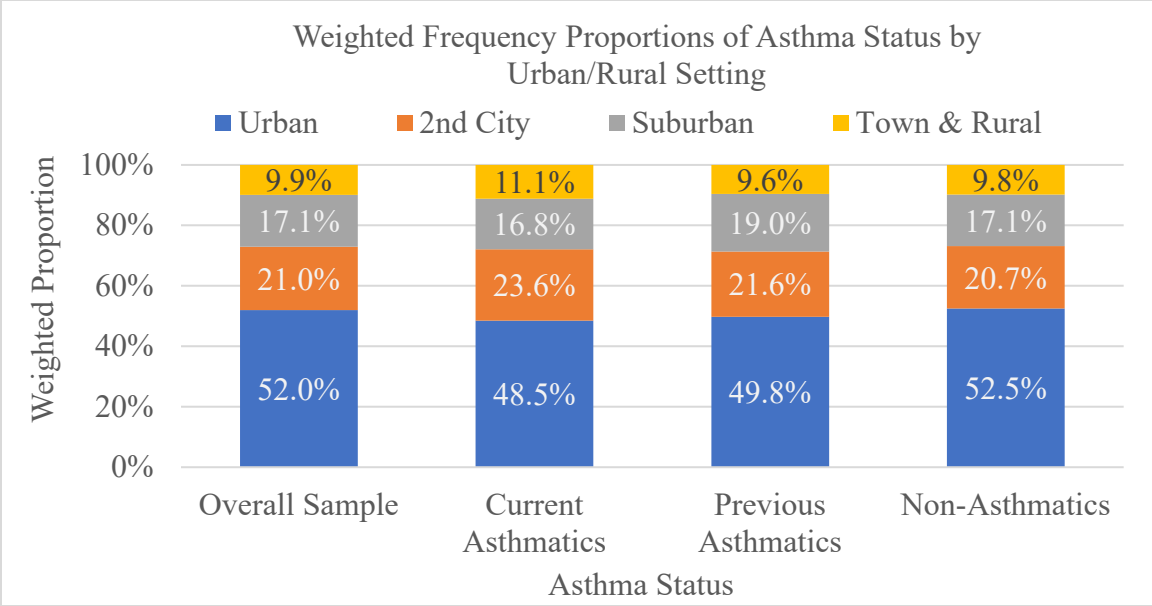

Figure 23: Weighted frequency proportion of asthma status by community type.

Socioeconomic status has been found to be correlated with asthma prevalence, necessitating a review of asthma status relative to income, which is calculated in this study as a percentage of the FPL. As shown in Figure 24, individuals earning below the FPL have proportionately higher instances of current asthma (19%, *wn* = 527,618) and proportionately lower instances of previous asthma (13%, *wn* = 158,240) than their overall population (17%, *wN* = 4,706,950). Individuals making at least three times FPL, however, have proportionately lower instances of current asthma (48%, *wn* = 1,313,699) and proportionately higher instances of previous asthma (56%, *wn* = 700,404) than their overall population (50%, *wN* = 14,037,805). Although there is a statistically significant association between income and asthma status at a .05 level of significance ($p < .001$), the mid-tiers of individuals making between 100% and 199% of FPL and those making between 200% and 299% of FPL, do not share the same pattern as seen with the other categories. While this is suggestive of below FPL and at least three-times FPL

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representing the threshold of asthma impact, additional study into the effects of income on asthma are necessary.

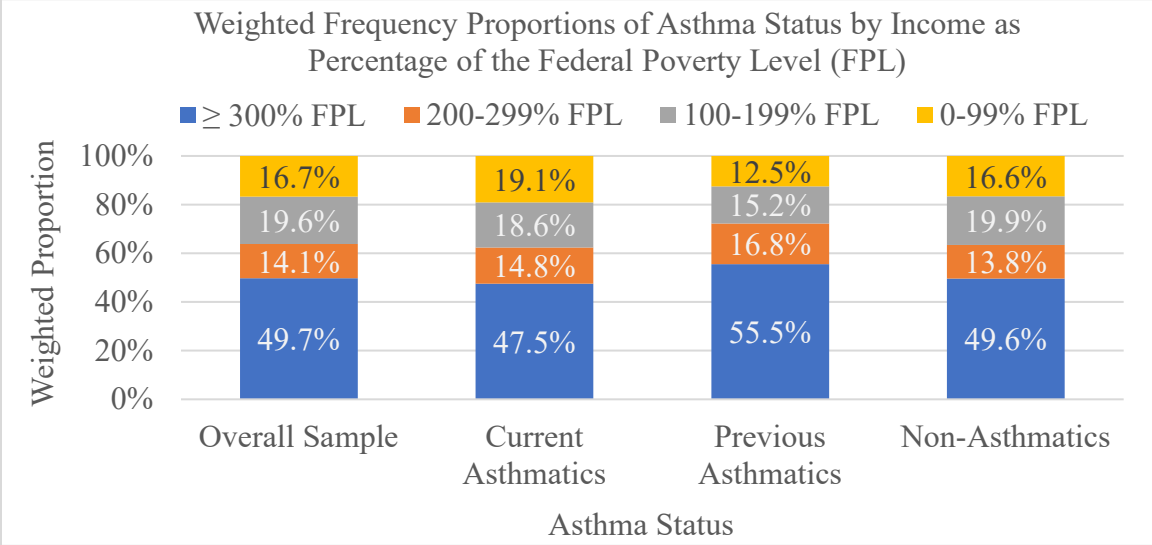

Figure 24: Weighted frequency proportion of asthmatic status by income.

Based on research studies indicating an association between asthma and depression and anxiety, asthmatic status was investigated relative to whether an individual had suffered psychological distress within the past year. A statistically significant association was found at a significance level of .05 ($p < .001$). The weighted proportion of those experiencing psychological distress was significantly higher for both current (15%, *wn* = 426,437) and previous (10%, *wn* = 123,314) than for the overall weighted respondent population (8%, *wN* = 2,281,964). Conversely, the proportion of non-asthmatics was higher amongst those not suffering from psychological distress (93%, *wn* = 22,486,507) than for the overall population (92%, *wN* = 27,174,091). CHIS PUF data collection proved insufficient to identity a temporal correlation as performed by Gao et al. (2015).

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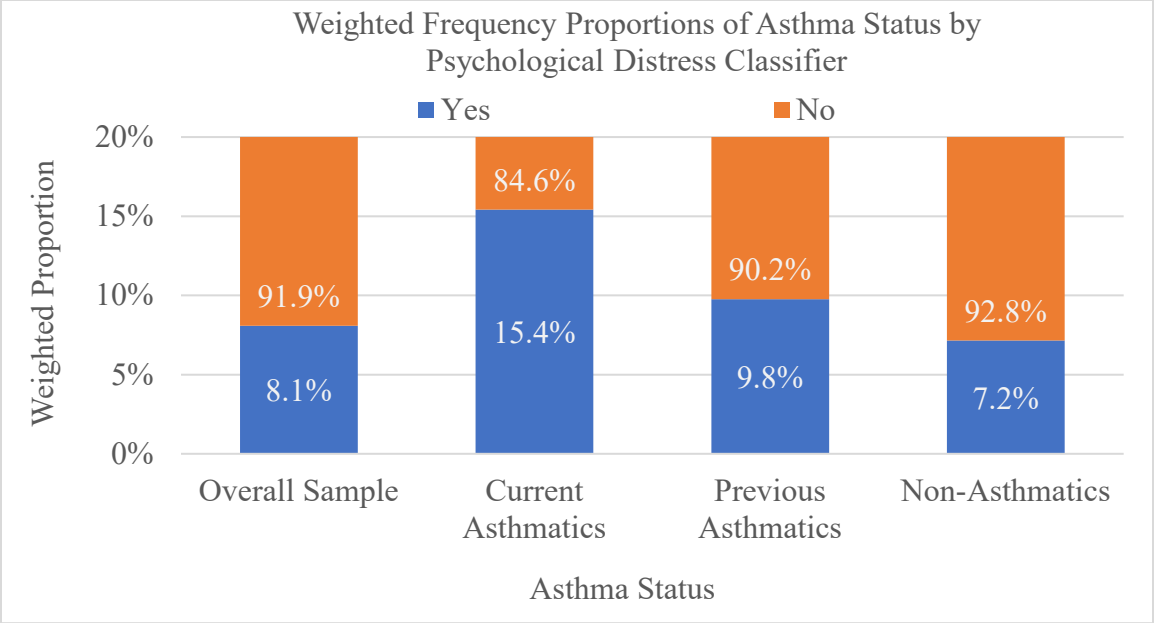

Figure 25: Weighted frequency proportion of asthma status by indicator of psychological distress.

An additional, comorbid, association was discovered between current asthmatics and individuals diagnosed with heart disease, although similar differences were not found within the previous-asthmatic or non-asthmatic samples. As shown in Figure 26, amongst current asthmatics, the weighted proportion who have been diagnosed with heart disease is higher at 10% (*wn* = 282,806) than the overall weighted respondent population (6%, *N* = 1,712,797). This association is in line with research performed by Wang, Gang, Yu, Sheng, and Tan, as published in "Association of asthma with coronary heart disease: A meta-analysis of 11 trials" (2017). Their literature review noted limited research in this area, but confirmed an indication of asthma association with heart disease, particularly in women who contracted asthma as adults (L. Wang et al., 2017). Results were statistically significant with a 95% confidence level ($p < .001$).

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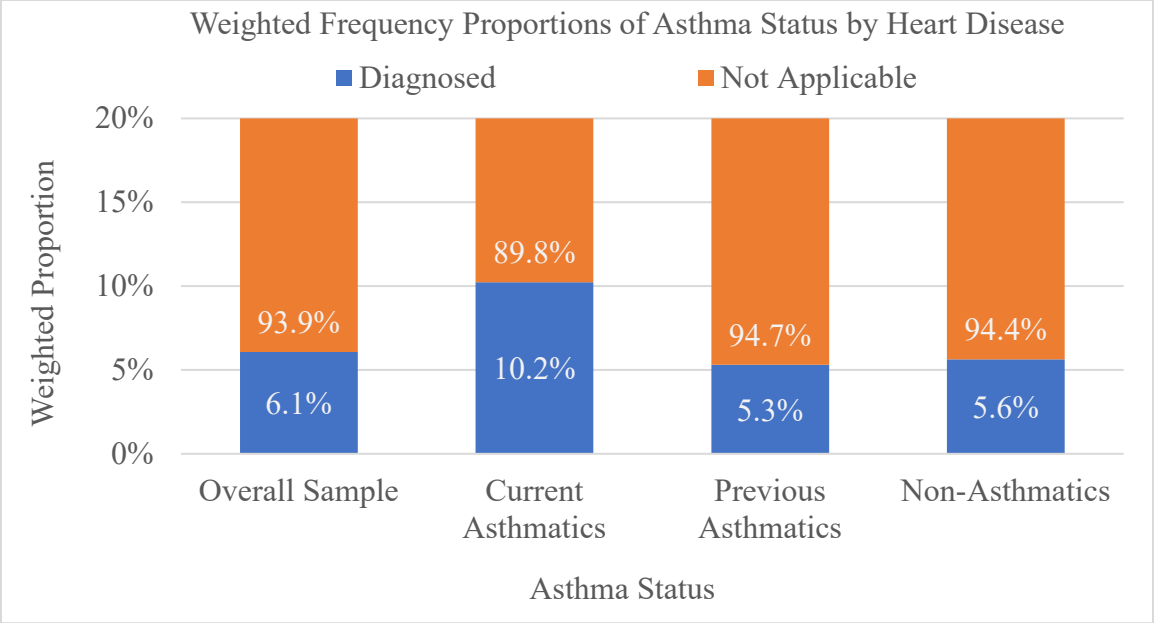

Figure 26: Weighted frequency proportion of asthma status by heart disease.

The association between asthma and heart disease is similar to that seen between asthma and diabetic status, which are visualized in Figure 27. The proportion of diabetics (12%, *wn* = 334,730) and pre-diabetics (2%, *wn* = 64,745) who were current diabetics was found to be higher than expected within the population (diabetics: 9%, *wN* = 2,503,190; pre-diabetics: 2%, *wN* = 449,490). Interestingly, the proportion of diabetics (7%%, *wn* = 82,183) and pre-diabetics (1%, *wn* = 10,121) classified as previous asthmatics was found to be lower than expected within the weighted respondent population. Results were determined to be statistically significant at a significance level of .05.

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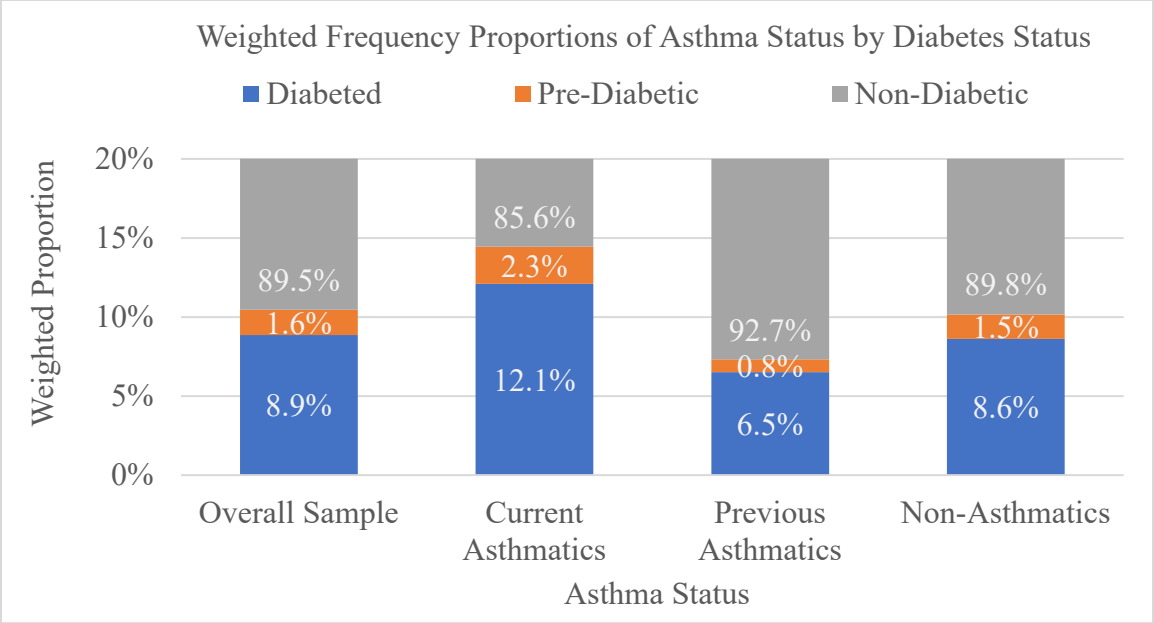

Figure 27: Weighted frequency proportion of asthma status by diabetes status.

It is expected that the associations between heart disease and diabetes with asthma are comorbid effects resulting from increased BMI. Similar to findings by Koebnick et al. in "Interacting effects of obesity, race, ethnicity and sex on the incidence and control of adult-onset asthma" (2016), obese individuals showed a higher weighted proportion amongst current asthmatics (36%, *wn* = 998,289) than for the overall population (26%, *wN* = 7,401,546). Among current asthmatics, the weighted proportion of normal-weight individuals was lower at 31% (*wn* = 852,078) than the overall population at 37% (*wN* = 10,426,170). Interestingly, current asthmatics also had a decreased association with being overweight, as only 31% (*wn* = 869,712) of the sample classified in this manner versus the overall sample at 35% (*wN* = 9,951,359). The charting of these details, which were found to be statistically significant at a significance level of .05 ($p < .001$), is provided in Figure 28.

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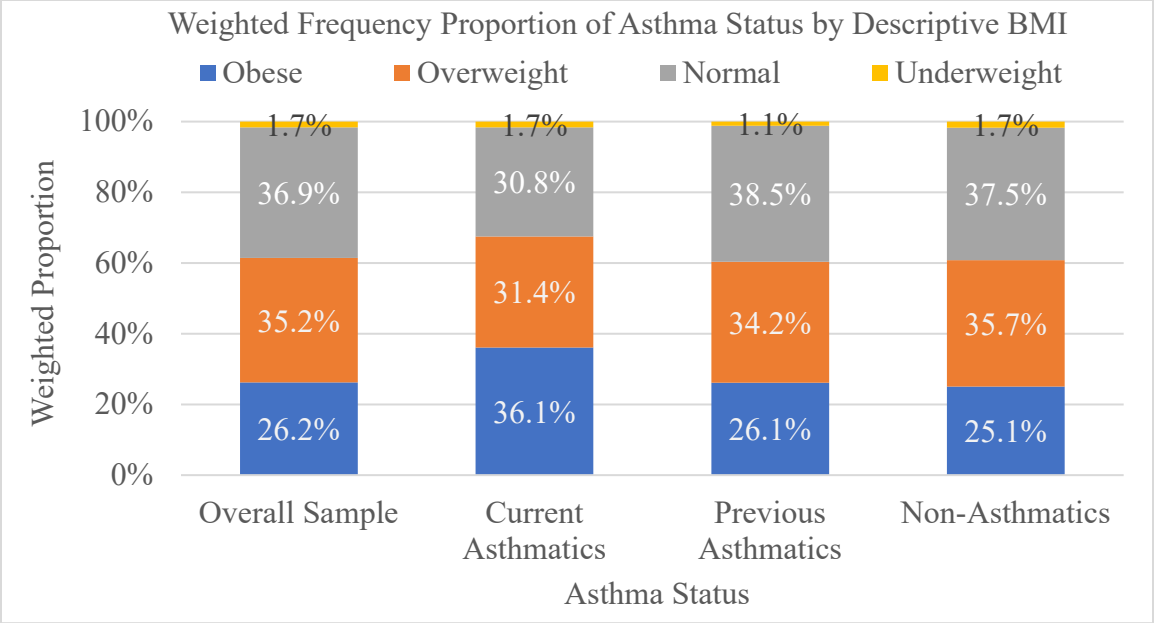

Figure 28: Weighted frequency proportion of asthma status by descriptive BMI.

Given the comorbidity of several health conditions, it comes as no surprise that both current asthmatics (91%, *wn* = 2,506,661) and previous asthmatics (88%, *wn* = 1,114,724) have a higher weighted proportion of individuals with some form of health care insurance than the overall weighted respondent population (86%, *wN* = 24,169,093). These associations are shown visually in Figure 29 and were found to be statistically significant at a 95% confidence level ($p < .001$). This aligns with the increased weighted proportion of current asthmatics that go to a doctor's office, Kaiser facility, or HMO, for their usual health care (64%, *wn* = 1,762,774) relative to the overall population (59%, *wN* = 16,690,639). It also aligns with the decreased weighted proportion of current asthmatics that have no usual source of health care (11%, *wn* = 298,918) relative to the overall population (16%, *N* = 4,477,507). These associations are visualized in Figure 30 and are statistically significant ($p < .001$).

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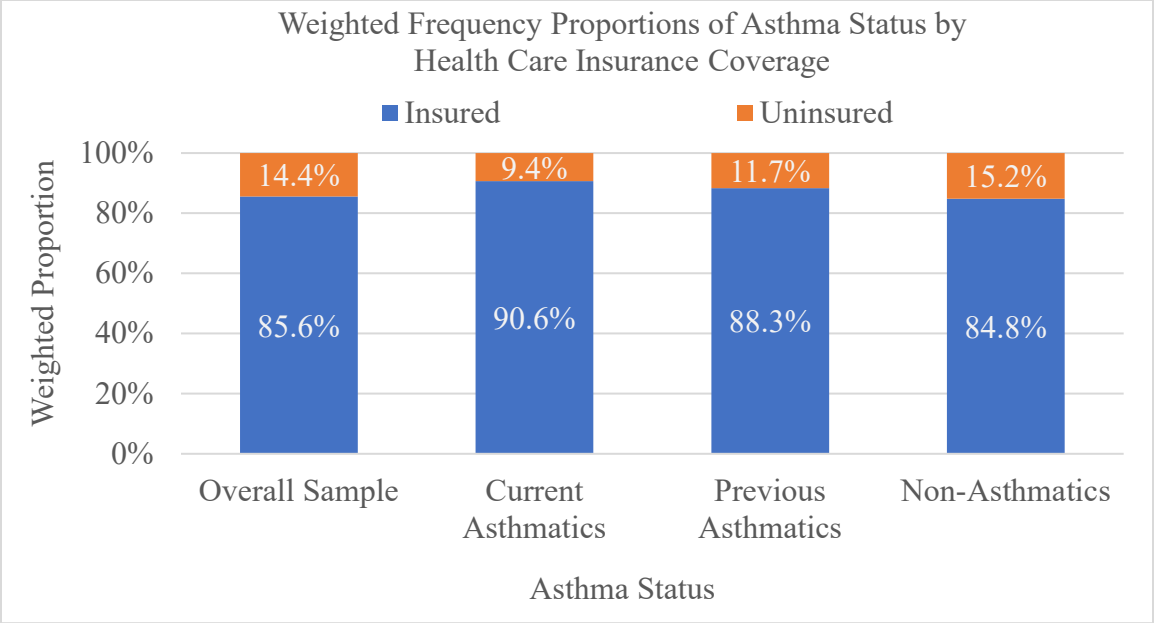

Figure 29: Weighted frequency proportion of asthma status by health coverage.

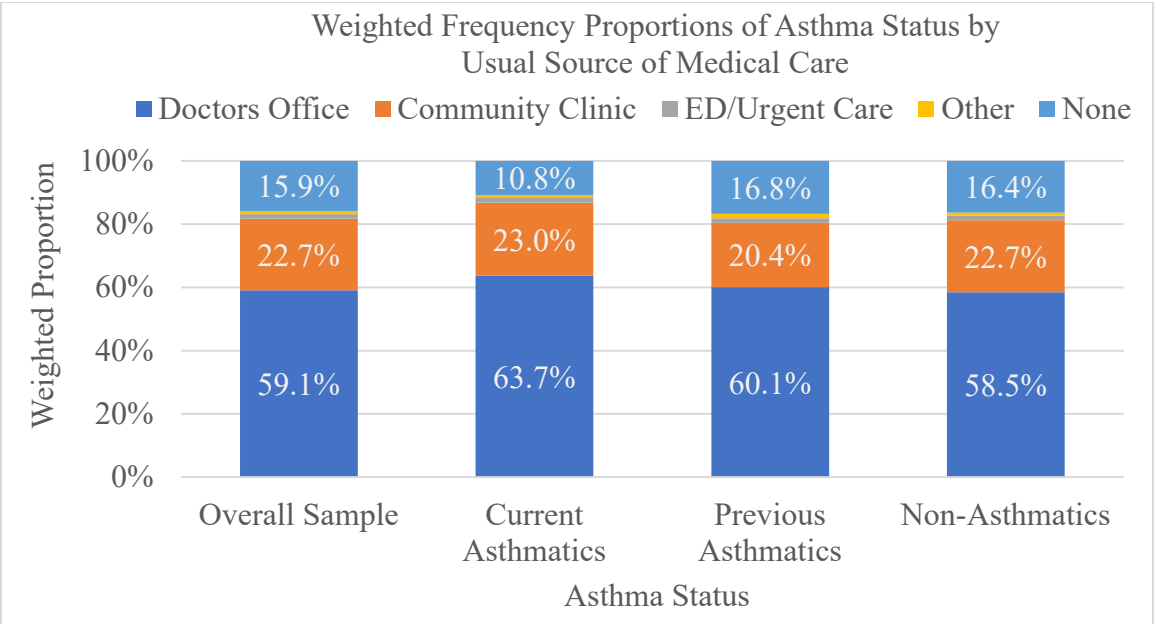

Figure 30: Weighted frequency proportion of asthma status by usual source of medical care. Labels are shown only for factors with proportion above two points.

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While asthmatics have a higher proportion of health care access than the overall population, they also have a statistically significant, increased, association with having to go to the ED for their health. Nearly one-tenth of current asthmatics visited the ED or urgent care during the prior twelve months in order to seek treatment for asthma symptoms (9%, *wn* = 237,259). Within the total weighted respondent population, these individuals account for only 0.8% of the total. Given that there is an association between asthma status and both going to a doctor's office for primary care and having health care insurance, this is suggestive of the increased disease severity faced by asthmatics that results in their need to utilize emergency health facilities. The next section provides similar analyses for asthmatics but shifts to evaluation of asthma control rather than asthma status.

4.2 Asthma Control Univariate Associations

Univariate associations with asthma control are shown in Table B9 for demographics, Table B10 for health conditions and behaviors, Table B11 for health care insurance and access, and Table B12 for socioeconomic status and conditions. All variables except for age group, service years of active military duty, and whether a respondent normally works, were associated with asthma control at a 95% confidence level ($p < .05$). Focus of univariate review for asthma control was reduced from that for asthma status, given that uncontrolled asthmatics represent a subset of the overall asthmatic population (10%, *wN* = 237,259).

As shown in Figure 31, the overall weighted respondent population is split 51% female (*wN* = 14,462,534) and 49% male (*wN* = 13,784,100). At a significance level of .05, the univariate association of asthma status to sex is statistically significant ($p < .001$).

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The proportion of females with uncontrolled asthma presents as higher at 74% (*wn* = 176,003) than the overall weighted respondent population. Conversely, the proportion of current male asthmatics is lower at 26% (*wn* = 61,256) than the overall weighted respondent population. This remains consistent with controlled asthmatics, where females are proportionately higher at 63% (*wn* = 1,285,246) and males are proportionately lower at 37% (*wn* = 756,490) than the overall weighted respondent population.

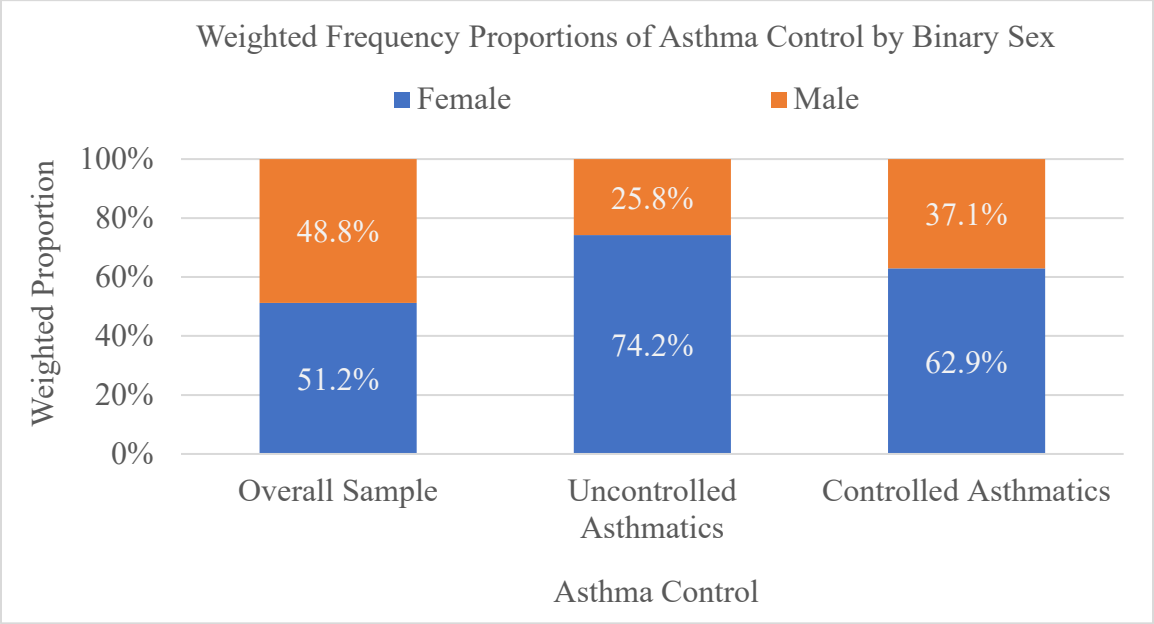

Figure 31: Weighted frequency proportion of asthma control by binary sex.

Age group was found to be statistically significant relative to asthma status ($p < .001$) and remained statistically significant relative to asthma control ($p = .039$). However, while ratios did not appear significantly different for asthma status, uncontrolled asthmatics do show obvious difference. Relative to the population, which is split 41% young adults (*wN* = 11,571,994), 43% middle-aged individuals (*wN* = 12,049,216), and 16% later adults (*wN* = 4,625,423), uncontrolled asthmatics have

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an increased proportion of middle-aged individuals at 49% (*wn* = 117,036) and decreased proportions of young and later adults at 35% (*wn* = 83,948) and 15% (*wn* = 36,275). Figure 32 provides visualization of these proportional differences.

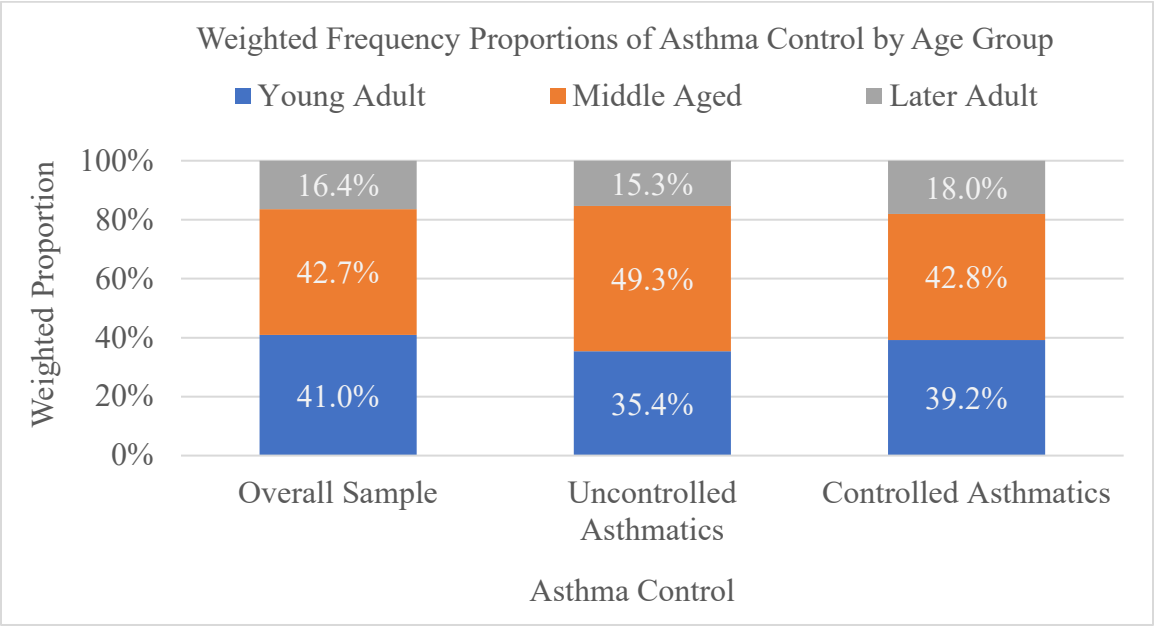

Figure 32: Weighted frequency proportion of asthma control by age group.

Figure 33 charts proportions of asthma control frequency by race, with the association to asthma control being determined at a .05 significance level ($p < .001$). Only African Americans show significantly increased likelihood to have uncontrolled asthmatics, with 19% (*wn* = 46,193) having that classification versus 6% of the overall weighted respondent sample being African American (*wN* = 1,581,649). Conversely, White and Asian individuals both have lower proportions amongst uncontrolled asthmatics population, with 33% (*wn* = 77,684) versus 43% (*wN* = 12,092,661) being white and 7% (*wn* = 15,962) versus 14% (*wN* = 3,924,43) being Asian. No significant differences were visually identified for the remaining races.

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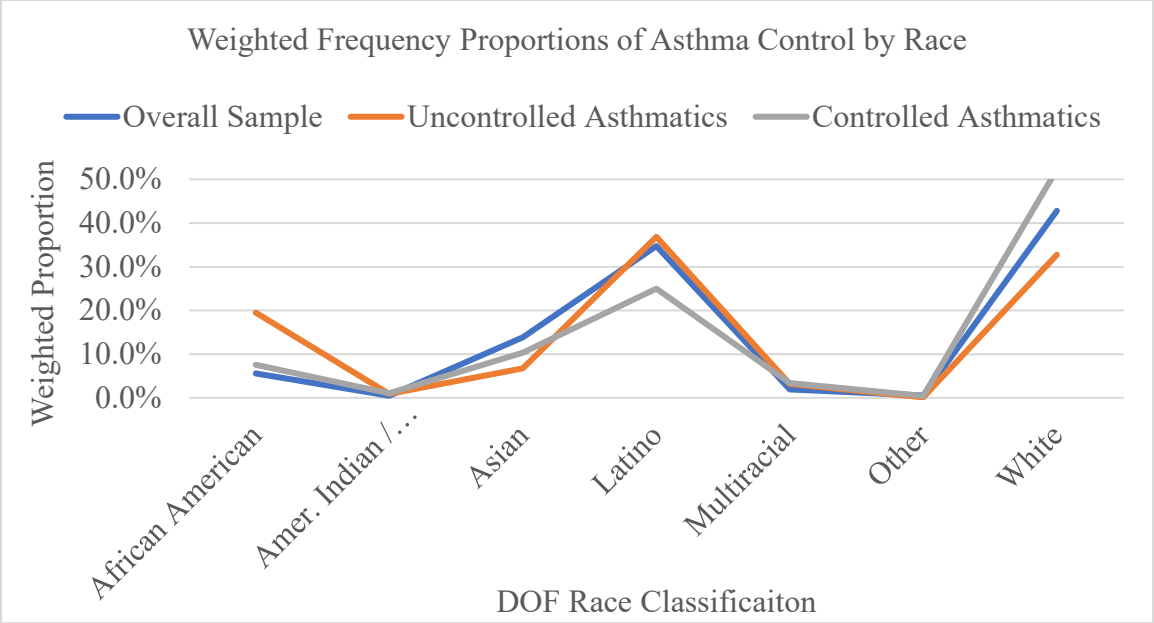

Figure 33: Weighted frequency proportion of asthmatic control by race.

As anticipated from reviewed research into the hygiene hypothesis and farming effect on asthma, and as seen with asthma status, individual born in the U.S. showed significantly higher proportion of uncontrolled asthmatics (76%, *wn* = 180,421) and controlled asthmatics (82%, *wn* = 1,676,087) than the overall weighted population (66%, *wN* = 18,689,704). The weighted frequency proportions of asthma control by nativity are shown in Figure 34. As expected, these proportions continue to hold for asthma control by citizenship, as shown in Figure 35. The association between each variable and asthma status were found to be statistically significant at a significance level of .05 ($p < .001$).

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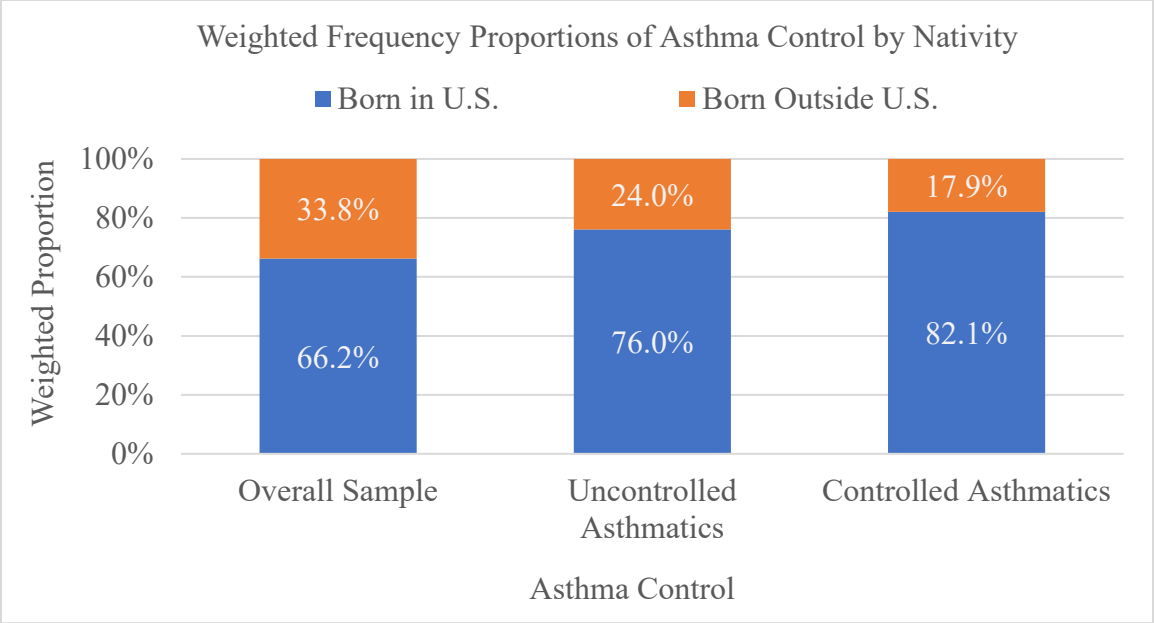

Figure 34: Weighted frequency proportion of asthma control by nativity.

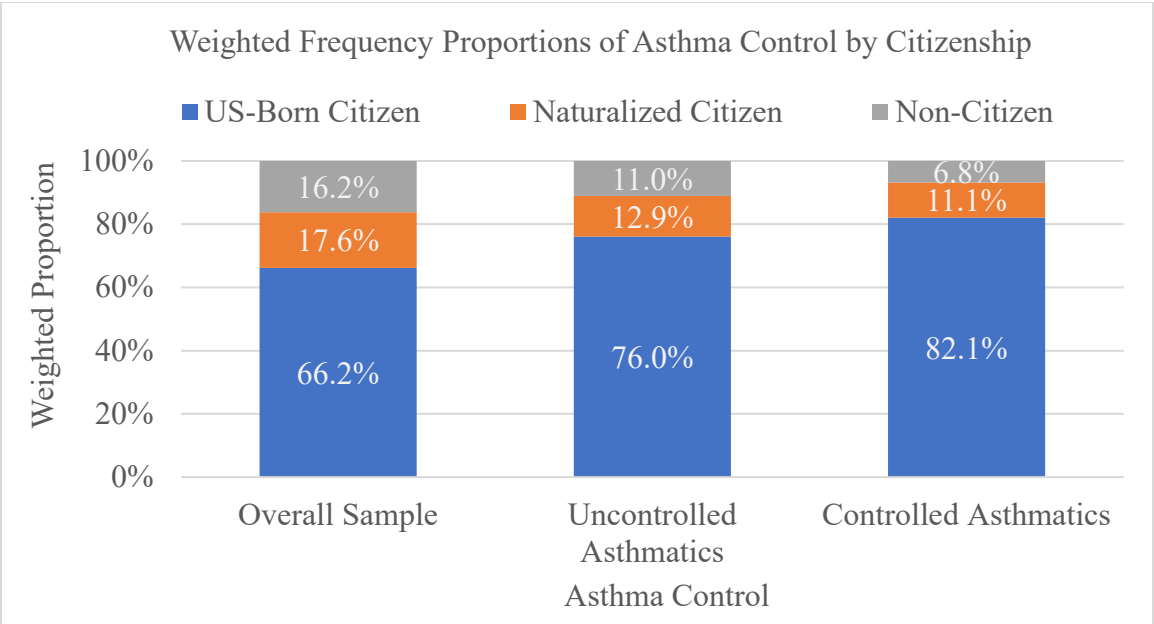

Figure 35: Weighted frequency proportion of asthma control by citizenship category.

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Review of income as a percentage of FPL and its association with asthma control provides interested results at a significance level of .05 ($p < .001$). As shown in Figure 36, individuals making below FPL (32%, *wn* = 75,819), above FPL but less than double FPL (25%, *wn* = 60,208), and those making twice but less than three times FPL (15%, *wn* = 34,423), comprise proportionately more of the uncontrolled asthmatic population than overall population proportions of 17% (*wN* = 4,706,950), 20% (*wN* = 5,528,155), and 14% (*wN* = 3,973,723), respectively. Individuals making at least 300% FPL comprised significantly less of the uncontrolled asthmatic population at 28% (*wn* = 66,809) than the overall population at 50% (*wN* = 14,037,805).

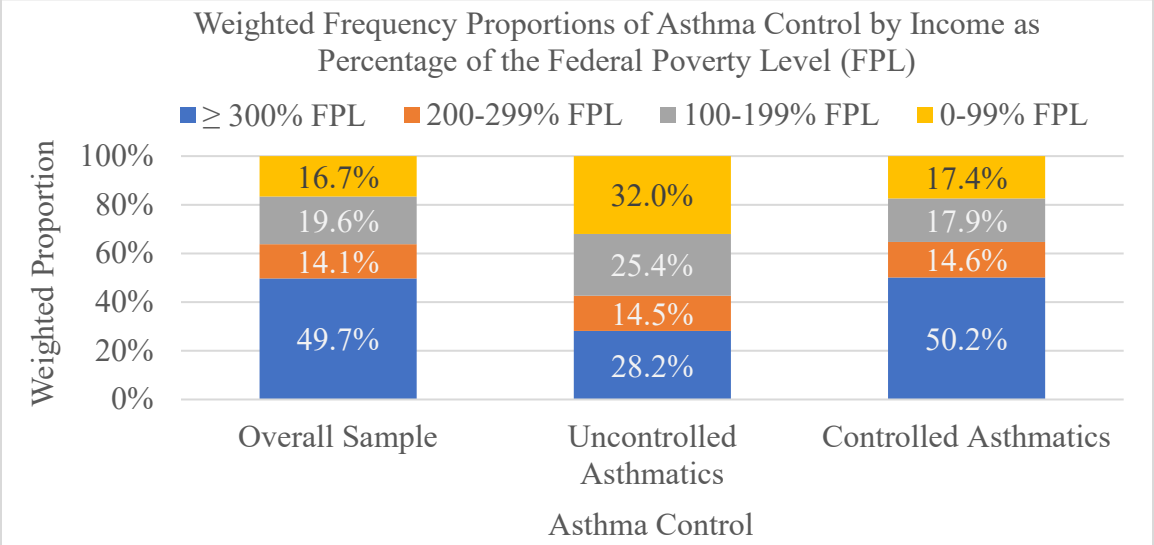

Figure 36: Weighted frequency proportion of asthmatic control by income.

4.3 Multinomial Logistic Regression of Asthma Status

Multinomial logistic regression was performed to determine the effects of sex, age, citizenship, family composition, descriptive BMI, smoking status, psychological distress, health insurance, income as a percentage of FPL, food security status, and employer type, on asthma status. This was designed to identify the impact of generalized

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demographic factors on asthma. The response profile was designed to be representative of factors available through collected census or EMR data. The null hypothesis, which assumed a regression coefficient of zero for each independent variable, was rejected based upon the Wald Chi-Squared Test (Wald test, $F = 44.1$, $p < .001$). As shown in Table 5, all variables were found to be statistically significant ($p < \alpha$ of 0.05) apart from the effect of urban characteristic.

Table 5

Type 3 Analysis of Effects – Multinomial Regression Model

Effect	**F Value**	**DF**	***P* Value***
Sex	58.6	2	<.0001
Age Group	19.18	4	<.0001
Citizenship	59.39	4	<.0001
Family Composition	3.89	6	0.0012
Urban Characteristic	1.6	6	0.1491
Descriptive BMI	25.47	6	<.0001
Smoking Status	3.39	4	0.0109
Psychological Distress	37.62	2	<.0001
Income (%FPL)	6.24	6	<.0001
Food Security Status	8.89	4	<.0001
Employer Type	5.33	8	<.0001
Health Plan	4.42	18	<.0001

Note: *P* values based on Pearson chi-square test of association

Table D1 provides the odds ratio estimates as compared to current asthmatics who were male, young adults, U.S.-born citizens, with households composed of married adults with children, normal BMI, non-smokers, no psychological distress, no health care insurance, earned at least 300% FPL, and were employed by the government. While 20 of 32 variable effects were not statistically significant in the comparison of previous

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asthmatics to current asthmatics, while only nine were not statistically significant in the comparison of non-asthmatics to current. Reviewing variable effects across both comparisons identified only 11 of 32 variables that were statistically significant.

Females were found to be less likely than males to be previous asthmatics (OR 0.49, 95% CI [0.42, 0.56]) or non-asthmatic (OR 0.62, 95% CI [0.56, 0.69]), meaning they were statistically more likely to be current asthmatics than males. As compared to young adults, later adults were statistically less likely to be previous asthmatics (OR 0.72, 95% CI [0.56, 0.93]), but 1.54 times as likely to be non-asthmatics (95% CI [1.32, 1.78]). Citizenship had no statistical significance in comparing current and previous asthmatics, yet it did identify that naturalized citizens are 1.90 times as likely to be non-asthmatics than U.S.-born citizens (95% CI [1.65, 2.18]) and that non-citizens are 2.69 times as likely to be non-asthmatics (95% CI [2.26, 3.21]). Being underweight showed no statistically significant effect in comparison of previous and non-asthmatics to current, although overweight individuals were found less likely to be non-asthmatics than those of normal BMI (OR 0.84, 95% CI [0.77, 0.92]). Consistent with research studies on the association of asthma and weight, obese individuals were found to be statistically less likely to be previous asthmatics (OR 0.64, 95% CI [0.53, 0.78]) or non-asthmatics (OR 0.57, 95% CI [0.52, 0.63]) than those with normal BMI. Active smoking showed no statistically significant impact on asthma status, although previous smokers were found less likely than non-smokers to be previous asthmatics (OR 0.81, 95% CI [0.69, 0.94]) or non-asthmatics (OR 0.85, 95% CI [0.77, 0.94]) than non-smokers, suggesting they were more likely to be current asthmatics. As expected from reviewed research, those with psychological distress were statistically less likely to be previous asthmatics (OR 0.74,

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95% CI [0.57, 0.97]) or non-asthmatics (OR 0.57, 95% CI [0.50, 0.65]), meaning they are more likely to be current asthmatics than those without psychological challenges. The odds of current versus previous asthma status were not found to be statistically significant for those who earned below FPL, but those individuals were statistically 2.33 times as likely to be non-asthmatics at 95% CI [1.66, 3.26] than those earning at least 300% FPL. Those making at least FPL, but less than 200% FPL, were found to be 2.07 times as likely to be previous asthmatics at 95% CI [1.10, 3.90] and 2.54 times as likely to be non-asthmatics at 95% CI [1.82, 3.56] than those making at least 300% FPL. No statistically significant asthma status odds were identified between those making 200% to 299% FPL and those making at least 300% FPL. Contradictorily, those with food insecurity, both with and without hunger, were found to be statistically less likely to be previous asthmatics or non-asthmatics than those earning sufficiently above FPL to not be classified for food-security status

In no way causative to asthma, several other factors were also investigated. Limited asthma status odds differences were identified based upon employer type, although individuals working at private companies were 1.26 times as likely to be non-asthmatics than government employees at 95% CI [1.09, 1.46]. Similarly, self-employed individuals were 1.31 times as likely to be non-asthmatics at 95% CI [1.09, 1.57] and 1.37 times as likely to be previous asthmatics at 95% CI [1.03, 1.83] than government employees. Family type also had limited statistical influence on asthma status odds, although single individuals without children were less likely to be previous asthmatics (OR 0.80, 95% CI [0.65, 0.99]) or non-asthmatics (OR 0.77, 95% CI [0.68, 0.87]) than married individuals with children. Married individuals without children were also found

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less likely to be non-asthmatics than married individuals with children (OR 0.80, 95% CI [0.70, 0.92]). Individuals' health-insurance plans showed no statistically significant differences in asthma-status likelihood amongst previous asthmatics, apart from Medicare and Medi-Cal patients being statistically less likely to be previous asthmatics (OR 0.75, 95% CI [0.58, 0.97]) than the uninsured. Every health plan except Aetna and other, for which there were no statistically significant odds differences identified, showed decreased likelihood of being non-asthmatics than the uninsured at 95% confidence. As identified through univariate analysis, this supports that current asthmatics are more likely to have health care insurance than non-asthmatics.

4.4 Binomial Logistic Regression of Asthma Status

Previous asthmatics comprise only 3.9% (n = 4,811) of the survey population excluding "proxy skipped" observations, and only 4.5% (wn = 1,262,024) of the weighted respondent population. This subpopulation represented those individuals that were diagnosed with asthma at some time in their lives, but who were not on asthma medications, had not experienced asthma symptoms within the past year, and who did not identify as currently having asthma. Given the varied reasons for these situations to occur and that such respondents represent a small subset of the population, binomial logistic regression was performed with only current asthmatics and non-asthmatics, excluding the previous-asthmatic population. The null hypothesis, which assumed a regression coefficient of zero for each independent variable, was rejected based upon the Wald Chi-Squared Test (Wald test, $F = 37.6$, $p < .0001$). As shown in Table 6, all variables were found to be statistically significant ($p < \alpha$ of 0.05), including the effect of urban classification, which was not statistically significant within the multinomial logistic

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regression model. Odds ratio results showed 23 of 32 variable effects as being statistically significant, which is an increase from those identified through multinomial logistic regression. Based upon the California 14.8% asthma population level identified by CDPH Environmental Health Investigations Branch (2015-2016), the model correctly identified asthmatics versus non-asthmatics 87.3% of the time, with 97.5% sensitivity and 8.7% specificity.

Table 6

Type 3 Analysis of Effects – Binomial Regression Model

Effect	**F Value**	**DF**	***P* Value***
Sex	89.41	1	<.0001
Age Group	17.06	2	<.0001
Citizenship	87.84	2	<.0001
Family Composition	6.52	3	0.0003
Urban Characteristic	2.76	3	0.0442
Descriptive BMI	44.89	3	<.0001
Smoking Status	6.09	2	0.0028
Psychological Distress	72.55	1	<.0001
Income (%FPL)	11.87	3	<.0001
Food Security Status	17.29	2	<.0001
Employer Type	7.53	4	<.0001
Health Plan	7.84	9	<.0001

Note: *P* values based on Pearson chi-square test of association

Figure D1 provides a visualization of odds ratios by variable effect for the initial binomial logistic regression model, with 95% CI limits shown. Females were less likely than males to be non-asthmatics (OR 0.62, 95% CI [0.56, 0.69]), meaning they have increased asthma likelihood. No statistically significant difference between the likelihood of young and middle-aged adults was identified (OR 1.1, 95% CI [1.00, 1.23]),

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although later adults were 1.54 times as likely to be non-asthmatics than young adults (95% CI [1.33, 1.79]). As compared to U.S.-born citizens, there was increased non-asthmatic likelihood amongst naturalized citizens (OR 1.90, 95% CI [1.65, 2.18]) and non-citizens (OR 2.67, 95% CI [2.24, 3.19]), suggesting increased asthma for U.S.-born citizens. Although being underweight showed no statistically significant difference in asthma likelihood from normal weight, decreases in non-asthmatic likelihoods were identified for both overweight (OR 0.84, 95% CI [0.76, 0.92]) and obese (OR 0.57, 95% CI [0.51, 0.63]) individuals. This increased likelihood of being a current asthmatic as weight increases to the overweight and obese classifications is consistent with identified research results. Current smokers showed no difference in asthma likelihood from non-smokers, suggestive of symptom masking within the subpopulation based on medical expectations. Prior smokers, however, showed decreased likelihood of being non-asthmatic than non-smokers (OR 0.85, 95% CI [0.77, 0.93]), identifying the expected increase in asthma risk from smoking. Individuals suffering psychological distress were found to be at decreased odds of being non-asthmatics (OR 0.56, 95% CI [0.50, 0.65]), continuing to support research into its association with asthma.

Both single (OR 0.77, 95% CI [0.68, 0.97]) and married (OR 0.81, 95% CI [0.70, 0.92]) households showed decreased likelihood of being non-asthmatic, or increased current-asthma likelihood, as compared to households of married families with children. No statistically significant difference in asthma status between single and married households with children was identified (OR 0.88, 95% CI [0.73, 1.06]). Earning between 200% and 299% FPL did not have a statistically significant likelihood difference from making at least three times FPL. However, individuals earning below FPL were

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2.32 times as likely at 95% CI [1.65, 3.27] to be non-asthmatic than those earning at least three times FPL, and those earning at least FPL but less than twice FPL were 2.53 times as likely at 95% CI [1.80, 3.55] to be non-asthmatic. Conversely, those with food insecurity with hunger (OR 0.27, 95% CI [0.17, 0.42]) and without hunger (OR 0.35, 95% CI [0.24, 0.50]) had decreased likelihood of being non-asthmatic than those earning at least 300%. Given that food insecurity is connected to FPL, this is suggestive of an underlying data issue to be resolved in refined modeling. In evaluation of employer type, no statistically significant odds differences were identified between working for the government and either a family company or farm (OR 1.06, 95% CI [0.72, 1.57]) or not working (OR 1.03, 95% CI [0.89, 1.19]). Increased likelihood of being non-asthmatic was found for those working at private companies or non-profit organizations (OR 1.26, 95% CI [1.09, 1.46]) and self-employed individuals (OR 1.31, 95% CI [1.10, 1.58]) relative to government employees.

In order to provide more refined modeling, additional recoding was performed based on previous results. This involved the collapse of variables for which certain effects were found to not have statistically significant odds differences, as well as creation of a reversed dependent variable for modeling. The three-level nominal value for asthma status, which was filtered to a dichotomous current asthmatic and non-asthmatic variable for binomial modeling, was recoded to a dichotomous non-asthmatic variable. For race and ethnicity categorization, other (0.6%, *wn* = 156,121) and multiracial (1.9%, *wn* = 549,824) were combined, as were White (42.8%, *wn* = 12,092,661) and African American (0.5%, *wn* = 1,581,649) and Asian (13.9%, *wn* = 3,924,430). The four-level family type variable was collapsed into a dichotomous

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variable indicating those households with and without children. A new dichotomous variable indicating later adults 65 years of age and up, was created from the existing age group categorization. The underweight and normal weight categories for descriptive BMI were collapsed to a single category for those not overweight. Finally, then three income categories indicating earnings of at least FPL were combined to create a dichotomous poverty variable identifying individuals earning below FPL and at least 100% FPL

Binomial logistic regression for the dependent variable of asthma status, indexed to non-asthmatics, was then executed. Modeling was based on the dependent variables of sex, indexed to female; age group, indexed to later adults; citizenship, indexed to U.S.-born citizens; race, indexed to White or Asian; household composition, indexed to those households with no children; descriptive BMI, indexed to those who were not overweight; psychological distress, indexed to not having any; poverty level, indexed to those earning at least twice FPL; and whether or not individuals had health insurance, indexed to having it.

4.5 Binomial Logistic Regression of Asthma Control

Given asthma control as a subset of current asthmatics, development of binomial logistic regression models focused on similar variables. Only sex, race, and income as a percentage of FPL provided to be statistically significant in modeling asthma control at a 95% confidence level. Based on odds ratios by classification, females were 1.67 times (p 0.004, 95% CI [1.18, 2.37]) as likely as men to have uncontrolled asthma. African Americans suffer significantly increased risk that White asthmatics (OR 3.67, 95% CI [2.47, 5.45]). While Latinos also showed increased odds of having uncontrolled

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asthma than White respondents (OR 1.89, 95% CI [1.37, 2.61]), the maximum likelihood estimate of the coefficient for that parameter effect failed to reject the hypothesis of a coefficient of zero ($p = 0.14$). The odds ratios for American Indians, Alaska Natives, and Asians, were not statistically significant, meaning that with 95% confidence, those raises will not have different uncontrolled asthma prevalence than White respondents. Income as a percentage of the poverty level did prove statistically significant, with 1.71 times the likelihood of having uncontrolled asthma necessitating ED or urgent care visits than White asthmatics ($p < .001$, 95% CI [1.29, 2.26]).

4.6 Resultant Asthma Models

Table F summarizes the variance and fit statistics for the primary models rendered, including linear models performed for multicollinearity testing purposes. Data includes the Akaike Information Criterion (AIC), which provides a means of comparing estimated information loss between similar models for aid in selecting the best fit. The concordance statistic, or C-statistic, is also shown. This figure provides additional information regarding model goodness-of-fit, with 0.5 equating to random chance. Increasing values above 0.5 directly relate to improved perception of model fit, while descending values represent models with lower predictive properties than randomness.

Weighted logistic regression *Model AF* was selected for predicting dichotomous asthma status based on mappable demographic, health insurance, and socioeconomic factors. The formula for Model AF is shown in Equation (3), with coefficients and confidence limits in Table 7 and the Receiving Operating Characteristic (ROC) curve in Figure 37. The AIC for this model was consistent with other modeling performed, and the C-statistic of 0.62 was aligned with other results and improved from random

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prediction. As anticipated based upon the C-statistic, the ROC curve provides additional confidence that the model is more predictive of asthma than random chance. Evaluation of the Type I error, or incorrect rejection of the null hypothesis, is performed through the Wald chi-square test and output likelihood ratio and score. All three tests resulted in $p < .0001$, resulting in rejection of the null hypothesis that at least one regression coefficient was zero, and acceptance of the alternate hypothesis at the specified significance level. The chi-square results for each variable given the other modeled variables also resulted in $p < .0001$, meaning the null hypotheses of regression coefficients of zero were rejected for each parameter. With 95% confidence, this model calculates the probability of an individual being considered a current asthmatic based upon the indicators of sex, citizenship, race, income level, and health insurance coverage.

$$P(X) = \frac{e^{-1.47+0.46\begin{pmatrix} Male\ 1 \\ Female\ 2 \end{pmatrix}-0.56\begin{pmatrix} US\ Born\ 1 \\ Ntrlzd\ 2 \\ Non-Cit\ 3 \end{pmatrix}+0.03\begin{pmatrix} Amr\ Ind\ Alsk\ Ntv\ 4 \\ Afr\ Amr\ 5 \\ Asian\ 4 \\ Latino\ 1 \\ White\ 6 \\ Multi—Other\ 9 \end{pmatrix}-0.10\begin{pmatrix} Inc < FPL \\ Inc \geq FPL \end{pmatrix}-0.30\begin{pmatrix} Insrd\ 1 \\ Unins\ 2 \end{pmatrix}}}{1+e^{-1.47+0.46S-0.56C+0.03R-0.10P-0.30I}} \quad (3)$$

where $P(X)$: probability of an individual having asthma

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Table 7

Logistic Regression Coefficients for Asthma Status

	Maximum Likelihood Estimates				Asthma Status		
Effect	**Est.**	**Std. Error**	***t* Value**	***p Value***	**Odds Ratio**	**95% Confidence Limits**	
Intercept	-1.472	0.155	-9.52	<.0001			
Sex	0.461	0.049	9.43	<.0001	1.586	1.440 - 1.746	
Citizenship	-0.560	0.041	-13.73	<.0001	0.571	0.527 - 0.619	
Race	0.033	0.010	3.37	0.001	1.034	1.014 - 1.054	
Health Insurance Status	-0.298	0.066	-4.49	<.0001	0.743	0.651 - 0.847	
Income Level	-0.104	0.015	-7.15	<.0001	0.901	0.875 - 0.927	

p values based on chi-square test of association.
† Includes Native Americans and Alaska Natives.

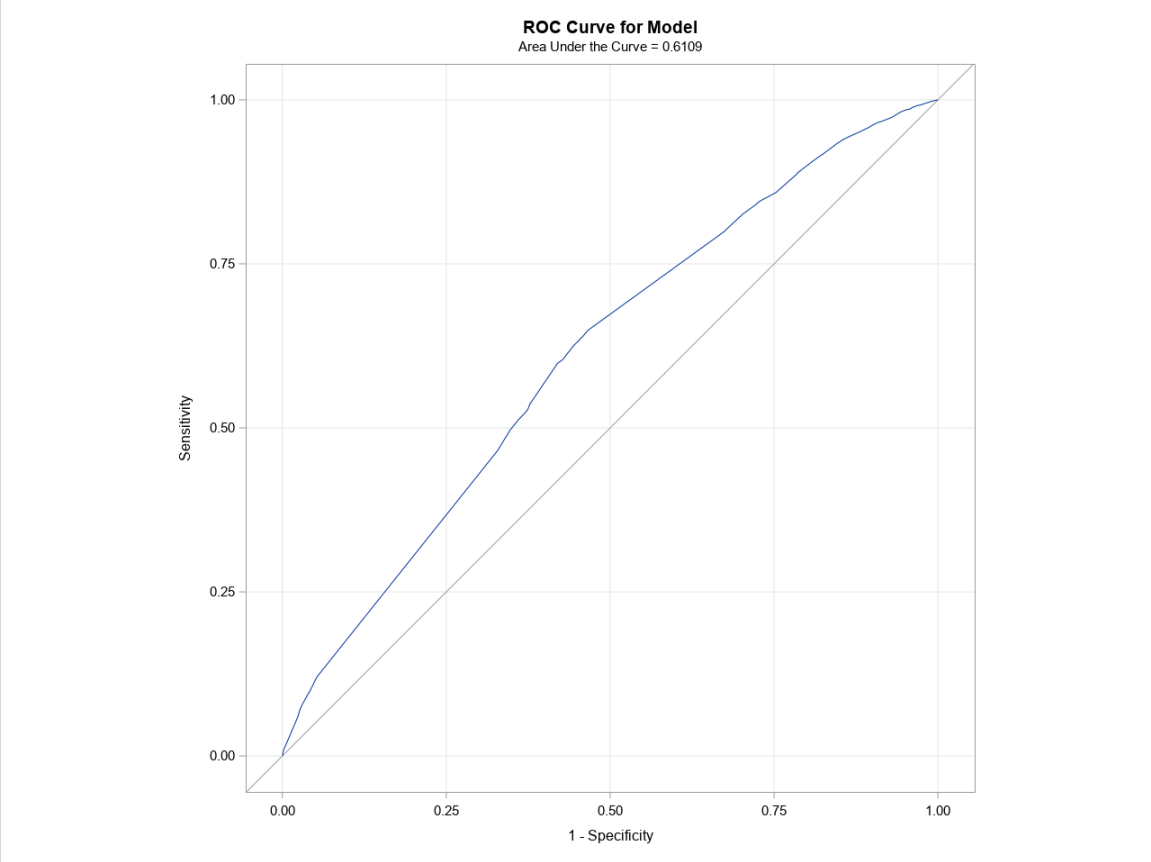

Figure 37: ROC Curve for Predictive Model of Asthma Prevalence.

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Weighted logistic regression *Model SB* was selected for predicting dichotomous asthma status based on mappable demographic, health insurance, and socioeconomic factors. The formula for Model SB is shown in Equation (4), with coefficients and confidence limits in Table 8 and ROC curve in Figure 38. The AIC for this model was consistent with other modeling performed, and the C-statistic of 0.63 was aligned with other results and improved from random prediction. As anticipated based upon the C-statistic, the ROC curve provides additional confidence that the model is more predictive of asthma than random chance. Evaluation of the Type I error, or incorrect rejection of the null hypothesis, is performed through the Wald chi-square test and output likelihood ratio and score. All three tests resulted in $p < .0001$, resulting in rejection of the null hypothesis that at least one regression coefficient was zero, and acceptance of the alternate hypothesis at the specified significance level. The chi-square results for each variable given the other modeled variables also resulted in p values below the .05 significance level, meaning the null hypotheses of regression coefficients of zero were rejected for each parameter. With 95% confidence, this model calculates the probability of a current asthmatic having uncontrolled asthma based upon sex, race, and income level.

$$P(X) = \frac{e^{-2.31+0.55\begin{pmatrix} Male\ 1 \\ Female\ 2 \end{pmatrix}-0.08\begin{pmatrix} Amr\ Ind\ Alsk\ Ntv\ 4 \\ Afr\ Amr\ 5 \\ Asian\ 4 \\ Latino\ 1 \\ White\ 6 \\ Multi—Other\ 9 \end{pmatrix}-0.16\begin{pmatrix} Inc < FPL \\ Inc \geq FPL \end{pmatrix}}}{1+e^{-2.31+0.55S-0.08R-0.16I}} \tag{4}$$

where $P(X)$: probability of an asthmatic individual needing ED or urgent care

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Table 8

Logistic Regression Coefficients for Uncontrolled Asthmatics

	Maximum Likelihood Estimates				Asthma Status		
Effect	**Est.**	**Std. Error**	***t* Value**	***p Value***	**Odds Ratio**	**95% Confidence Limits**	
Intercept	-2.314	0.369	-6.27	<.0001			
Sex	0.555	0.179	3.11	0.002	1.742	1.224 - 2.478	
Race	-0.081	0.029	-2.83	0.005	0.923	0.872 - 0.976	
Income Level	-0.160	0.035	-4.58	<.0001	0.852	0.795 - 0.913	

p values based on chi-square test of association.

† Includes Native Americans and Alaska Natives.

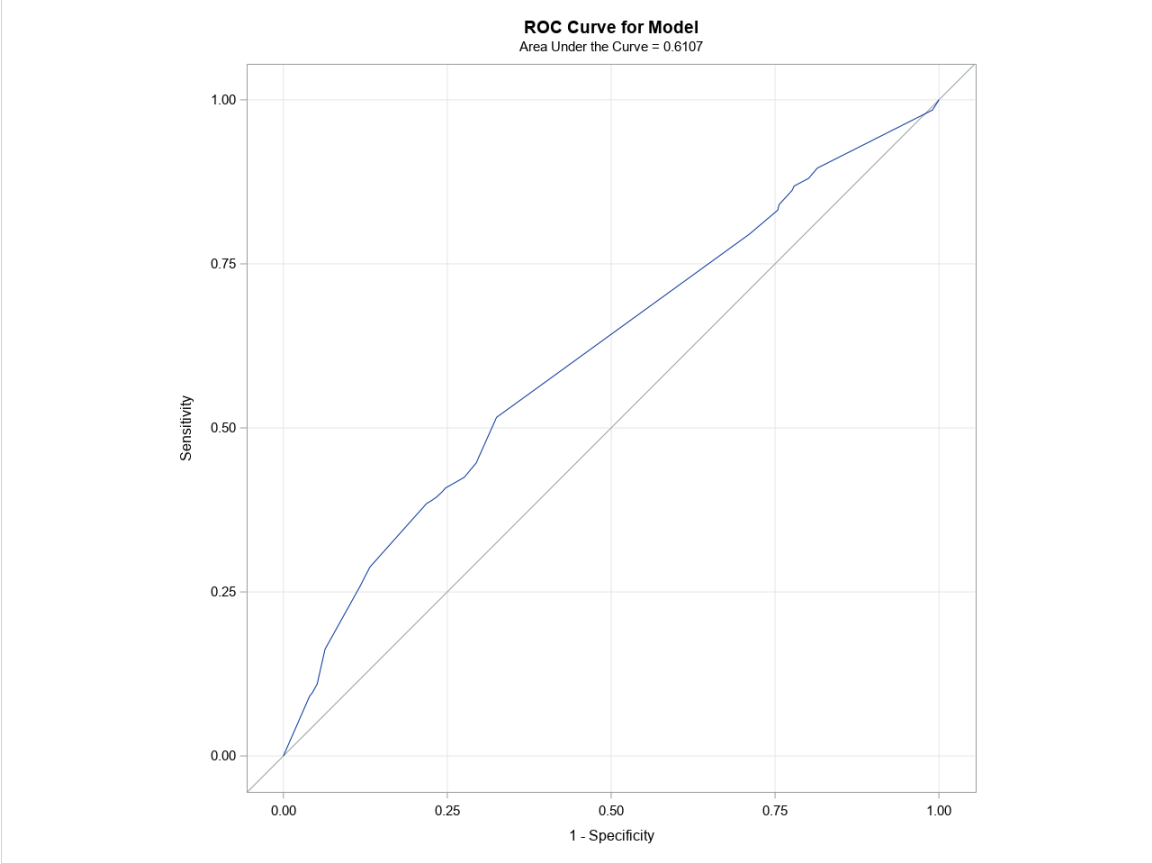

Figure 38: ROC Curve for Predictive Model of Uncontrolled Asthmatics.

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4.7 Geospatial Mapping of Population Outcome Models

Through application of the asthma and asthma-control models to population estimates by PUMA, predictions of current asthmatics and uncontrolled asthmatics were created and mapped across the entire state of California. Static images of the resultant Tableau dashboard are shown in Appendix H: Tableau Dashboard. Based on PUMA, the dashboard allows for filtering and automated zooming by county and city or town, with some levels being grouped based upon PUMA criteria. Dynamic filtering by sex, race, citizenship, health insurance status and income level are included.

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Chapter 5: Conclusions and Recommendations

Leveraging six years of CHIS data from 2011 through 2016, this study developed predictive logistic regression models for assessing probability of individuals being asthmatic, as well as the probability of those asthmatics having uncontrolled asthma. Utilizing ACS data from 2013 through 2017, population estimates by California PUMA were created. Through the application of logistic regression models to the population estimates, as well as inclusion of geospatial shape files, a public Tableau dashboard was created to allow for visual investigation into asthmatics throughout California by key demographic variable. This tool enables health care practitioners, institutions, and researchers, to investigate and target outreach to asthmatics throughout the state. Within an individual county, such as San Diego, this reduces outreach and clinical-trial targeting from the entire territory to high-risk geographic areas of approximately 85,000 to 150,000 adult residents. Further, by sex, race, citizenship, health insurance status, and income level, such outreach may be strategically adjusted to even smaller subsets of the population.

An example of county-level analysis is provided in Figure 39, which shows predicted asthmatics for San Diego. As identified in red, the most predicted asthmatics live in Southwest City of San Diego, Central Coast City of San Diego, City of Oceanside, and Camp Pendleton. Through the application of filtering to those earning below FPL, this changes to City of Oceanside, Camp Pendleton, and Central and Mid-City San Diego, as shown in Figure 40. Adding filters for females not covered by health insurance shifts the highest-prevalence area to Central San Diego, Centre City, and Balboa Park, followed closely by Central and Mid-City San Diego, as shown in Figure 41.

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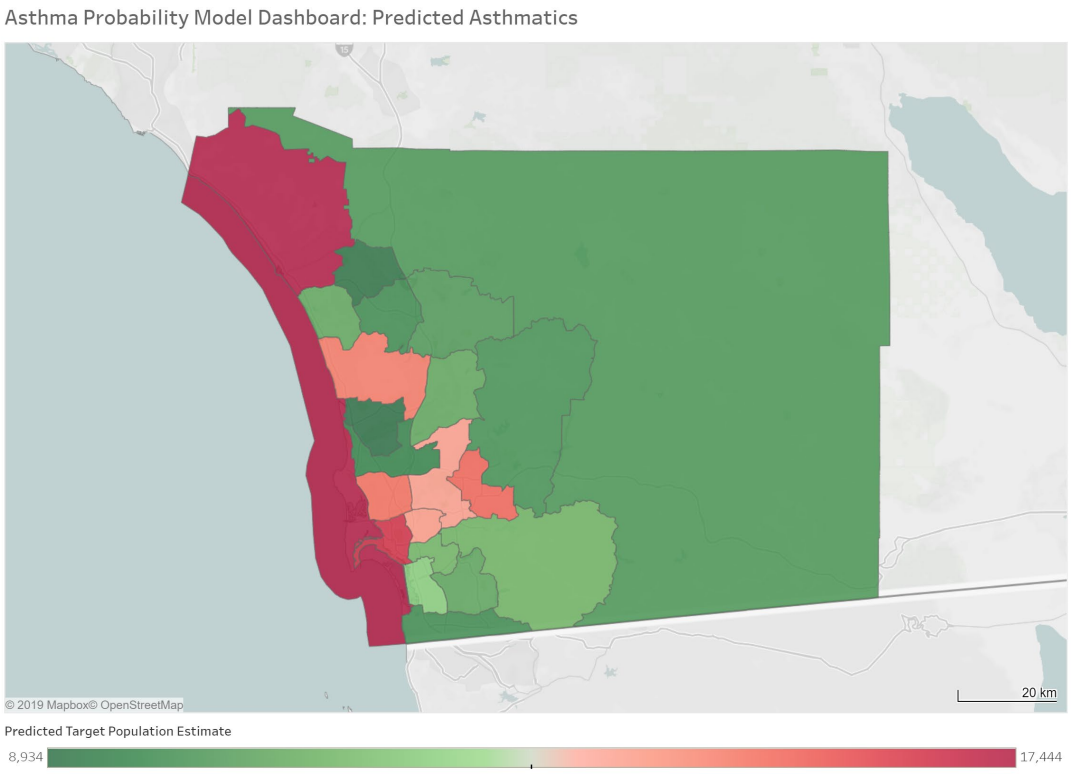

Figure 39: Predicted Asthmatics in San Diego.

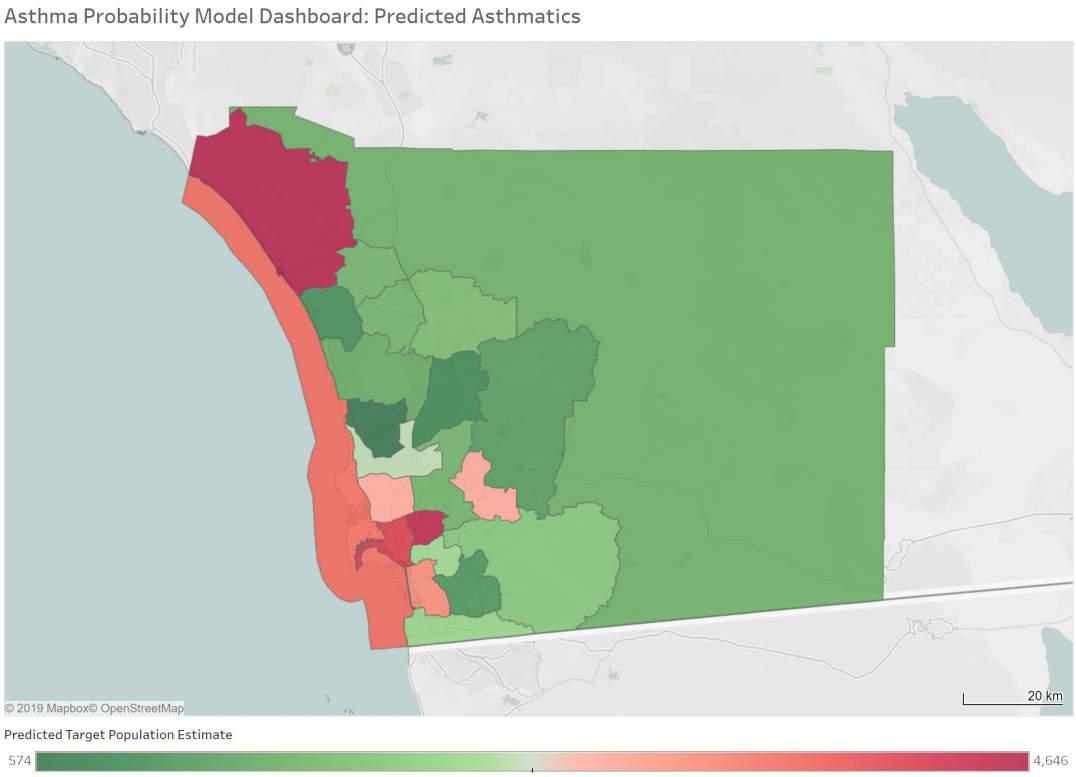

Figure 40: Predicted Low-Income Asthmatics in San Diego.

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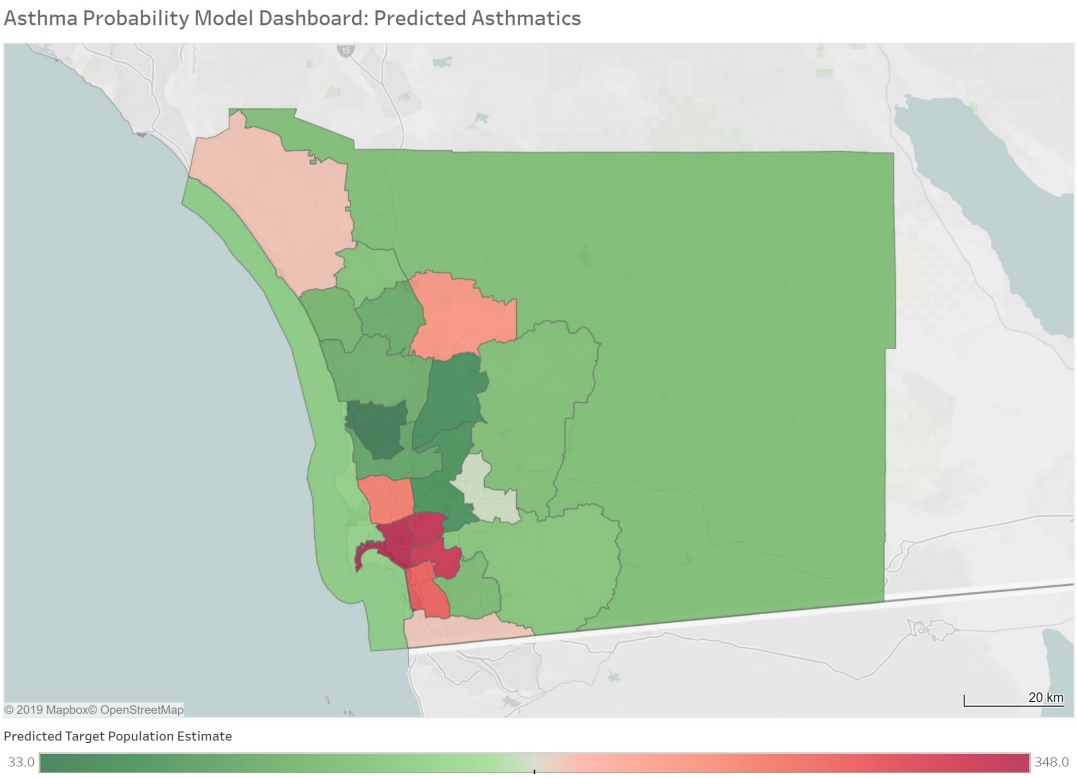

Figure 41: Predicted Low-Income, Uninsured, Asthmatic Women in San Diego.

Based upon the odds ratios shown in Figure D6, the highest likelihood asthmatics are multiracial individuals, those of other races, and American Indians and Alaska Natives, who are female, born in the U.S., insured, and earning below FPL. Applying these filters to San Diego results in creation of Figure 42 and Figure 43. This model predicts target areas of Northwest San Diego and Del Mar, where 110 of the 480 applicable residents will have asthma, as well as Central and Mid-City San Diego, where 117 of the 511 applicable residents will have asthma. These represent localized areas where specific marketing may be applied to target individuals of the specified demographics in order to provide health care outreach services to improve symptoms or identify clinical trial and research efforts most applicable to them.

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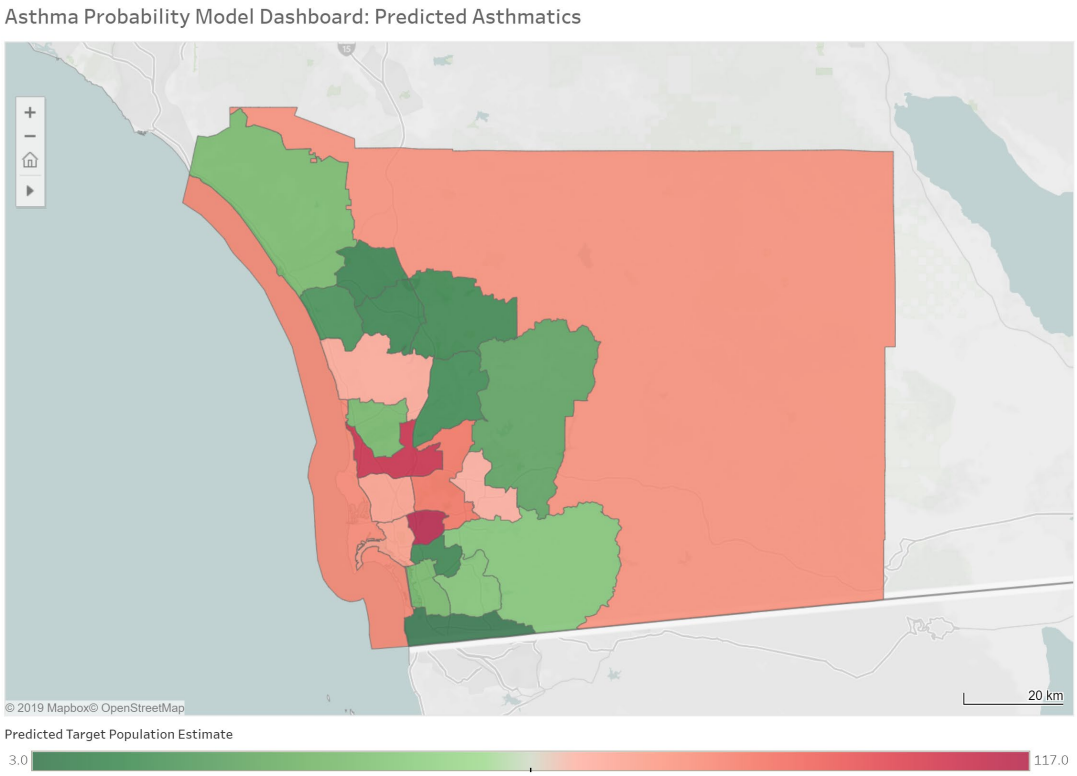

Figure 42: Highest Odds-Risk Demographics for Asthma in San Diego

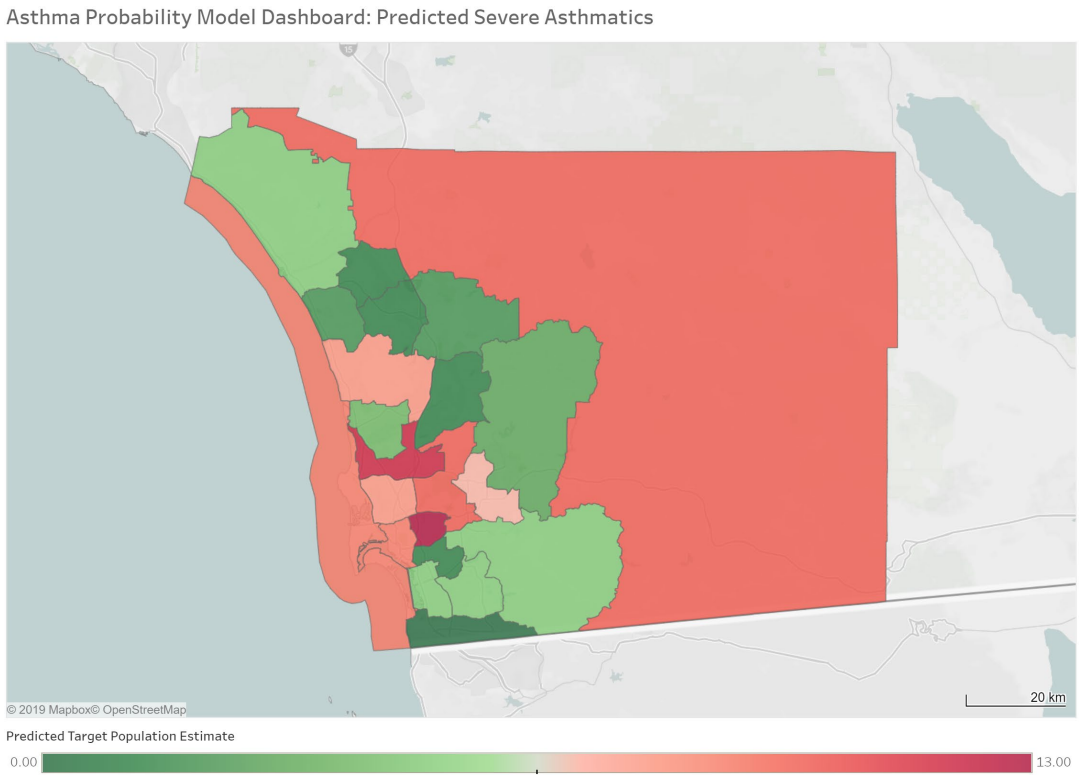

Figure 43: Highest Odds-Risk Demographics for Uncontrolled Asthma in San Diego

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Specific to San Diego, Table 9 details the output of asthma metrics from the Tableau dashboard with additional information added regarding uncontrolled asthmatics per 100,000 residents and asthmatics per 10,000 residents. The population-adjusted detail readily enables identification of Southwest and Central Coastal San Diego having the most asthmatics per capita at 1,183 per 10,000 residents, while Central and Mid-City San Diego have the most uncontrolled asthmatics per capita at 954 per 100,000 residents.

Table 9

Asthma Population Estimates for San Diego

City	City Area	Untrld. Asthma [A]	Asthma Est. Pop. [B]	Total Est. Pop. [C]	Uncontrolled Asthmatics per 100K Residents	Asthmatics per 10K Residents
Carlsbad City		789	10,890	94,758	833	1,149
Chula Vista	West	1,216	12,257	135,378	898	905
El Cajon & Santee Cities		1,227	15,363	139,606	879	1,100
Escondido City	East	875	10,400	107,631	813	966
Fallbrook, Alpine & Valley Center		800	10,274	90,887	880	1,130
Lakeside, Winter Gardens & Ramona		754	10,108	86,936	867	1,163
Lemon Grove City, La Presa & Spring Valley		929	11,331	105,268	883	1,076
Oceanside City & Camp Pendleton		1,434	17,444	155,845	920	1,119
San Diego City	Central/Centre City & Balboa Park	1,382	16,637	149,880	922	1,110
	Central/Clairemont & Kearny Mesa	1,213	15,151	138,325	877	1,095
	Central/Mid-City	1,302	14,106	136,505	954	1,033
	Central/Mira Mesa & University Heights	799	9,597	94,921	842	1,011
	East Central/Navajo	1,064	14,018	122,533	868	1,144
	Northeast/Rancho Bernardo	788	10,884	100,305	786	1,085
	Northwest/Del Mar Mesa	643	8,934	89,572	718	997
	Northwest/San Dieguito	1,095	14,917	133,360	821	1,119
	South/Otay Mesa & South Bay	953	9,908	108,778	876	911
	Southeast/Encanto & Skyline	1,048	11,405	122,742	854	929
	Southwest/Central Coastal	1,333	17,429	147,389	904	1,183
San Marcos & Escondido	West	807	9,912	94,497	854	1,049
Sweetwater Region		913	10,797	112,408	812	961
Vista City		746	9,018	87,245	855	1,034
		22,110	**270,780**	**2,554,769**	**865**	**1,060**

A. Uncontrolled asthmatics.
B. Estimated asthmatic population.
C. Total estimated population.

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The utility of this study and resultant tool are not limited to the identification of asthmatic outreach target areas with focusing for demographic and socioeconomic factors; it also creates the framework for business justification of those decisions. As reported in the 2017 AHA Annual Survey by Health Forum, LLC, California inpatient hospital expenses per day for state and local government, non-profit, and for-profit, hospitals were $3,217, $3,800, and $2,255, respectively (Henry J Kaiser Family Foundation, n.d.). This equates to approximately $3,330, $3,934, and $2,334, respectively, in 2019 dollars after adjusting to the San Diego-Carlsbad Medical Consumer Price Index (Bureau of Labor Statistics, 2019). In 2018, Zeiger et al. published "Drivers of health care costs for adults with persistent asthma" to investigate direct health care costs per asthma patient. Data from Kaiser Permanente Southern California was reviewed, with costs inflated to 2014 dollars. Their research identified the total asthma-related cost per patient to be $2,602 (SD $2,172, $p < .001$) (Zeiger et al., 2018), which inflates to $3,016 (SD $2,517) in 2019 dollars. In 2014, Wang, Srebotnjak, Brownell, and Renee, published "Emergency department charges for asthma-related outpatient visits by insurance status," which used 2006 through 2008 data from the U.S. Department of Health and Human Services Medical Expenditure Panel Survey to determine the average outpatient ED cost for adult (20 to 64 years of age) asthma care as between $1,259 and $2,599 (95% CI [$820, $4,028]) in 2008 dollars (T. Wang, Srebotnjak, Brownell, & Hsia, 2014). These figures equate to a range of $1,699 and $3,507 (95% CI [$1,107, $5,436]) in 2019 dollars.

As shown in Table 10, the simple-average cost per uncontrolled asthma incident is $7,500, with inpatient and ED visits costing $5,300 and $9,600. Grossed up to the total

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estimated population of uncontrolled asthmatics, who represent individuals that will need annual ED or urgent care visits for treatment of their symptoms, the model identifies a $166-million health care cost burden in San Diego. While individual health system costs and payor mix would need to be considered, this indicates how the population estimates may be merged with financial information to demonstrate the cost/benefit of outreach. For example, a San Diego health system such as UC San Diego Health, which holds the third highest in-patient market share in San Diego in 2014 at 11% (Graham, 2016, para. 10), faces uncontrolled-asthma-patient costs of at least $18.2 million in 2019. Based on their potentially higher uninsured and indigent patient mix as the only state and academic health system in San Diego, these costs and potential losses may be significantly higher. Coupled with the targeted outreach possible through the results of this study, especially through refinement from application of the framework to their EMR, this research enables development of a cost-effective business case that will improve health outcomes while reducing preventable ED, urgent care, and hospitalizations.

Table 10

Generalized Medical cost per Uncontrolled Asthma Incident

Category	Simple Mean Cost per Instance	Annual Cost for Uncontrolled Asthmatics
Southern California Asthma-Related Costs per Patient	$ 3,000	$ 66,330,000
California Inpatient Hospital Expense per Day, All Conditions	9,600	212,256,000
National Emergency Department Charges per Asthma Patient	5,300	117,183,000
Simple Mean Cost per Instance	$ 7,500	$ 165,825,000

This study has successfully identified subpopulations throughout California who may be uniquely targeted for health care outreach to mitigate symptoms and reduce

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preventable hospitalizations for asthma. It has shown the means by which financial information may be merged with predictions for the development of outreach business cases. Most importantly, the framework developed through this study demonstrates the power of advanced population health analytics in evaluating conditions and targeting individuals for health improvement. These tools may be readily scaled for different conditions and data sets, as well as applied within health systems and state agencies for near real-time health monitoring.

The asthma models herein were created with publicly available health data containing limited demographic, geospatial, and health variables. However, it still resulted in good predictive capabilities and provided a dynamic mapping tool. The next evolution of this framework must be the implementation with detailed health care information. Scaling the framework up to confidential CHIS data containing Personal Health Information (PHI) would enable stronger modeling leveraging increased in causative variables, as well as more finite geospatial information. This would allow for outreach targeting by ZIP or even localized community area. Additional factors to asthma could also be included, such as sexual orientation, which has recently been identified as strongly correlated with increased asthma prevalence (Collins et al., 2017). The more refined and strongly predictive the geospatial mapping statistics, the more precise and cost-effective the outreach measure. This would serve patients and health systems by providing health outcome improvements, cost avoidance and savings, and decreased utilization of patient space. As health providers are consistently pressured to provide more patient value through innovation (Barnes et al., 2018), strategic

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implementation of this population health framework would enable increased market share, public perception, and goodwill for the implementation leader.

Applied more dynamically, this framework could change the face of health care today. A health emergency for an outbreak of the Hepatitis A Virus (HAV) was identified and declared by public health officials in San Diego on September 1, 2017 ("Hepatitis A," 2017). The emergency concluded January 23, 2018, after 592 cases and 20 deaths, with epidemiology research ultimately identifying the outbreak as having begun with a specific homeless population in November 2016 (Health & Human Services Agency, 2017). Application of the framework crated by this study on county-wide EMR, such as the Epic medical record instance shared by UC San Diego Health and Scripps Health or County of San Diego Health & Human Services reporting systems, may have mitigated cases and deaths and would certainly have identified and located the outbreak significantly faster. By leveraging predictive analytics and near real-time data monitoring, systems could have automatically identified increased case prevalence and leveraged geospatial logic to pinpoint the shared home location of each patient. This would have enabled local health practitioners to initiate vaccination events sooner at a more precise location. Ultimately, this would have benefited the public through improved health, reduced or prevented the outbreak, and provided more cost-effective health care outreach.

The landscape of health care is changing within the United States. The Affordable Care Act of 2019 created a dynamic change in levels of insured individuals. As the under- and un-insured population is expected to increase through removal of the individual mandate, unpaid cost of health care will continue to rise while the paradigm

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shift in health care will push for lower cost services (Barnes et al., 2018). This is driven further by original direction from the U.S. Department of Health & Human Services to increase Medicare fee-for-service arrangements through implementations of Accountable Care Organizations, with a goal of 50% of payments being tied to such models by the end of 2018 (HHS Press Office, 2015). While there has been some success in lowering the rate of health care cost increases, they remain above inflation and will continue to do so as improvements in treatment drugs and technologies are developed (Barnes et al., 2018). This pressures health systems to innovate and reduce costs in other ways to increase patient value while maintaining sufficient operating margins for growth and capital investment. One method to do this is implementation of rapid analytics processes that will drive outreach and outcome improvements. This research shows how population health initiatives may be rapidly implemented without multi-million-dollar initiatives across numerous development and implementation years by large departments of biostatisticians and data scientists. Rapid build of dynamic systems created to be easily expanded and upgraded will enable agile systems with immediate health care benefits.

The unique nature of health causes imperfections in any model, and refinements improve predictive capabilities but will never result in perfect results. Additionally, the moral implications of population health monitoring create numerous legal and ethical dilemmas that must be addressed and require significant research beyond the scope of this study. The benefit to individuals and communities is too great to ignore, however, and this research clearly demonstrates that this population health framework may be quickly implemented for enabling information-based health care and business decisions

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in a cost-effective and non-resource-intensive manner. This is the next breakthrough in health care, and it is ready for broader implementation today.

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Appendix A: Reference Tables

Table A1

Asthma Codes for ICD-10

Category	ICD-10 Code	Description
Respiratory-System Disease	J45.2x	Mild Intermittent
Respiratory-System Disease	J45.3x	Mild Persistent
Respiratory-System Disease	J45.4x	Moderate Persistent
Respiratory-System Disease	J45.5x	Severe Persistent
Respiratory-System Disease	J45.90x	Unspecified
Respiratory-System Disease	J45.990	Exercise-Induced Bronchospasm
Respiratory-System Disease	J45.991	Cough Variant Asthma
Respiratory-System Disease	J45.998	Other Asthma
Symptom / Abnormal Finding	R05	Cough
Symptom / Abnormal Finding	R06.00	Dyspnea
Symptom / Abnormal Finding	R06.01	Orthopnea
Symptom / Abnormal Finding	R06.02	Shortness of Breath
Symptom / Abnormal Finding	R06.09	Other Forms of Dyspnea
Symptom / Abnormal Finding	R06.1	Stridor
Symptom / Abnormal Finding	R06.2	Wheezing

Note: Adapted from *Asthma Codes for ICD-10* (American Academy of Allergy Asthma & Immunology (AAAI), 2014). The indicator "x" is used to further describe asthma as 0, uncomplicated; 1, with exacerbation; and 2, with status.

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Table A2

Relationship Between Asthma Phenotypes and Endotypes

Endotype / **Phenotype**	Adult-Onset Asthma	Eosinophilic Asthma	Exacerbation-Prone Asthma	Exercise-Induced Asthma	Fixed Airflow Limitation	Obesity-Related Asthma	Poorly Steroid-Responsive Asthma
Airflow Obstruction Caused by Obesity						◉	◉
Allergic Asthma		◉	◉	◉			
Allergic Bronchopulmonary Mycosis		◉	◉				
API-Positive Preschool Wheezer			◉	◉			
Aspirin-Sensitive Asthma	◉	◉	◉				
Cross-Country Skiers' Asthma				◉			
Infection-Induced Asthma	◉						
Late-Onset Hypereosinophilic Asthma			◉				
Noneosinophilic (Neutrophilic) Asthma					◉		◉
Other Forms of Elite-Athlete Asthma				◉			
Premenstrual Asthma			◉				
Severe Late-Onset Hypereosinophilic Asthma	◉	◉				◉	
Severe Steroid-Dependent Asthma						◉	
Steroid-Insensitive Eosinophilic Asthma							◉
Viral-Exacerbated Asthma			◉				

Note: Adapted from *Asthma endotypes* (Lötvall et al., 2011, p. 357).

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Appendix B: Tables of Characteristics, Associations, and Regression Results

B.1 Characteristics of CHIS Respondents

Table B1

Demographic Characteristics of CHIS Respondents

Variable	Frequency *N* (%) (N=124,521)	Wtd. Population *Wtd. N* (%) (N=28,246,634)	Standard Error of Wtd. *f*	Standard Error of Percent
Gender				
Male	52,159 (41.9%)	13,784,100 (48.8%)	5,219	0.0%
Female	72,362 (58.1%)	14,462,534 (51.2%)	4,218	0.0%
Age Group				
Young Adult (18-39)	25,402 (20.4%)	11,571,994 (41.0%)	2,267	0.0%
Middle Aged (40-64)	54,256 (43.6%)	12,049,216 (42.7%)	2,792	0.0%
Later Adult (65+)	44,863 (36.0%)	4,625,423 (16.4%)	5,389	0.0%
Race				
African American	5,964 (4.8%)	1,581,649 (5.6%)	1,805	0.0%
American Indian / Alaska Native	1,167 (0.9%)	135,904 (0.5%)	872	0.0%
Asian	12,006 (9.6%)	3,924,430 (13.9%)	7,553	0.0%
Latino	27,690 (22.2%)	9,806,044 (34.7%)	3,643	0.0%
Multiracial	2,724 (2.2%)	549,824 (1.9%)	5,483	0.0%
Other	473 (0.4%)	156,121 (0.6%)	11,151	0.0%
White	74,497 (59.8%)	12,092,661 (42.8%)	8,954	0.0%
Nativity, Respondent				
Born in U.S.	93,930 (75.4%)	18,689,704 (66.2%)	58,245	0.2%
Born Outside U.S.	30,591 (24.6%)	9,556,930 (33.8%)	57,751	0.2%
Nativity, Maternal				
Born in U.S.	80,109 (64.3%)	14,462,940 (51.2%)	56,793	0.2%
Born Outside U.S.	13,625 (10.9%)	4,177,673 (14.8%)	55,237	0.2%
Inapplicable	30,787 (24.7%)	9,606,021 (34.0%)	58,321	0.2%
Nativity, Paternal				
Born in U.S.	78,721 (63.2%)	14,194,039 (50.3%)	61,626	0.2%
Born Outside U.S.	15,013 (12.1%)	4,446,573 (15.7%)	60,248	0.2%
Inapplicable	30,787 (24.7%)	9,606,021 (34.0%)	58,321	0.2%
Citizenship				
US-Born Citizen	93,930 (75.4%)	18,689,704 (66.2%)	58,245	0.2%
Naturalized Citizen	18,659 (15.0%)	4,973,380 (17.6%)	61,062	0.2%
Non-Citizen	11,932 (9.6%)	4,583,550 (16.2%)	57,865	0.2%
Years Lived in U.S.				
< 5 Years	1,330 (1.1%)	629,541 (2.2%)	31,779	0.1%
5-9 Years	2,047 (1.6%)	896,636 (3.2%)	33,576	0.1%
10-14 Years	3,418 (2.7%)	1,312,040 (4.6%)	34,274	0.1%
15-19 Years	23,796 (19.1%)	6,718,712 (23.8%)	61,134	0.2%
Inapplicable	93,930 (75.4%)	18,689,704 (66.2%)	58,245	0.2%

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Variable	Frequency *N* (%) (N=124,521)	Wtd. Population *Wtd. N* (%) (N=28,246,634)	Standard Error of Wtd. *f*	Standard Error of Percent
Percent of Life Lived in U.S.				
0-20	2,942 (2.4%)	1,168,011 (4.1%)	40,266	0.1%
21-40	7,081 (5.7%)	2,216,985 (7.8%)	51,020	0.2%
41-60	9,937 (8.0%)	3,079,665 (10.9%)	55,890	0.2%
61-80	6,846 (5.5%)	1,962,817 (6.9%)	50,715	0.2%
81+	97,715 (78.5%)	19,819,156 (70.2%)	62,711	0.2%
Primary Spoken Language				
English (Includes English & Other)	109,884 (88.2%)	23,849,238 (84.4%)	57,107	0.2%
Spanish	7,909 (6.4%)	2,693,544 (9.5%)	46,559	0.2%
Chinese	1,268 (1.0%)	345,526 (1.2%)	18,386	0.1%
Vietnamese	1,254 (1.0%)	215,542 (0.8%)	11,820	0.0%
Korean	921 (0.7%)	154,628 (0.5%)	11,596	0.0%
Other	3,285 (2.6%)	988,156 (3.5%)	32,626	0.1%
Level of English Proficiency				
Very Well	15,467 (12.4%)	5,136,355 (18.2%)	61,061	0.2%
Well	9,534 (7.7%)	3,181,415 (11.3%)	55,921	0.2%
Not Well	9,116 (7.3%)	2,980,824 (10.6%)	53,294	0.2%
Not at All	4,916 (3.9%)	1,422,487 (5.0%)	40,086	0.1%
Inapplicable	85,488 (68.7%)	15,525,552 (55.0%)	70,990	0.2%
Marital Status				
Married/Partnered	66,278 (53.2%)	16,204,700 (57.4%)	74,560	0.3%
Widowed/Separated	35,620 (28.6%)	4,550,212 (16.1%)	59,008	0.2%
Never Married	22,623 (18.2%)	7,491,722 (26.5%)	59,892	0.2%
Marital Status				
Single w/o Children	58,181 (46.7%)	11,981,749 (42.4%)	69,087	0.2%
Single w/ Children	6,164 (5.0%)	1,786,003 (6.3%)	43,685	0.2%
Married w/o Children	39,729 (31.9%)	7,451,383 (26.4%)	60,895	0.2%
Married w/ Children	20,447 (16.4%)	7,027,498 (24.9%)	66,940	0.2%
Residency Type				
Own	79,045 (63.5%)	16,150,351 (57.2%)	5,143	0.0%
Rent/Other	45,476 (36.5%)	12,096,283 (42.8%)	4,001	0.0%
Highest Education Attained				
None / Primary School	8,013 (6.4%)	2,557,364 (9.1%)	39,887	0.1%
High School, Partial	5,945 (4.8%)	1,991,818 (7.1%)	40,249	0.1%
High School, Graduate	27,788 (22.3%)	6,619,205 (23.4%)	7,230	0.0%
College, Partial	19,693 (15.8%)	4,056,019 (14.4%)	55,783	0.2%
Vocational School	3,733 (3.0%)	820,813 (2.9%)	27,812	0.1%
Associates Degree	10,348 (8.3%)	2,126,465 (7.5%)	43,281	0.2%
Bachelors Degree	29,110 (23.4%)	6,470,239 (22.9%)	58,586	0.2%
Masters Degree	14,498 (11.6%)	2,656,530 (9.4%)	41,009	0.1%
Doctorate Degree	5,393 (4.3%)	948,181 (3.4%)	29,433	0.1%
Served in U.S. Armed Forces				
Yes	14,208 (11.4%)	2,083,549 (7.4%)	37,937	0.1%
No	110,313 (88.6%)	26,163,085 (92.6%)	39,436	0.1%

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Variable	Frequency *N* (%) (N=124,521)	Wtd. Population *Wtd. N* (%) (N=28,246,634)	Standard Error of Wtd. *f*	Standard Error of Percent
Active Duty Service Years				
< 0.5 Years	378 (0.3%)	58,849 (0.2%)	10,550	0.0%
0.5 - 2 Years	3,655 (2.9%)	468,124 (1.7%)	16,878	0.1%
2 - 4 Years	5,266 (4.2%)	753,854 (2.7%)	24,711	0.1%
4 - 20 Years	3,491 (2.8%)	623,836 (2.2%)	22,689	0.1%
20+ Years	1,410 (1.1%)	175,725 (0.6%)	9,338	0.0%
Inapplicable	110,321 (88.6%)	26,166,246 (92.6%)	39,329	0.1%
Respondent Usually Works				
Yes	7,758 (6.2%)	2,150,788 (7.6%)	47,702	0.2%
No	12,277 (9.9%)	3,408,162 (12.1%)	55,420	0.2%
Looking for Work	4,192 (3.4%)	1,401,951 (5.0%)	35,315	0.1%
Inapplicable	100,294 (80.5%)	21,285,732 (75.4%)	78,452	0.3%
Employment Classification				
Full-Time Employment	50,935 (40.9%)	15,423,269 (54.6%)	75,420	0.3%
Part-Time Employment	10,188 (8.2%)	2,487,583 (8.8%)	52,116	0.2%
Other Employment	426 (0.3%)	80,623 (0.3%)	7,653	0.0%
Unemployed, Looking for Work	5,870 (4.7%)	1,947,924 (6.9%)	44,303	0.2%
Unemployed, Not Looking for Work	57,102 (45.9%)	8,307,234 (29.4%)	68,045	0.2%
Telephone Calls Received				
Nearly All Calls on Cell Phone	23,962 (19.2%)	5,742,098 (20.3%)	53,551	0.2%
Mixed Cellular/Landline Use	30,867 (24.8%)	4,974,751 (17.6%)	48,785	0.2%
Few or No Cellular Calls	28,183 (22.6%)	3,299,589 (11.7%)	38,551	0.1%
Inapplicable	41,509 (33.3%)	14,230,196 (50.4%)	38,729	0.1%
Urban / Rural Setting				
Urban	46,921 (37.7%)	14,675,331 (52.0%)	68,719	0.2%
2nd City	32,754 (26.3%)	5,926,684 (21.0%)	47,068	0.2%
Suburban	20,871 (16.8%)	4,835,966 (17.1%)	60,933	0.2%
Town & Rural	23,975 (19.3%)	2,808,653 (9.9%)	37,202	0.1%

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Table B2

Health Characteristics of CHIS Respondents

Variable	Frequency *N* (%) (N=124,521)	Wtd. Population *Wtd. N* (%) (N=28,246,634)	Standard Error of Wtd. *f*	Standard Error of Percent
General Health Condition				
Excellent	21,659 (17.4%)	5,250,635 (18.6%)	72,027	0.3%
Very Good	38,194 (30.7%)	8,661,085 (30.7%)	76,426	0.3%
Good	37,435 (30.1%)	8,622,494 (30.5%)	82,551	0.3%
Fair	20,166 (16.2%)	4,545,146 (16.1%)	63,145	0.2%
Poor	7,067 (5.7%)	1,167,273 (4.1%)	32,160	0.1%
Descriptive BMI				
Obese 30.0+	32,625 (26.2%)	7,401,546 (26.2%)	79,280	0.3%
Overweight 25.0-29.99	43,640 (35.0%)	9,951,359 (35.2%)	92,652	0.3%
Normal 18.5-24.99	46,048 (37.0%)	10,426,170 (36.9%)	86,335	0.3%
Underweight 0-18.49	2,208 (1.8%)	467,558 (1.7%)	22,114	0.1%
Asthmatic Status				
Current Asthmatic	13,590 (10.9%)	2,765,889 (9.8%)	51,187	0.2%
Lifetime Asthmatic	4,811 (3.9%)	1,262,024 (4.5%)	41,075	0.1%
Non-Asthmatic	106,120 (85.2%)	24,218,720 (85.7%)	63,095	0.2%
Diagnosed with Asthma				
Yes	18,401 (14.8%)	4,027,914 (14.3%)	63,803	0.2%
No	106,120 (85.2%)	24,218,720 (85.7%)	63,095	0.2%
Provided Asthma Management Plan				
Yes	10,662 (8.6%)	2,129,829 (7.5%)	44,941	0.2%
No	7,739 (6.2%)	1,898,085 (6.7%)	47,924	0.2%
Inapplicable	106,120 (85.2%)	24,218,720 (85.7%)	63,095	0.2%
Have Asthma Management Plan				
Yes	2,730 (2.2%)	522,998 (1.9%)	21,405	0.1%
No	7,932 (6.4%)	1,606,831 (5.7%)	39,483	0.1%
Inapplicable	113,859 (91.4%)	26,116,805 (92.5%)	44,583	0.2%
Asthma Control Confidence				
Very Confident	14,267 (11.5%)	3,175,594 (11.2%)	55,173	0.2%
Somewhat Confident	3,408 (2.7%)	699,907 (2.5%)	28,829	0.1%
Limited-to-No Confidence	726 (0.6%)	152,412 (0.5%)	12,578	0.0%
Inapplicable	106,120 (85.2%)	24,218,720 (85.7%)	63,095	0.2%
Current Asthmatic				
Yes	11,091 (8.9%)	2,191,133 (7.8%)	46,903	0.2%
No	7,310 (5.9%)	1,836,781 (6.5%)	49,537	0.2%
Inapplicable	106,120 (85.2%)	24,218,720 (85.7%)	63,095	0.2%
Recent Asthma Episode/Attack				
Yes	5,837 (4.7%)	1,142,723 (4.0%)	30,140	0.1%
No	12,564 (10.1%)	2,885,191 (10.2%)	57,309	0.2%
Inapplicable	106,120 (85.2%)	24,218,720 (85.7%)	63,095	0.2%

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Variable	Frequency *N* (%) (N=124,521)	Wtd. Population *Wtd. N* (%) (N=28,246,634)	Standard Error of Wtd. *f*	Standard Error of Percent
Current Asthma Status				
Current Asthma	11,505 (9.2%)	2,278,995 (8.1%)	48,596	0.2%
No Current Asthma	113,016 (90.8%)	25,967,638 (91.9%)	49,026	0.2%
Recent Asthma Symptoms, Lifetime Asthmatics				
Yes	12,377 (9.9%)	2,524,776 (8.9%)	48,265	0.2%
No	6,024 (4.8%)	1,503,138 (5.3%)	45,297	0.2%
Inapplicable	106,120 (85.2%)	24,218,720 (85.7%)	63,095	0.2%
Recent Asthma Symptoms, Current Asthmatics				
Yes	10,390 (8.3%)	2,054,349 (7.3%)	45,944	0.2%
No	1,115 (0.9%)	224,646 (0.8%)	14,495	0.1%
Inapplicable	113,016 (90.8%)	25,967,638 (91.9%)	49,026	0.2%
Taking Daily Asthma Medications				
Yes	6,321 (5.1%)	1,101,625 (3.9%)	30,743	0.1%
No	12,080 (9.7%)	2,926,288 (10.4%)	55,754	0.2%
Inapplicable	106,120 (85.2%)	24,218,720 (85.7%)	63,095	0.2%
Frequency of Asthma Symptoms				
Every Day	1,786 (1.4%)	261,257 (0.9%)	14,564	0.1%
Every Week	1,593 (1.3%)	287,845 (1.0%)	16,810	0.1%
Every Month	2,416 (1.9%)	518,528 (1.8%)	23,541	0.1%
Less than Every Month	4,595 (3.7%)	986,719 (3.5%)	31,206	0.1%
Not at All	1,115 (0.9%)	224,646 (0.8%)	14,495	0.1%
Inapplicable	113,016 (90.8%)	25,967,638 (91.9%)	49,026	0.2%
ER/Urgent Care for Asthma				
Yes	1,095 (0.9%)	237,259 (0.8%)	16,258	0.1%
No	10,410 (8.4%)	2,041,736 (7.2%)	43,390	0.2%
Inapplicable	113,016 (90.8%)	25,967,638 (91.9%)	49,026	0.2%
Diagnosed with Diabetes				
Yes	14,643 (11.8%)	2,503,190 (8.9%)	47,571	0.2%
No	107,332 (86.2%)	25,293,954 (89.5%)	50,234	0.2%
Borderline/Pre-Diabetes	2,546 (2.0%)	449,490 (1.6%)	20,168	0.1%
Currently Taking Insulin				
Yes	4,137 (3.3%)	698,457 (2.5%)	21,797	0.1%
No	10,506 (8.4%)	1,804,733 (6.4%)	41,513	0.1%
Inapplicable	109,878 (88.2%)	25,743,443 (91.1%)	47,765	0.2%
Currently Taking Diabetes Medication				
Yes	10,550 (8.5%)	1,773,209 (6.3%)	37,959	0.1%
No	4,093 (3.3%)	729,981 (2.6%)	26,713	0.1%
Inapplicable	109,878 (88.2%)	25,743,443 (91.1%)	47,765	0.2%
Diagnosed with Heart Disease				
Yes	13,244 (10.6%)	1,712,797 (6.1%)	34,290	0.1%
No	111,277 (89.4%)	26,533,837 (93.9%)	35,032	0.1%

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Variable	Frequency *N* (%) (N=124,521)	Wtd. Population *Wtd. N* (%) (N=28,246,634)	Standard Error of Wtd. *f*	Standard Error of Percent
Diagnosed with Heart Failure				
Yes	3,863 (3.1%)	509,271 (1.8%)	20,583	0.1%
No	9,381 (7.5%)	1,203,526 (4.3%)	29,519	0.1%
Inapplicable	111,277 (89.4%)	26,533,837 (93.9%)	35,032	0.1%
Currently Taking Blood Pressure Medication				
Yes	37,896 (30.4%)	5,375,795 (19.0%)	50,437	0.2%
No	10,021 (8.0%)	2,484,143 (8.8%)	49,519	0.2%
Inapplicable	76,604 (61.5%)	20,386,696 (72.2%)	66,056	0.2%
Recent Heart-Disease Hospitalization				
Yes	1,902 (1.5%)	247,351 (0.9%)	11,754	0.0%
No	11,342 (9.1%)	1,465,446 (5.2%)	33,580	0.1%
Inapplicable	111,277 (89.4%)	26,533,837 (93.9%)	35,032	0.1%
Recent Psychological Distress				
Yes	8,650 (6.9%)	2,281,964 (8.1%)	44,414	0.2%
No	115,871 (93.1%)	25,964,669 (91.9%)	45,737	0.2%
Psychological Distress Last Month				
Yes	4,541 (3.6%)	1,072,542 (3.8%)	29,653	0.1%
No	119,980 (96.4%)	27,174,091 (96.2%)	30,675	0.1%
Feelings of Restlessness				
All of the Time	2,162 (1.7%)	620,695 (2.2%)	26,415	0.1%
Most of the Time	3,792 (3.0%)	1,072,345 (3.8%)	29,185	0.1%
Some of the Time	7,497 (6.0%)	1,863,334 (6.6%)	44,972	0.2%
A Little of the Time	5,077 (4.1%)	1,211,937 (4.3%)	36,502	0.1%
Not at All	4,215 (3.4%)	845,404 (3.0%)	28,528	0.1%
Inapplicable	101,778 (81.7%)	22,632,919 (80.1%)	67,635	0.2%
Feelings of Nervousness				
All of the Time	2,756 (2.2%)	697,950 (2.5%)	25,595	0.1%
Most of the Time	4,938 (4.0%)	1,349,450 (4.8%)	36,094	0.1%
Some of the Time	7,074 (5.7%)	1,757,919 (6.2%)	39,002	0.1%
A Little of the Time	5,086 (4.1%)	1,211,858 (4.3%)	34,825	0.1%
Not at All	2,889 (2.3%)	596,537 (2.1%)	23,175	0.1%
Inapplicable	101,778 (81.7%)	22,632,919 (80.1%)	67,635	0.2%
Blind/Deaf or Severe Impairment				
Yes	12,816 (10.3%)	2,038,977 (7.2%)	40,316	0.1%
No	111,705 (89.7%)	26,207,656 (92.8%)	41,032	0.1%
Smoked 100+ Cigarettes in Lifetime				
Yes	50,265 (40.4%)	9,963,444 (35.3%)	77,502	0.3%
No	74,256 (59.6%)	18,283,189 (64.7%)	78,250	0.3%
Smoking Frequency				
Every Day	9,751 (7.8%)	2,281,344 (8.1%)	48,772	0.2%
Some Days	4,242 (3.4%)	1,359,354 (4.8%)	40,956	0.1%
Not at All	36,272 (29.1%)	6,322,746 (22.4%)	64,303	0.2%
Inapplicable	74,256 (59.6%)	18,283,189 (64.7%)	78,250	0.3%

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Variable	Frequency *N* (%) (N=124,521)	Wtd. Population *Wtd. N* (%) (N=28,246,634)	Standard Error of Wtd. *f*	Standard Error of Percent
Current Smoker				
Current Smoker	13,993 (11.2%)	3,640,698 (12.9%)	55,249	0.2%
Not Current Smoker	110,528 (88.8%)	24,605,935 (87.1%)	55,201	0.2%
Current Smoking Habits				
Currently Smokes	13,993 (11.2%)	3,640,698 (12.9%)	55,249	0.2%
Quit Smoking	36,272 (29.1%)	6,322,746 (22.4%)	64,303	0.2%
Never Smoked Regularly	74,256 (59.6%)	18,283,189 (64.7%)	78,250	0.3%
Cigarettes Smoked per Day				
20 or More	2,837 (2.3%)	513,455 (1.8%)	21,776	0.1%
11-19 Cigarettes	1,608 (1.3%)	369,158 (1.3%)	19,801	0.1%
6-10 Cigarettes	4,212 (3.4%)	1,030,376 (3.6%)	31,948	0.1%
2-5 Cigarettes	4,172 (3.4%)	1,278,069 (4.5%)	35,626	0.1%
<=1 Cigarette	1,164 (0.9%)	449,640 (1.6%)	26,575	0.1%
None	110,528 (88.8%)	24,605,935 (87.1%)	55,201	0.2%
Walks for Transportation				
Yes	58,365 (46.9%)	15,110,572 (53.5%)	92,010	0.3%
No	65,203 (52.4%)	13,014,149 (46.1%)	91,684	0.3%
Unable to Walk	953 (0.8%)	121,913 (0.4%)	8,712	0.0%
Walks for Leisure				
Yes	79,370 (63.7%)	18,432,648 (65.3%)	85,519	0.3%
No	44,199 (35.5%)	9,692,162 (34.3%)	84,865	0.3%
Inapplicable	952 (0.8%)	121,823 (0.4%)	8,730	0.0%
Weekly Soda Intake				
21+ Times	1,684 (1.4%)	485,029 (1.7%)	21,315	0.1%
14-20 Times	2,086 (1.7%)	651,844 (2.3%)	30,524	0.1%
7-13 Times	6,869 (5.5%)	1,960,790 (6.9%)	41,162	0.1%
4-6 Times	3,307 (2.7%)	1,063,224 (3.8%)	33,406	0.1%
2-3 Times	10,308 (8.3%)	3,277,601 (11.6%)	58,738	0.2%
1 Time	14,570 (11.7%)	4,189,989 (14.8%)	60,956	0.2%
0 Times	85,697 (68.8%)	16,618,156 (58.8%)	84,050	0.3%
Neighborhood Access to Fresh Fruit				
Always	97,755 (78.5%)	21,478,856 (76.0%)	73,188	0.3%
Usually	11,579 (9.3%)	3,118,658 (11.0%)	52,053	0.2%
Sometimes	8,808 (7.1%)	2,416,462 (8.6%)	54,269	0.2%
Never	4,844 (3.9%)	991,455 (3.5%)	34,009	0.1%
Inapplicable	1,535 (1.2%)	241,204 (0.9%)	16,152	0.1%
Afordability of Fresh Fruit & Vegetables				
Always	63,525 (51.0%)	13,129,925 (46.5%)	88,813	0.3%
Usually	32,612 (26.2%)	8,105,740 (28.7%)	81,945	0.3%
Sometimes	20,276 (16.3%)	5,403,648 (19.1%)	70,259	0.2%
Never	1,729 (1.4%)	374,663 (1.3%)	20,589	0.1%
Inapplicable	6,379 (5.1%)	1,232,658 (4.4%)	39,266	0.1%

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Table B3

Health Insurance and Access Characteristics of CHIS Respondents

Variable	Frequency *N* (%) (N=124,521)	Wtd. Population *Wtd. N* (%) (N=28,246,634)	Standard Error of Wtd. *f*	Standard Error of Percent
General Insured				
Yes	112,998 (90.7%)	24,169,093 (85.6%)	65,549	0.2%
No	11,523 (9.3%)	4,077,541 (14.4%)	64,306	0.2%
Health Plan Name				
Aetna	3,085 (2.5%)	1,025,313 (3.6%)	35,178	0.1%
Blue Cross	13,418 (10.8%)	3,291,847 (11.7%)	42,255	0.1%
Blue Shield	7,412 (6.0%)	1,939,588 (6.9%)	40,301	0.1%
Cigna Health Care	1,672 (1.3%)	560,767 (2.0%)	24,531	0.1%
Health Net	2,567 (2.1%)	781,447 (2.8%)	31,480	0.1%
Kaiser	13,033 (10.5%)	4,117,495 (14.6%)	59,722	0.2%
Medicare/Medi-Cal	60,333 (48.5%)	9,194,952 (32.6%)	63,692	0.2%
United Healthcare	3,386 (2.7%)	1,031,881 (3.7%)	32,847	0.1%
Other	6,383 (5.1%)	1,714,388 (6.1%)	42,477	0.2%
Inapplicable	13,232 (10.6%)	4,588,955 (16.2%)	67,850	0.2%
HMO Status				
HMO	57,990 (46.6%)	13,725,422 (48.6%)	79,248	0.3%
Non-HMO	55,008 (44.2%)	10,443,671 (37.0%)	78,715	0.3%
Uninsured	11,523 (9.3%)	4,077,541 (14.4%)	64,306	0.2%
Health Plan Deductible > $1,000				
Yes	17,881 (14.4%)	4,937,904 (17.5%)	69,175	0.2%
No	41,064 (33.0%)	10,687,933 (37.8%)	77,928	0.3%
Inapplicable	65,576 (52.7%)	12,620,796 (44.7%)	71,276	0.3%
Health Plan Deductible > $2,000				
Yes	7,748 (6.2%)	2,231,914 (7.9%)	52,903	0.2%
No	44,010 (35.3%)	11,390,713 (40.3%)	81,621	0.3%
Inapplicable	72,763 (58.4%)	14,624,006 (51.8%)	76,000	0.3%
Insurance Covers Prescription Drugs				
Yes	104,900 (84.2%)	22,308,086 (79.0%)	70,395	0.2%
No	8,413 (6.8%)	1,912,455 (6.8%)	48,115	0.2%
Inapplicable	11,208 (9.0%)	4,026,092 (14.3%)	60,805	0.2%
Have Usual Source of Health Care				
Yes	83,599 (67.1%)	18,574,824 (65.8%)	90,871	0.3%
No	13,210 (10.6%)	4,477,507 (15.9%)	64,861	0.2%
Doctor / My Doctor	21,944 (17.6%)	3,786,485 (13.4%)	59,866	0.2%
Kaiser	5,379 (4.3%)	1,303,439 (4.6%)	31,997	0.1%
More than One Place	389 (0.3%)	104,380 (0.4%)	14,712	0.1%

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Variable	Frequency *N* (%) (N=124,521)	Wtd. Population *Wtd. N* (%) (N=28,246,634)	Standard Error of Wtd. *f*	Standard Error of Percent
Usual Source of Health Care				
Doctors Office / Kaiser / HMO	84,046 (67.5%)	16,690,639 (59.1%)	81,854	0.3%
Community/Government Clinic	24,922 (20.0%)	6,400,429 (22.7%)	70,413	0.2%
Emergency Room / Urgent Care	1,263 (1.0%)	409,905 (1.5%)	22,958	0.1%
Other	1,080 (0.9%)	268,153 (0.9%)	19,550	0.1%
No Usual Source of Care	13,210 (10.6%)	4,477,507 (15.9%)	64,861	0.2%
Recent Prescription Drug Delay				
Yes	13,517 (10.9%)	3,123,473 (11.1%)	50,809	0.2%
No	111,004 (89.1%)	25,123,161 (88.9%)	50,287	0.2%
Cost/Insurance Responsible for Delay				
Yes	6,337 (5.1%)	1,508,680 (5.3%)	41,097	0.1%
No	7,180 (5.8%)	1,614,793 (5.7%)	40,514	0.1%
Inapplicable	111,004 (89.1%)	25,123,161 (88.9%)	50,287	0.2%
Recent Medical Care Delay				
Yes	16,390 (13.2%)	3,946,413 (14.0%)	62,892	0.2%
No	108,131 (86.8%)	24,300,221 (86.0%)	63,312	0.2%
Cost/Insurance Responsible for Delay				
Yes	8,105 (6.5%)	2,102,002 (7.4%)	47,810	0.2%
No	8,285 (6.7%)	1,844,411 (6.5%)	46,083	0.2%
Inapplicable	108,131 (86.8%)	24,300,221 (86.0%)	63,312	0.2%
Recently Required Medical Appointment				
Yes	38,431 (30.9%)	8,225,559 (29.1%)	76,048	0.3%
No	81,286 (65.3%)	18,136,582 (64.2%)	85,803	0.3%
Inapplicable	4,804 (3.9%)	1,884,492 (6.7%)	48,460	0.2%
Doctor Listens Carefully				
Always	70,817 (56.9%)	13,657,140 (48.3%)	87,768	0.3%
Usually	20,220 (16.2%)	4,181,815 (14.8%)	56,353	0.2%
Sometimes	7,038 (5.7%)	1,693,089 (6.0%)	44,985	0.2%
Never	1,254 (1.0%)	321,413 (1.1%)	20,320	0.1%
Inapplicable	25,192 (20.2%)	8,393,176 (29.7%)	79,729	0.3%
Doctor Provides Clear Explanations				
Always	69,927 (56.2%)	13,751,483 (48.7%)	95,998	0.3%
Usually	21,082 (16.9%)	4,253,671 (15.1%)	68,073	0.2%
Sometimes	6,867 (5.5%)	1,487,437 (5.3%)	40,963	0.1%
Never	1,453 (1.2%)	360,867 (1.3%)	22,349	0.1%
Inapplicable	25,192 (20.2%)	8,393,176 (29.7%)	79,729	0.3%
Awareness of Interpretor Rights				
Yes	9,052 (7.3%)	2,809,062 (9.9%)	50,656	0.2%
No	4,917 (3.9%)	1,575,123 (5.6%)	38,432	0.1%
Inapplicable	110,552 (88.8%)	23,862,449 (84.5%)	51,328	0.2%
Language Barrior with Physician				
Yes	2,192 (1.8%)	589,248 (2.1%)	22,678	0.1%
No	1,553 (1.2%)	356,401 (1.3%)	19,408	0.1%
Inapplicable	120,776 (97.0%)	27,300,985 (96.7%)	29,467	0.1%

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Variable	Frequency *N* (%) (N=124,521)	Wtd. Population *Wtd. N* (%) (N=28,246,634)	Standard Error of Wtd. *f*	Standard Error of Percent
Recent Hospital Stay				
Yes	11,460 (9.2%)	2,233,813 (7.9%)	43,409	0.2%
No	110,328 (88.6%)	25,591,067 (90.6%)	48,045	0.2%
Inapplicable	2,733 (2.2%)	421,754 (1.5%)	16,422	0.1%
Recent ER Visit				
Yes	22,004 (17.7%)	4,983,284 (17.6%)	61,638	0.2%
No	98,598 (79.2%)	22,596,022 (80.0%)	64,041	0.2%
Inapplicable	3,919 (3.1%)	667,328 (2.4%)	24,145	0.1%
ER Visit - Past Year				
Yes	25,923 (20.8%)	5,650,611 (20.0%)	63,393	0.2%
No	98,598 (79.2%)	22,596,022 (80.0%)	64,041	0.2%
Internet Utilization				
Yes	98,147 (78.8%)	23,540,735 (83.3%)	53,026	0.2%
No	26,374 (21.2%)	4,705,899 (16.7%)	52,675	0.2%

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Table B4

Socioeconomic Characteristics of CHIS Respondents

Variable	Frequency *N* (%) (N=124,521)	Wtd. Population *Wtd. N* (%) (N=28,246,634)	Standard Error of Wtd. *f*	Standard Error of Percent
Poverty Level				
0-99% FPL	18,295 (14.7%)	4,706,950 (16.7%)	61,906	0.2%
100-199% FPL	22,822 (18.3%)	5,528,155 (19.6%)	62,497	0.2%
200-299% FPL	17,229 (13.8%)	3,973,723 (14.1%)	63,387	0.2%
300% FPL and Above	66,175 (53.1%)	14,037,805 (49.7%)	74,028	0.3%
Food Security Status Level				
Inapplicable / >=200% FPL	83,404 (67.0%)	18,011,528 (63.8%)	68,701	0.2%
Food Security	25,598 (20.6%)	5,893,084 (20.9%)	73,076	0.3%
Food Insecurity w/o Hunger	9,689 (7.8%)	2,799,403 (9.9%)	50,236	0.2%
Food Insecurity w/ Hunger	5,830 (4.7%)	1,542,618 (5.5%)	37,862	0.1%
Receiving SSI				
Yes	7,055 (5.7%)	1,051,201 (3.7%)	21,114	0.1%
No	56,598 (45.5%)	14,081,588 (49.9%)	73,054	0.3%
Inapplicable	60,868 (48.9%)	13,113,845 (46.4%)	74,586	0.3%
Receiving Social Security Disability				
Yes	5,647 (4.5%)	941,037 (3.3%)	23,489	0.1%
No	15,847 (12.7%)	4,054,493 (14.4%)	63,438	0.2%
Inapplicable	103,027 (82.7%)	23,251,104 (82.3%)	64,420	0.2%
Received SS or Pension Prior Month				
Yes	21,914 (17.6%)	2,474,490 (8.8%)	31,821	0.1%
No	7,460 (6.0%)	1,535,907 (5.4%)	33,074	0.1%
Inapplicable	95,147 (76.4%)	24,236,236 (85.8%)	38,866	0.1%
Primary Employer Type				
Private Company, Non-Profit Org	36,525 (29.3%)	12,025,511 (42.6%)	88,244	0.3%
Government	11,574 (9.3%)	2,790,005 (9.9%)	52,233	0.2%
Self-Employed	12,787 (10.3%)	3,020,842 (10.7%)	62,154	0.2%
Family Business or Farm	1,354 (1.1%)	359,229 (1.3%)	19,358	0.1%
Inapplicable	62,281 (50.0%)	10,051,046 (35.6%)	70,022	0.2%
Volunteer / Community Service				
Yes	54,129 (43.5%)	11,510,519 (40.8%)	73,339	0.3%
No	70,392 (56.5%)	16,736,114 (59.2%)	73,936	0.3%
Housing Category				
House	88,039 (70.7%)	19,630,532 (69.5%)	62,395	0.2%
Duplex	5,401 (4.3%)	1,456,177 (5.2%)	38,553	0.1%
Building with 3 or More Units	24,435 (19.6%)	6,009,190 (21.3%)	63,239	0.2%
Mobile Home	6,646 (5.3%)	1,150,735 (4.1%)	33,902	0.1%

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Variable	Frequency *N* (%) (N=124,521)	Wtd. Population *Wtd. N* (%) (N=28,246,634)	Standard Error of Wtd. *f*	Standard Error of Percent
Own or Rent Home				
Own	78,415 (63.0%)	15,966,479 (56.5%)	17,888	0.1%
Rent	40,152 (32.2%)	10,846,268 (38.4%)	30,542	0.1%
Other Arrangement	4,789 (3.8%)	1,106,778 (3.9%)	30,073	0.1%
Refused	530 (0.4%)	132,099 (0.5%)	13,633	0.0%
Dont Know	237 (0.2%)	72,073 (0.3%)	10,211	0.0%
Not Ascertained	398 (0.3%)	122,937 (0.4%)	11,688	0.0%
Neighborhood Helpful				
Strongly Agree	31,372 (25.2%)	5,843,472 (20.7%)	67,842	0.2%
Agree	75,031 (60.3%)	17,204,672 (60.9%)	97,204	0.3%
Disagree	14,782 (11.9%)	4,284,453 (15.2%)	70,001	0.2%
Strongly Disagree	3,336 (2.7%)	914,036 (3.2%)	36,547	0.1%
Neighborhood Trustworthy				
Strongly Agree	26,665 (21.4%)	4,876,387 (17.3%)	60,874	0.2%
Agree	78,854 (63.3%)	17,927,829 (63.5%)	86,663	0.3%
Disagree	15,619 (12.5%)	4,560,740 (16.1%)	71,168	0.3%
Strongly Disagree	3,383 (2.7%)	881,677 (3.1%)	29,263	0.1%
Neighborhood Safe				
All of the Time	66,413 (53.3%)	13,917,961 (49.3%)	83,525	0.3%
Most of the Time	46,044 (37.0%)	10,668,364 (37.8%)	81,954	0.3%
Some of the Time	10,228 (8.2%)	3,157,631 (11.2%)	55,506	0.2%
None of the Time	1,836 (1.5%)	502,678 (1.8%)	25,889	0.1%

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B.2 Univariate Associations with Asthma Status

Table B5

Weighted CHIS Demographic Characteristics by Asthma Status

Variable	Wtd. Population *Wtd. N* (%) (N=28,246,634)	Current Asthmatics *Wtd. n* (%) (N=2,765,889)	Previous Asthmatics *Wtd. n* (%) (N=1,262,024)	Non-Asthmatics *Wtd. n* (%) (N=24,218,720)	*p* value*
Sex					<.0001
Male	13,784,100 (48.8%)	1,041,898 (37.7%)	719,775 (57.0%)	12,022,426 (49.6%)	
Female	14,462,534 (51.2%)	1,723,991 (62.3%)	542,249 (43.0%)	12,196,294 (50.4%)	
Age Group					<.0001
Young Adult (18-39)	11,571,994 (41.0%)	1,150,310 (41.6%)	697,720 (55.3%)	9,723,964 (40.2%)	
Middle Aged (40-64)	12,049,216 (42.7%)	1,150,939 (41.6%)	421,798 (33.4%)	10,476,480 (43.3%)	
Later Adult (65+)	4,625,423 (16.4%)	464,640 (16.8%)	142,507 (11.3%)	4,018,276 (16.6%)	
Race					<.0001
African American	1,581,649 (5.6%)	229,044 (8.3%)	91,290 (7.2%)	1,261,315 (5.2%)	
American Indian / Alaska Native	135,904 (0.5%)	26,802 (1.0%)	6,871 (0.5%)	102,231 (0.4%)	
Asian	3,924,430 (13.9%)	272,817 (9.9%)	176,128 (14.0%)	3,475,486 (14.4%)	
Latino	9,806,044 (34.7%)	762,675 (27.6%)	393,295 (31.2%)	8,650,074 (35.7%)	
Multiracial	549,824 (1.9%)	95,513 (3.5%)	42,374 (3.4%)	411,937 (1.7%)	
Other	156,121 (0.6%)	17,084 (0.6%)	3,823 (0.3%)	135,213 (0.6%)	
White	12,092,661 (42.8%)	1,361,955 (49.2%)	548,243 (43.4%)	10,182,463 (42.0%)	
Nativity, Respondent					<.0001
Born in U.S.	18,689,704 (66.2%)	2,239,461 (81.0%)	1,013,137 (80.3%)	15,437,106 (63.7%)	
Born Outside U.S.	9,556,930 (33.8%)	526,428 (19.0%)	248,888 (19.7%)	8,781,614 (36.3%)	
Nativity, Maternal					<.0001
Born in U.S.	14,462,940 (51.2%)	1,851,388 (66.9%)	765,028 (60.6%)	11,846,523 (48.9%)	
Born Outside U.S.	4,177,673 (14.8%)	384,657 (13.9%)	245,479 (19.5%)	3,547,537 (14.6%)	
Inapplicable	9,606,021 (34.0%)	529,844 (19.2%)	251,517 (19.9%)	8,824,660 (36.4%)	
Nativity, Paternal					<.0001
Born in U.S.	14,194,039 (50.3%)	1,809,421 (65.4%)	750,010 (59.4%)	11,634,609 (48.0%)	
Born Outside U.S.	4,446,573 (15.7%)	426,625 (15.4%)	260,498 (20.6%)	3,759,451 (15.5%)	
Inapplicable	9,606,021 (34.0%)	529,844 (19.2%)	251,517 (19.9%)	8,824,660 (36.4%)	
Citizenship					<.0001
US-Born Citizen	18,689,704 (66.2%)	2,239,461 (81.0%)	1,013,137 (80.3%)	15,437,106 (63.7%)	
Naturalized Citizen	4,973,380 (17.6%)	311,407 (11.3%)	160,687 (12.7%)	4,501,286 (18.6%)	
Non-Citizen	4,583,550 (16.2%)	215,021 (7.8%)	88,201 (7.0%)	4,280,328 (17.7%)	
Years Lived in U.S.					<.0001
< 5 Years	629,541 (2.2%)	19,002 (0.7%)	16,218 (1.3%)	594,321 (2.5%)	
5-9 Years	896,636 (3.2%)	41,474 (1.5%)	21,590 (1.7%)	833,571 (3.4%)	
10-14 Years	1,312,040 (4.6%)	55,476 (2.0%)	23,590 (1.9%)	1,232,974 (5.1%)	
15-19 Years	6,718,712 (23.8%)	410,476 (14.8%)	187,489 (14.9%)	6,120,748 (25.3%)	
Inapplicable	18,689,704 (66.2%)	2,239,461 (81.0%)	1,013,137 (80.3%)	15,437,106 (63.7%)	
Percent of Life Lived in U.S.					<.0001
0-20	1,168,011 (4.1%)	40,985 (1.5%)	35,126 (2.8%)	1,091,900 (4.5%)	
21-40	2,216,985 (7.8%)	100,582 (3.6%)	40,129 (3.2%)	2,076,274 (8.6%)	
41-60	3,079,665 (10.9%)	169,195 (6.1%)	65,518 (5.2%)	2,844,952 (11.7%)	
61-80	1,962,817 (6.9%)	117,906 (4.3%)	63,343 (5.0%)	1,781,568 (7.4%)	
81+	19,819,156 (70.2%)	2,337,221 (84.5%)	1,057,909 (83.8%)	16,424,025 (67.8%)	
Primary Spoken Language					<.0001
English (Includes English & Other)	23,849,238 (84.4%)	2,527,590 (91.4%)	1,157,982 (91.8%)	20,163,667 (83.3%)	
Spanish	2,693,544 (9.5%)	142,610 (5.2%)	53,923 (4.3%)	2,497,012 (10.3%)	
Chinese	345,526 (1.2%)	10,357 (0.4%)	10,780 (0.9%)	324,389 (1.3%)	
Vietnamese	215,542 (0.8%)	14,210 (0.5%)	1,796 (0.1%)	199,536 (0.8%)	
Korean	154,628 (0.5%)	5,422 (0.2%)	36 (0.0%)	149,170 (0.6%)	
Other	988,156 (3.5%)	65,701 (2.4%)	37,508 (3.0%)	884,948 (3.7%)	

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Variable	Wtd. Population *Wtd. N* (%) (N=28,246,634)	Current Asthmatics *Wtd. n* (%) (N=2,765,889)	Previous Asthmatics *Wtd. n* (%) (N=1,262,024)	Non-Asthmatics *Wtd. n* (%) (N=24,218,720)	*p* value*
Level of English Proficiency					<.0001
Very Well	5,136,355 (18.2%)	479,694 (17.3%)	277,799 (22.0%)	4,378,862 (18.1%)	
Well	3,181,415 (11.3%)	169,941 (6.1%)	105,539 (8.4%)	2,905,935 (12.0%)	
Not Well	2,980,824 (10.6%)	155,842 (5.6%)	49,972 (4.0%)	2,775,010 (11.5%)	
Not at All	1,422,487 (5.0%)	69,523 (2.5%)	18,653 (1.5%)	1,334,311 (5.5%)	
Inapplicable	15,525,552 (55.0%)	1,890,888 (68.4%)	810,062 (64.2%)	12,824,602 (53.0%)	
Marital Status					<.0001
Married/Partnered	16,204,700 (57.4%)	1,449,704 (52.4%)	655,694 (52.0%)	14,099,302 (58.2%)	
Widowed/Separated	4,550,212 (16.1%)	512,948 (18.5%)	148,033 (11.7%)	3,889,230 (16.1%)	
Never Married	7,491,722 (26.5%)	803,237 (29.0%)	458,297 (36.3%)	6,230,188 (25.7%)	
Family Composition					<.0001
Single w/o Children	11,981,749 (42.4%)	1,319,568 (47.7%)	613,874 (48.6%)	10,048,307 (41.5%)	
Single w/ Children	1,786,003 (6.3%)	215,353 (7.8%)	64,636 (5.1%)	1,506,014 (6.2%)	
Married w/o Children	7,451,383 (26.4%)	706,270 (25.5%)	280,869 (22.3%)	6,464,244 (26.7%)	
Married w/ Children	7,027,498 (24.9%)	524,698 (19.0%)	302,645 (24.0%)	6,200,156 (25.6%)	
Residency Type					.6282
Own	16,150,351 (57.2%)	1,555,725 (56.2%)	727,114 (57.6%)	13,867,512 (57.3%)	
Rent/Other	12,096,283 (42.8%)	1,210,164 (43.8%)	534,910 (42.4%)	10,351,208 (42.7%)	
Highest Education Attained					<.0001
None / Primary School	2,557,364 (9.1%)	150,685 (5.4%)	50,940 (4.0%)	2,355,739 (9.7%)	
High School, Partial	1,991,818 (7.1%)	190,729 (6.9%)	55,455 (4.4%)	1,745,634 (7.2%)	
High School, Graduate	6,619,205 (23.4%)	648,383 (23.4%)	292,209 (23.2%)	5,678,613 (23.4%)	
College, Partial	4,056,019 (14.4%)	488,977 (17.7%)	196,246 (15.6%)	3,370,795 (13.9%)	
Vocational School	820,813 (2.9%)	84,968 (3.1%)	53,716 (4.3%)	682,129 (2.8%)	
Associates Degree	2,126,465 (7.5%)	257,668 (9.3%)	116,006 (9.2%)	1,752,791 (7.2%)	
Bachelors Degree	6,470,239 (22.9%)	620,885 (22.4%)	318,244 (25.2%)	5,531,111 (22.8%)	
Masters Degree	2,656,530 (9.4%)	245,317 (8.9%)	133,154 (10.6%)	2,278,059 (9.4%)	
Doctorate Degree	948,181 (3.4%)	78,277 (2.8%)	46,055 (3.6%)	823,849 (3.4%)	
Served in U.S. Armed Forces					.0141
Yes	2,083,549 (7.4%)	167,526 (6.1%)	80,654 (6.4%)	1,835,368 (7.6%)	
No	26,163,085 (92.6%)	2,598,364 (93.9%)	1,181,370 (93.6%)	22,383,352 (92.4%)	
Active Duty Service Years					.1183
< 0.5 Years	58,849 (0.2%)	3,230 (0.1%)	4,214 (0.3%)	51,405 (0.2%)	
0.5 - 2 Years	468,124 (1.7%)	42,865 (1.5%)	15,244 (1.2%)	410,015 (1.7%)	
2 - 4 Years	753,854 (2.7%)	61,383 (2.2%)	31,152 (2.5%)	661,319 (2.7%)	
4 - 20 Years	623,836 (2.2%)	47,092 (1.7%)	26,770 (2.1%)	549,974 (2.3%)	
20+ Years	175,725 (0.6%)	12,956 (0.5%)	3,275 (0.3%)	159,494 (0.7%)	
Inapplicable	26,166,246 (92.6%)	2,598,364 (93.9%)	1,181,370 (93.6%)	22,386,513 (92.4%)	
Respondent Usually Works					.3404
Yes	2,150,788 (7.6%)	226,072 (8.2%)	103,546 (8.2%)	1,821,170 (7.5%)	
No	3,408,162 (12.1%)	353,941 (12.8%)	138,561 (11.0%)	2,915,660 (12.0%)	
Looking for Work	1,401,951 (5.0%)	147,499 (5.3%)	56,324 (4.5%)	1,198,129 (4.9%)	
Inapplicable	21,285,732 (75.4%)	2,038,378 (73.7%)	963,593 (76.4%)	18,283,761 (75.5%)	
Employment Classification					<.0001
Full-Time Employment	15,423,269 (54.6%)	1,310,954 (47.4%)	751,410 (59.5%)	13,360,905 (55.2%)	
Part-Time Employment	2,487,583 (8.8%)	240,472 (8.7%)	135,863 (10.8%)	2,111,249 (8.7%)	
Other Employment	80,623 (0.3%)	10,836 (0.4%)	4,305 (0.3%)	65,483 (0.3%)	
Unemployed, Looking for Work	1,947,924 (6.9%)	204,819 (7.4%)	77,895 (6.2%)	1,665,210 (6.9%)	
Unemployed, Not Looking for Work	8,307,234 (29.4%)	998,808 (36.1%)	292,551 (23.2%)	7,015,874 (29.0%)	

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Variable	Wtd. Population *Wtd. N* (%) (N=28,246,634)	Current Asthmatics *Wtd. n* (%) (N=2,765,889)	Previous Asthmatics *Wtd. n* (%) (N=1,262,024)	Non-Asthmatics *Wtd. n* (%) (N=24,218,720)	*p* value*
Telephone Calls Received					<.0001
Nearly All Calls on Cell Phone	5,742,098 (20.3%)	561,030 (20.3%)	309,872 (24.6%)	4,871,196 (20.1%)	
Mixed Cellular/Landline Use	4,974,751 (17.6%)	499,579 (18.1%)	199,912 (15.8%)	4,275,259 (17.7%)	
Limited Cellular Use	3,299,589 (11.7%)	341,282 (12.3%)	104,404 (8.3%)	2,853,903 (11.8%)	
Inapplicable	14,230,196 (50.4%)	1,363,998 (49.3%)	647,836 (51.3%)	12,218,362 (50.5%)	
Urban / Rural Setting					.0001
Urban	14,675,331 (52.0%)	1,341,843 (48.5%)	628,509 (49.8%)	12,704,979 (52.5%)	
2nd City	5,926,684 (21.0%)	652,279 (23.6%)	272,227 (21.6%)	5,002,178 (20.7%)	
Suburban	4,835,966 (17.1%)	463,750 (16.8%)	239,635 (19.0%)	4,132,581 (17.1%)	
Town & Rural	2,808,653 (9.9%)	308,017 (11.1%)	121,653 (9.6%)	2,378,982 (9.8%)	

* *p* values based on Pearson chi-square test of association.

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Table B6

Weighted CHIS Health Characteristics by Asthma Status

Variable	Wtd. Population *Wtd. N* (%) (N=28,246,634)	Current Asthmatics *Wtd. n* (%) (N=2,765,889)	Previous Asthmatics *Wtd. n* (%) (N=1,262,024)	Non-Asthmatics *Wtd. n* (%) (N=24,218,720)	*p* value*
General Health Condition					<.0001
Excellent	5,250,635 (18.6%)	259,127 (9.4%)	276,952 (21.9%)	4,714,556 (19.5%)	
Very Good	8,661,085 (30.7%)	757,071 (27.4%)	428,010 (33.9%)	7,476,004 (30.9%)	
Good	8,622,494 (30.5%)	857,917 (31.0%)	376,366 (29.8%)	7,388,211 (30.5%)	
Fair	4,545,146 (16.1%)	622,952 (22.5%)	150,471 (11.9%)	3,771,723 (15.6%)	
Poor	1,167,273 (4.1%)	268,823 (9.7%)	30,225 (2.4%)	868,225 (3.6%)	
Descriptive BMI					<.0001
Obese 30.0+	7,401,546 (26.2%)	998,289 (36.1%)	329,734 (26.1%)	6,073,523 (25.1%)	
Overweight 25.0-29.99	9,951,359 (35.2%)	869,712 (31.4%)	431,709 (34.2%)	8,649,938 (35.7%)	
Normal 18.5-24.99	10,426,170 (36.9%)	852,078 (30.8%)	486,175 (38.5%)	9,087,918 (37.5%)	
Underweight 0-18.49	467,558 (1.7%)	45,811 (1.7%)	14,406 (1.1%)	407,341 (1.7%)	
Diagnosed with Asthma					N/A
Yes	4,027,914 (14.3%)	2,765,889 (100.0%)	1,262,024 (100.0%)	. (0.0%)	
No	24,218,720 (85.7%)	. (0.0%)	. (0.0%)	24,218,720 (100.0%)	
Provided Asthma Management Plan					N/A
Yes	2,129,829 (7.5%)	1,833,219 (66.3%)	296,609 (23.5%)	. (0.0%)	
No	1,898,085 (6.7%)	932,670 (33.7%)	965,415 (76.5%)	. (0.0%)	
Inapplicable	24,218,720 (85.7%)	. (0.0%)	. (0.0%)	24,218,720 (100.0%)	
Have Asthma Management Plan					N/A
Yes	522,998 (1.9%)	486,803 (17.6%)	36,195 (2.9%)	. (0.0%)	
No	1,606,831 (5.7%)	1,346,417 (48.7%)	260,414 (20.6%)	. (0.0%)	
Inapplicable	26,116,805 (92.5%)	932,670 (33.7%)	965,415 (76.5%)	24,218,720 (100.0%)	
Asthma Control Confidence					N/A
Very Confident	3,175,594 (11.2%)	1,997,216 (72.2%)	1,178,378 (93.4%)	. (0.0%)	
Somewhat Confident	699,907 (2.5%)	644,905 (23.3%)	55,002 (4.4%)	. (0.0%)	
Limited-to-No Confidence	152,412 (0.5%)	123,768 (4.5%)	28,644 (2.3%)	. (0.0%)	
Inapplicable	24,218,720 (85.7%)	. (0.0%)	. (0.0%)	24,218,720 (100.0%)	
Current Asthmatic					N/A
Yes	2,191,133 (7.8%)	2,191,133 (79.2%)	. (0.0%)	. (0.0%)	
No	1,836,781 (6.5%)	574,756 (20.8%)	1,262,024 (100.0%)	. (0.0%)	
Inapplicable	24,218,720 (85.7%)	. (0.0%)	. (0.0%)	24,218,720 (100.0%)	
Recent Asthma Episode/Attack					N/A
Yes	1,142,723 (4.0%)	1,142,723 (41.3%)	. (0.0%)	. (0.0%)	
No	2,885,191 (10.2%)	1,623,166 (58.7%)	1,262,024 (100.0%)	. (0.0%)	
Inapplicable	24,218,720 (85.7%)	. (0.0%)	. (0.0%)	24,218,720 (100.0%)	
Current Asthma Status					N/A
Current Asthma	2,278,995 (8.1%)	2,278,995 (82.4%)	. (0.0%)	. (0.0%)	
No Current Asthma	25,967,638 (91.9%)	486,894 (17.6%)	1,262,024 (100.0%)	24,218,720 (100.0%)	
Recent Asthma Symptoms, Lifetime Asthmatics					N/A
Yes	2,524,776 (8.9%)	2,524,776 (91.3%)	. (0.0%)	. (0.0%)	
No	1,503,138 (5.3%)	241,114 (8.7%)	1,262,024 (100.0%)	. (0.0%)	
Inapplicable	24,218,720 (85.7%)	. (0.0%)	. (0.0%)	24,218,720 (100.0%)	
Recent Asthma Symptoms, Current Asthmatics					N/A
Yes	2,054,349 (7.3%)	2,054,349 (74.3%)	. (0.0%)	. (0.0%)	
No	224,646 (0.8%)	224,646 (8.1%)	. (0.0%)	. (0.0%)	
Inapplicable	25,967,638 (91.9%)	486,894 (17.6%)	1,262,024 (100.0%)	24,218,720 (100.0%)	
Taking Daily Asthma Medications					N/A
Yes	1,101,625 (3.9%)	1,101,625 (39.8%)	. (0.0%)	. (0.0%)	
No	2,926,288 (10.4%)	1,664,264 (60.2%)	1,262,024 (100.0%)	. (0.0%)	
Inapplicable	24,218,720 (85.7%)	. (0.0%)	. (0.0%)	24,218,720 (100.0%)	

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Variable	Wtd. Population *Wtd. N* (%) (N=28,246,634)	Current Asthmatics *Wtd. n* (%) (N=2,765,889)	Previous Asthmatics *Wtd. n* (%) (N=1,262,024)	Non-Asthmatics *Wtd. n* (%) (N=24,218,720)	*p* value*
Frequency of Asthma Symptoms					N/A
Every Day	261,257 (0.9%)	261,257 (9.4%)	. (0.0%)	. (0.0%)	
Every Week	287,845 (1.0%)	287,845 (10.4%)	. (0.0%)	. (0.0%)	
Every Month	518,528 (1.8%)	518,528 (18.7%)	. (0.0%)	. (0.0%)	
Less than Every Month	986,719 (3.5%)	986,719 (35.7%)	. (0.0%)	. (0.0%)	
Not at All	224,646 (0.8%)	224,646 (8.1%)	. (0.0%)	. (0.0%)	
Inapplicable	25,967,638 (91.9%)	486,894 (17.6%)	1,262,024 (100.0%)	24,218,720 (100.0%)	
ER/Urgent Care for Asthma					N/A
Yes	237,259 (0.8%)	237,259 (8.6%)	. (0.0%)	. (0.0%)	
No	2,041,736 (7.2%)	2,041,736 (73.8%)	. (0.0%)	. (0.0%)	
Inapplicable	25,967,638 (91.9%)	486,894 (17.6%)	1,262,024 (100.0%)	24,218,720 (100.0%)	
Diagnosed with Diabetes					<.0001
Yes	2,503,190 (8.9%)	334,730 (12.1%)	82,183 (6.5%)	2,086,277 (8.6%)	
No	25,293,954 (89.5%)	2,366,415 (85.6%)	1,169,720 (92.7%)	21,757,818 (89.8%)	
Borderline/Pre-Diabetes	449,490 (1.6%)	64,745 (2.3%)	10,121 (0.8%)	374,624 (1.5%)	
Currently Taking Insulin					<.0001
Yes	698,457 (2.5%)	94,819 (3.4%)	22,905 (1.8%)	580,733 (2.4%)	
No	1,804,733 (6.4%)	239,911 (8.7%)	59,278 (4.7%)	1,505,544 (6.2%)	
Inapplicable	25,743,443 (91.1%)	2,431,159 (87.9%)	1,179,841 (93.5%)	22,132,443 (91.4%)	
Currently Taking Diabetes Medication					<.0001
Yes	1,773,209 (6.3%)	243,844 (8.8%)	49,349 (3.9%)	1,480,016 (6.1%)	
No	729,981 (2.6%)	90,886 (3.3%)	32,834 (2.6%)	606,262 (2.5%)	
Inapplicable	25,743,443 (91.1%)	2,431,159 (87.9%)	1,179,841 (93.5%)	22,132,443 (91.4%)	
Diagnosed with Heart Disease					<.0001
Yes	1,712,797 (6.1%)	282,806 (10.2%)	66,976 (5.3%)	1,363,015 (5.6%)	
No	26,533,837 (93.9%)	2,483,084 (89.8%)	1,195,048 (94.7%)	22,855,705 (94.4%)	
Diagnosed with Heart Failure					<.0001
Yes	509,271 (1.8%)	103,084 (3.7%)	17,597 (1.4%)	388,590 (1.6%)	
No	1,203,526 (4.3%)	179,722 (6.5%)	49,380 (3.9%)	974,425 (4.0%)	
Inapplicable	26,533,837 (93.9%)	2,483,084 (89.8%)	1,195,048 (94.7%)	22,855,705 (94.4%)	
Currently Taking Blood Pressure Medication					<.0001
Yes	5,375,795 (19.0%)	705,832 (25.5%)	177,853 (14.1%)	4,492,109 (18.5%)	
No	2,484,143 (8.8%)	291,478 (10.5%)	120,239 (9.5%)	2,072,426 (8.6%)	
Inapplicable	20,386,696 (72.2%)	1,768,579 (63.9%)	963,932 (76.4%)	17,654,185 (72.9%)	
Recent Heart-Disease Hospitalization					<.0001
Yes	247,351 (0.9%)	48,263 (1.7%)	7,410 (0.6%)	191,677 (0.8%)	
No	1,465,446 (5.2%)	234,542 (8.5%)	59,566 (4.7%)	1,171,338 (4.8%)	
Inapplicable	26,533,837 (93.9%)	2,483,084 (89.8%)	1,195,048 (94.7%)	22,855,705 (94.4%)	
Recent Psychological Distress					<.0001
Yes	2,281,964 (8.1%)	426,437 (15.4%)	123,314 (9.8%)	1,732,213 (7.2%)	
No	25,964,669 (91.9%)	2,339,453 (84.6%)	1,138,710 (90.2%)	22,486,507 (92.8%)	
Psychological Distress Last Month					<.0001
Yes	1,072,542 (3.8%)	224,547 (8.1%)	48,419 (3.8%)	799,576 (3.3%)	
No	27,174,091 (96.2%)	2,541,342 (91.9%)	1,213,605 (96.2%)	23,419,144 (96.7%)	
Feelings of Restlessness					<.0001
All of the Time	620,695 (2.2%)	115,337 (4.2%)	28,897 (2.3%)	476,461 (2.0%)	
Most of the Time	1,072,345 (3.8%)	173,189 (6.3%)	57,996 (4.6%)	841,159 (3.5%)	
Some of the Time	1,863,334 (6.6%)	240,190 (8.7%)	95,862 (7.6%)	1,527,283 (6.3%)	
A Little of the Time	1,211,937 (4.3%)	120,046 (4.3%)	49,736 (3.9%)	1,042,154 (4.3%)	
Not at All	845,404 (3.0%)	105,763 (3.8%)	40,275 (3.2%)	699,366 (2.9%)	
Inapplicable	22,632,919 (80.1%)	2,011,365 (72.7%)	989,257 (78.4%)	19,632,297 (81.1%)	
Feelings of Nervousness					<.0001
All of the Time	697,950 (2.5%)	145,502 (5.3%)	31,322 (2.5%)	521,126 (2.2%)	
Most of the Time	1,349,450 (4.8%)	205,407 (7.4%)	81,459 (6.5%)	1,062,584 (4.4%)	
Some of the Time	1,757,919 (6.2%)	217,044 (7.8%)	80,707 (6.4%)	1,460,168 (6.0%)	
A Little of the Time	1,211,858 (4.3%)	107,636 (3.9%)	47,953 (3.8%)	1,056,268 (4.4%)	
Not at All	596,537 (2.1%)	78,935 (2.9%)	31,325 (2.5%)	486,278 (2.0%)	
Inapplicable	22,632,919 (80.1%)	2,011,365 (72.7%)	989,257 (78.4%)	19,632,297 (81.1%)	

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Variable	Wtd. Population *Wtd. N* (%) (N=28,246,634)	Current Asthmatics *Wtd. n* (%) (N=2,765,889)	Previous Asthmatics *Wtd. n* (%) (N=1,262,024)	Non-Asthmatics *Wtd. n* (%) (N=24,218,720)	*p* value*
Blind/Deaf or Severe Impairment					<.0001
Yes	2,038,977 (7.2%)	287,041 (10.4%)	90,029 (7.1%)	1,661,907 (6.9%)	
No	26,207,656 (92.8%)	2,478,848 (89.6%)	1,171,995 (92.9%)	22,556,813 (93.1%)	
Smoked 100+ Cigarettes in Lifetime					<.0001
Yes	9,963,444 (35.3%)	1,106,372 (40.0%)	425,919 (33.7%)	8,431,153 (34.8%)	
No	18,283,189 (64.7%)	1,659,517 (60.0%)	836,105 (66.3%)	15,787,567 (65.2%)	
Smoking Frequency					<.0001
Every Day	2,281,344 (8.1%)	281,716 (10.2%)	101,898 (8.1%)	1,897,730 (7.8%)	
Some Days	1,359,354 (4.8%)	138,222 (5.0%)	68,853 (5.5%)	1,152,279 (4.8%)	
Not at All	6,322,746 (22.4%)	686,434 (24.8%)	255,168 (20.2%)	5,381,144 (22.2%)	
Inapplicable	18,283,189 (64.7%)	1,659,517 (60.0%)	836,105 (66.3%)	15,787,567 (65.2%)	
Current Smoker					.0003
Current Smoker	3,640,698 (12.9%)	419,938 (15.2%)	170,751 (13.5%)	3,050,009 (12.6%)	
Not Current Smoker	24,605,935 (87.1%)	2,345,951 (84.8%)	1,091,273 (86.5%)	21,168,711 (87.4%)	
Current Smoking Habits					<.0001
Currently Smokes	3,640,698 (12.9%)	419,938 (15.2%)	170,751 (13.5%)	3,050,009 (12.6%)	
Quit Smoking	6,322,746 (22.4%)	686,434 (24.8%)	255,168 (20.2%)	5,381,144 (22.2%)	
Never Smoked Regularly	18,283,189 (64.7%)	1,659,517 (60.0%)	836,105 (66.3%)	15,787,567 (65.2%)	
Cigarettes Smoked per Day					.0137
20 or More	513,455 (1.8%)	74,975 (2.7%)	20,883 (1.7%)	417,597 (1.7%)	
11-19 Cigarettes	369,158 (1.3%)	41,506 (1.5%)	20,871 (1.7%)	306,781 (1.3%)	
6-10 Cigarettes	1,030,376 (3.6%)	113,465 (4.1%)	49,695 (3.9%)	867,216 (3.6%)	
2-5 Cigarettes	1,278,069 (4.5%)	143,833 (5.2%)	58,254 (4.6%)	1,075,982 (4.4%)	
<=1 Cigarette	449,640 (1.6%)	46,158 (1.7%)	21,049 (1.7%)	382,433 (1.6%)	
None	24,605,935 (87.1%)	2,345,951 (84.8%)	1,091,273 (86.5%)	21,168,711 (87.4%)	
Walks for Transportation					.0036
Yes	15,110,572 (53.5%)	1,431,925 (51.8%)	690,083 (54.7%)	12,988,564 (53.6%)	
No	13,014,149 (46.1%)	1,311,979 (47.4%)	568,258 (45.0%)	11,133,912 (46.0%)	
Unable to Walk	121,913 (0.4%)	21,986 (0.8%)	3,683 (0.3%)	96,244 (0.4%)	
Walks for Leisure					.0005
Yes	18,432,648 (65.3%)	1,729,288 (62.5%)	853,441 (67.6%)	15,849,919 (65.4%)	
No	9,692,162 (34.3%)	1,014,615 (36.7%)	404,901 (32.1%)	8,272,646 (34.2%)	
Inapplicable	121,823 (0.4%)	21,986 (0.8%)	3,683 (0.3%)	96,154 (0.4%)	
Weekly Soda Intake					.0030
21+ Times	485,029 (1.7%)	66,436 (2.4%)	32,584 (2.6%)	386,009 (1.6%)	
14-20 Times	651,844 (2.3%)	75,743 (2.7%)	27,395 (2.2%)	548,707 (2.3%)	
7-13 Times	1,960,790 (6.9%)	178,705 (6.5%)	69,179 (5.5%)	1,712,907 (7.1%)	
4-6 Times	1,063,224 (3.8%)	121,838 (4.4%)	42,057 (3.3%)	899,329 (3.7%)	
2-3 Times	3,277,601 (11.6%)	310,557 (11.2%)	176,494 (14.0%)	2,790,549 (11.5%)	
1 Time	4,189,989 (14.8%)	383,935 (13.9%)	195,937 (15.5%)	3,610,116 (14.9%)	
0 Times	16,618,156 (58.8%)	1,628,676 (58.9%)	718,378 (56.9%)	14,271,103 (58.9%)	
Neighborhood Access to Fresh Fruit					.0258
Always	21,478,856 (76.0%)	2,130,537 (77.0%)	1,003,932 (79.5%)	18,344,387 (75.7%)	
Usually	3,118,658 (11.0%)	263,794 (9.5%)	127,823 (10.1%)	2,727,041 (11.3%)	
Sometimes	2,416,462 (8.6%)	248,330 (9.0%)	86,091 (6.8%)	2,082,041 (8.6%)	
Never	991,455 (3.5%)	103,693 (3.7%)	36,825 (2.9%)	850,937 (3.5%)	
Inapplicable	241,204 (0.9%)	19,536 (0.7%)	7,353 (0.6%)	214,315 (0.9%)	
Afordability of Fresh Fruit & Vegetables					<.0001
Always	13,129,925 (46.5%)	1,151,436 (41.6%)	629,456 (49.9%)	11,349,033 (46.9%)	
Usually	8,105,740 (28.7%)	769,482 (27.8%)	354,841 (28.1%)	6,981,417 (28.8%)	
Sometimes	5,403,648 (19.1%)	660,039 (23.9%)	213,192 (16.9%)	4,530,417 (18.7%)	
Never	374,663 (1.3%)	61,704 (2.2%)	20,357 (1.6%)	292,602 (1.2%)	
Inapplicable	1,232,658 (4.4%)	123,229 (4.5%)	44,178 (3.5%)	1,065,252 (4.4%)	

* *p* values based on Pearson chi-square test of association.

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Table B7

Weighted CHIS Health Insurance Characteristics by Asthma Status

Variable	Wtd. Population *Wtd. N* (%) (N=28,246,634)	Current Asthmatics *Wtd. n* (%) (N=2,765,889)	Previous Asthmatics *Wtd. n* (%) (N=1,262,024)	Non-Asthmatics *Wtd. n* (%) (N=24,218,720)	*p* value*
Covered by Health Insurance					<.0001
Yes	24,169,093 (85.6%)	2,506,661 (90.6%)	1,114,724 (88.3%)	20,547,708 (84.8%)	
No	4,077,541 (14.4%)	259,229 (9.4%)	147,300 (11.7%)	3,671,012 (15.2%)	
Health Plan Name					<.0001
Aetna	1,025,313 (3.6%)	72,026 (2.6%)	52,981 (4.2%)	900,305 (3.7%)	
Blue Cross	3,291,847 (11.7%)	278,035 (10.1%)	168,467 (13.3%)	2,845,346 (11.7%)	
Blue Shield	1,939,588 (6.9%)	191,292 (6.9%)	98,847 (7.8%)	1,649,449 (6.8%)	
Cigna Health Care	560,767 (2.0%)	55,454 (2.0%)	20,323 (1.6%)	484,990 (2.0%)	
Health Net	781,447 (2.8%)	74,264 (2.7%)	35,844 (2.8%)	671,339 (2.8%)	
Kaiser	4,117,495 (14.6%)	437,330 (15.8%)	230,717 (18.3%)	3,449,449 (14.2%)	
Medicare/Medi-Cal	9,194,952 (32.6%)	1,107,856 (40.1%)	335,154 (26.6%)	7,751,942 (32.0%)	
United Healthcare	1,031,881 (3.7%)	97,458 (3.5%)	56,756 (4.5%)	877,667 (3.6%)	
Other	1,714,388 (6.1%)	150,094 (5.4%)	92,178 (7.3%)	1,472,116 (6.1%)	
Inapplicable	4,588,955 (16.2%)	302,080 (10.9%)	170,757 (13.5%)	4,116,117 (17.0%)	
HMO Status					<.0001
HMO	13,725,422 (48.6%)	1,437,669 (52.0%)	638,447 (50.6%)	11,649,306 (48.1%)	
Non-HMO	10,443,671 (37.0%)	1,068,992 (38.6%)	476,277 (37.7%)	8,898,402 (36.7%)	
Uninsured	4,077,541 (14.4%)	259,229 (9.4%)	147,300 (11.7%)	3,671,012 (15.2%)	
Health Plan Deductible > $1,000					<.0001
Yes	4,937,904 (17.5%)	423,639 (15.3%)	264,517 (21.0%)	4,249,748 (17.5%)	
No	10,687,933 (37.8%)	1,064,344 (38.5%)	538,997 (42.7%)	9,084,592 (37.5%)	
Inapplicable	12,620,796 (44.7%)	1,277,907 (46.2%)	458,509 (36.3%)	10,884,380 (44.9%)	
Health Plan Deductible > $2,000					<.0001
Yes	2,231,914 (7.9%)	190,477 (6.9%)	117,718 (9.3%)	1,923,719 (7.9%)	
No	11,390,713 (40.3%)	1,131,525 (40.9%)	584,034 (46.3%)	9,675,153 (39.9%)	
Inapplicable	14,624,006 (51.8%)	1,443,887 (52.2%)	560,271 (44.4%)	12,619,848 (52.1%)	
Insurance Covers Prescription Drugs					<.0001
Yes	22,308,086 (79.0%)	2,377,372 (86.0%)	1,045,766 (82.9%)	18,884,948 (78.0%)	
No	1,912,455 (6.8%)	133,092 (4.8%)	71,515 (5.7%)	1,707,848 (7.1%)	
Inapplicable	4,026,092 (14.3%)	255,425 (9.2%)	144,742 (11.5%)	3,625,924 (15.0%)	
Have Usual Source of Health Care					<.0001
Yes	18,574,824 (65.8%)	1,996,408 (72.2%)	859,022 (68.1%)	15,719,393 (64.9%)	
No	4,477,507 (15.9%)	298,918 (10.8%)	211,728 (16.8%)	3,966,861 (16.4%)	
Doctor / My Doctor	3,786,485 (13.4%)	335,843 (12.1%)	128,028 (10.1%)	3,322,614 (13.7%)	
Kaiser	1,303,439 (4.6%)	125,889 (4.6%)	60,407 (4.8%)	1,117,142 (4.6%)	
More than One Place	104,380 (0.4%)	8,831 (0.3%)	2,839 (0.2%)	92,710 (0.4%)	
Usual Source of Health Care					<.0001
Doctors Office / Kaiser / HMO	16,690,639 (59.1%)	1,762,774 (63.7%)	758,166 (60.1%)	14,169,699 (58.5%)	
Community/Government Clinic	6,400,429 (22.7%)	637,438 (23.0%)	257,060 (20.4%)	5,505,931 (22.7%)	
Emergency Room / Urgent Care	409,905 (1.5%)	47,256 (1.7%)	17,856 (1.4%)	344,793 (1.4%)	
Other	268,153 (0.9%)	19,503 (0.7%)	17,214 (1.4%)	231,436 (1.0%)	
No Usual Source of Care	4,477,507 (15.9%)	298,918 (10.8%)	211,728 (16.8%)	3,966,861 (16.4%)	
Recent Prescription Drug Delay					<.0001
Yes	3,123,473 (11.1%)	565,944 (20.5%)	136,804 (10.8%)	2,420,725 (10.0%)	
No	25,123,161 (88.9%)	2,199,945 (79.5%)	1,125,220 (89.2%)	21,797,995 (90.0%)	
Cost/Insurance Responsible for Delay					<.0001
Yes	1,508,680 (5.3%)	306,619 (11.1%)	62,673 (5.0%)	1,139,388 (4.7%)	
No	1,614,793 (5.7%)	259,325 (9.4%)	74,131 (5.9%)	1,281,337 (5.3%)	
Inapplicable	25,123,161 (88.9%)	2,199,945 (79.5%)	1,125,220 (89.2%)	21,797,995 (90.0%)	

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Variable	Wtd. Population *Wtd. N* (%) (N=28,246,634)	Current Asthmatics *Wtd. n* (%) (N=2,765,889)	Previous Asthmatics *Wtd. n* (%) (N=1,262,024)	Non-Asthmatics *Wtd. n* (%) (N=24,218,720)	*p* value*
Recent Medical Care Delay					<.0001
Yes	3,946,413 (14.0%)	579,653 (21.0%)	175,667 (13.9%)	3,191,092 (13.2%)	
No	24,300,221 (86.0%)	2,186,237 (79.0%)	1,086,357 (86.1%)	21,027,628 (86.8%)	
Cost/Insurance Responsible for Delay					<.0001
Yes	2,102,002 (7.4%)	304,848 (11.0%)	92,927 (7.4%)	1,704,227 (7.0%)	
No	1,844,411 (6.5%)	274,805 (9.9%)	82,740 (6.6%)	1,486,866 (6.1%)	
Inapplicable	24,300,221 (86.0%)	2,186,237 (79.0%)	1,086,357 (86.1%)	21,027,628 (86.8%)	
Recently Required Medical Appointment					<.0001
Yes	8,225,559 (29.1%)	1,309,298 (47.3%)	378,586 (30.0%)	6,537,675 (27.0%)	
No	18,136,582 (64.2%)	1,342,667 (48.5%)	811,513 (64.3%)	15,982,402 (66.0%)	
Inapplicable	1,884,492 (6.7%)	113,924 (4.1%)	71,925 (5.7%)	1,698,643 (7.0%)	
Doctor Listens Carefully					<.0001
Always	13,657,140 (48.3%)	1,491,670 (53.9%)	662,855 (52.5%)	11,502,616 (47.5%)	
Usually	4,181,815 (14.8%)	451,649 (16.3%)	162,611 (12.9%)	3,567,555 (14.7%)	
Sometimes	1,693,089 (6.0%)	228,072 (8.2%)	52,526 (4.2%)	1,412,492 (5.8%)	
Never	321,413 (1.1%)	32,341 (1.2%)	13,525 (1.1%)	275,547 (1.1%)	
Inapplicable	8,393,176 (29.7%)	562,157 (20.3%)	370,508 (29.4%)	7,460,511 (30.8%)	
Doctor Provides Clear Explanations					<.0001
Always	13,751,483 (48.7%)	1,529,102 (55.3%)	637,381 (50.5%)	11,584,999 (47.8%)	
Usually	4,253,671 (15.1%)	466,162 (16.9%)	186,207 (14.8%)	3,601,303 (14.9%)	
Sometimes	1,487,437 (5.3%)	183,273 (6.6%)	53,392 (4.2%)	1,250,772 (5.2%)	
Never	360,867 (1.3%)	25,195 (0.9%)	14,537 (1.2%)	321,135 (1.3%)	
Inapplicable	8,393,176 (29.7%)	562,157 (20.3%)	370,508 (29.4%)	7,460,511 (30.8%)	
Awareness of Interpretor Rights					<.0001
Yes	2,809,062 (9.9%)	149,914 (5.4%)	42,005 (3.3%)	2,617,142 (10.8%)	
No	1,575,123 (5.6%)	74,636 (2.7%)	26,619 (2.1%)	1,473,868 (6.1%)	
Inapplicable	23,862,449 (84.5%)	2,541,339 (91.9%)	1,193,399 (94.6%)	20,127,710 (83.1%)	
Language Barrior with Physician					.0005
Yes	589,248 (2.1%)	73,554 (2.7%)	17,364 (1.4%)	498,329 (2.1%)	
No	356,401 (1.3%)	54,072 (2.0%)	15,345 (1.2%)	286,985 (1.2%)	
Inapplicable	27,300,985 (96.7%)	2,638,263 (95.4%)	1,229,315 (97.4%)	23,433,406 (96.8%)	
Recent Hospital Stay					<.0001
Yes	2,233,813 (7.9%)	290,026 (10.5%)	85,556 (6.8%)	1,858,232 (7.7%)	
No	25,591,067 (90.6%)	2,334,898 (84.4%)	1,165,708 (92.4%)	22,090,461 (91.2%)	
Inapplicable	421,754 (1.5%)	140,966 (5.1%)	10,760 (0.9%)	270,027 (1.1%)	
Recent ER Visit					<.0001
Yes	4,983,284 (17.6%)	616,419 (22.3%)	254,357 (20.2%)	4,112,507 (17.0%)	
No	22,596,022 (80.0%)	1,843,370 (66.6%)	992,470 (78.6%)	19,760,182 (81.6%)	
Inapplicable	667,328 (2.4%)	306,100 (11.1%)	15,197 (1.2%)	346,031 (1.4%)	
ER Visit - Past Year					<.0001
Yes	5,650,611 (20.0%)	922,519 (33.4%)	269,554 (21.4%)	4,458,538 (18.4%)	
No	22,596,022 (80.0%)	1,843,370 (66.6%)	992,470 (78.6%)	19,760,182 (81.6%)	
Internet Utilization					<.0001
Yes	23,540,735 (83.3%)	2,396,470 (86.6%)	1,155,910 (91.6%)	19,988,355 (82.5%)	
No	4,705,899 (16.7%)	369,419 (13.4%)	106,114 (8.4%)	4,230,365 (17.5%)	

* *p* values based on Pearson chi-square test of association.

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Table B8

Weighted CHIS Socioeconomic Characteristics by Asthma Status

Variable	Wtd. Population *Wtd. N* (%) (N=28,246,634)	Current Asthmatics *Wtd. n* (%) (N=2,765,889)	Previous Asthmatics *Wtd. n* (%) (N=1,262,024)	Non-Asthmatics *Wtd. n* (%) (N=24,218,720)	*p* value*
Poverty Level					<.0001
0-99% FPL	4,706,950 (16.7%)	527,618 (19.1%)	158,240 (12.5%)	4,021,092 (16.6%)	
100-199% FPL	5,528,155 (19.6%)	514,388 (18.6%)	191,898 (15.2%)	4,821,869 (19.9%)	
200-299% FPL	3,973,723 (14.1%)	410,184 (14.8%)	211,482 (16.8%)	3,352,057 (13.8%)	
300% FPL and Above	14,037,805 (49.7%)	1,313,699 (47.5%)	700,404 (55.5%)	12,023,702 (49.6%)	
Food Security Status Level					<.0001
Inapplicable / >=200% FPL	18,011,528 (63.8%)	1,723,883 (62.3%)	911,886 (72.3%)	15,375,759 (63.5%)	
Food Security	5,893,084 (20.9%)	489,495 (17.7%)	210,676 (16.7%)	5,192,913 (21.4%)	
Food Insecurity w/o Hunger	2,799,403 (9.9%)	289,787 (10.5%)	88,367 (7.0%)	2,421,249 (10.0%)	
Food Insecurity w/ Hunger	1,542,618 (5.5%)	262,724 (9.5%)	51,095 (4.0%)	1,228,800 (5.1%)	
Receiving SSI					<.0001
Yes	1,051,201 (3.7%)	208,925 (7.6%)	38,522 (3.1%)	803,754 (3.3%)	
No	14,081,588 (49.9%)	1,318,123 (47.7%)	549,794 (43.6%)	12,213,672 (50.4%)	
Inapplicable	13,113,845 (46.4%)	1,238,842 (44.8%)	673,708 (53.4%)	11,201,295 (46.3%)	
Receiving Social Security Disability					<.0001
Yes	941,037 (3.3%)	200,901 (7.3%)	38,093 (3.0%)	702,042 (2.9%)	
No	4,054,493 (14.4%)	457,449 (16.5%)	161,722 (12.8%)	3,435,321 (14.2%)	
Inapplicable	23,251,104 (82.3%)	2,107,539 (76.2%)	1,062,209 (84.2%)	20,081,357 (82.9%)	
Received SS or Pension Prior Month					<.0001
Yes	2,474,490 (8.8%)	261,493 (9.5%)	75,514 (6.0%)	2,137,483 (8.8%)	
No	1,535,907 (5.4%)	120,654 (4.4%)	36,089 (2.9%)	1,379,164 (5.7%)	
Inapplicable	24,236,236 (85.8%)	2,383,743 (86.2%)	1,150,421 (91.2%)	20,702,073 (85.5%)	
Primary Employer Type					<.0001
Private Company, Non-Profit Org	12,025,511 (42.6%)	985,355 (35.6%)	586,749 (46.5%)	10,453,407 (43.2%)	
Government	2,790,005 (9.9%)	330,815 (12.0%)	150,079 (11.9%)	2,309,112 (9.5%)	
Self-Employed	3,020,842 (10.7%)	228,365 (8.3%)	144,233 (11.4%)	2,648,244 (10.9%)	
Family Business or Farm	359,229 (1.3%)	38,182 (1.4%)	19,503 (1.5%)	301,543 (1.2%)	
Inapplicable	10,051,046 (35.6%)	1,183,172 (42.8%)	361,460 (28.6%)	8,506,414 (35.1%)	
Volunteer / Community Service					<.0001
Yes	11,510,519 (40.8%)	1,231,607 (44.5%)	608,658 (48.2%)	9,670,255 (39.9%)	
No	16,736,114 (59.2%)	1,534,283 (55.5%)	653,366 (51.8%)	14,548,465 (60.1%)	
Housing Category					.1582
House	19,630,532 (69.5%)	1,900,412 (68.7%)	896,033 (71.0%)	16,834,086 (69.5%)	
Duplex	1,456,177 (5.2%)	134,717 (4.9%)	58,212 (4.6%)	1,263,249 (5.2%)	
Building with 3 or More Units	6,009,190 (21.3%)	596,203 (21.6%)	268,500 (21.3%)	5,144,487 (21.2%)	
Mobile Home	1,150,735 (4.1%)	134,558 (4.9%)	39,278 (3.1%)	976,899 (4.0%)	
Own or Rent Home					.4141
Own	15,966,479 (56.5%)	1,540,616 (55.7%)	719,983 (57.0%)	13,705,880 (56.6%)	
Rent	10,846,268 (38.4%)	1,072,836 (38.8%)	470,515 (37.3%)	9,302,917 (38.4%)	
Other Arrangement	1,106,778 (3.9%)	125,020 (4.5%)	59,550 (4.7%)	922,209 (3.8%)	
Refused	132,099 (0.5%)	10,299 (0.4%)	5,380 (0.4%)	116,420 (0.5%)	
Dont Know	72,073 (0.3%)	8,336 (0.3%)	3,953 (0.3%)	59,784 (0.2%)	
Not Ascertained	122,937 (0.4%)	8,783 (0.3%)	2,644 (0.2%)	111,511 (0.5%)	
Neighborhood Helpful					<.0001
Strongly Agree	5,843,472 (20.7%)	622,683 (22.5%)	289,748 (23.0%)	4,931,041 (20.4%)	
Agree	17,204,672 (60.9%)	1,572,375 (56.8%)	751,342 (59.5%)	14,880,954 (61.4%)	
Disagree	4,284,453 (15.2%)	445,314 (16.1%)	182,909 (14.5%)	3,656,230 (15.1%)	
Strongly Disagree	914,036 (3.2%)	125,517 (4.5%)	38,024 (3.0%)	750,495 (3.1%)	

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Variable	Wtd. Population *Wtd. N* (%) (N=28,246,634)	Current Asthmatics *Wtd. n* (%) (N=2,765,889)	Previous Asthmatics *Wtd. n* (%) (N=1,262,024)	Non-Asthmatics *Wtd. n* (%) (N=24,218,720)	*p* value*
Neighborhood Trustworthy					<.0001
Strongly Agree	4,876,387 (17.3%)	495,364 (17.9%)	237,394 (18.8%)	4,143,629 (17.1%)	
Agree	17,927,829 (63.5%)	1,656,626 (59.9%)	781,963 (62.0%)	15,489,240 (64.0%)	
Disagree	4,560,740 (16.1%)	483,228 (17.5%)	211,194 (16.7%)	3,866,318 (16.0%)	
Strongly Disagree	881,677 (3.1%)	130,671 (4.7%)	31,473 (2.5%)	719,533 (3.0%)	
Neighborhood Safe					<.0001
All of the Time	13,917,961 (49.3%)	1,221,701 (44.2%)	611,169 (48.4%)	12,085,092 (49.9%)	
Most of the Time	10,668,364 (37.8%)	1,135,927 (41.1%)	500,121 (39.6%)	9,032,317 (37.3%)	
Some of the Time	3,157,631 (11.2%)	338,042 (12.2%)	129,592 (10.3%)	2,689,998 (11.1%)	
None of the Time	502,678 (1.8%)	70,221 (2.5%)	21,143 (1.7%)	411,314 (1.7%)	

* *p* values based on Pearson chi-square test of association.

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B.3 Univariate Associations with Asthma Control

Table B9

Weighted CHIS Demographic Characteristics by Asthma Status

Variable	Wtd. Population *Wtd. N* (%) (N=28,246,634)	Uncontrolled Asthma *Wtd. n* (%) (N=237,259)	Controlled Asthma *Wtd. n* (%) (N=2,041,736)	Non-Asthmatic *Wtd. n* (%) (N=25,967,638)	*p* value*
Sex					<.0001
Male	13,784,100 (48.8%)	61,256 (25.8%)	756,490 (37.1%)	12,966,354 (49.9%)	
Female	14,462,534 (51.2%)	176,003 (74.2%)	1,285,246 (62.9%)	13,001,284 (50.1%)	
Age Group					.0390
Young Adult (18-39)	11,571,994 (41.0%)	83,948 (35.4%)	800,221 (39.2%)	10,687,825 (41.2%)	
Middle Aged (40-64)	12,049,216 (42.7%)	117,036 (49.3%)	873,139 (42.8%)	11,059,042 (42.6%)	
Later Adult (65+)	4,625,423 (16.4%)	36,275 (15.3%)	368,377 (18.0%)	4,220,772 (16.3%)	
Race					<.0001
African American	1,581,649 (5.6%)	46,193 (19.5%)	154,003 (7.5%)	1,381,454 (5.3%)	
American Indian / Alaska Native	135,904 (0.5%)	2,170 (0.9%)	21,600 (1.1%)	112,134 (0.4%)	
Asian	3,924,430 (13.9%)	15,962 (6.7%)	210,491 (10.3%)	3,697,977 (14.2%)	
Latino	9,806,044 (34.7%)	87,416 (36.8%)	510,150 (25.0%)	9,208,477 (35.5%)	
Multiracial	549,824 (1.9%)	7,544 (3.2%)	69,344 (3.4%)	472,936 (1.8%)	
Other	156,121 (0.6%)	290 (0.1%)	8,885 (0.4%)	146,945 (0.6%)	
White	12,092,661 (42.8%)	77,684 (32.7%)	1,067,262 (52.3%)	10,947,715 (42.2%)	
Nativity, Respondent					<.0001
Born in U.S.	18,689,704 (66.2%)	180,421 (76.0%)	1,676,087 (82.1%)	16,833,195 (64.8%)	
Born Outside U.S.	9,556,930 (33.8%)	56,838 (24.0%)	365,649 (17.9%)	9,134,443 (35.2%)	
Nativity, Maternal					<.0001
Born in U.S.	14,462,940 (51.2%)	145,369 (61.3%)	1,411,009 (69.1%)	12,906,562 (49.7%)	
Born Outside U.S.	4,177,673 (14.8%)	34,582 (14.6%)	262,415 (12.9%)	3,880,675 (14.9%)	
Inapplicable	9,606,021 (34.0%)	57,308 (24.2%)	368,312 (18.0%)	9,180,401 (35.4%)	
Nativity, Paternal					<.0001
Born in U.S.	14,194,039 (50.3%)	144,218 (60.8%)	1,370,829 (67.1%)	12,678,993 (48.8%)	
Born Outside U.S.	4,446,573 (15.7%)	35,734 (15.1%)	302,595 (14.8%)	4,108,245 (15.8%)	
Inapplicable	9,606,021 (34.0%)	57,308 (24.2%)	368,312 (18.0%)	9,180,401 (35.4%)	
Citizenship					<.0001
US-Born Citizen	18,689,704 (66.2%)	180,421 (76.0%)	1,676,087 (82.1%)	16,833,195 (64.8%)	
Naturalized Citizen	4,973,380 (17.6%)	30,645 (12.9%)	226,340 (11.1%)	4,716,395 (18.2%)	
Non-Citizen	4,583,550 (16.2%)	26,192 (11.0%)	139,309 (6.8%)	4,418,048 (17.0%)	
Years Lived in U.S.					<.0001
< 5 Years	629,541 (2.2%)	1,789 (0.8%)	14,531 (0.7%)	613,221 (2.4%)	
5-9 Years	896,636 (3.2%)	2,390 (1.0%)	28,232 (1.4%)	866,014 (3.3%)	
10-14 Years	1,312,040 (4.6%)	4,759 (2.0%)	37,916 (1.9%)	1,269,365 (4.9%)	
15-19 Years	6,718,712 (23.8%)	47,900 (20.2%)	284,969 (14.0%)	6,385,843 (24.6%)	
Inapplicable	18,689,704 (66.2%)	180,421 (76.0%)	1,676,087 (82.1%)	16,833,195 (64.8%)	
Percent of Life Lived in U.S.					<.0001
0-20	1,168,011 (4.1%)	4,377 (1.8%)	29,726 (1.5%)	1,133,908 (4.4%)	
21-40	2,216,985 (7.8%)	10,582 (4.5%)	70,660 (3.5%)	2,135,744 (8.2%)	
41-60	3,079,665 (10.9%)	17,629 (7.4%)	115,306 (5.6%)	2,946,730 (11.3%)	
61-80	1,962,817 (6.9%)	13,589 (5.7%)	80,608 (3.9%)	1,868,621 (7.2%)	
81+	19,819,156 (70.2%)	191,083 (80.5%)	1,745,437 (85.5%)	17,882,635 (68.9%)	
Primary Spoken Language					<.0001
English (Includes English & Other)	23,849,238 (84.4%)	206,727 (87.1%)	1,885,008 (92.3%)	21,757,503 (83.8%)	
Spanish	2,693,544 (9.5%)	19,408 (8.2%)	92,090 (4.5%)	2,582,046 (9.9%)	
Chinese	345,526 (1.2%)	745 (0.3%)	6,017 (0.3%)	338,764 (1.3%)	
Vietnamese	215,542 (0.8%)	741 (0.3%)	12,085 (0.6%)	202,716 (0.8%)	
Korean	154,628 (0.5%)	131 (0.1%)	5,030 (0.2%)	149,467 (0.6%)	
Other	988,156 (3.5%)	9,507 (4.0%)	41,506 (2.0%)	937,142 (3.6%)	

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Variable	Wtd. Population *Wtd. N* (%) (N=28,246,634)	Uncontrolled Asthma *Wtd. n* (%) (N=237,259)	Controlled Asthma *Wtd. n* (%) (N=2,041,736)	Non-Asthmatic *Wtd. n* (%) (N=25,967,638)	*p* value*
Level of English Proficiency					<.0001
Very Well	5,136,355 (18.2%)	46,195 (19.5%)	331,744 (16.2%)	4,758,417 (18.3%)	
Well	3,181,415 (11.3%)	17,189 (7.2%)	116,652 (5.7%)	3,047,574 (11.7%)	
Not Well	2,980,824 (10.6%)	24,016 (10.1%)	96,167 (4.7%)	2,860,641 (11.0%)	
Not at All	1,422,487 (5.0%)	7,685 (3.2%)	46,050 (2.3%)	1,368,752 (5.3%)	
Inapplicable	15,525,552 (55.0%)	142,175 (59.9%)	1,451,122 (71.1%)	13,932,255 (53.7%)	
Marital Status					<.0001
Married/Partnered	16,204,700 (57.4%)	119,493 (50.4%)	1,084,807 (53.1%)	15,000,399 (57.8%)	
Widowed/Separated	4,550,212 (16.1%)	54,770 (23.1%)	390,473 (19.1%)	4,104,969 (15.8%)	
Never Married	7,491,722 (26.5%)	62,996 (26.6%)	566,457 (27.7%)	6,862,270 (26.4%)	
Family Composition					<.0001
Single w/o Children	11,981,749 (42.4%)	115,040 (48.5%)	949,754 (46.5%)	10,916,956 (42.0%)	
Single w/ Children	1,786,003 (6.3%)	27,559 (11.6%)	159,738 (7.8%)	1,598,706 (6.2%)	
Married w/o Children	7,451,383 (26.4%)	47,334 (20.0%)	562,879 (27.6%)	6,841,170 (26.3%)	
Married w/ Children	7,027,498 (24.9%)	47,326 (19.9%)	369,366 (18.1%)	6,610,807 (25.5%)	
Residency Type					.0015
Own	16,150,351 (57.2%)	107,374 (45.3%)	1,182,993 (57.9%)	14,859,984 (57.2%)	
Rent/Other	12,096,283 (42.8%)	129,885 (54.7%)	858,743 (42.1%)	11,107,655 (42.8%)	
Highest Education Attained					<.0001
None / Primary School	2,557,364 (9.1%)	19,952 (8.4%)	101,635 (5.0%)	2,435,777 (9.4%)	
High School, Partial	1,991,818 (7.1%)	26,688 (11.2%)	127,494 (6.2%)	1,837,636 (7.1%)	
High School, Graduate	6,619,205 (23.4%)	54,982 (23.2%)	471,829 (23.1%)	6,092,394 (23.5%)	
College, Partial	4,056,019 (14.4%)	53,491 (22.5%)	348,192 (17.1%)	3,654,336 (14.1%)	
Vocational School	820,813 (2.9%)	8,367 (3.5%)	60,780 (3.0%)	751,666 (2.9%)	
Associates Degree	2,126,465 (7.5%)	20,521 (8.6%)	196,209 (9.6%)	1,909,735 (7.4%)	
Bachelors Degree	6,470,239 (22.9%)	35,158 (14.8%)	488,162 (23.9%)	5,946,919 (22.9%)	
Masters Degree	2,656,530 (9.4%)	13,466 (5.7%)	185,582 (9.1%)	2,457,481 (9.5%)	
Doctorate Degree	948,181 (3.4%)	4,635 (2.0%)	61,853 (3.0%)	881,694 (3.4%)	
Served in U.S. Armed Forces					.0028
Yes	2,083,549 (7.4%)	12,413 (5.2%)	121,887 (6.0%)	1,949,249 (7.5%)	
No	26,163,085 (92.6%)	224,846 (94.8%)	1,919,849 (94.0%)	24,018,390 (92.5%)	
Active Duty Service Years					.0976
< 0.5 Years	58,849 (0.2%)	289 (0.1%)	2,446 (0.1%)	56,114 (0.2%)	
0.5 - 2 Years	468,124 (1.7%)	3,229 (1.4%)	30,461 (1.5%)	434,434 (1.7%)	
2 - 4 Years	753,854 (2.7%)	4,746 (2.0%)	44,523 (2.2%)	704,585 (2.7%)	
4 - 20 Years	623,836 (2.2%)	3,868 (1.6%)	33,806 (1.7%)	586,163 (2.3%)	
20+ Years	175,725 (0.6%)	281 (0.1%)	10,652 (0.5%)	164,792 (0.6%)	
Inapplicable	26,166,246 (92.6%)	224,846 (94.8%)	1,919,849 (94.0%)	24,021,551 (92.5%)	
Respondent Usually Works					.2307
Yes	2,150,788 (7.6%)	17,227 (7.3%)	167,649 (8.2%)	1,965,912 (7.6%)	
No	3,408,162 (12.1%)	41,104 (17.3%)	257,479 (12.6%)	3,109,579 (12.0%)	
Looking for Work	1,401,951 (5.0%)	11,995 (5.1%)	96,374 (4.7%)	1,293,583 (5.0%)	
Inapplicable	21,285,732 (75.4%)	166,933 (70.4%)	1,520,235 (74.5%)	19,598,565 (75.5%)	
Employment Classification					<.0001
Full-Time Employment	15,423,269 (54.6%)	85,328 (36.0%)	976,335 (47.8%)	14,361,605 (55.3%)	
Part-Time Employment	2,487,583 (8.8%)	12,270 (5.2%)	177,456 (8.7%)	2,297,858 (8.8%)	
Other Employment	80,623 (0.3%)	1,248 (0.5%)	7,851 (0.4%)	71,523 (0.3%)	
Unemployed, Looking for Work	1,947,924 (6.9%)	20,588 (8.7%)	135,464 (6.6%)	1,791,872 (6.9%)	
Unemployed, Not Looking for Work	8,307,234 (29.4%)	117,825 (49.7%)	744,629 (36.5%)	7,444,780 (28.7%)	

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Variable	Wtd. Population *Wtd. N* (%) (N=28,246,634)	Uncontrolled Asthma *Wtd. n* (%) (N=237,259)	Controlled Asthma *Wtd. n* (%) (N=2,041,736)	Non-Asthmatic *Wtd. n* (%) (N=25,967,638)	*p* value*
Telephone Calls Received					.0002
Nearly All Calls on Cell Phone	5,742,098 (20.3%)	38,653 (16.3%)	410,553 (20.1%)	5,292,892 (20.4%)	
Mixed Cellular/Landline Use	4,974,751 (17.6%)	29,381 (12.4%)	385,057 (18.9%)	4,560,313 (17.6%)	
Limited Cellular Use	3,299,589 (11.7%)	23,809 (10.0%)	272,531 (13.3%)	3,003,249 (11.6%)	
Inapplicable	14,230,196 (50.4%)	145,415 (61.3%)	973,596 (47.7%)	13,111,185 (50.5%)	
Urban / Rural Setting					<.0001
Urban	14,675,331 (52.0%)	130,699 (55.1%)	952,758 (46.7%)	13,591,873 (52.3%)	
2nd City	5,926,684 (21.0%)	51,419 (21.7%)	495,947 (24.3%)	5,379,318 (20.7%)	
Suburban	4,835,966 (17.1%)	30,622 (12.9%)	355,787 (17.4%)	4,449,558 (17.1%)	
Town & Rural	2,808,653 (9.9%)	24,518 (10.3%)	237,245 (11.6%)	2,546,889 (9.8%)	

* *p* values based on Pearson chi-square test of association.

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Table B10

Weighted CHIS Health Characteristics by Asthma Status

Variable	Wtd. Population *Wtd. N* (%) (N=28,246,634)	Uncontrolled Asthma *Wtd. n* (%) (N=237,259)	Controlled Asthma *Wtd. n* (%) (N=2,041,736)	Non-Asthmatic *Wtd. n* (%) (N=25,967,638)	*p* value*
General Health Condition					<.0001
Excellent	5,250,635 (18.6%)	12,418 (5.2%)	201,863 (9.9%)	5,036,354 (19.4%)	
Very Good	8,661,085 (30.7%)	30,134 (12.7%)	578,260 (28.3%)	8,052,692 (31.0%)	
Good	8,622,494 (30.5%)	56,434 (23.8%)	639,580 (31.3%)	7,926,479 (30.5%)	
Fair	4,545,146 (16.1%)	84,355 (35.6%)	430,817 (21.1%)	4,029,974 (15.5%)	
Poor	1,167,273 (4.1%)	53,918 (22.7%)	191,216 (9.4%)	922,139 (3.6%)	
Descriptive BMI					<.0001
Obese 30.0+	7,401,546 (26.2%)	111,189 (46.9%)	734,545 (36.0%)	6,555,811 (25.2%)	
Overweight 25.0-29.99	9,951,359 (35.2%)	68,050 (28.7%)	645,765 (31.6%)	9,237,544 (35.6%)	
Normal 18.5-24.99	10,426,170 (36.9%)	54,088 (22.8%)	629,696 (30.8%)	9,742,386 (37.5%)	
Underweight 0-18.49	467,558 (1.7%)	3,932 (1.7%)	31,730 (1.6%)	431,897 (1.7%)	
Diagnosed with Asthma					N/A
Yes	4,027,914 (14.3%)	237,259 (100.0%)	2,041,736 (100.0%)	1,748,918 (6.7%)	
No	24,218,720 (85.7%)	. (0.0%)	. (0.0%)	24,218,720 (93.3%)	
Provided Asthma Management Plan					N/A
Yes	2,129,829 (7.5%)	178,574 (75.3%)	1,454,208 (71.2%)	497,046 (1.9%)	
No	1,898,085 (6.7%)	58,685 (24.7%)	587,528 (28.8%)	1,251,872 (4.8%)	
Inapplicable	24,218,720 (85.7%)	. (0.0%)	. (0.0%)	24,218,720 (93.3%)	
Have Asthma Management Plan					N/A
Yes	522,998 (1.9%)	84,295 (35.5%)	365,160 (17.9%)	73,543 (0.3%)	
No	1,606,831 (5.7%)	94,279 (39.7%)	1,089,048 (53.3%)	423,503 (1.6%)	
Inapplicable	26,116,805 (92.5%)	58,685 (24.7%)	587,528 (28.8%)	25,470,592 (98.1%)	
Asthma Control Confidence					N/A
Very Confident	3,175,594 (11.2%)	106,079 (44.7%)	1,496,214 (73.3%)	1,573,301 (6.1%)	
Somewhat Confident	699,907 (2.5%)	98,735 (41.6%)	462,453 (22.6%)	138,720 (0.5%)	
Limited-to-No Confidence	152,412 (0.5%)	32,446 (13.7%)	83,069 (4.1%)	36,897 (0.1%)	
Inapplicable	24,218,720 (85.7%)	. (0.0%)	. (0.0%)	24,218,720 (93.3%)	
Current Asthmatic					N/A
Yes	2,191,133 (7.8%)	227,630 (95.9%)	1,963,503 (96.2%)	. (0.0%)	
No	1,836,781 (6.5%)	9,628 (4.1%)	78,234 (3.8%)	1,748,918 (6.7%)	
Inapplicable	24,218,720 (85.7%)	. (0.0%)	. (0.0%)	24,218,720 (93.3%)	
Recent Asthma Episode/Attack					N/A
Yes	1,142,723 (4.0%)	193,155 (81.4%)	949,568 (46.5%)	. (0.0%)	
No	2,885,191 (10.2%)	44,104 (18.6%)	1,092,169 (53.5%)	1,748,918 (6.7%)	
Inapplicable	24,218,720 (85.7%)	. (0.0%)	. (0.0%)	24,218,720 (93.3%)	
Current Asthma Status					N/A
Current Asthma	2,278,995 (8.1%)	237,259 (100.0%)	2,041,736 (100.0%)	. (0.0%)	
No Current Asthma	25,967,638 (91.9%)	. (0.0%)	. (0.0%)	25,967,638 (100.0%)	
Recent Asthma Symptoms, Lifetime Asthmatics					N/A
Yes	2,524,776 (8.9%)	233,016 (98.2%)	1,821,333 (89.2%)	470,427 (1.8%)	
No	1,503,138 (5.3%)	4,243 (1.8%)	220,403 (10.8%)	1,278,491 (4.9%)	
Inapplicable	24,218,720 (85.7%)	. (0.0%)	. (0.0%)	24,218,720 (93.3%)	
Recent Asthma Symptoms, Current Asthmatics					N/A
Yes	2,054,349 (7.3%)	233,016 (98.2%)	1,821,333 (89.2%)	. (0.0%)	
No	224,646 (0.8%)	4,243 (1.8%)	220,403 (10.8%)	. (0.0%)	
Inapplicable	25,967,638 (91.9%)	. (0.0%)	. (0.0%)	25,967,638 (100.0%)	
Taking Daily Asthma Medications					N/A
Yes	1,101,625 (3.9%)	172,068 (72.5%)	885,528 (43.4%)	44,029 (0.2%)	
No	2,926,288 (10.4%)	65,191 (27.5%)	1,156,208 (56.6%)	1,704,889 (6.6%)	
Inapplicable	24,218,720 (85.7%)	. (0.0%)	. (0.0%)	24,218,720 (93.3%)	

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Variable	Wtd. Population *Wtd. N* (%) (N=28,246,634)	Uncontrolled Asthma *Wtd. n* (%) (N=237,259)	Controlled Asthma *Wtd. n* (%) (N=2,041,736)	Non-Asthmatic *Wtd. n* (%) (N=25,967,638)	*p* value*
Frequency of Asthma Symptoms					N/A
Every Day	261,257 (0.9%)	47,858 (20.2%)	213,399 (10.5%)	. (0.0%)	
Every Week	287,845 (1.0%)	39,387 (16.6%)	248,458 (12.2%)	. (0.0%)	
Every Month	518,528 (1.8%)	68,620 (28.9%)	449,908 (22.0%)	. (0.0%)	
Less than Every Month	986,719 (3.5%)	77,151 (32.5%)	909,568 (44.5%)	. (0.0%)	
Not at All	224,646 (0.8%)	4,243 (1.8%)	220,403 (10.8%)	. (0.0%)	
Inapplicable	25,967,638 (91.9%)	. (0.0%)	. (0.0%)	25,967,638 (100.0%)	
ER/Urgent Care for Asthma					N/A
Yes	237,259 (0.8%)	237,259 (100.0%)	. (0.0%)	. (0.0%)	
No	2,041,736 (7.2%)	. (0.0%)	2,041,736 (100.0%)	. (0.0%)	
Inapplicable	25,967,638 (91.9%)	. (0.0%)	. (0.0%)	25,967,638 (100.0%)	
Diagnosed with Diabetes					<.0001
Yes	2,503,190 (8.9%)	31,949 (13.5%)	259,193 (12.7%)	2,212,048 (8.5%)	
No	25,293,954 (89.5%)	199,147 (83.9%)	1,735,997 (85.0%)	23,358,809 (90.0%)	
Borderline/Pre-Diabetes	449,490 (1.6%)	6,163 (2.6%)	46,546 (2.3%)	396,781 (1.5%)	
Currently Taking Insulin					<.0001
Yes	698,457 (2.5%)	12,405 (5.2%)	71,745 (3.5%)	614,307 (2.4%)	
No	1,804,733 (6.4%)	19,544 (8.2%)	187,448 (9.2%)	1,597,741 (6.2%)	
Inapplicable	25,743,443 (91.1%)	205,310 (86.5%)	1,782,543 (87.3%)	23,755,590 (91.5%)	
Currently Taking Diabetes Medication					<.0001
Yes	1,773,209 (6.3%)	22,880 (9.6%)	191,884 (9.4%)	1,558,446 (6.0%)	
No	729,981 (2.6%)	9,069 (3.8%)	67,309 (3.3%)	653,603 (2.5%)	
Inapplicable	25,743,443 (91.1%)	205,310 (86.5%)	1,782,543 (87.3%)	23,755,590 (91.5%)	
Diagnosed with Heart Disease					<.0001
Yes	1,712,797 (6.1%)	36,496 (15.4%)	206,769 (10.1%)	1,469,533 (5.7%)	
No	26,533,837 (93.9%)	200,763 (84.6%)	1,834,968 (89.9%)	24,498,106 (94.3%)	
Diagnosed with Heart Failure					<.0001
Yes	509,271 (1.8%)	16,849 (7.1%)	69,192 (3.4%)	423,230 (1.6%)	
No	1,203,526 (4.3%)	19,646 (8.3%)	137,577 (6.7%)	1,046,303 (4.0%)	
Inapplicable	26,533,837 (93.9%)	200,763 (84.6%)	1,834,968 (89.9%)	24,498,106 (94.3%)	
Currently Taking Blood Pressure Medication					<.0001
Yes	5,375,795 (19.0%)	71,731 (30.2%)	531,828 (26.0%)	4,772,237 (18.4%)	
No	2,484,143 (8.8%)	32,945 (13.9%)	201,257 (9.9%)	2,249,941 (8.7%)	
Inapplicable	20,386,696 (72.2%)	132,583 (55.9%)	1,308,652 (64.1%)	18,945,461 (73.0%)	
Recent Heart-Disease Hospitalization					<.0001
Yes	247,351 (0.9%)	13,465 (5.7%)	26,502 (1.3%)	207,384 (0.8%)	
No	1,465,446 (5.2%)	23,030 (9.7%)	180,267 (8.8%)	1,262,148 (4.9%)	
Inapplicable	26,533,837 (93.9%)	200,763 (84.6%)	1,834,968 (89.9%)	24,498,106 (94.3%)	
Recent Psychological Distress					<.0001
Yes	2,281,964 (8.1%)	56,436 (23.8%)	293,385 (14.4%)	1,932,144 (7.4%)	
No	25,964,669 (91.9%)	180,823 (76.2%)	1,748,351 (85.6%)	24,035,495 (92.6%)	
Psychological Distress Last Month					<.0001
Yes	1,072,542 (3.8%)	43,638 (18.4%)	147,314 (7.2%)	881,590 (3.4%)	
No	27,174,091 (96.2%)	193,621 (81.6%)	1,894,422 (92.8%)	25,086,049 (96.6%)	
Feelings of Restlessness					<.0001
All of the Time	620,695 (2.2%)	14,365 (6.1%)	77,240 (3.8%)	529,089 (2.0%)	
Most of the Time	1,072,345 (3.8%)	15,842 (6.7%)	122,500 (6.0%)	934,003 (3.6%)	
Some of the Time	1,863,334 (6.6%)	24,546 (10.3%)	170,072 (8.3%)	1,668,716 (6.4%)	
A Little of the Time	1,211,937 (4.3%)	9,442 (4.0%)	84,612 (4.1%)	1,117,882 (4.3%)	
Not at All	845,404 (3.0%)	11,011 (4.6%)	80,015 (3.9%)	754,378 (2.9%)	
Inapplicable	22,632,919 (80.1%)	162,052 (68.3%)	1,507,297 (73.8%)	20,963,571 (80.7%)	
Feelings of Nervousness					<.0001
All of the Time	697,950 (2.5%)	21,417 (9.0%)	96,114 (4.7%)	580,420 (2.2%)	
Most of the Time	1,349,450 (4.8%)	18,801 (7.9%)	151,455 (7.4%)	1,179,194 (4.5%)	
Some of the Time	1,757,919 (6.2%)	11,981 (5.0%)	156,150 (7.6%)	1,589,788 (6.1%)	
A Little of the Time	1,211,858 (4.3%)	12,214 (5.1%)	74,293 (3.6%)	1,125,352 (4.3%)	
Not at All	596,537 (2.1%)	10,795 (4.5%)	56,429 (2.8%)	529,313 (2.0%)	
Inapplicable	22,632,919 (80.1%)	162,052 (68.3%)	1,507,297 (73.8%)	20,963,571 (80.7%)	

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Variable	Wtd. Population *Wtd. N* (%) (N=28,246,634)	Uncontrolled Asthma *Wtd. n* (%) (N=237,259)	Controlled Asthma *Wtd. n* (%) (N=2,041,736)	Non-Asthmatic *Wtd. n* (%) (N=25,967,638)	*p* value*
Blind/Deaf or Severe Impairment					<.0001
Yes	2,038,977 (7.2%)	41,162 (17.3%)	205,966 (10.1%)	1,791,850 (6.9%)	
No	26,207,656 (92.8%)	196,097 (82.7%)	1,835,770 (89.9%)	24,175,789 (93.1%)	
Smoked 100+ Cigarettes in Lifetime					<.0001
Yes	9,963,444 (35.3%)	107,814 (45.4%)	797,885 (39.1%)	9,057,745 (34.9%)	
No	18,283,189 (64.7%)	129,445 (54.6%)	1,243,851 (60.9%)	16,909,893 (65.1%)	
Smoking Frequency					<.0001
Every Day	2,281,344 (8.1%)	29,940 (12.6%)	194,699 (9.5%)	2,056,705 (7.9%)	
Some Days	1,359,354 (4.8%)	12,569 (5.3%)	99,089 (4.9%)	1,247,696 (4.8%)	
Not at All	6,322,746 (22.4%)	65,305 (27.5%)	504,097 (24.7%)	5,753,344 (22.2%)	
Inapplicable	18,283,189 (64.7%)	129,445 (54.6%)	1,243,851 (60.9%)	16,909,893 (65.1%)	
Current Smoker					.0091
Current Smoker	3,640,698 (12.9%)	42,509 (17.9%)	293,788 (14.4%)	3,304,401 (12.7%)	
Not Current Smoker	24,605,935 (87.1%)	194,750 (82.1%)	1,747,948 (85.6%)	22,663,237 (87.3%)	
Current Smoking Habits					<.0001
Currently Smokes	3,640,698 (12.9%)	42,509 (17.9%)	293,788 (14.4%)	3,304,401 (12.7%)	
Quit Smoking	6,322,746 (22.4%)	65,305 (27.5%)	504,097 (24.7%)	5,753,344 (22.2%)	
Never Smoked Regularly	18,283,189 (64.7%)	129,445 (54.6%)	1,243,851 (60.9%)	16,909,893 (65.1%)	
Cigarettes Smoked per Day					.0307
20 or More	513,455 (1.8%)	7,453 (3.1%)	50,502 (2.5%)	455,500 (1.8%)	
11-19 Cigarettes	369,158 (1.3%)	1,887 (0.8%)	29,343 (1.4%)	337,929 (1.3%)	
6-10 Cigarettes	1,030,376 (3.6%)	12,927 (5.4%)	82,103 (4.0%)	935,346 (3.6%)	
2-5 Cigarettes	1,278,069 (4.5%)	17,826 (7.5%)	96,375 (4.7%)	1,163,867 (4.5%)	
<=1 Cigarette	449,640 (1.6%)	2,416 (1.0%)	35,465 (1.7%)	411,758 (1.6%)	
None	24,605,935 (87.1%)	194,750 (82.1%)	1,747,948 (85.6%)	22,663,237 (87.3%)	
Walks for Transportation					<.0001
Yes	15,110,572 (53.5%)	134,534 (56.7%)	1,029,757 (50.4%)	13,946,281 (53.7%)	
No	13,014,149 (46.1%)	98,783 (41.6%)	994,787 (48.7%)	11,920,579 (45.9%)	
Unable to Walk	121,913 (0.4%)	3,941 (1.7%)	17,193 (0.8%)	100,779 (0.4%)	
Walks for Leisure					<.0001
Yes	18,432,648 (65.3%)	140,434 (59.2%)	1,285,314 (63.0%)	17,006,900 (65.5%)	
No	9,692,162 (34.3%)	92,883 (39.1%)	739,230 (36.2%)	8,860,049 (34.1%)	
Inapplicable	121,823 (0.4%)	3,941 (1.7%)	17,193 (0.8%)	100,689 (0.4%)	
Weekly Soda Intake					.0048
21+ Times	485,029 (1.7%)	9,685 (4.1%)	43,705 (2.1%)	431,640 (1.7%)	
14-20 Times	651,844 (2.3%)	13,146 (5.5%)	52,964 (2.6%)	585,734 (2.3%)	
7-13 Times	1,960,790 (6.9%)	15,961 (6.7%)	125,514 (6.1%)	1,819,315 (7.0%)	
4-6 Times	1,063,224 (3.8%)	11,098 (4.7%)	86,787 (4.3%)	965,339 (3.7%)	
2-3 Times	3,277,601 (11.6%)	30,942 (13.0%)	223,416 (10.9%)	3,023,243 (11.6%)	
1 Time	4,189,989 (14.8%)	34,646 (14.6%)	273,408 (13.4%)	3,881,935 (14.9%)	
0 Times	16,618,156 (58.8%)	121,782 (51.3%)	1,235,943 (60.5%)	15,260,432 (58.8%)	
Neighborhood Access to Fresh Fruit					<.0001
Always	21,478,856 (76.0%)	158,280 (66.7%)	1,608,228 (78.8%)	19,712,348 (75.9%)	
Usually	3,118,658 (11.0%)	27,861 (11.7%)	181,692 (8.9%)	2,909,105 (11.2%)	
Sometimes	2,416,462 (8.6%)	29,478 (12.4%)	173,127 (8.5%)	2,213,857 (8.5%)	
Never	991,455 (3.5%)	21,490 (9.1%)	62,761 (3.1%)	907,203 (3.5%)	
Inapplicable	241,204 (0.9%)	149 (0.1%)	15,929 (0.8%)	225,125 (0.9%)	
Afordability of Fresh Fruit & Vegetables					<.0001
Always	13,129,925 (46.5%)	79,522 (33.5%)	870,266 (42.6%)	12,180,137 (46.9%)	
Usually	8,105,740 (28.7%)	49,566 (20.9%)	566,576 (27.7%)	7,489,597 (28.8%)	
Sometimes	5,403,648 (19.1%)	78,542 (33.1%)	479,106 (23.5%)	4,846,000 (18.7%)	
Never	374,663 (1.3%)	7,990 (3.4%)	47,097 (2.3%)	319,576 (1.2%)	
Inapplicable	1,232,658 (4.4%)	21,639 (9.1%)	78,690 (3.9%)	1,132,329 (4.4%)	

* *p* values based on Pearson chi-square test of association.

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Table B11

Weighted CHIS Health Insurance Characteristics by Asthma Status

Variable	Wtd. Population *Wtd. N* (%) (N=28,246,634)	Uncontrolled Asthma *Wtd. n* (%) (N=237,259)	Controlled Asthma *Wtd. n* (%) (N=2,041,736)	Non-Asthmatic *Wtd. n* (%) (N=25,967,638)	*p* value*
Covered by Health Insurance					<.0001
Yes	24,169,093 (85.6%)	216,394 (91.2%)	1,864,257 (91.3%)	22,088,442 (85.1%)	
No	4,077,541 (14.4%)	20,865 (8.8%)	177,479 (8.7%)	3,879,197 (14.9%)	
Health Plan Name					<.0001
Aetna	1,025,313 (3.6%)	2,676 (1.1%)	57,150 (2.8%)	965,487 (3.7%)	
Blue Cross	3,291,847 (11.7%)	10,633 (4.5%)	213,765 (10.5%)	3,067,450 (11.8%)	
Blue Shield	1,939,588 (6.9%)	8,068 (3.4%)	149,550 (7.3%)	1,781,970 (6.9%)	
Cigna Health Care	560,767 (2.0%)	2,480 (1.0%)	44,885 (2.2%)	513,403 (2.0%)	
Health Net	781,447 (2.8%)	5,180 (2.2%)	54,078 (2.6%)	722,188 (2.8%)	
Inapplicable	4,588,955 (16.2%)	26,252 (11.1%)	206,946 (10.1%)	4,355,756 (16.8%)	
Medicare/Medi-Cal	9,194,952 (32.6%)	130,966 (55.2%)	803,650 (39.4%)	8,260,336 (31.8%)	
United Healthcare	1,031,881 (3.7%)	4,951 (2.1%)	70,795 (3.5%)	956,134 (3.7%)	
Other	1,714,388 (6.1%)	11,376 (4.8%)	117,416 (5.8%)	1,585,596 (6.1%)	
Inapplicable	4,588,955 (16.2%)	26,252 (11.1%)	206,946 (10.1%)	4,355,756 (16.8%)	
HMO Status					<.0001
HMO	13,725,422 (48.6%)	115,071 (48.5%)	1,077,273 (52.8%)	12,533,078 (48.3%)	
Non-HMO	10,443,671 (37.0%)	101,323 (42.7%)	786,984 (38.5%)	9,555,364 (36.8%)	
Uninsured	4,077,541 (14.4%)	20,865 (8.8%)	177,479 (8.7%)	3,879,197 (14.9%)	
Health Plan Deductible > $1,000					<.0001
Yes	4,937,904 (17.5%)	21,568 (9.1%)	317,741 (15.6%)	4,598,595 (17.7%)	
No	10,687,933 (37.8%)	68,785 (29.0%)	807,667 (39.6%)	9,811,481 (37.8%)	
Inapplicable	12,620,796 (44.7%)	146,906 (61.9%)	916,328 (44.9%)	11,557,563 (44.5%)	
Health Plan Deductible > $2,000					.0004
Yes	2,231,914 (7.9%)	11,552 (4.9%)	137,778 (6.7%)	2,082,584 (8.0%)	
No	11,390,713 (40.3%)	69,879 (29.5%)	866,128 (42.4%)	10,454,706 (40.3%)	
Inapplicable	14,624,006 (51.8%)	155,828 (65.7%)	1,037,829 (50.8%)	13,430,348 (51.7%)	
Insurance Covers Prescription Drugs					<.0001
Yes	22,308,086 (79.0%)	204,382 (86.1%)	1,773,059 (86.8%)	20,330,646 (78.3%)	
No	1,912,455 (6.8%)	10,970 (4.6%)	94,909 (4.6%)	1,806,577 (7.0%)	
Inapplicable	4,026,092 (14.3%)	21,908 (9.2%)	173,769 (8.5%)	3,830,415 (14.8%)	
Have Usual Source of Health Care					<.0001
Yes	18,574,824 (65.8%)	163,172 (68.8%)	1,493,644 (73.2%)	16,918,007 (65.2%)	
No	4,477,507 (15.9%)	33,927 (14.3%)	187,958 (9.2%)	4,255,621 (16.4%)	
Doctor / My Doctor	3,786,485 (13.4%)	29,460 (12.4%)	255,572 (12.5%)	3,501,454 (13.5%)	
Kaiser	1,303,439 (4.6%)	10,458 (4.4%)	96,559 (4.7%)	1,196,421 (4.6%)	
More than One Place	104,380 (0.4%)	241 (0.1%)	8,003 (0.4%)	96,136 (0.4%)	
Usual Source of Health Care					<.0001
Doctors Office / Kaiser / HMO	16,690,639 (59.1%)	130,021 (54.8%)	1,343,193 (65.8%)	15,217,425 (58.6%)	
Community/Government Clinic	6,400,429 (22.7%)	65,107 (27.4%)	466,951 (22.9%)	5,868,371 (22.6%)	
Emergency Room / Urgent Care	409,905 (1.5%)	7,412 (3.1%)	30,473 (1.5%)	372,021 (1.4%)	
Other	268,153 (0.9%)	792 (0.3%)	13,159 (0.6%)	254,201 (1.0%)	
No Usual Source of Care	4,477,507 (15.9%)	33,927 (14.3%)	187,958 (9.2%)	4,255,621 (16.4%)	
Recent Prescription Drug Delay					<.0001
Yes	3,123,473 (11.1%)	63,815 (26.9%)	413,381 (20.2%)	2,646,277 (10.2%)	
No	25,123,161 (88.9%)	173,444 (73.1%)	1,628,355 (79.8%)	23,321,362 (89.8%)	
Cost/Insurance Responsible for Delay					<.0001
Yes	1,508,680 (5.3%)	37,647 (15.9%)	225,908 (11.1%)	1,245,125 (4.8%)	
No	1,614,793 (5.7%)	26,167 (11.0%)	187,473 (9.2%)	1,401,152 (5.4%)	
Inapplicable	25,123,161 (88.9%)	173,444 (73.1%)	1,628,355 (79.8%)	23,321,362 (89.8%)	

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Variable	Wtd. Population *Wtd. N* (%) (N=28,246,634)	Uncontrolled Asthma *Wtd. n* (%) (N=237,259)	Controlled Asthma *Wtd. n* (%) (N=2,041,736)	Non-Asthmatic *Wtd. n* (%) (N=25,967,638)	*p* value*
Recent Medical Care Delay					<.0001
Yes	3,946,413 (14.0%)	58,968 (24.9%)	408,357 (20.0%)	3,479,087 (13.4%)	
No	24,300,221 (86.0%)	178,291 (75.1%)	1,633,379 (80.0%)	22,488,552 (86.6%)	
Cost/Insurance Responsible for Delay					<.0001
Yes	2,102,002 (7.4%)	27,228 (11.5%)	210,761 (10.3%)	1,864,012 (7.2%)	
No	1,844,411 (6.5%)	31,740 (13.4%)	197,596 (9.7%)	1,615,074 (6.2%)	
Inapplicable	24,300,221 (86.0%)	178,291 (75.1%)	1,633,379 (80.0%)	22,488,552 (86.6%)	
Recently Required Medical Appointment					<.0001
Yes	8,225,559 (29.1%)	150,122 (63.3%)	959,156 (47.0%)	7,116,281 (27.4%)	
No	18,136,582 (64.2%)	79,031 (33.3%)	1,005,315 (49.2%)	17,052,236 (65.7%)	
Inapplicable	1,884,492 (6.7%)	8,106 (3.4%)	77,265 (3.8%)	1,799,121 (6.9%)	
Doctor Listens Carefully					<.0001
Always	13,657,140 (48.3%)	132,401 (55.8%)	1,133,016 (55.5%)	12,391,723 (47.7%)	
Usually	4,181,815 (14.8%)	26,244 (11.1%)	347,389 (17.0%)	3,808,181 (14.7%)	
Sometimes	1,693,089 (6.0%)	22,262 (9.4%)	164,516 (8.1%)	1,506,312 (5.8%)	
Never	321,413 (1.1%)	3,627 (1.5%)	22,332 (1.1%)	295,453 (1.1%)	
Inapplicable	8,393,176 (29.7%)	52,724 (22.2%)	374,483 (18.3%)	7,965,969 (30.7%)	
Doctor Provides Clear Explanations					<.0001
Always	13,751,483 (48.7%)	135,546 (57.1%)	1,157,568 (56.7%)	12,458,369 (48.0%)	
Usually	4,253,671 (15.1%)	25,956 (10.9%)	361,796 (17.7%)	3,865,919 (14.9%)	
Sometimes	1,487,437 (5.3%)	17,192 (7.2%)	131,833 (6.5%)	1,338,412 (5.2%)	
Never	360,867 (1.3%)	5,842 (2.5%)	16,056 (0.8%)	338,970 (1.3%)	
Inapplicable	8,393,176 (29.7%)	52,724 (22.2%)	374,483 (18.3%)	7,965,969 (30.7%)	
Awareness of Interpretor Rights					<.0001
Yes	2,809,062 (9.9%)	21,838 (9.2%)	95,438 (4.7%)	2,691,785 (10.4%)	
No	1,575,123 (5.6%)	9,863 (4.2%)	45,964 (2.3%)	1,519,297 (5.9%)	
Yes	1,508,680 (5.3%)	37,647 (15.9%)	225,908 (11.1%)	1,245,125 (4.8%)	
Language Barrior with Physician					<.0001
Yes	589,248 (2.1%)	12,159 (5.1%)	49,315 (2.4%)	527,774 (2.0%)	
No	356,401 (1.3%)	9,595 (4.0%)	35,817 (1.8%)	310,989 (1.2%)	
Inapplicable	27,300,985 (96.7%)	215,505 (90.8%)	1,956,605 (95.8%)	25,128,875 (96.8%)	
Recent Hospital Stay					<.0001
Yes	2,233,813 (7.9%)	28,253 (11.9%)	214,559 (10.5%)	1,991,001 (7.7%)	
No	25,591,067 (90.6%)	135,222 (57.0%)	1,772,697 (86.8%)	23,683,147 (91.2%)	
Inapplicable	421,754 (1.5%)	73,783 (31.1%)	54,480 (2.7%)	293,491 (1.1%)	
Recent ER Visit					N/A
Yes	4,983,284 (17.6%)	. (0.0%)	499,490 (24.5%)	4,483,793 (17.3%)	
No	22,596,022 (80.0%)	. (0.0%)	1,490,705 (73.0%)	21,105,318 (81.3%)	
Inapplicable	667,328 (2.4%)	237,259 (100.0%)	51,541 (2.5%)	378,527 (1.5%)	
ER Visit - Past Year					N/A
Yes	5,650,611 (20.0%)	237,259 (100.0%)	551,032 (27.0%)	4,862,321 (18.7%)	
No	22,596,022 (80.0%)	. (0.0%)	1,490,705 (73.0%)	21,105,318 (81.3%)	
Internet Utilization					<.0001
Yes	23,540,735 (83.3%)	181,029 (76.3%)	1,781,522 (87.3%)	21,578,183 (83.1%)	
No	4,705,899 (16.7%)	56,230 (23.7%)	260,214 (12.7%)	4,389,455 (16.9%)	

* *p* values based on Pearson chi-square test of association.

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Table B12

Weighted CHIS Socioeconomic Characteristics by Asthma Status

Variable	Wtd. Population *Wtd. N* (%) (N=28,246,634)	Uncontrolled Asthma *Wtd. n* (%) (N=237,259)	Controlled Asthma *Wtd. n* (%) (N=2,041,736)	Non-Asthmatic *Wtd. n* (%) (N=25,967,638)	*p* value*
Poverty Level					<.0001
300% FPL and Above	14,037,805 (49.7%)	66,809 (28.2%)	1,024,056 (50.2%)	12,946,941 (49.9%)	
200-299% FPL	3,973,723 (14.1%)	34,423 (14.5%)	297,456 (14.6%)	3,641,844 (14.0%)	
100-199% FPL	5,528,155 (19.6%)	60,208 (25.4%)	365,313 (17.9%)	5,102,634 (19.6%)	
0-99% FPL	4,706,950 (16.7%)	75,819 (32.0%)	354,912 (17.4%)	4,276,219 (16.5%)	
Food Security Status Level					<.0001
Inapplicable / >=200% FPL	18,011,528 (63.8%)	101,232 (42.7%)	1,321,511 (64.7%)	16,588,785 (63.9%)	
Food Security	5,893,084 (20.9%)	48,049 (20.3%)	356,303 (17.5%)	5,488,732 (21.1%)	
Food Insecurity w/o Hunger	2,799,403 (9.9%)	39,875 (16.8%)	192,673 (9.4%)	2,566,855 (9.9%)	
Food Insecurity w/ Hunger	1,542,618 (5.5%)	48,102 (20.3%)	171,249 (8.4%)	1,323,267 (5.1%)	
Receiving SSI					<.0001
Yes	1,051,201 (3.7%)	37,728 (15.9%)	145,980 (7.1%)	867,493 (3.3%)	
No	14,081,588 (49.9%)	135,422 (57.1%)	928,783 (45.5%)	13,017,382 (50.1%)	
Inapplicable	13,113,845 (46.4%)	64,109 (27.0%)	966,973 (47.4%)	12,082,763 (46.5%)	
Receiving Social Security Disability					<.0001
Yes	941,037 (3.3%)	38,845 (16.4%)	140,869 (6.9%)	761,324 (2.9%)	
No	4,054,493 (14.4%)	52,391 (22.1%)	333,532 (16.3%)	3,668,571 (14.1%)	
Inapplicable	23,251,104 (82.3%)	146,023 (61.5%)	1,567,336 (76.8%)	21,537,744 (82.9%)	
Received SS or Pension Prior Month					.0208
Yes	2,474,490 (8.8%)	25,358 (10.7%)	203,512 (10.0%)	2,245,620 (8.6%)	
No	1,535,907 (5.4%)	15,439 (6.5%)	88,819 (4.4%)	1,431,649 (5.5%)	
Inapplicable	24,236,236 (85.8%)	196,462 (82.8%)	1,749,405 (85.7%)	22,290,369 (85.8%)	
Primary Employer Type					<.0001
Private Company, Non-Profit Org	12,025,511 (42.6%)	58,551 (24.7%)	725,187 (35.5%)	11,241,773 (43.3%)	
Government	2,790,005 (9.9%)	24,753 (10.4%)	248,545 (12.2%)	2,516,707 (9.7%)	
Self-Employed	3,020,842 (10.7%)	14,896 (6.3%)	174,267 (8.5%)	2,831,679 (10.9%)	
Family Business or Farm	359,229 (1.3%)	3,426 (1.4%)	26,030 (1.3%)	329,773 (1.3%)	
Inapplicable	10,051,046 (35.6%)	135,632 (57.2%)	867,707 (42.5%)	9,047,707 (34.8%)	
Volunteer / Community Service					.0008
Yes	11,510,519 (40.8%)	91,163 (38.4%)	914,039 (44.8%)	10,505,316 (40.5%)	
No	16,736,114 (59.2%)	146,096 (61.6%)	1,127,697 (55.2%)	15,462,322 (59.5%)	
Housing Category					.0644
House	19,630,532 (69.5%)	147,098 (62.0%)	1,405,743 (68.9%)	18,077,690 (69.6%)	
Duplex	1,456,177 (5.2%)	14,663 (6.2%)	95,712 (4.7%)	1,345,803 (5.2%)	
Building with 3 or More Units	6,009,190 (21.3%)	62,863 (26.5%)	439,291 (21.5%)	5,507,035 (21.2%)	
Mobile Home	1,150,735 (4.1%)	12,634 (5.3%)	100,990 (4.9%)	1,037,111 (4.0%)	
Own or Rent Home					.0030
Own	15,966,479 (56.5%)	103,988 (43.8%)	1,173,762 (57.5%)	14,688,729 (56.6%)	
Rent	10,846,268 (38.4%)	116,227 (49.0%)	760,195 (37.2%)	9,969,846 (38.4%)	
Other Arrangement	1,106,778 (3.9%)	11,574 (4.9%)	90,337 (4.4%)	1,004,867 (3.9%)	
Refused	132,099 (0.5%)	1,293 (0.5%)	7,989 (0.4%)	122,817 (0.5%)	
Dont Know	72,073 (0.3%)	1,914 (0.8%)	4,273 (0.2%)	65,885 (0.3%)	
Not Ascertained	122,937 (0.4%)	2,262 (1.0%)	5,181 (0.3%)	115,494 (0.4%)	
Neighborhood Helpful					<.0001
Strongly Agree	5,843,472 (20.7%)	42,743 (18.0%)	481,645 (23.6%)	5,319,084 (20.5%)	
Agree	17,204,672 (60.9%)	121,565 (51.2%)	1,164,546 (57.0%)	15,918,561 (61.3%)	
Disagree	4,284,453 (15.2%)	56,720 (23.9%)	307,179 (15.0%)	3,920,554 (15.1%)	
Strongly Disagree	914,036 (3.2%)	16,230 (6.8%)	88,367 (4.3%)	809,439 (3.1%)	

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Variable	Wtd. Population *Wtd. N* (%) (N=28,246,634)	Uncontrolled Asthma *Wtd. n* (%) (N=237,259)	Controlled Asthma *Wtd. n* (%) (N=2,041,736)	Non-Asthmatic *Wtd. n* (%) (N=25,967,638)	*p* value*
Neighborhood Trustworthy					<.0001
Strongly Agree	4,876,387 (17.3%)	42,340 (17.8%)	376,680 (18.4%)	4,457,367 (17.2%)	
Agree	17,927,829 (63.5%)	120,379 (50.7%)	1,250,441 (61.2%)	16,557,009 (63.8%)	
Disagree	4,560,740 (16.1%)	54,076 (22.8%)	325,011 (15.9%)	4,181,652 (16.1%)	
Strongly Disagree	881,677 (3.1%)	20,463 (8.6%)	89,604 (4.4%)	771,610 (3.0%)	
Neighborhood Safe					<.0001
All of the Time	13,917,961 (49.3%)	96,970 (40.9%)	936,771 (45.9%)	12,884,220 (49.6%)	
Most of the Time	10,668,364 (37.8%)	76,109 (32.1%)	837,528 (41.0%)	9,754,727 (37.6%)	
Some of the Time	3,157,631 (11.2%)	49,722 (21.0%)	227,204 (11.1%)	2,880,705 (11.1%)	
None of the Time	502,678 (1.8%)	14,458 (6.1%)	40,234 (2.0%)	447,985 (1.7%)	

* *p* values based on Pearson chi-square test of association.

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Appendix C: SAS Output Plots

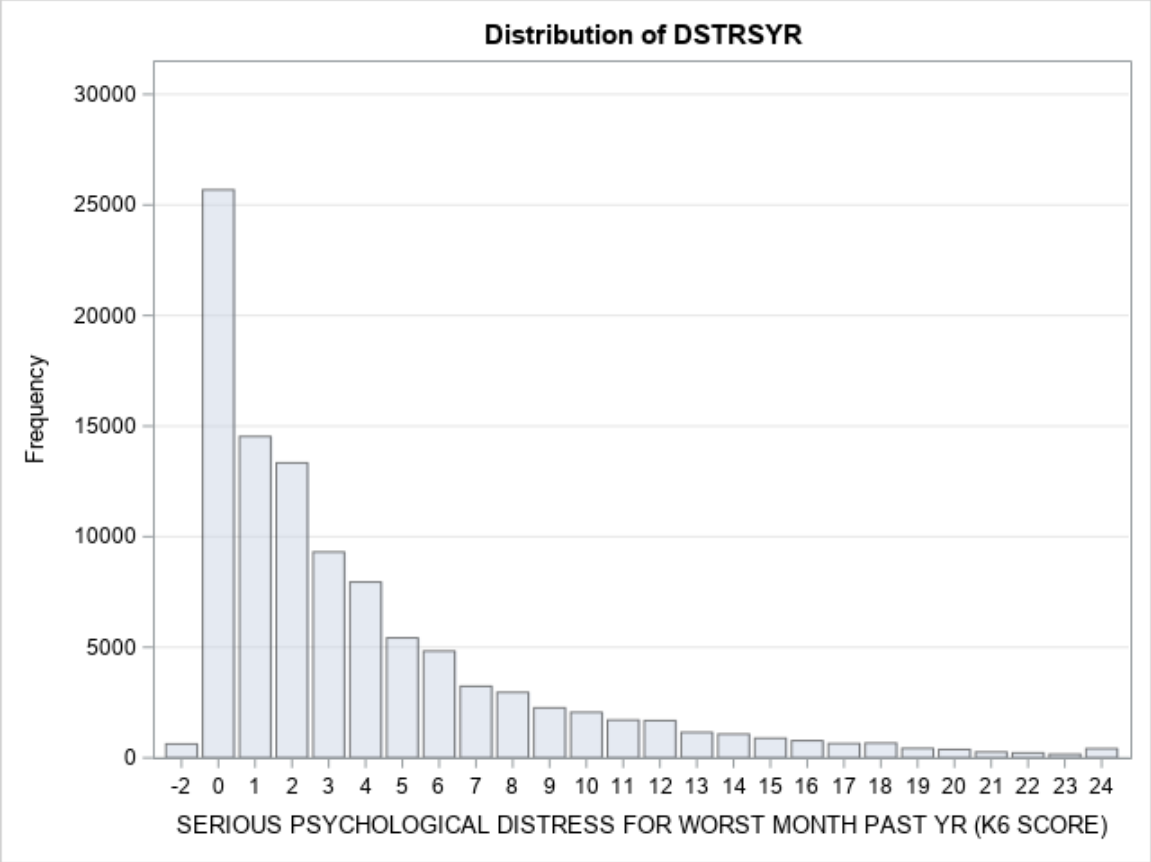

Figure C1: Raw and unweighted SAS output showing CHIS PUF frequency distribution of respondents' classification across the Kessler K6 nonspecific distress scale for their worst emotional month during the prior 12 months. Data has 22,580 (18.0%) missing observations and 628 (0.5%), identified as -2, where the proxy respondent skipped the question. Values of 13 and above are indicative of severe mental illness (Prochaska et al., 2012).

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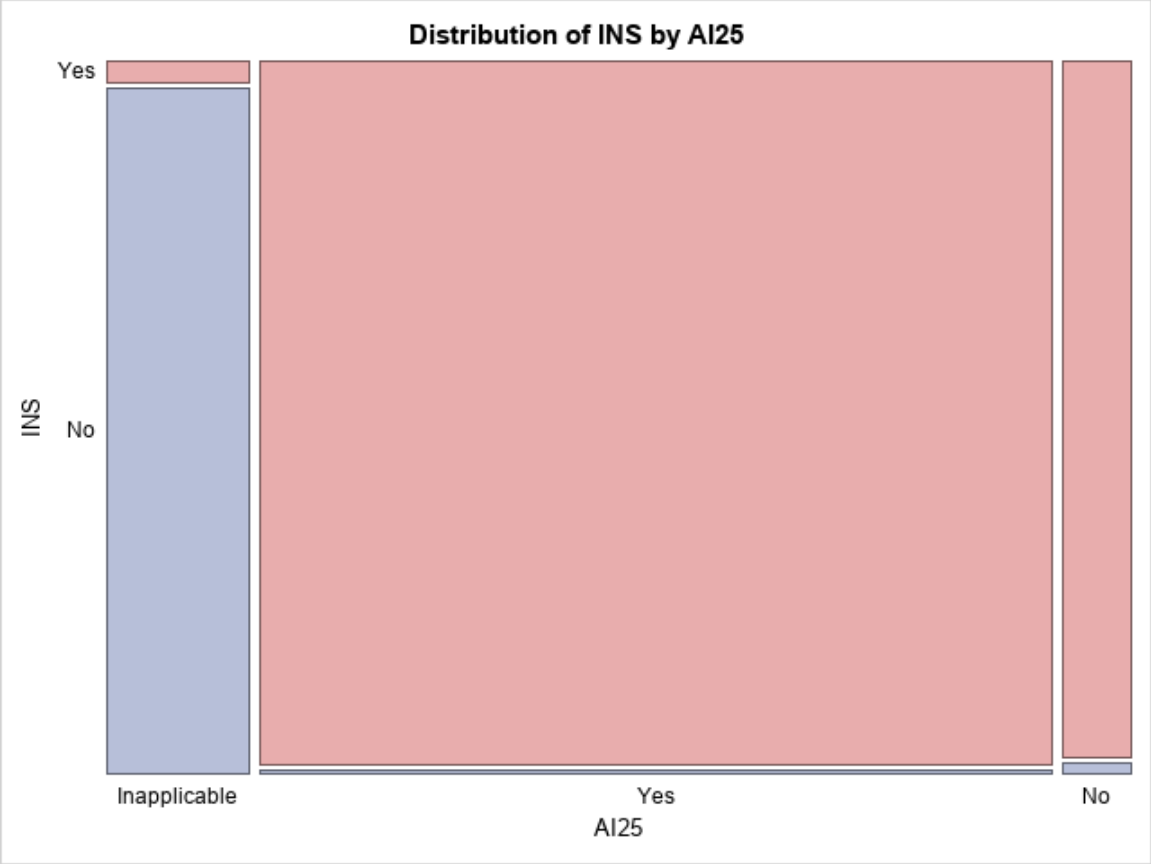

Figure C2: Mosaic plot of the weighted respondent population showing whether individuals have health insurance (INS) relative to having prescription drug coverage (AI25).

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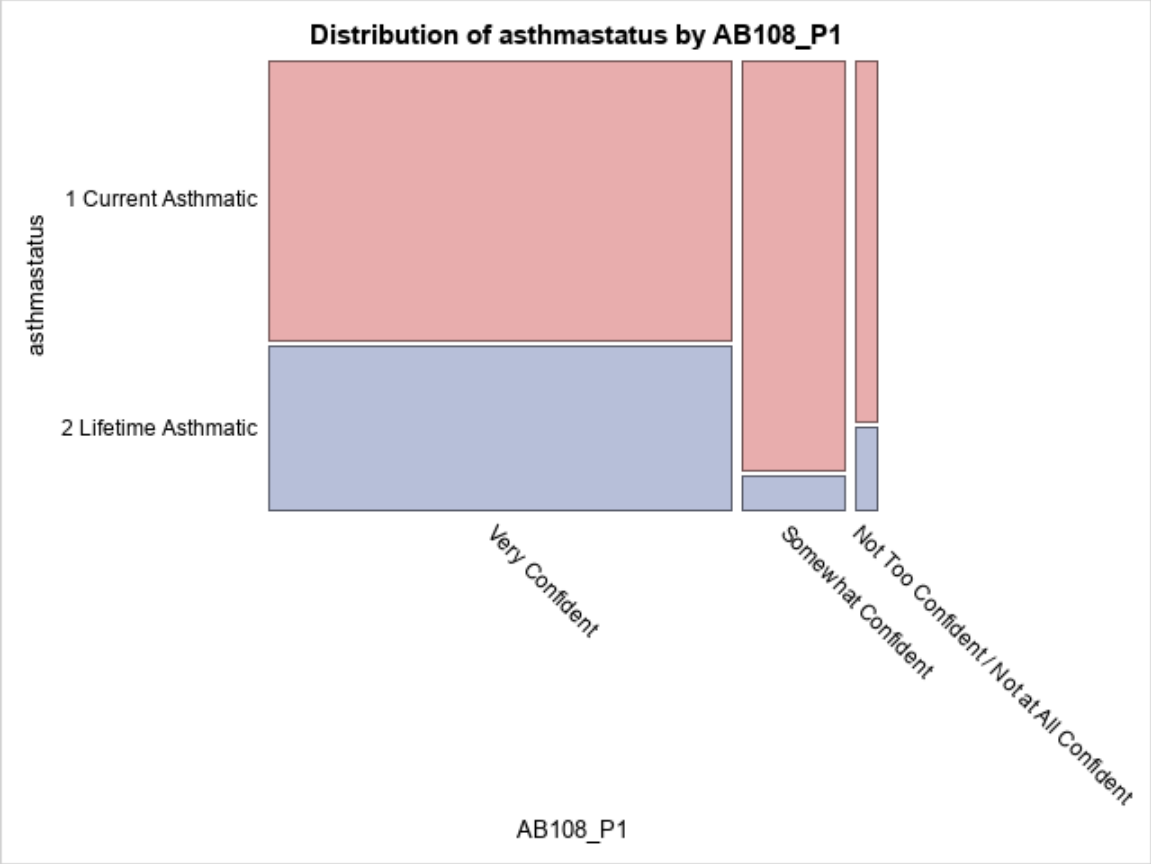

Figure C3: Mosaic plot of the weighted respondent population comparing status for those diagnosed with asthma (asthmastatus), with *Lifetime Asthmatic* representing *Previous Asthmatics* or those individuals who were diagnosed with asthma at some point but who are not classified as *Current Asthmatics*, and disease control confidence (AB108_P1).

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Appendix D: Binomial Asthma Probability Models

D.1 Multinomial Logistic Regression (Model A0)

Table D1

Odds Ratio Estimates for Multinomial Logistic Regression

	Current Asthmatics vs					
	Previous Asthmatics			Non-Asthmatics		
Effect	Odds Ratio	95% Confidence Limits		Odds Ratio	95% Confidence Limits	
Demographics						
Female vs Male	0.485	0.418 - 0.562	✓	0.622	0.563 - 0.686	✓
Middle Aged vs Young Adult	0.631	0.531 - 0.750	✓	1.107	0.995 - 1.231	✗
Later Adult vs Young Adult	0.724	0.561 - 0.933	✓	1.536	1.323 - 1.782	✓
Naturalized Citizen vs US-Born Citizen	1.215	0.973 - 1.517	✗	1.898	1.650 - 2.182	✓
Non-Citizen vs US-Born Citizen	0.917	0.642 - 1.311	✗	2.690	2.257 - 3.205	✓
Single w/o vs Married w/ Children	0.804	0.652 - 0.993	✓	0.767	0.679 - 0.866	✓
Single w/ vs Married w/ Children	0.736	0.506 - 1.070	✗	0.875	0.727 - 1.053	✗
Married w/o vs Married w/ Children	0.823	0.648 - 1.044	✗	0.804	0.701 - 0.922	✓
Health						
Underweight vs Normal	0.637	0.344 - 1.177	✗	0.932	0.701 - 1.238	✗
Overweight vs Normal	0.842	0.707 - 1.002	✗	0.839	0.765 - 0.921	✓
Obese vs Normal	0.640	0.527 - 0.775	✓	0.568	0.515 - 0.626	✓
Current Smokers vs Non-Smokers	0.876	0.708 - 1.084	✗	0.896	0.792 - 1.014	✗
Previous Smokers vs Non-Smokers	0.806	0.691 - 0.940	✓	0.849	0.770 - 0.935	✓
Recent Pyschological Distress vs None	0.743	0.571 - 0.965	✓	0.566	0.497 - 0.645	✓
Health Insurance & Access						
Aetna vs No Insurance	1.125	0.739 - 1.712	✗	0.958	0.732 - 1.254	✗
Blue Cross vs No Insurance	0.975	0.742 - 1.281	✗	0.820	0.697 - 0.964	✓
Blue Shield vs No Insurance	0.820	0.558 - 1.204	✗	0.701	0.556 - 0.884	✓
Cigna Health Care vs No Insurance	0.571	0.298 - 1.094	✗	0.636	0.439 - 0.923	✓
Health Net vs No Insurance	0.792	0.475 - 1.322	✗	0.705	0.503 - 0.990	✓
Kaiser vs No Insurance	0.876	0.656 - 1.170	✗	0.651	0.548 - 0.772	✓
Medicare/Medi-Cal vs No Insurance	0.752	0.582 - 0.973	✓	0.601	0.517 - 0.698	✓
Other Insurance vs No Insurance	1.050	0.727 - 1.518	✗	0.823	0.637 - 1.064	✗
United Healthcare vs No Insurance	0.922	0.665 - 1.277	✗	0.698	0.541 - 0.902	✓
Socioeconomics						
0-99% FPL vs 300% FPL and Above	1.968	0.995 - 3.893	✗	2.329	1.662 - 3.264	✓
100-199% FPL vs 300% FPL and Above	2.074	1.104 - 3.896	✓	2.543	1.815 - 3.562	✓
200-299% FPL vs 300% FPL and Above	1.037	0.866 - 1.241	✗	0.906	0.805 - 1.020	✗
Food Insecurity w/o Hunger vs N/A	0.359	0.169 - 0.761	✓	0.345	0.240 - 0.496	✓
Food Insecurity w/ Hunger vs N/A	0.263	0.107 - 0.649	✓	0.265	0.168 - 0.418	✓
Private Company vs Government	1.182	0.908 - 1.539	✗	1.262	1.091 - 1.459	✓
Family Co. or Farm vs Government	1.134	0.573 - 2.243	✗	1.057	0.714 - 1.564	✗
Self-Employed vs Government	1.373	1.034 - 1.825	✓	1.309	1.093 - 1.568	✓
Inapplicable vs Government	0.869	0.676 - 1.118	✗	1.026	0.887 - 1.186	✗

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D.2 Binomial Logistic Regression (Model AA)

Table D2

Model A – Binomial Logistic Regression Results

	Maximum Likelihood Estimates				Non-Asthmatic		
Effect	**Est.**	**Std. Error**	***t* Value**	***p Value***	**Odds Ratio**	**95% Confidence Limits**	
Intercept	2.082	0.096	21.63	<.0001			
Demographics							
Female vs Male	-0.238	0.025	-9.46	<.0001	0.622	0.563 - 0.687	
Middle Aged vs Young Adult	-0.077	0.032	-2.45	0.016	1.105	0.995 - 1.228	
Later Adult vs Young Adult	0.254	0.044	5.78	<.0001	1.539	1.326 - 1.786	
Naturalized Citizen vs US-Born Citizen	0.098	0.051	1.92	0.057	1.895	1.648 - 2.179	
Non-Citizen vs US-Born Citizen	0.443	0.060	7.38	<.0001	2.674	2.243 - 3.186	
Single w/o vs Married w/ Children	-0.109	0.030	-3.58	0.001	0.770	0.683 - 0.869	
Single w/ vs Married w/ Children	0.022	0.059	0.37	0.710	0.878	0.730 - 1.056	
Married w/o vs Married w/ Children	-0.065	0.037	-1.77	0.078	0.805	0.703 - 0.922	
Health							
Underweight vs Normal	0.129	0.106	1.21	0.227	0.927	0.697 - 1.233	
Overweight vs Normal	0.027	0.047	0.59	0.558	0.838	0.763 - 0.921	
Obese vs Normal	-0.360	0.045	-8.01	<.0001	0.569	0.516 - 0.627	
Current Smokers vs Non-Smokers	-0.018	0.041	-0.43	0.667	0.896	0.792 - 1.015	
Previous Smokers vs Non-Smokers	-0.074	0.034	-2.19	0.030	0.847	0.768 - 0.933	
Recent Pyschological Distress vs None	-0.283	0.033	-8.52	<.0001	0.568	0.498 - 0.647	
Health Insurance & Access							
Aetna vs No Insurance	0.245	0.103	2.38	0.018	0.960	0.733 - 1.258	
Blue Cross vs No Insurance	0.091	0.061	1.48	0.140	0.823	0.699 - 0.968	
Blue Shield vs No Insurance	-0.061	0.084	-0.73	0.468	0.707	0.561 - 0.892	
Cigna Health Care vs No Insurance	-0.157	0.153	-1.02	0.307	0.642	0.442 - 0.933	
Health Net vs No Insurance	-0.067	0.133	-0.50	0.617	0.703	0.500 - 0.988	
Kaiser vs No Insurance	-0.143	0.053	-2.70	0.008	0.652	0.549 - 0.774	
Medicare/Medi-Cal vs No Insurance	-0.143	0.053	-2.70	0.008	0.601	0.517 - 0.699	
Other Insurance vs No Insurance	0.093	0.093	1.00	0.317	0.825	0.638 - 1.066	
United Healthcare vs No Insurance	-0.064	0.111	-0.58	0.562	0.705	0.546 - 0.909	
Socioeconomics							
0-99% FPL vs 300% FPL and Above	0.425	0.092	4.62	<.0001	2.324	1.654 - 3.266	
100-199% FPL vs 300% FPL and Above	0.511	0.090	5.67	<.0001	2.532	1.804 - 3.554	
200-299% FPL vs 300% FPL and Above	-0.517	0.090	-5.75	<.0001	0.906	0.805 - 1.020	
Food Insecurity w/o Hunger vs N/A	-0.266	0.065	-4.11	<.0001	0.347	0.241 - 0.499	
Food Insecurity w/ Hunger vs N/A	-0.526	0.104	-5.08	<.0001	0.267	0.169 - 0.422	
Private Company vs Government	0.115	0.055	2.10	0.037	1.264	1.094 - 1.461	
Family Co. or Farm vs Government	-0.058	0.157	-0.37	0.713	1.063	0.718 - 1.574	
Self-Employed vs Government	0.154	0.073	2.12	0.035	1.314	1.097 - 1.575	
Inapplicable vs Government	-0.093	0.049	-1.89	0.060	1.026	0.888 - 1.186	

p values based on chi-square test of association.

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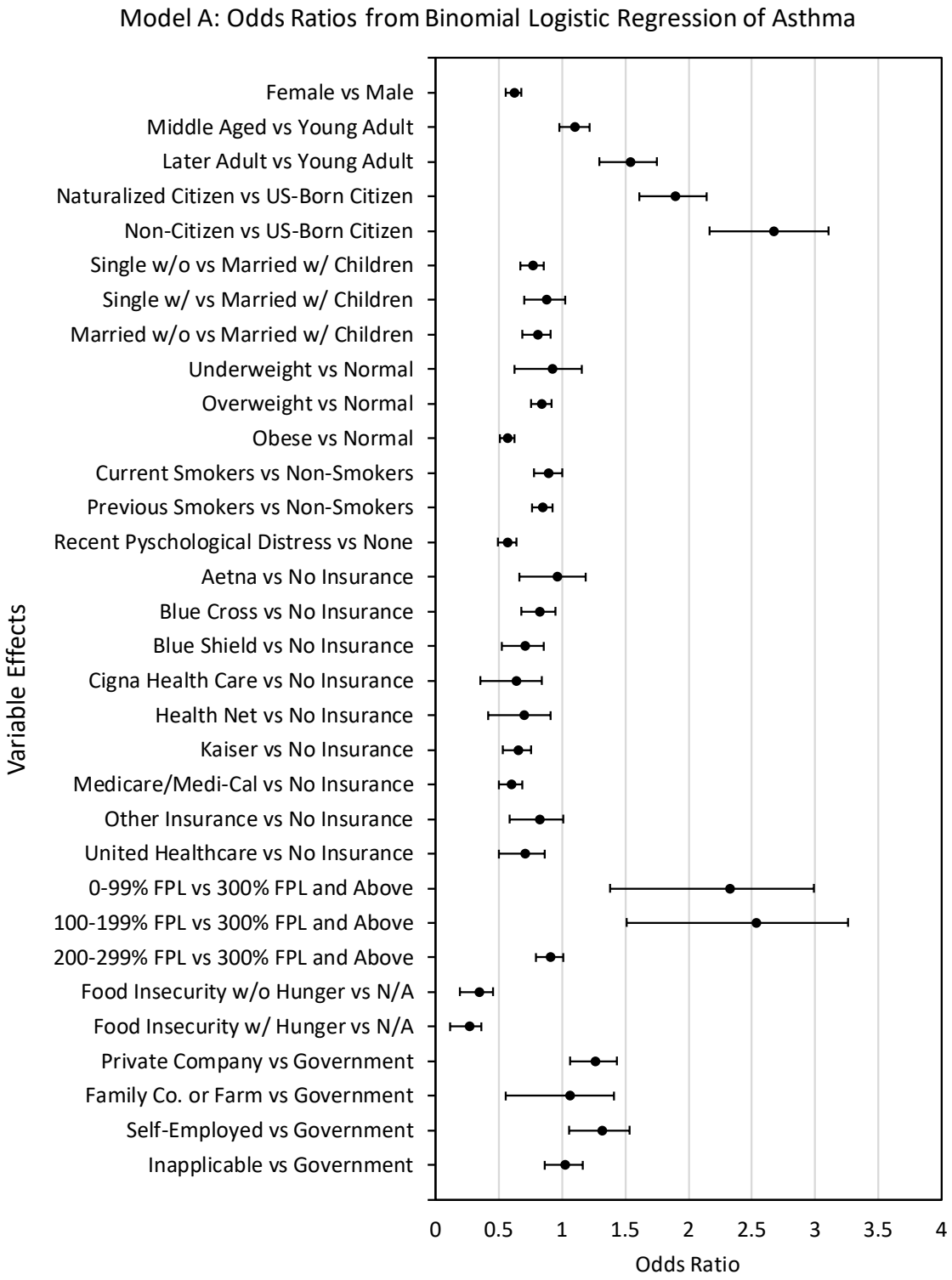

Figure D1: Model A – Odds ratios from binomial logistic regression of asthma.

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D.3 Binomial Logistic Regression (Model AB)

Table D3

Model B – Binomial Logistic Regression Results

	Maximum Likelihood Estimates					Asthmatic		
Effect	**Est.**	**Std. Error**	***t* Value**	***p Value***		**Odds Ratio**	**95% Confidence Limits**	
Intercept	-2.187	0.055	-39.72	<.0001	✓			
Demographics								
Female vs Male	0.246	0.025	9.91	<.0001	✓	1.635	1.482 - 1.803	✓
Young / Middle Aged vs Later Adult	0.074	0.026	2.86	0.005	✓	1.160	1.047 - 1.285	✓
U.S. Born vs Naturalized Citizens	0.513	0.042	12.29	<.0001	✓	1.889	1.638 - 2.178	✓
Non-Citizens vs Naturalized Citizens	-0.390	0.057	-6.81	<.0001	✓	0.766	0.630 - 0.931	✓
African American vs White	0.023	0.068	0.34	0.738	✗	1.156	0.994 - 1.344	✗
American Native† vs White	0.348	0.133	2.62	0.010	✓	1.600	1.181 - 2.169	✓
Asian vs White	-0.168	0.083	-2.01	0.046	✓	0.956	0.798 - 1.144	✗
Latino vs White	-0.310	0.050	-6.27	<.0001	✓	0.829	0.744 - 0.924	✓
Multiracial / Other vs White	0.229	0.100	2.30	0.023	✓	1.421	1.143 - 1.766	✓
Health								
Overweight vs Underweight / Normal	-0.077	0.029	-2.66	0.009	✓	1.213	1.105 - 1.332	✓
Obese vs Underweight / Normal	0.348	0.030	11.58	<.0001	✓	1.855	1.683 - 2.044	✓
Recent Psychological Distress vs None	0.354	0.031	11.33	<.0001	✓	2.032	1.795 - 2.299	✓
Health Insurance & Access								
Insured vs No Health Insurance Cover	0.183	0.034	5.36	<.0001	✓	1.441	1.260 - 1.649	✓
Socioeconomics								
No Children in Household vs Reverse	0.095	0.025	3.80	0.000	✓	1.210	1.096 - 1.336	✓
Income Below vs At Least FPL	0.141	0.029	4.86	<.0001	✓	1.327	1.183 - 1.488	✓

p values based on chi-square test of association.

† Includes Native Americans and Alaska Natives.

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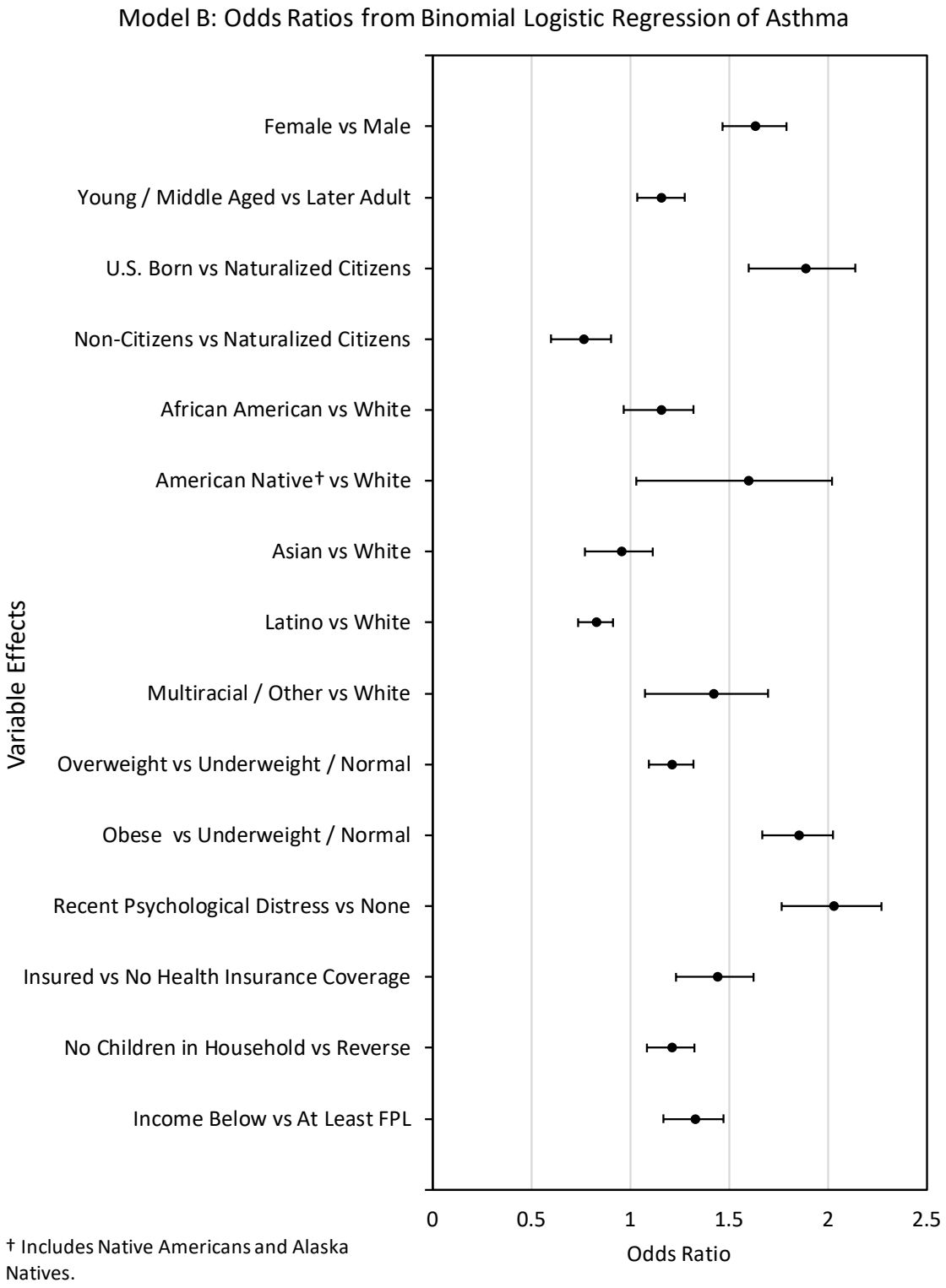

Figure D2: Model B – Odds ratios from binomial logistic regression of asthma.

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D.4 Binomial Logistic Regression (Model AC)

Table D4

Model C – Binomial Logistic Regression Results

	Maximum Likelihood Estimates				Asthmatic		
Effect	**Est.**	**Std. Error**	***t* Value**	***p Value***	**Odds Ratio**	**95% Confidence Limits**	
Intercept	-2.466	0.051	-48.73	<.0001 ✓			
Demographics							
Female vs Male	0.239	0.025	9.72	<.0001 ✓	1.614	1.464 - 1.779	✓
Young / Middle Aged vs Later Adult	0.101	0.026	3.89	0.000 ✓	1.223	1.104 - 1.355	✓
U.S. Born vs Naturalized Citizens	0.528	0.042	12.57	<.0001 ✓	1.910	1.654 - 2.205	✓
Non-Citizens vs Naturalized Citizens	-0.410	0.057	-7.22	<.0001 ✓	0.748	0.616 - 0.908	✓
African American vs White	0.076	0.066	1.15	0.252 ✗	1.265	1.096 - 1.460	✓
American Native† vs White	0.432	0.131	3.31	0.001 ✓	1.806	1.340 - 2.434	✓
Asian vs White	-0.316	0.082	-3.87	0.000 ✓	0.855	0.715 - 1.024	✗
Latino vs White	-0.272	0.049	-5.57	<.0001 ✓	0.893	0.805 - 0.992	✓
Multiracial / Other vs White	0.239	0.097	2.47	0.015 ✓	1.490	1.204 - 1.843	✓
Health Insurance & Access							
Insured vs No Health Insurance Covera	0.187	0.034	5.59	<.0001 ✓	1.454	1.274 - 1.660	✓
Socioeconomics							
No Children in Household vs Reverse	0.098	0.025	3.95	0.000 ✓	1.218	1.103 - 1.344	✓
Income Below vs At Least FPL	0.187	0.029	6.38	<.0001 ✓	1.454	1.295 - 1.633	✓

p values based on chi-square test of association.
† Includes Native Americans and Alaska Natives.

Table D5

Model C – MLE Sorted by Standard Estimate

Parameter	**Effect**	**Estimate**	**Standard Error**	**Wald Chi-Square**	**p value***	**Std. Est.**
Intercept	N/A	-2.466	0.002	1,451,192.6	<.0001 ✓	
Citizenship	US-Born Citizen	0.528	0.001	177,993.6	<.0001 ✓	3.404
Citizenship	Non-Citizen	-0.410	0.002	57,092.8	<.0001 ✓	-1.991
Sex	Female	0.239	0.001	130,236.9	<.0001 ✓	1.981
Race / Ethnicity	Latino	-0.272	0.002	23,612.0	<.0001 ✓	-1.977
Race / Ethnicity	Asian	-0.316	0.002	18,954.9	<.0001 ✓	-1.815
Race / Ethnicity	American Indian / Alaska Native	0.432	0.006	5,474.3	<.0001 ✓	1.800
Income %FPL	0-99% FPL	0.187	0.001	46,918.4	<.0001 ✓	1.160
Covered by Health Insurance	Yes	0.187	0.001	27,894.0	<.0001 ✓	1.093
Race / Ethnicity	Multiracial / Other	0.239	0.003	6,160.6	<.0001 ✓	1.065
Children in Household	No Children in HH	0.098	0.001	16,657.5	<.0001 ✓	0.756
Later Adult	Young / Middle Aged	0.101	0.001	12,226.5	<.0001 ✓	0.620
Race / Ethnicity	African American	0.076	0.002	1,038.7	<.0001 ✓	0.368

* *p* values based on Pearson chi-square test of association.

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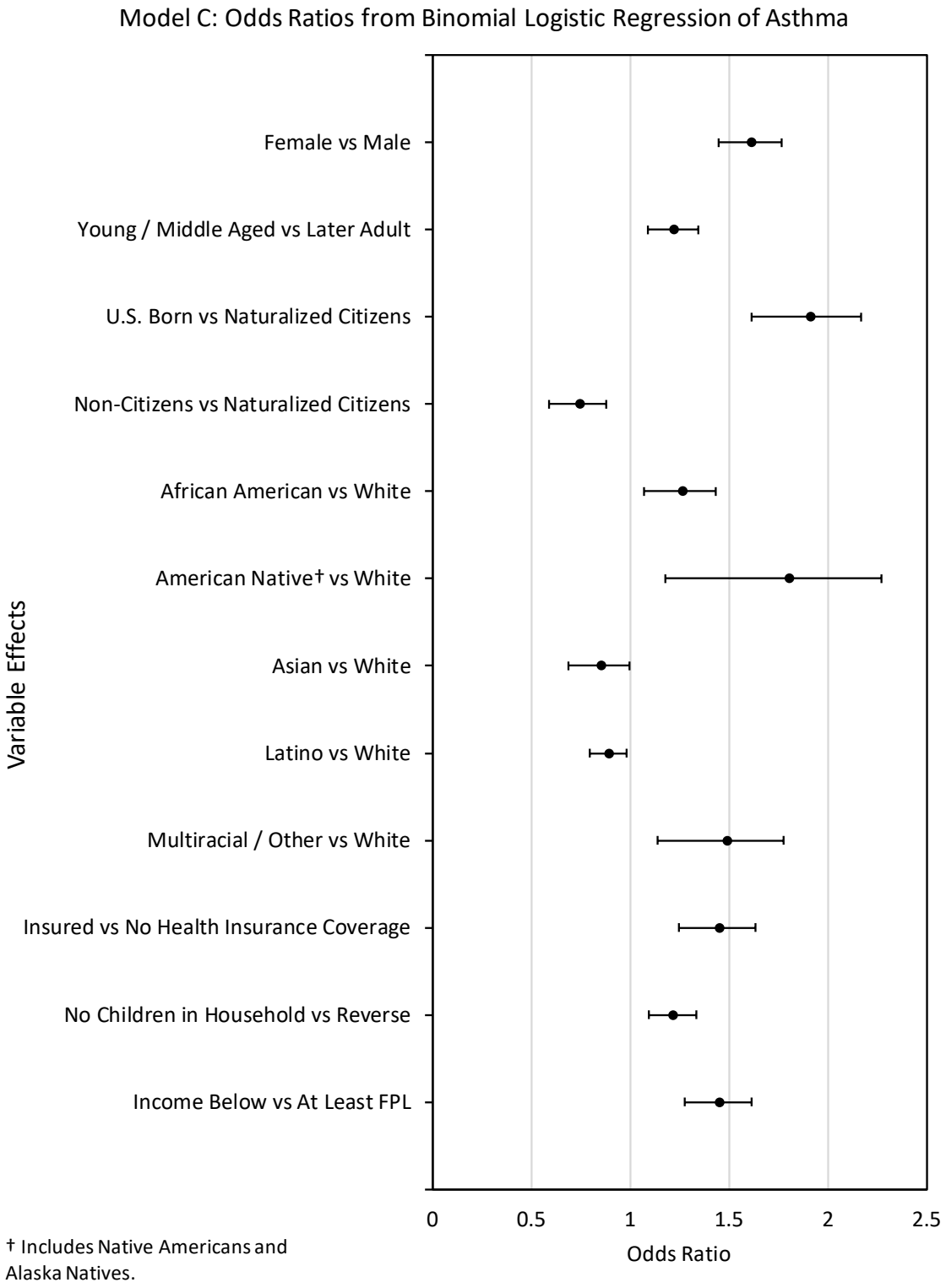

Figure D3: Model C – Odds ratios from binomial logistic regression of asthma.

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D.5 Binomial Logistic Regression (Model AD)

Table D6

Model D – Binomial Logistic Regression Results

	Maximum Likelihood Estimates				Asthmatic		
Effect	**Est.**	**Std. Error**	***t* Value**	***p Value***	**Odds Ratio**	**95% Confidence Limits**	
Intercept	-2.431	0.048	-51.14	<.0001 ✓			
Demographics							
Female vs Male	0.240	0.025	9.75	<.0001 ✓	1.615	1.466 - 1.780	✓
Young Adult vs Later Adult	0.088	0.034	2.55	0.012 ✓	1.251	1.104 - 1.418	✓
Middle Aged vs Later Adult	0.048	0.028	1.73	0.086 ✗	1.203	1.083 - 1.336	✓
U.S. Born vs Naturalized Citizens	0.522	0.043	12.10	<.0001 ✓	1.886	1.634 - 2.177	✓
Non-Citizens vs Naturalized Citizens	-0.409	0.057	-7.19	<.0001 ✓	0.744	0.614 - 0.900	✓
African American vs White	0.079	0.067	1.19	0.235 ✗	1.264	1.096 - 1.458	✓
American Native† vs White	0.438	0.131	3.34	0.001 ✓	1.809	1.343 - 2.438	✓
Asian vs White	-0.323	0.084	-3.86	0.000 ✓	0.846	0.703 - 1.017	✗
Latino vs White	-0.277	0.049	-5.62	<.0001 ✓	0.886	0.797 - 0.984	✓
Multiracial / Other vs White	0.237	0.097	2.45	0.015 ✓	1.481	1.198 - 1.830	✓
Health Insurance & Access							
Insured vs No Health Insurance Covera	0.189	0.034	5.63	<.0001 ✓	1.459	1.278 - 1.666	✓
Socioeconomics							
No Children in Household vs Reverse	0.099	0.025	3.96	0.000 ✓	1.219	1.105 - 1.346	✓
Income Below vs At Least FPL	0.186	0.030	6.21	<.0001 ✓	1.450	1.288 - 1.632	✓

p values based on chi-square test of association.
† Includes Native Americans and Alaska Natives.

Table D7

Model D – MLE Sorted by Standard Estimate

Parameter	**Effect**	**Estimate**	**Standard Error**	***t* value**	**p value***	**Std. Est.**
Intercept	N/A	-2.431	0.048	-51.1	<.0001 ✓	
Citizenship	US-Born Citizen	0.522	0.043	12.1	<.0001 ✓	3.297
Race / Ethnicity	Latino	-0.277	0.049	-5.6	<.0001 ✓	-1.971
Citizenship	Non-Citizen	-0.409	0.057	-7.2	<.0001 ✓	-1.949
Sex	Female	0.240	0.025	9.8	<.0001 ✓	1.944
Race / Ethnicity	Asian	-0.323	0.084	-3.9	0.000 ✓	-1.820
Race / Ethnicity	American Indian / Alaska Native	0.438	0.131	3.3	0.001 ✓	1.790
Income %FPL	0-99% FPL	0.186	0.030	6.2	<.0001 ✓	1.129
Covered by Health Insurance	Yes	0.189	0.034	5.6	<.0001 ✓	1.082
Race / Ethnicity	Multiracial / Other	0.237	0.097	2.5	0.015 ✓	1.036
Children in Household	No Children in HH	0.099	0.025	4.0	0.000 ✓	0.746
Age Group	Young Adult (18-39)	0.088	0.034	2.6	0.012 ✓	0.511
Race / Ethnicity	African American	0.079	0.067	1.2	0.235 ✗	0.378
Age Group	Middle Aged (40-64)	0.048	0.028	1.7	0.086 ✗	0.285

* *p* values based on Pearson chi-square test of association.

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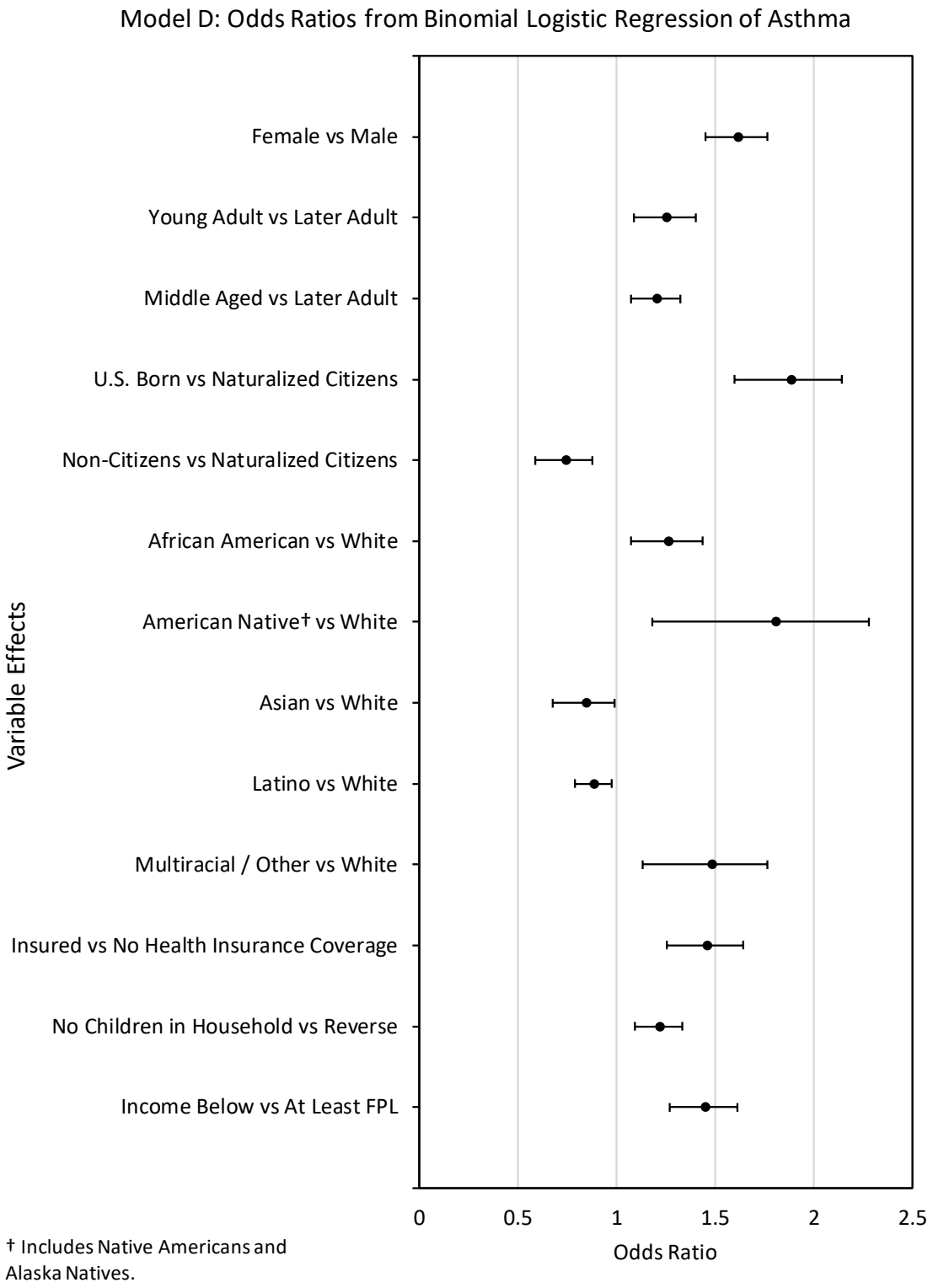

Figure D4: Model D – Odds ratios from binomial logistic regression of asthma.

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D.6 Binomial Logistic Regression (Model AE)

Table D8

Model E – Binomial Logistic Regression Results

	Maximum Likelihood Estimates				Asthmatic		
Effect	**Est.**	**Std. Error**	***t* Value**	***p Value***	**Odds Ratio**	**95% Confidence Limits**	
Intercept	-2.380	0.045	-52.55	<.0001 ✓			
Demographics							
Female vs Male	0.235	0.025	9.54	<.0001 ✓	1.601	1.453 - 1.765	✓
U.S. Born vs Naturalized Citizens	0.538	0.042	12.72	<.0001 ✓	1.952	1.688 - 2.258	✓
Non-Citizens vs Naturalized Citizens	-0.406	0.057	-7.16	<.0001 ✓	0.760	0.625 - 0.923	✓
African American vs White	0.075	0.066	1.14	0.255 ✗	1.283	1.111 - 1.480	✓
American Native† vs White	0.413	0.130	3.18	0.002 ✓	1.798	1.337 - 2.419	✓
Asian vs White	-0.299	0.081	-3.68	0.000 ✓	0.882	0.738 - 1.054	✗
Latino vs White	-0.261	0.049	-5.38	<.0001 ✓	0.916	0.827 - 1.015	✗
Multiracial / Other vs White	0.245	0.097	2.54	0.012 ✓	1.520	1.231 - 1.878	✓
Health Insurance & Access							
Insured vs No Health Insurance Coverage	0.170	0.033	5.12	<.0001 ✓	1.406	1.233 - 1.603	✓
Socioeconomics							
No Children in Household vs Reverse	0.076	0.024	3.21	0.002 ✓	1.163	1.060 - 1.277	✓
Income Below vs At Least FPL	0.189	0.029	6.42	<.0001 ✓	1.458	1.298 - 1.637	✓

p values based on chi-square test of association.
† Includes Native Americans and Alaska Natives.

Table D9

Model E – MLE Sorted by Standard Estimate

Parameter	**Effect**	**Estimate**	**Standard Error**	***t* value**	**p value***	**Std. Est.**
Intercept	N/A	-2.380	0.045	-52.6	<.0001 ✓	
Citizenship	US-Born Citizen	0.538	0.042	12.7	<.0001 ✓	3.398
Citizenship	Non-Citizen	-0.406	0.057	-7.2	<.0001 ✓	-1.937
Sex	Female	0.235	0.025	9.5	<.0001 ✓	1.910
Race / Ethnicity	Latino	-0.261	0.049	-5.4	<.0001 ✓	-1.862
Race / Ethnicity	American Indian / Alaska Native	0.413	0.130	3.2	0.002 ✓	1.689
Race / Ethnicity	Asian	-0.299	0.081	-3.7	0.000 ✓	-1.687
Income %FPL	0-99% FPL	0.189	0.029	6.4	<.0001 ✓	1.146
Race / Ethnicity	Multiracial / Other	0.245	0.097	2.5	0.012 ✓	1.072
Covered by Health Insurance	Yes	0.170	0.033	5.1	<.0001 ✓	0.975
Children in Household	No Children in HH	0.076	0.024	3.2	0.002 ✓	0.570
Race / Ethnicity	African American	0.075	0.066	1.1	0.255 ✗	0.358

* *p* values based on Pearson chi-square test of association.

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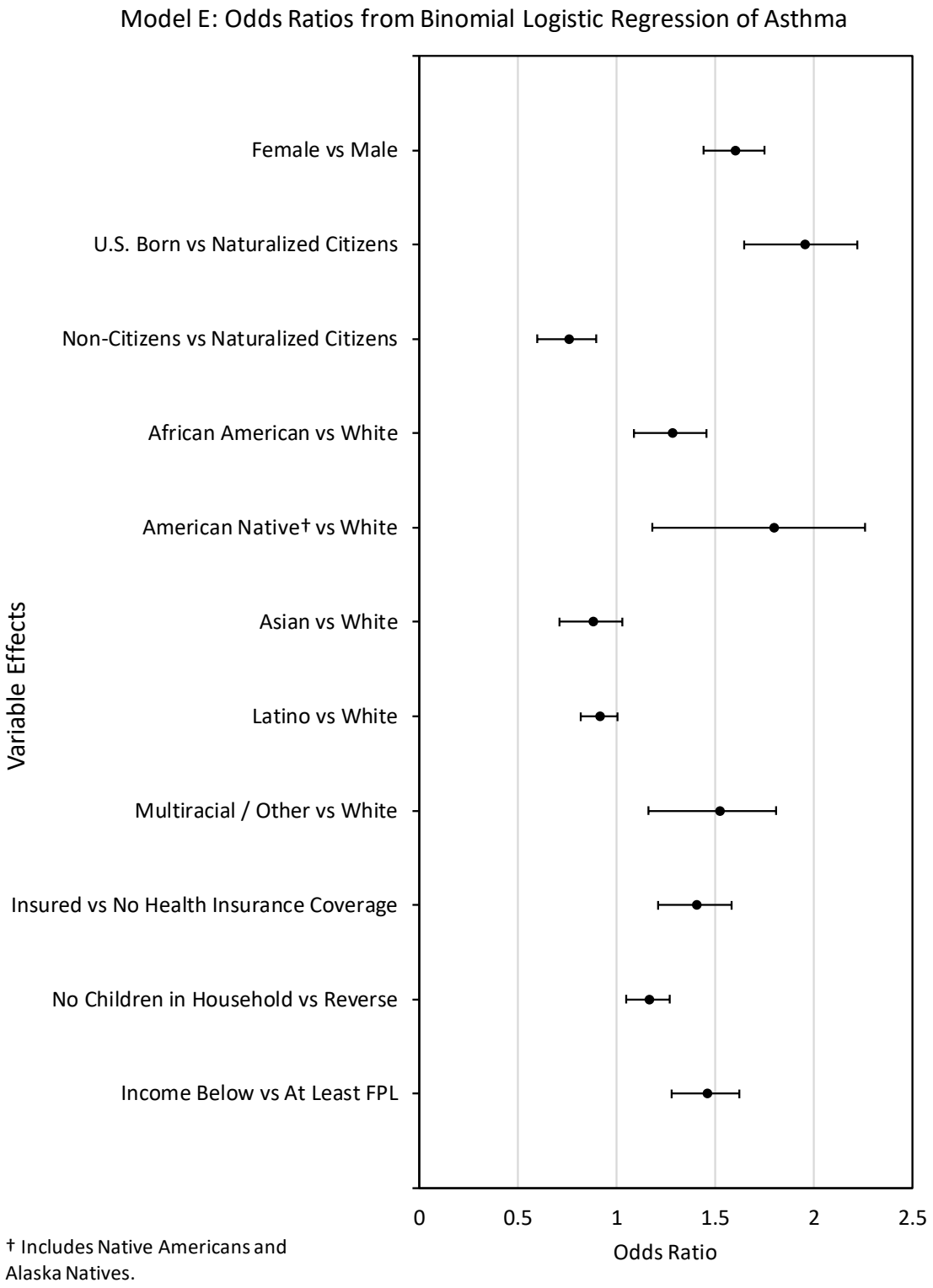

Figure D5: Model E – Odds ratios from binomial logistic regression of asthma.

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B.7 Binomial Logistic Regression (Model AF)

Table D10

Model F – Binomial Logistic Regression Results

	Maximum Likelihood Estimates				Asthmatic		
Effect	**Est.**	**Std. Error**	***t* Value**	***p Value***	**Odds Ratio**	**95% Confidence Limits**	
Intercept	-2.355	0.044	-53.71	<.0001 ✓			
Demographics							
Female vs Male	0.232	0.025	9.45	<.0001 ✓	1.589	1.442 - 1.750	✓
U.S. Born vs Naturalized Citizens	0.553	0.043	13.02	<.0001 ✓	1.975	1.707 - 2.284	✓
Non-Citizens vs Naturalized Citizens	-0.426	0.057	-7.42	<.0001 ✓	0.741	0.609 - 0.902	✓
African American vs White	0.076	0.066	1.16	0.249 ✗	1.277	1.107 - 1.473	✓
American Native† vs White	0.405	0.130	3.12	0.002 ✓	1.774	1.318 - 2.387	✓
Asian vs White	-0.290	0.081	-3.56	0.001 ✓	0.886	0.741 - 1.059	✗
Latino vs White	-0.270	0.049	-5.56	<.0001 ✓	0.903	0.815 - 1.001	✗
Multiracial / Other vs White	0.246	0.096	2.56	0.011 ✓	1.513	1.226 - 1.868	✓
Health Insurance & Access							
Insured vs No Health Insurance Coverage	0.164	0.034	4.90	<.0001 ✓	1.388	1.216 - 1.585	✓
Socioeconomics							
Income Below vs At Least FPL	0.187	0.029	6.34	<.0001 ✓	1.452	1.293 - 1.631	✓

p values based on chi-square test of association.
† Includes Native Americans and Alaska Natives.

Table D11

Model F – MLE Sorted by Standard Estimate

Parameter	**Effect**	**Estimate**	**Standard Error**	***t* value**	**p value***	**Std. Est.**
Intercept	N/A	-2.355	0.044	-53.7	<.0001 ✓	
Citizenship	US-Born Citizen	0.553	0.043	13.0	<.0001 ✓	3.496
Citizenship	Non-Citizen	-0.426	0.057	-7.4	<.0001 ✓	-2.031
Race / Ethnicity	Latino	-0.270	0.049	-5.6	<.0001 ✓	-1.921
Sex	Female	0.232	0.025	9.5	<.0001 ✓	1.878
Race / Ethnicity	American Indian / Alaska Native	0.405	0.130	3.1	0.002 ✓	1.655
Race / Ethnicity	Asian	-0.290	0.081	-3.6	0.001 ✓	-1.634
Income %FPL	0-99% FPL	0.187	0.029	6.3	<.0001 ✓	1.133
Race / Ethnicity	Multiracial / Other	0.246	0.096	2.6	0.011 ✓	1.076
Covered by Health Insurance	Yes	0.164	0.034	4.9	<.0001 ✓	0.939
Race / Ethnicity	African American	0.076	0.066	1.2	0.249 ✗	0.363

* *p* values based on Pearson chi-square test of association.

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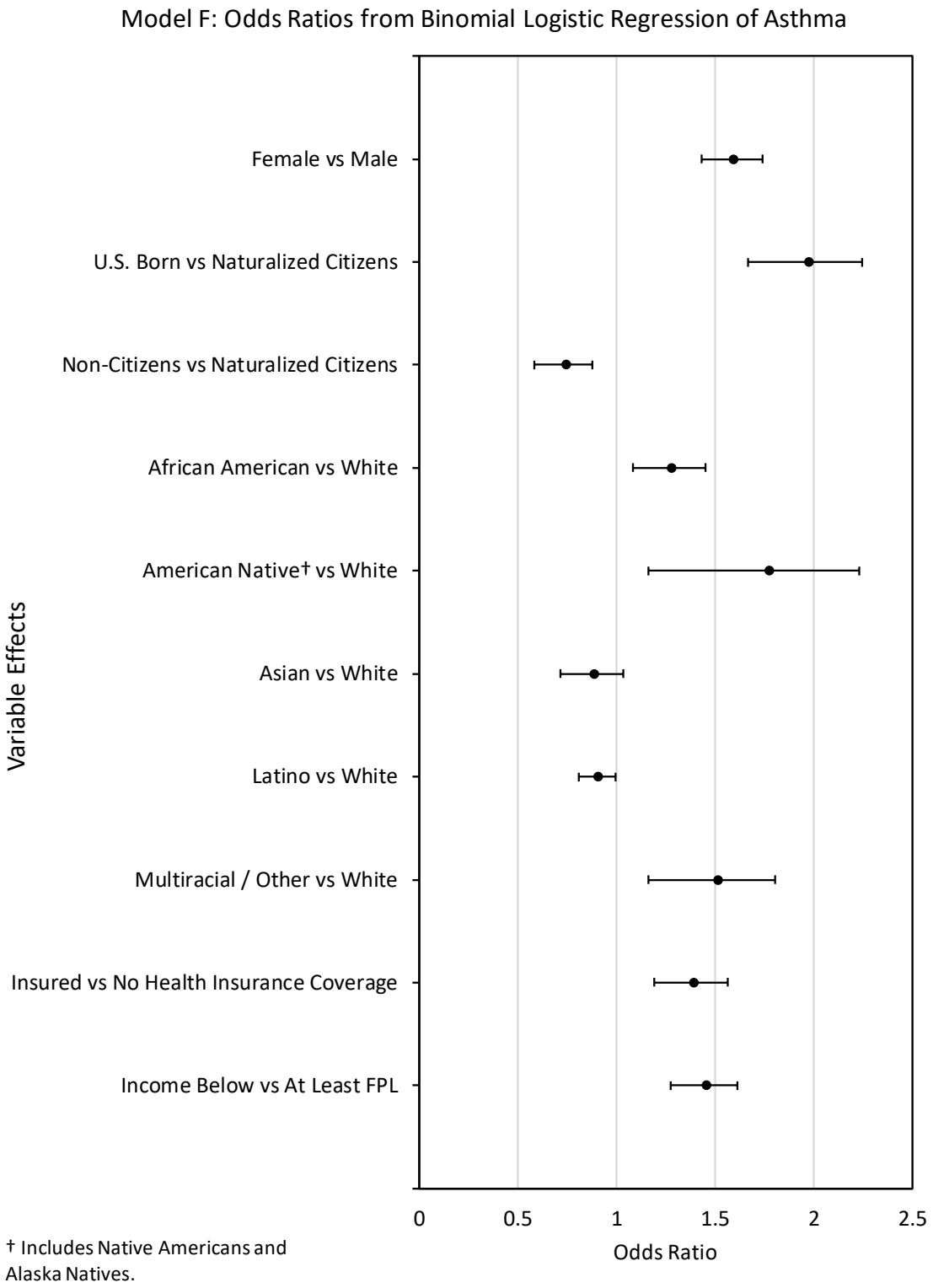

Figure D6: Model F – Odds ratios from binomial logistic regression of asthma.

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Appendix E: Binomial Severe Asthma Probability Model

E.1 Binomial Logistic Regression (Model SA)

Table E1

Model G – Binomial Logistic Regression Results

	Maximum Likelihood Estimates				ED/Urgent Care for Asthma		
Effect	**Est.**	**Std. Error**	***t* Value**	***p Value***	**Odds Ratio**	**95% Confidence Limits**	
Intercept	-2.225	0.229	-9.72	<.0001			
Demographics							
Female vs Male	0.245	0.090	2.73	0.007	1.633	1.145 - 2.329	
Young / Middle Aged vs Later Adult	-0.027	0.088	-0.30	0.761	0.948	0.670 - 1.341	
U.S. Born vs Naturalized Citizens	-0.161	0.157	-1.03	0.306	0.765	0.464 - 1.261	
Non-Citizens vs Naturalized Citizens	0.055	0.223	0.25	0.806	0.949	0.455 - 1.980	
African American vs White	0.940	0.175	5.36	<.0001	3.713	2.505 - 5.505	
American Native† vs White	-0.092	0.441	-0.21	0.835	1.323	0.456 - 3.844	
Asian vs White	-0.472	0.264	-1.79	0.076	0.905	0.483 - 1.698	
Latino vs White	0.198	0.157	1.26	0.208	1.768	1.256 - 2.488	
Multiracial / Other vs White	-0.202	0.270	-0.75	0.456	1.186	0.618 - 2.275	
Health Insurance & Access							
Insured vs No Health Insurance Cover	0.092	0.143	0.64	0.520	1.202	0.684 - 2.115	
Socioeconomics							
No Children in Household vs Reverse	-0.050	0.096	-0.53	0.600	0.904	0.620 - 1.320	
Income Below vs At Least FPL	0.260	0.075	3.49	0.001	1.682	1.253 - 2.258	

p values based on chi-square test of association.

† Includes Native Americans and Alaska Natives.

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Table E2

Model G – MLE Sorted by Standard Estimate

Parameter	Effect	Estimate	Standard Error	*t* value	p value*	Std. Est.
Intercept	N/A	-2.225	0.229	-9.7	<.0001	
Race / Ethnicity	African American	0.940	0.175	5.4	<.0001	1.559
Race / Ethnicity	Asian	-0.472	0.264	-1.8	0.076	-0.809
Sex	Female	0.245	0.090	2.7	0.007	0.618
Income %FPL	0-99% FPL	0.260	0.075	3.5	0.001	0.531
Race / Ethnicity	Latino	0.198	0.157	1.3	0.208	0.436
Race / Ethnicity	Multiracial / Other	-0.202	0.270	-0.8	0.456	-0.301
Citizenship	US-Born Citizen	-0.161	0.157	-1.0	0.306	-0.277
Covered by Health Insurance	Yes	0.092	0.143	0.6	0.520	0.140
Race / Ethnicity	American Indian / Alaska Native	-0.092	0.441	-0.2	0.835	-0.124
Children in Household	No Children in HH	-0.050	0.096	-0.5	0.600	-0.116
Citizenship	Non-Citizen	0.055	0.223	0.3	0.806	0.062
Later Adult	Young / Middle Aged	-0.027	0.088	-0.3	0.761	-0.052

* *p* values based on Pearson chi-square test of association.

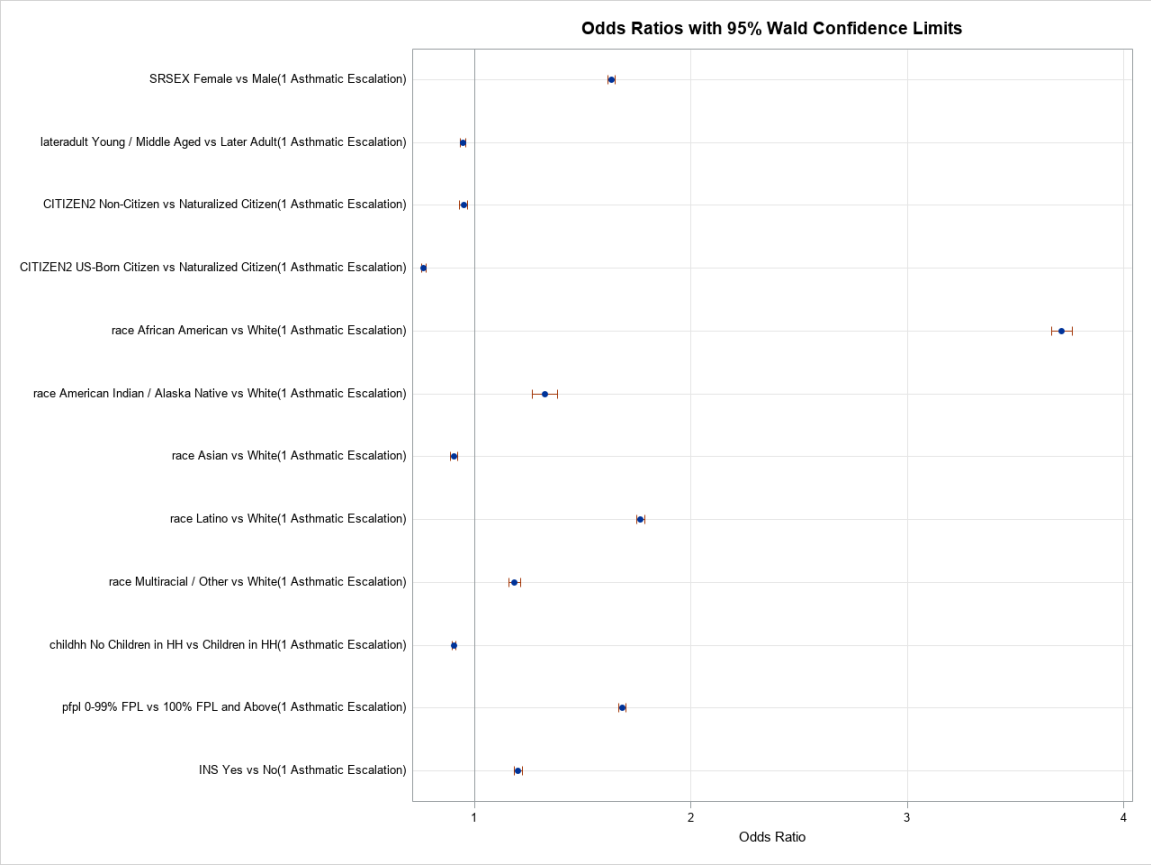

Figure E1: Model G – Unweighted odds ratios for asthmatic escalation.

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E.2 Binomial Logistic Regression (Model SB)

Table E3

Model H – Binomial Logistic Regression Results

	Maximum Likelihood Estimates				ED/Urgent Care for Asthma		
Effect	**Est.**	**Std. Error**	***t* Value**	***p Value***	**Odds Ratio**	**95% Confidence Limits**	
Intercept	-2.262	0.189	-11.95	<.0001 ✓			
Demographics							
Female vs Male	0.250	0.088	2.83	0.005 ✓	1.647	1.163 - 2.333	✓
U.S. Born vs Naturalized Citizens	-0.175	0.155	-1.13	0.260 ✗	0.754	0.458 - 1.242	✗
Non-Citizens vs Naturalized Citizens	0.068	0.222	0.31	0.760 ✗	0.962	0.460 - 2.013	✗
African American vs White	0.941	0.176	5.35	<.0001 ✓	3.714	2.503 - 5.513	✓
American Native† vs White	-0.087	0.441	-0.20	0.845 ✗	1.329	0.458 - 3.857	✗
Asian vs White	-0.482	0.264	-1.83	0.070 ✗	0.895	0.481 - 1.666	✗
Latino vs White	0.198	0.157	1.26	0.211 ✗	1.766	1.255 - 2.485	✓
Multiracial / Other vs White	-0.200	0.270	-0.74	0.461 ✗	1.187	0.620 - 2.275	✗
Health Insurance & Access							
Insured vs No Health Insurance Cover	0.100	0.137	0.73	0.469 ✗	1.220	0.710 - 2.097	✗
Socioeconomics							
Income Below vs At Least FPL	0.259	0.074	3.49	0.001 ✓	1.680	1.253 - 2.252	✓

p values based on chi-square test of association.
† Includes Native Americans and Alaska Natives.

Table E4

Model H – MLE Sorted by Standard Estimate

Parameter	**Effect**	**Estimate**	**Standard Error**	***t* value**	**p value***	**Std. Est.**
Intercept	N/A	-2.262	0.189	-12.0	<.0001 ✓	
Race / Ethnicity	African American	0.941	0.176	5.4	<.0001 ✓	1.561
Race / Ethnicity	Asian	-0.482	0.264	-1.8	0.070 ✗	-0.827
Sex	Female	0.250	0.088	2.8	0.005 ✓	0.628
Income %FPL	0-99% FPL	0.259	0.074	3.5	0.001 ✓	0.529
Race / Ethnicity	Latino	0.198	0.157	1.3	0.211 ✗	0.436
Citizenship	US-Born Citizen	-0.175	0.155	-1.1	0.260 ✗	-0.300
Race / Ethnicity	Multiracial / Other	-0.200	0.270	-0.7	0.461 ✗	-0.298
Covered by Health Insurance	Yes	0.100	0.137	0.7	0.469 ✗	0.151
Race / Ethnicity	American Indian / Alaska Native	-0.087	0.441	-0.2	0.845 ✗	-0.117
Citizenship	Non-Citizen	0.068	0.222	0.3	0.760 ✗	0.077

* *p* values based on Pearson chi-square test of association.

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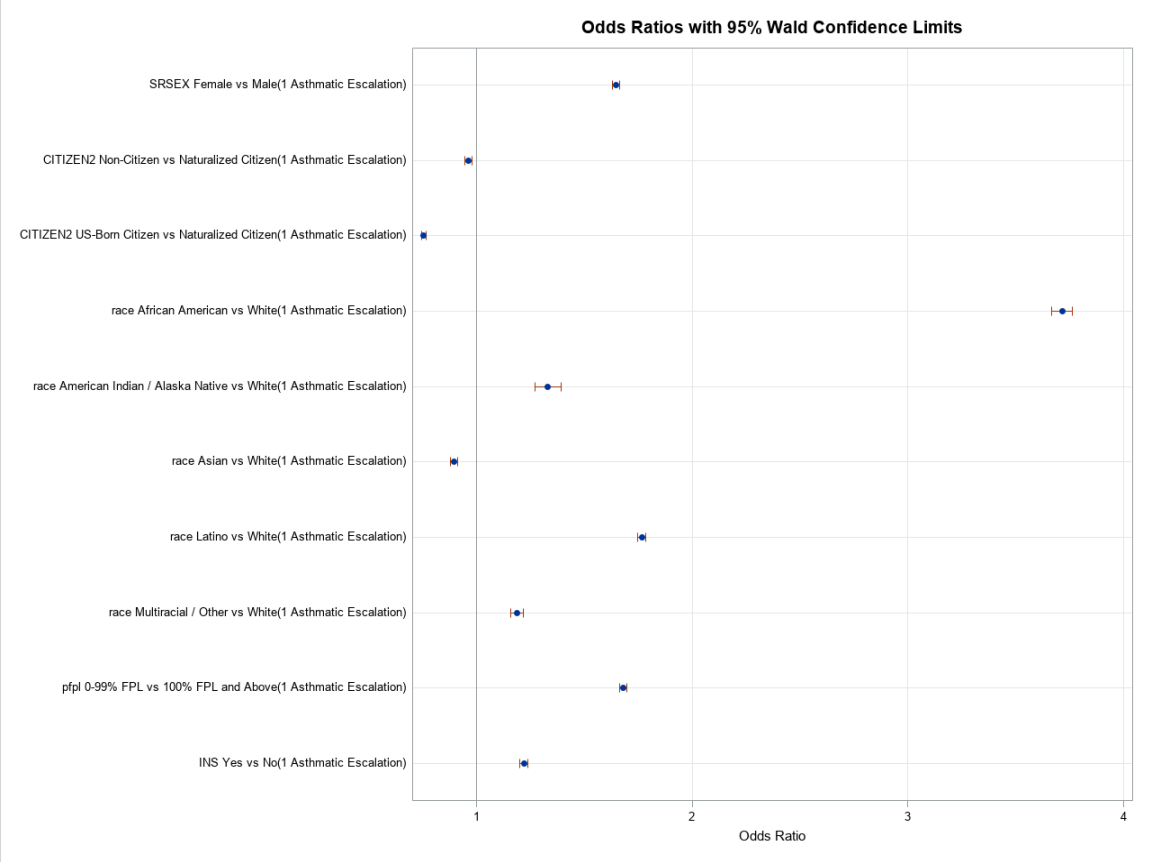

Figure E2: Model H – Unweighted odds ratios for asthmatic escalation.

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Appendix F: Comparison of Primary Regression Models

Table F

Comparison of Regression Model Performance

		Analysis of Variance				
Model [B]		**DF**	***F* Value**	***p* value** [A]	**C Statistic**	**AIC**
$A0_1$	Asthma Status (M)	250	5.7E+09	<.0001	[C]	28,151,126
$A0_2$	Asthma Status (M)	20	50.6	<.0001	[C]	28,151,126
$A0_3$	Asthma Status (M)	70	44.1	<.0001	[C]	28,151,126
AA	Current Asthmatic (B)	35	37.6	<.0001	0.658	17,838,929
AB	Non-Asthmatic (B)	15	49.7	<.0001	0.650	17,838,929
AC	Non-Asthmatic (B)	12	43.1	<.0001	0.623	17,838,929
AD	Non-Asthmatic (B)	13	40.3	<.0001	0.623	17,838,929
AE	Non-Asthmatic (B)	11	46.8	<.0001	0.617	17,838,929
AF	Non-Asthmatic (B)	10	51.2	<.0001	0.617	17,838,929
	Non-Classed Version [D]	5	86.2	<.0001	0.611	17,838,929
SA	Uncontrolled Asthma (B)	12	9.1	<.0001	0.632	1,618,959
SB	Uncontrolled Asthma (B)	10	10.9	<.0001	0.633	1,618,959
	Non-Classed Version [D]	3	17.1	<.0001	0.611	1,618,959

A. *P* values based on Pearson chi-square test of association.
B. "M" indicates a multinomial model, while "B" indicates a binomial model.
C. Models intentionally over-fit for generalized review across all factors.
D. For odds-ratio evaluation, most models were run with identified classes across all variables. Classification was limited to the dependent variable for creation of the final version in order to identify the coefficients for population modeling.

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Appendix G: Investigated PUMA Polygons

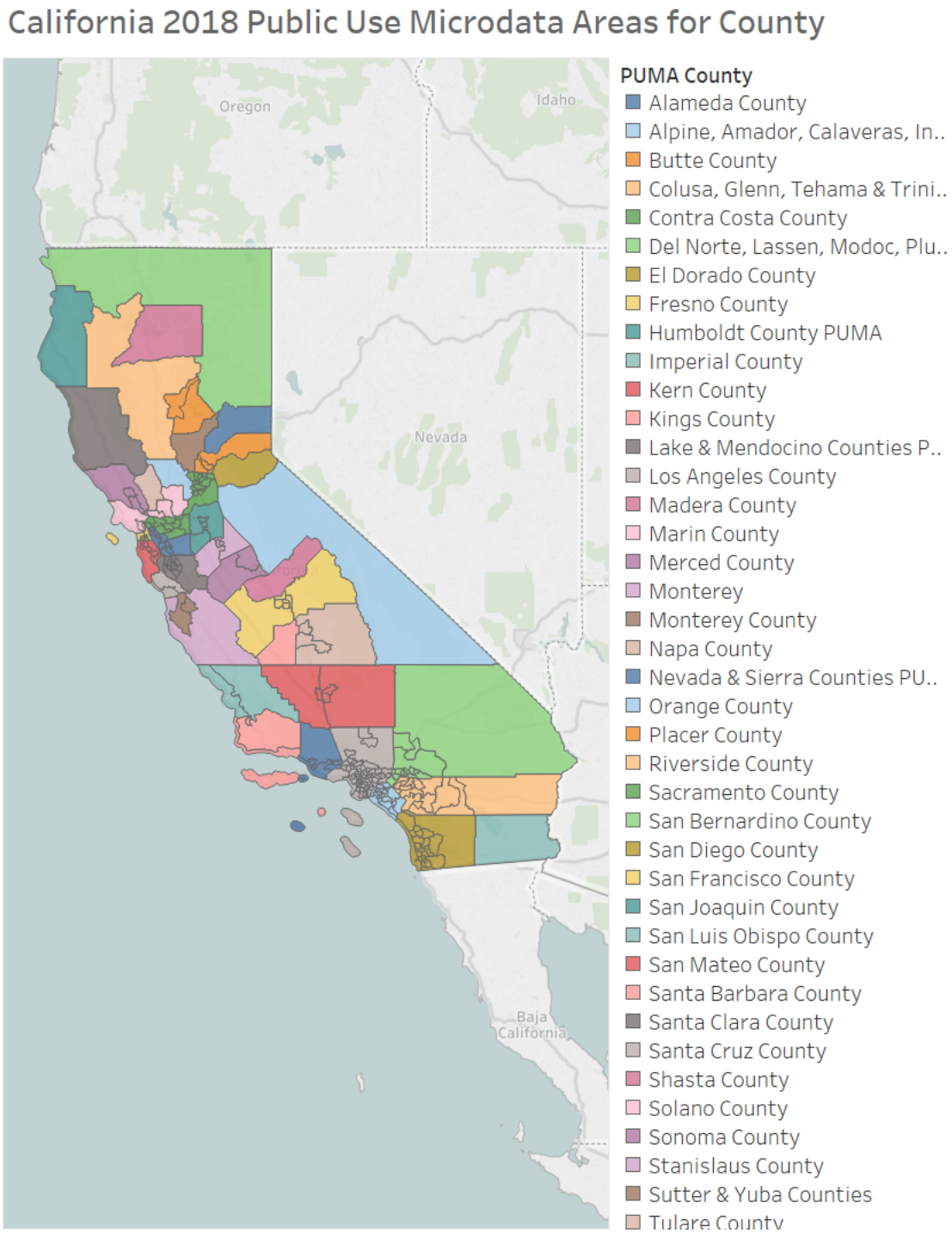

Figure G1: Map of California PUMA by County

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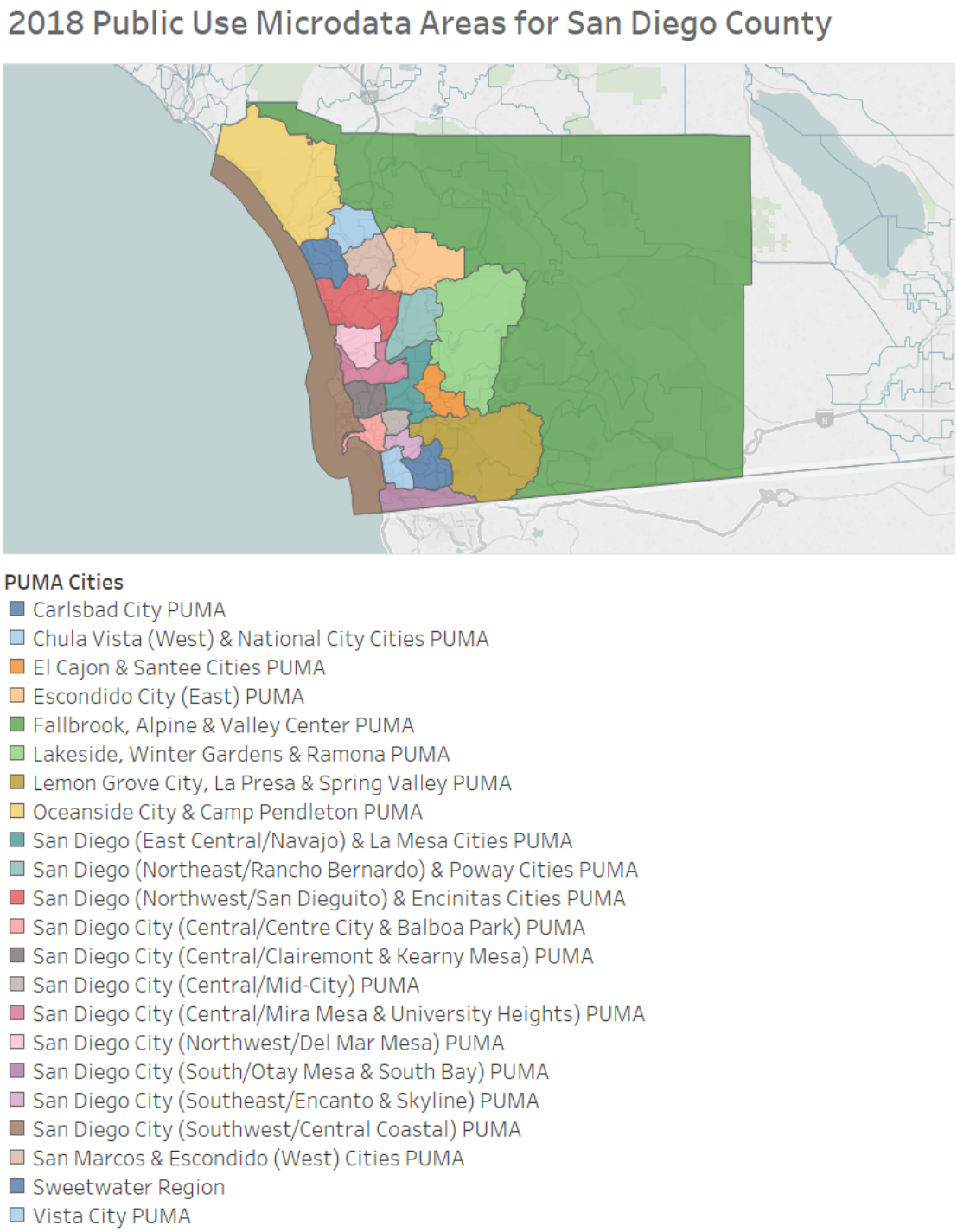

Figure G2: Map of San Diego County PUMA

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Appendix H: Tableau Dashboard

The interactive Tableau dashboard resultant from this study was published to the Tableau Public servers and is accessible via https://mcvanderbilt.com/asthma-dashboard as of the publication data. Figure H1 and Figure H2 provide static images of the predicted asthmatics and predicted severe asthmatics dashboard for California by PUMA without filtering. While every effort is intended to ensure the continuation and maintenance of this link, the nature of the internet and cloud-based services creates the possibility of system deprecation in the future. In order to mitigate the loss of this system, a Tableau Packaged Workbook has been uploaded to the GitHub© repository for this project. Information on the GitHub repository is provided in Appendix I.

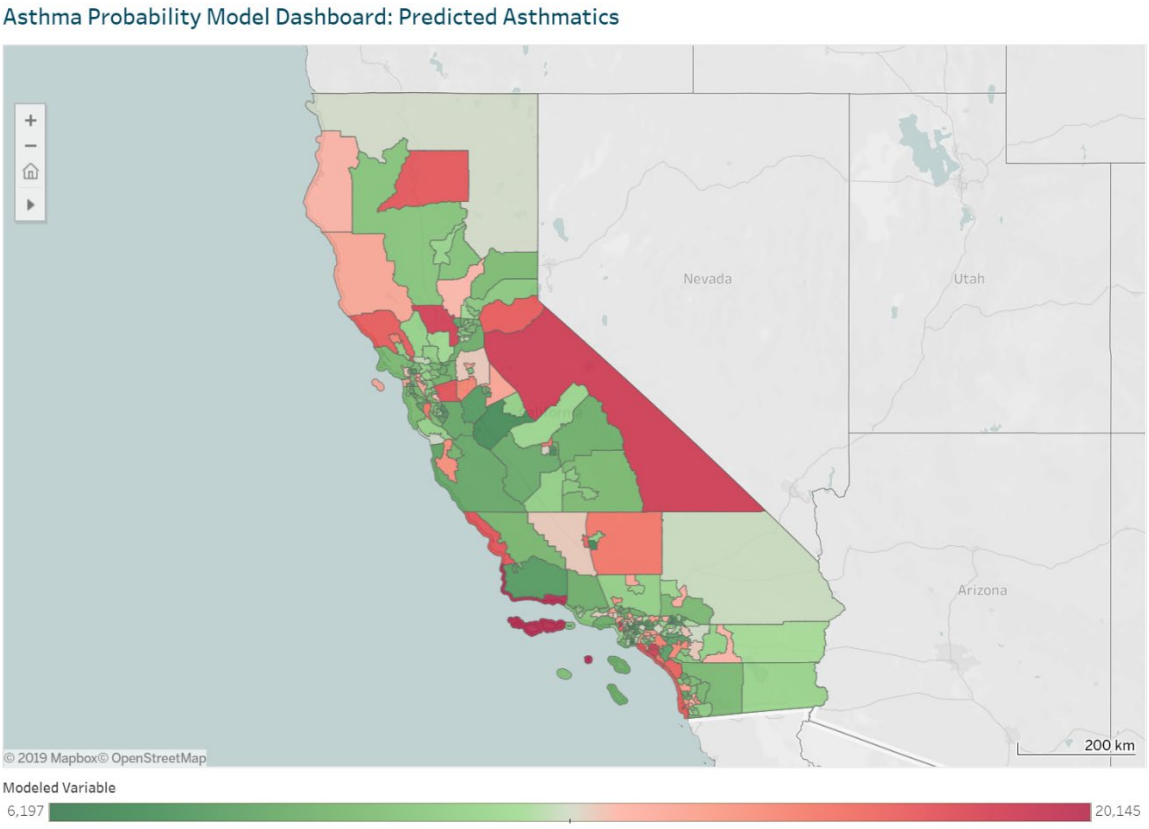

Figure H1: Tableau Dashboard – California Predicated Asthmatics by PUMA

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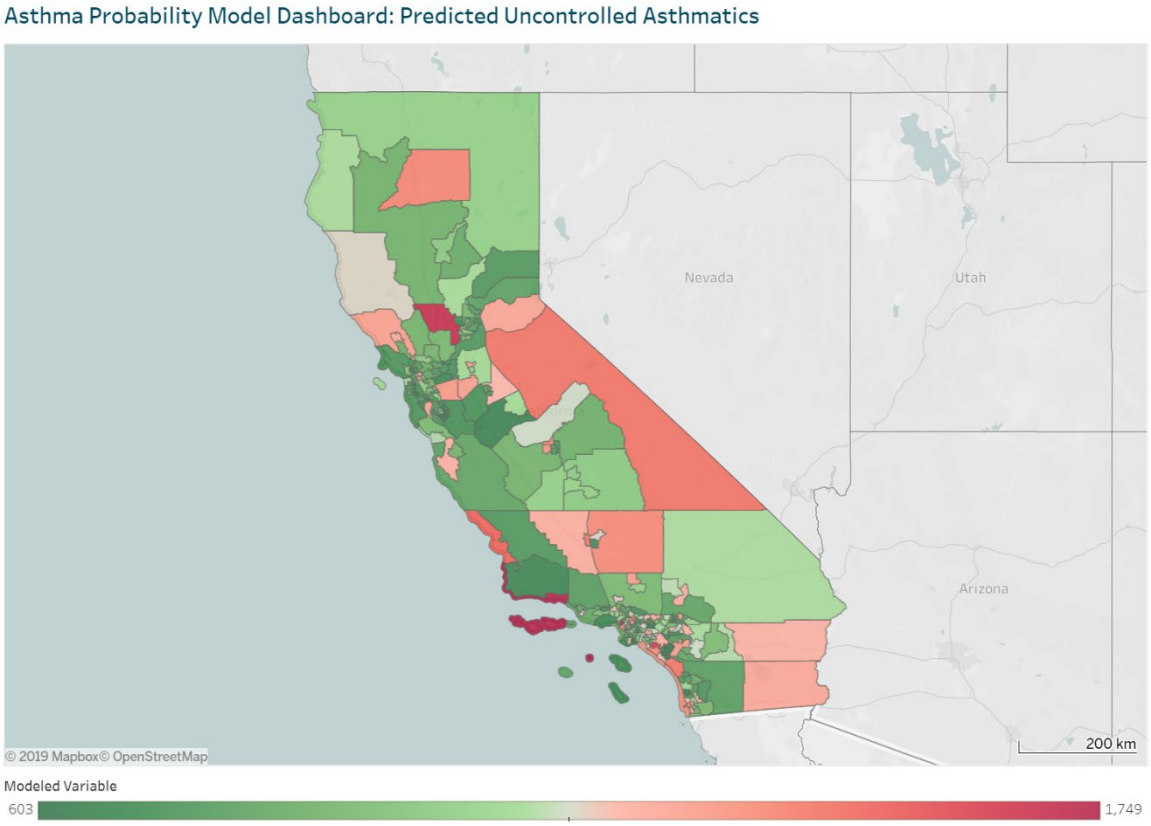

Figure H2: Tableau Dashboard – California Severe Asthmatic Predictions by PUMA

.

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Appendix I: Computer Code

All computer code utilized for this study is available online at https://mcvanderbilt.com/asthma or via direct link to the GitHub repository at https://github.com/mcvanderbilt/Preventable-Asthma-Hospitalizations. Repository code is subject to post-publication updates due to refinement and modification as future study phases progress; change logs are included through the commit history. The Version 1.0 release provides a snapshot of all code at the time of this publication.

All code is intended for execution in the order presented. File names consistent with the GitHub repository are provided as section headings.

Program: AsthmaAnalysis_RunFirst

```
/*******************************************************************************
**  Project Name    : Secondary Research of Asthma  Hospitalizations          **
**                    Masters of Science in Business Analytics Capstone Project **
**                    March / April 2019                                       **
**  Author          : Matthew C. Vanderbilt                                  **
**                    MSBA Candidate & NU Scholar, National University         **
**                    Director of Fiscal Affairs, Department of Medicine,      **
**                    UC San Diego School of Medicine                          **
**  ========================================================================== **
**  Date Created    : 30 April 2019 08:57                                    **
**  Program Name    : AsthmaAnalysis_RunFirst                                **
**  Purpose         : Loads libraries and global variables; code duplicated as **
**                    needed within each individual program, as well.          **
**  Note            : Capitalized values represent SAS commands and unadjusted **
**                    variables; lower-case variables represent study-created  **
**                    variables.                                               **
**                                                                             **
*******************************************************************************/

/* DISABLE SAS GRAPHICS */
ODS GRAPHICS OFF;

/* GLOBAL VARIABLES */
* Determine File Path for SAS EGP;
%LET localProjectPath = %SYSFUNC(SUBSTR(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH)), 1,
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH))) -
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTNAME))) ));

* Pull Secure File Path from Text
* Determine C:\MyDocuments Path to Raw Data;
FILENAME scrPath "&localProjectPath.RawDataPath.txt";
DATA _NULL_;
    LENGTH text $265;
    RETAIN text '';
    INFILE scrPath FLOWOVER DLMSTR='//' END=last;
```

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```
    INPUT;
    text = CATS(text,_INFILE_);
    IF last THEN CALL SYMPUT('rawpath',text);
RUN;
%LET localRawDataPath =
%SYSFUNC(CAT(C:\Users\,%SYSFUNC(DEQUOTE(&_CLIENTUSERID)),%SYSFUNC(TRIM(%SYSFUNC(DEQUOT
E(&rawpath)))) ));

/* MASTER LIBRARIES */
LIBNAME CHIS   "&localProjectPath.CHIS";
LIBNAME CENSUS "&localProjectPath.Census";
LIBNAME RCENSUS "&localRawDataPath.\Census_ACS5PUMS_CA";

/* Determine PDF Password */
* Pull PDF Password from Text;
FILENAME scrPath "&localProjectPath.PDFPassword.txt";
DATA _NULL_;
    LENGTH text $265;
    RETAIN text '';
    INFILE scrPath FLOWOVER DLMSTR='//' END=last;
    INPUT;
    text = CATS(text,_INFILE_);
    IF last THEN CALL SYMPUT('rawpath',text);
RUN;
%LET pdfPassword = %SYSFUNC(TRIM(%SYSFUNC(DEQUOTE(&rawpath))));

/* DEFINE GLOBAL OPTIONS */
ODS GRAPHICS OFF;
OPTIONS PDFSECURITY=HIGH;
OPTIONS PDFPASSWORD=(owner="&pdfPassword");

/* APPLY CHIS FORMATS */
OPTIONS fmtsearch=(CHIS);
OPTIONS fmtsearch=(CENSUS);

QUIT;
```

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Program: CHIS_10_LoadData

```
/*******************************************************************************
**  Project Name    : Secondary Research of Asthma  Hospitalizations          **
**                    Masters of Science in Business Analytics Capstone Project **
**                    March / April 2019                                        **
**  Author          : Matthew C. Vanderbilt                                   **
**                    MSBA Candidate & NU Scholar, National University        **
**                    Director of Fiscal Affairs, Department of Medicine,     **
**                    UC San Diego School of Medicine                         **
**  ============================================================================ **
**  Date Created    : 18 February 2019 21:23                                  **
**  Program Name    : CHIS_10_LoadData                                        **
**  Purpose         : Loads CHIS data files and creates combined file with adjusted **
**                    weightings                                              **
**  Note            : Capitalized values represent SAS commands and unadjusted **
**                    variables; lower-case variables represent study-created **
**                    variables.                                              **
**                                                                            **
*******************************************************************************/

/* DISABLE SAS GRAPHICS */
ODS GRAPHICS OFF;

/* GLOBAL VARIABLES */
* Determine File Path for SAS EGP;
%LET localProjectPath = %SYSFUNC(SUBSTR(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH)), 1,
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH))) -
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTNAME))) ));

* Pull Secure File Path from Text
* Determine C:\MyDocuments Path to Raw Data;
FILENAME scrPath "&localProjectPath.RawDataPath.txt";
DATA _NULL_;
    LENGTH text $265;
    RETAIN text '';
    INFILE scrPath FLOWOVER DLMSTR='//' END=last;
    INPUT;
    text = CATS(text,_INFILE_);
    IF last THEN CALL SYMPUT('rawpath',text);
RUN;
%LET localRawDataPath =
%SYSFUNC(CAT(C:\Users\,%SYSFUNC(DEQUOTE(&_CLIENTUSERID)),%SYSFUNC(TRIM(%SYSFUNC(DEQUOT
E(&rawpath)))) ));

/* MASTER LIBRARIES */
LIBNAME CHIS "&localProjectPath.CHIS";

/* Determine PDF Password */
* Pull PDF Password from Text;
FILENAME scrPath "&localProjectPath.PDFPassword.txt";
DATA _NULL_;
    LENGTH text $265;
    RETAIN text '';
    INFILE scrPath FLOWOVER DLMSTR='//' END=last;
    INPUT;
    text = CATS(text,_INFILE_);
    IF last THEN CALL SYMPUT('rawpath',text);
RUN;
%LET pdfPassword = %SYSFUNC(TRIM(%SYSFUNC(DEQUOTE(&rawpath))));
```

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```
/* DEFINE GLOBAL OPTIONS */
ODS GRAPHICS OFF;
OPTIONS PDFSECURITY=HIGH;
OPTIONS PDFPASSWORD=(owner="&pdfPassword");

/* APPLY CHIS FORMATS */
OPTIONS fmtsearch=(CHIS);

/* LOAD & VALIDATE 2016 DATA */
LIBNAME CHIS2016 "&localRawDataPath.\CHIS\CHIS16_adult_sas\Data\";
%INCLUDE "&localRawDataPath.\CHIS\CHIS16_adult_sas\Data\ADULT_PROC_FORMAT.SAS";
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
CONTENTS-2016.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC CONTENTS DATA=CHIS2016.adult VARNUM;
        TITLE 'PROC CONTENTS - CHIS2016.adult';
        %INCLUDE "&localRawDataPath.\CHIS\CHIS16_adult_sas\Data\ADULT_FORMAT.SAS";
        %INCLUDE "&localRawDataPath.\CHIS\CHIS16_adult_sas\Data\ADULT_LABEL.SAS";
    RUN;
ODS PDF CLOSE;

/* LOAD & VALIDATE 2015 DATA */
LIBNAME CHIS2015 "&localRawDataPath.\CHIS\CHIS15_adult_sas\Data\";
%INCLUDE "&localRawDataPath.\CHIS\CHIS15_adult_sas\Data\ADULT_PROC_FORMAT.SAS";
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
CONTENTS-2015.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC CONTENTS DATA=CHIS2015.adult VARNUM;
        TITLE 'PROC CONTENTS - CHIS2015.adult';
        %INCLUDE "&localRawDataPath.\CHIS\CHIS15_adult_sas\Data\ADULT_FORMAT.SAS";
        %INCLUDE "&localRawDataPath.\CHIS\CHIS15_adult_sas\Data\ADULT_LABEL.SAS";
    RUN;
ODS PDF CLOSE;

/* LOAD & VALIDATE 2014 DATA */
LIBNAME CHIS2014 "&localRawDataPath.\CHIS\CHIS14_adult_sas\Data\";
%INCLUDE "&localRawDataPath.\CHIS\CHIS14_adult_sas\Data\ADULT_PROC_FORMAT.SAS";
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
CONTENTS-2014.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC CONTENTS DATA=CHIS2014.adult VARNUM;
        TITLE 'PROC CONTENTS - CHIS2014.adult';
        %INCLUDE "&localRawDataPath.\CHIS\CHIS14_adult_sas\Data\ADULT_FORMAT.SAS";
        %INCLUDE "&localRawDataPath.\CHIS\CHIS14_adult_sas\Data\ADULT_LABEL.SAS";
    RUN;
ODS PDF CLOSE;

/* LOAD & VALIDATE 2013 DATA */
LIBNAME CHIS2013 "&localRawDataPath.\CHIS\CHIS13_adult_sas\Data\";
%INCLUDE "&localRawDataPath.\CHIS\CHIS13_adult_sas\Data\ADULT_PROC_FORMAT.SAS";
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
CONTENTS-2013.pdf"
```

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```
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC CONTENTS DATA=CHIS2013.adult VARNUM;
        TITLE 'PROC CONTENTS - CHIS2013.adult';
        %INCLUDE "&localRawDataPath.\CHIS\CHIS13_adult_sas\Data\ADULT_FORMAT.SAS";
        %INCLUDE "&localRawDataPath.\CHIS\CHIS13_adult_sas\Data\ADULT_LABEL.SAS";
    RUN;
ODS PDF CLOSE;

/* LOAD & VALIDATE 2012 DATA */
LIBNAME CHIS2012 "&localRawDataPath.\CHIS\CHIS12_adult_sas\Data\";
%INCLUDE "&localRawDataPath.\CHIS\CHIS12_adult_sas\Data\ADULT_PROC_FORMAT.SAS";
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
CONTENTS-2012.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC CONTENTS DATA=CHIS2012.adult VARNUM;
        TITLE 'PROC CONTENTS - CHIS2012.adult';
        %INCLUDE "&localRawDataPath.\CHIS\CHIS12_adult_sas\Data\ADULT_FORMAT.SAS";
        %INCLUDE "&localRawDataPath.\CHIS\CHIS12_adult_sas\Data\ADULT_LABEL.SAS";
    RUN;
ODS PDF CLOSE;

/* LOAD & VALIDATE 2011 DATA */
LIBNAME CHIS2011 "&localRawDataPath.\CHIS\CHIS11_adult_sas\Data\";
%INCLUDE "&localRawDataPath.\CHIS\CHIS11_adult_sas\Data\ADULT_PROC_FORMAT.SAS";
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
CONTENTS-2011.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC CONTENTS DATA=CHIS2011.adult VARNUM;
        TITLE 'PROC CONTENTS - CHIS2011.adult';
        %INCLUDE "&localRawDataPath.\CHIS\CHIS11_adult_sas\Data\ADULT_FORMAT.SAS";
        %INCLUDE "&localRawDataPath.\CHIS\CHIS11_adult_sas\Data\ADULT_LABEL.SAS";
    RUN;
ODS PDF CLOSE;

/* COMBINE & REWEIGHT DATA TALBES */
DATA CHIS.CHIS_DATA_RAW;
    SET CHIS2011.adult (in=in11)
        CHIS2012.adult (in=in12)
        CHIS2013.adult (in=in13)
        CHIS2014.adult (in=in14)
        CHIS2015.adult (in=in15)
        CHIS2016.adult (in=in16);

    IF      in11 THEN year=2011;
    ELSE iF in12 THEN year=2012;
    ELSE IF in13 THEN year=2013;
    ELSE IF in14 THEN year=2014;
    ELSE IF in15 THEN year=2015;
    ELSE IF in16 THEN year=2016;

    ***Create new weight variables;
```

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```
    fnwgt0 = rakedw0/6;

    ARRAY a_origwgts[80] rakedw1-rakedw80;
    ARRAY a_newwgts[160] fnwgt1-fnwgt160;

    DO i = 1 to 80;
            IF year=2016 THEN DO;
                a_newwgts[i]    = a_origwgts[i]/6;
                a_newwgts[i+80] = rakedw0/6;
            END;
            ELSE IF year<2016 then do;
              a_newwgts[i]    = rakedw0/6;
              a_newwgts[i+80] = a_origwgts[i]/6;
            END;
      END;
RUN;

/* CHREATE MUTLI-USE CHIS FORMATS */
PROC FORMAT LIBRARY=CHIS;
    VALUE fCHISBool     -9    = 'Not Ascertained'
                        -8    = 'Dont Know'
                        -7    = 'Refused'
                        -2    = 'Proxy Skipped'
                        -1    = 'Inapplicable'
                         1    = 'Yes'
                         2    = 'No'
                        ;

    VALUE fCHIS4Lichert -9    = 'Not Ascertained'
                        -8    = 'Dont Know'
                        -7    = 'Refused'
                        -2    = 'Proxy Skipped'
                        -1    = 'Inapplicable'
                         1    = 'Strongly Agree'
                         2    = 'Agree'
                         3    = 'Disagree'
                         4    = 'Strongly Disagree'
                        ;

    VALUE fCHIS4NvrAlys  -9    = 'Not Ascertained'
                        -8    = 'Dont Know'
                        -7    = 'Refused'
                        -2    = 'Proxy Skipped'
                        -1    = 'Inapplicable'
                         1    = 'Never'
                         2    = 'Sometimes'
                         3    = 'Usually'
                         4    = 'Always'
                        ;

    VALUE fCHIS4LichTim -9    = 'Not Ascertained'
                        -8    = 'Dont Know'
                        -7    = 'Refused'
                        -2    = 'Proxy Skipped'
                        -1    = 'Inapplicable'
                         1    = 'All of the Time'
                         2    = 'Most of the Time'
                         3    = 'Some of the Time'
                         4    = 'None of the Time'
                        ;
```

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```
VALUE fCHIS5LichTim -9    = 'Not Ascertained'
                    -8    = 'Dont Know'
                    -7    = 'Refused'
                    -2    = 'Proxy Skipped'
                    -1    = 'Inapplicable'
                     1    = 'All of the Time'
                     2    = 'Most of the Time'
                     3    = 'Some of the Time'
                     4    = 'A Little of the Time'
                     5    = 'Not at All'
                    ;

VALUE fCHIS3Truth   -9    = 'Not Ascertained'
                    -8    = 'Dont Know'
                    -7    = 'Refused'
                    -2    = 'Proxy Skipped'
                    -1    = 'Inapplicable'
                     1    = 'Often True'
                     2    = 'Sometimes True'
                     3    = 'Never True'
                    ;

VALUE fCHIS4Amt     -9    = 'Not Ascertained'
                    -8    = 'Dont Know'
                    -7    = 'Refused'
                    -2    = 'Proxy Skipped'
                    -1    = 'Inapplicable'
                     1    = 'A Lot'
                     2    = 'Some'
                     3    = 'Not at All'
                     4    = 'Does Not Work'
                    ;

VALUE fCHIS3Amt     -9    = 'Not Ascertained'
                    -8    = 'Dont Know'
                    -7    = 'Refused'
                    -2    = 'Proxy Skipped'
                    -1    = 'Inapplicable'
                     1    = 'A Lot'
                     2    = 'Some'
                     3    = 'Not at All'
                    ;

VALUE fCHIS3Severit -9    = 'Not Ascertained'
                    -8    = 'Dont Know'
                    -7    = 'Refused'
                    -2    = 'Proxy Skipped'
                    -1    = 'Inapplicable'
                     0    = 'None'
                     1    = 'Moderate'
                     2    = 'Severe'
                    ;

VALUE fCHIS3Diffic  -9    = 'Not Ascertained'
                    -8    = 'Dont Know'
                    -7    = 'Refused'
                    -2    = 'Proxy Skipped'
                    -1    = 'Inapplicable'
                     1    = 'Very Difficult'
                     2    = 'Somewhat Difficult'
                     3    = 'Not Too Difficult / Not at All Difficult'
```

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```
                        ;

    VALUE fCHIS3Confid  -9    = 'Not Ascertained'
                        -8    = 'Dont Know'
                        -7    = 'Refused'
                        -2    = 'Proxy Skipped'
                        -1    = 'Inapplicable'
                         1    = 'Very Confident'
                         2    = 'Somewhat Confident'
                         3    = 'Not Too Confident / Not at All Confident'
                        ;
RUN;

/* FORMAT CHIS SECTION A: DEMOGRAPHIC INFORMATION FORMATS */
PROC FORMAT LIBRARY=CHIS;
    VALUE fage          -1    = 'NA'
                         18   = '18-25'
                         26   = '26-29'
                         30   = '30-34'
                         35   = '35-39'
                         40   = '40-44'
                         45   = '45-49'
                         50   = '50-54'
                         55   = '55-59'
                         60   = '60-64'
                         65   = '65-69'
                         70   = '70-74'
                         75   = '75-79'
                         80   = '80-84'
                         85   = '85+'
                        ;

    VALUE fbnrysex       1    = 'Male'
                         2    = 'Female'
                        ;

    VALUE flatintp      -1    = 'Non-Latino'
                         1    = 'Mexican'
                         2    = 'Other'
                        ;

    VALUE fombsrr_p      1    = 'Hispanic'
                         2    = 'White, Non-Hispanic'
                         3    = 'African American'
                         4    = 'American Indian / Alaska Native'
                         5    = 'Asian'
                         6    = 'Other / Multiracial'
                        ;

    VALUE fracecn_p      1    = 'Other'
                         2    = 'American Indian / Alaska Native'
                         3    = 'Asian'
                         4    = 'African American'
                         5    = 'White'
                         7    = 'Multiracial'
                        ;

    VALUE fracedf_p      1    = 'Latino'
                         2    = 'Other'
                         3    = 'American Indian / Alaska Native'
                         4    = 'Asian'
```

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```
                        5    = 'African American'
                        6    = 'White'
                        8    = 'Multiracial'
                       ;

    VALUE fracehp_p      1    = 'Latino'
                        2    = 'Other / Mutliracial'
                        3    = 'American Indian / Alaska Native'
                        4    = 'Asian'
                        5    = 'African American'
                        6    = 'White'
                       ;

    VALUE faac          -9    = 'Not Ascertained'
                       -8    = 'Dont Know'
                       -7    = 'Refused'
                       -1    = 'Inapplicable'
                        1    = 'Yes'
                        2    = 'No'
                       ;

    VALUE fmarit         1    = 'Married'
                        2    = 'Other'
                        3    = 'Never Married'
                       ;

    VALUE fmarit_adlt   -1    = 'Inapplicable'
                        1    = 'Married'
                        2    = 'Living with Partner'
                        3    = 'Widowed'
                        4    = 'Divorced/Separated'
                        5    = 'Never Married'
                       ;

    VALUE fmarit_scnd    1    = 'Married'
                        2    = 'Living w/ Partner'
                        3    = 'Wid/Sep/Div'
                        4    = 'Never Married'
                       ;

RUN;
DATA CHIS.CHIS_DATA_RAW;
    SET CHIS.CHIS_DATA_RAW;
    FORMAT    srage_p1      fage.;
    FORMAT    srsex         fbnrysex.;
    FORMAT    latin2tp      flatintp.;
    FORMAT    sras          fCHISBool.;
    FORMAT    sraso         fCHISBool.;
    FORMAT    srch          fCHISBool.;
    FORMAT    srkr          fCHISBool.;
    FORMAT    srjp          fCHISBool.;
    FORMAT    srph          fCHISBool.;
    FORMAT    srvt          fCHISBool.;
    FORMAT    srh           fCHISBool.;
    FORMAT    srw           fCHISBool.;
    FORMAT    sraa          fCHISBool.;
    FORMAT    srai          fCHISBool.;
    FORMAT    sro           fCHISBool.;
    FORMAT    ombsrr_p1     fombsrr_p.;
    FORMAT    racecn_p1     fracecn_p.;
    FORMAT    racedf_p1     fracedf_p.;
```

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```
    FORMAT    racehp2_p1    fracehp_p.;
    FORMAT    aa5c          faac.;
    FORMAT    marit         fmarit.;
    FORMAT    marit_45      fmarit_adlt.;
    FORMAT    marit2        fmarit_scnd.;
RUN;

/* FORMAT CHIS SECTION B: GENERAL HEALTH CONDITION */
PROC FORMAT LIBRARY=CHIS;
    VALUE fab            1    = 'Excellent'
                         2    = 'Very Good'
                         3    = 'Good'
                         4    = 'Fair'
                         5    = 'Poor'
                        ;

    VALUE fab19z        -1    = 'Inapplicable'
                         1    = 'Not at All'
                         2    = 'Less than Every Month'
                         3    = 'Every Month'
                         4    = 'Every Week'
                         5    = 'Every Day'
                        ;

    VALUE fastcur        1    = 'Current Asthma'
                         2    = 'No Current Asthma'
                        ;

    VALUE fabadlt_p     -1    = 'Inapplicable'
                         0    = '0 Days'
                         1    = '1-2 Days'
                         3    = '3-4 Days'
                         5    = '5+ Days'
                        ;

    VALUE fabdiabet      1    = 'Yes'
                         2    = 'No'
                         3    = 'Borderline/Pre-Diabetes'
                        ;

    VALUE fdiabage      -1    = 'Inapplicable'
                         1    = '<= 18'
                         2    = '19-29'
                         3    = '30-39'
                         4    = '40-49'
                         5    = '50-59'
                         6    = '60-69'
                         7    = '70-79'
                         8    = '>= 80'
                        ;

    VALUE fdiabtype     -1    = 'Inapplicable'
                         1    = 'Type I'
                         2    = 'Type II'
                        ;

    VALUE fdiabfeet     -1    = 'Inapplicable'
                         0    = '0 Times'
                         1    = '1 Time'
                         2    = '2 Times'
                         3    = '3 Times'
```

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```
                        4     = '4 Times'
                        5     = '5+ Times'
                       ;

    VALUE fdiabdilat   -1     = 'Inapplicable'
                        1     = 'Within the Past Month'
                        2     = '1 to 12 Months Ago'
                        3     = '1 to 2 Years Ago'
                        4     = '2 or More Years Ago'
                        5     = 'Never'
                       ;

    VALUE fdiabctlmgt  -2     = 'Proxy Skipped'
                       -1     = 'Inapplicable'
                        1     = 'Very Confident'
                        2     = 'Somewhat Confident'
                        3     = 'Not Too Confident / Not at All Confident'
                       ;

    VALUE fdiabpreg    -1     = 'Inapplicable'
                        1     = 'Yes'
                        2     = 'No'
                        3     = 'Borderline Gestational Diabetes'
                       ;

    VALUE fhighbp       1     = 'Yes'
                        2     = 'No'
                        3     = 'Borderline Hypertension'
                       ;
RUN;
DATA CHIS.CHIS_DATA_RAW;
    SET CHIS.CHIS_DATA_RAW;
    FORMAT    ab1       fab.;
    FORMAT    ab17      fCHISBool.;
    FORMAT    ab40      fCHISBool.;
    FORMAT    ab41      fCHISBool.;
    FORMAT    ab19      fab19z.;
    FORMAT    astcur    fastcur.;
    FORMAT    ah13a     fCHISBool.;
    FORMAT    asts      fCHISBool.;
    FORMAT    astyr     fCHISBool.;
    FORMAT    ab18      fCHISBool.;
    FORMAT    ab42_p1   fabadlt_p.;
    FORMAT    ab43      fCHISBool.;
    FORMAT    ab98      fCHISBool.;
    FORMAT    ab108_p1  fCHIS3Confid.;
    FORMAT    ab22      fabdiabet.;
    FORMAT    ab99      fCHISBool.;
    FORMAT    diabetes  fCHISBool.;
    FORMAT    prediab   fCHISBool.;
    FORMAT    ab23_p1   fdiabage.;
    FORMAT    ab51_p1   fdiabtype.;
    FORMAT    ab24      fCHISBool.;
    FORMAT    ab25      fCHISBool.;
    FORMAT    ab28_p1   fdiabfeet.;
    FORMAT    ab63      fdiabdilat.;
    FORMAT    ab112     fCHISBool.;
    FORMAT    ab114_p1  fdiabctlmgt.;
    FORMAT    ab81      fdiabpreg.;
    FORMAT    ab29      fhighbp.;
    FORMAT    ab30      fCHISBool.;
```

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```
    FORMAT    insmc     fCHISBool.;
    FORMAT    insmd     fCHISBool.;
    FORMAT    ab34      fCHISBool.;
    FORMAT    ab52      fCHISBool.;
    FORMAT    ab115     fCHISBool.;
    FORMAT    ab116_p1  fCHISBool.;
    FORMAT    ab117     fCHISBool.;
    FORMAT    ab118     fCHISBool.;
RUN;

/* FORMAT CHIS SECTION C: HEALTH BEHAVIOURS */
PROC FORMAT LIBRARY=CHIS;
    VALUE fad37w         1    = 'Yes'
                         2    = 'No'
                         3    = 'Unable to Walk'
                        ;

    VALUE faesoda_p1z    0    = '0 Times'
                         1    = '1 Time'
                         2    = '2-3 Times'
                         3    = '4-6 Times'
                         4    = '7-13 Times'
                         5    = '14-20 Times'
                         6    = '21+ Times'
                        ;

    VALUE fac42z         1    = 'Never'
                         2    = 'Sometimes'
                         3    = 'Usually'
                         4    = 'Always'
                         5    = 'Doesnt Eat Fruits & Vegetables'
                         6    = 'Doesnt Shop for Fruits & Vegetables'
                         7    = 'Doesnt Shop in His/Her Neighborhood'
                        ;

    VALUE fac42_p        1    = 'Never'
                         2    = 'Sometimes'
                         3    = 'Usually'
                         4    = 'Always'
                         5    = 'Does Eat/Shop for Fruits & Vegetables'
                        ;

    VALUE fac44z        -1    = 'Inapplicable'
                         1    = 'Never'
                         2    = 'Sometimes'
                         3    = 'Usually'
                         4    = 'Always'
                        ;

    VALUE fae15a        -1    = 'Inapplicable'
                         1    = 'Every Day'
                         2    = 'Some Days'
                         3    = 'Not at All'
                        ;

    VALUE fad32_p1z     -1    = 'Inapplicable'
                         0    = '0 Cigarettes'
                         1    = '1-5 Cigarettes'
                         6    = '6-10 Cigarettes'
                         11   = '11-15 Cigarettes'
                         16   = '16+ Cigarettes'
```

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```
                        ;

    VALUE fae16_p1z     -1    = 'Inapplicable'
                         0    = '0 Cigarettes'
                         1    = '1 Cigarette'
                         2    = '2 Cigarettes'
                         3    = '3 Cigarettes'
                         4    = '4 Cigarettes'
                         5    = '5 Cigarettes'
                         6    = '6-10 Cigarettes'
                         11   = '11+ Cigarettes'
                        ;

    VALUE fsmkcur        1    = 'Current Smoker'
                         2    = 'Not Current Smoker'
                        ;

    VALUE fsmoking       1    = 'Currently Smokes'
                         2    = 'Quit Smoking'
                         3    = 'Never Smoked Regularly'
                        ;

    VALUE fnumcig        1    = 'None'
                         2    = '<=1 Cigarette'
                         3    = '2-5 Cigarettes'
                         4    = '6-10 Cigarettes'
                         5    = '11-19 Cigarettes'
                         6    = '20 or More'
                        ;
RUN;
DATA CHIS.CHIS_DATA_RAW;
    SET CHIS.CHIS_DATA_RAW;
    FORMAT    ad37w       fad37w.;
    FORMAT    ad40w       fCHISBool.;
    FORMAT    aesoda_p1   faesoda_p1z.;
    FORMAT    ac42        fac42z.;
    FORMAT    ac42_p      fac42_p.;
    FORMAT    ac44        fac44z.;
    FORMAT    ae15        fCHISBool.;
    FORMAT    ae15a       fae15a.;
    FORMAT    ad32_p1     fad32_p1z.;
    FORMAT    ae16_p1     fae16_p1z.;
    FORMAT    smkcur      fsmkcur.;
    FORMAT    smoking     fsmoking.;
    FORMAT    numcig      fnumcig.;
    FORMAT    ac49        fCHISBool.;
    FORMAT    ac50        fCHISBool.;
RUN;

/* FORMAT CHIS SECTION D: GENERAL HEALTH, DISABILITY & SEXUAL HEALTH */
PROC FORMAT LIBRARY=CHIS;
    VALUE    frbmi       1    = 'Underweight 0-18.49'
                         2    = 'Normal 18.5-24.99'
                         3    = 'Overweight 25.0-29.99'
                         4    = 'Obese 30.0+'
                        ;
RUN;

DATA CHIS.CHIS_DATA_RAW;
    SET CHIS.CHIS_DATA_RAW;
    FORMAT    rbmi      frbmi.;
```

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```
    FORMAT    ovrwt     fCHISBool.;
    FORMAT    ad50      fCHISBool.;
RUN;

/* CHIS SECTION F: MENTAL HEALTH */
PROC FORMAT LIBRARY=CHIS;
    VALUE faj1z         -2    = 'Proxy Skipped'
                        -1    = 'Inapplicable'
                         1    = 'Yes'
                         2    = 'No'
                         3    = 'No Insurance'
                        ;
RUN;
DATA CHIS.CHIS_DATA_RAW;
    SET CHIS.CHIS_DATA_RAW;

    FORMAT    aj29       fCHIS5LichTim.;
    FORMAT    aj30       fCHIS5LichTim.;
    FORMAT    aj31       fCHIS5LichTim.;
    FORMAT    aj32       fCHIS5LichTim.;
    FORMAT    aj33       fCHIS5LichTim.;
    FORMAT    aj34       fCHIS5LichTim.;
    FORMAT    dstrs30    fCHISBool.;
    FORMAT    af62       fCHISBool.;
    FORMAT    af63       fCHIS5LichTim.;
    FORMAT    af64       fCHIS5LichTim.;
    FORMAT    af65       fCHIS5LichTim.;
    FORMAT    af66       fCHIS5LichTim.;
    FORMAT    af67       fCHIS5LichTim.;
    FORMAT    af68       fCHIS5LichTim.;
    FORMAT    af69b      fCHIS4Amt.;
    FORMAT    af70b      fCHIS3Amt.;
    FORMAT    af71b      fCHIS3Amt.;
    FORMAT    af72b      fCHIS3Amt.;
    FORMAT    dstrs12    fCHISBool.;
    FORMAT    chores2    fCHIS3Severit.;
    FORMAT    social2    fCHIS3Severit.;
    FORMAT    work2      fCHIS3Severit.;
    FORMAT    family2    fCHIS3Severit.;
    FORMAT    aj1        faj1z.;
RUN;

/* FORMAT CHIS SECTION G: DEMOGRAPHIC INFORMATION / CHILD CARE */
PROC FORMAT LIBRARY=CHIS;

    VALUE fah3nativity  -1    = 'Inapplicable'
                         1    = 'Born in U.S.'
                         2    = 'Born Outside U.S.'
                        ;

    VALUE flnghm_p1z    1    = 'English'
                        2    = 'Spanish'
                        3    = 'Chinese'
                        4    = 'Vietnamese'
                        5    = 'Korean'
                        6    = 'Other One Language Only'
                        8    = 'English & Spanish'
                        9    = 'English & Chinese'
                        10   = 'English & European Language'
                        11   = 'English & Another Asian Language'
                        12   = 'English & One Other Language'
```

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```
                    13   = 'Other Languages (2+)'
                    ;

VALUE fah37z        -9    = 'Not Ascertained'
                    -8    = 'Dont Know'
                    -7    = 'Refused'
                    -2    = 'Proxy Skipped'
                    -1    = 'Inapplicable'
                     1    = 'Very Well'
                     2    = 'Well'
                     3    = 'Not Well'
                     4    = 'Not at All'
                    ;

VALUE fspk_eng       1    = 'Speak Only English'
                     2    = 'Very Well / Well'
                     3    = 'Not Well / Not at All'
                    ;

VALUE fcitizen       1    = 'US-Born Citizen'
                     2    = 'Naturalized Citizen'
                     3    = 'Non-Citizen'
                    ;

VALUE fyrus_p1z     -1    = 'Inapplicable'
                     1    = '<5 Years'
                     3    = '5-9 Years'
                     4    = '10-14 Years'
                     5    = '15-19 Years'
                    ;

VALUE fpctlf_p       1    = '0-20'
                     2    = '21-40'
                     3    = '41-60'
                     4    = '61-80'
                     5    = '81+'
                    ;

VALUE fahedc_p1z     1    = 'None / Primary School'
                     2    = 'High School, Partial'
                     3    = 'High School, Graduate'
                     4    = 'College, Partial'
                     5    = 'Vocational School'
                     6    = 'Associates Degree'
                     7    = 'Bachelors Degree'
                     8    = 'Masters Degree'
                     9    = 'Doctorate Degree'
                    ;

VALUE fag10z        -1    = 'Inapplicable'
                     1    = 'Yes'
                     2    = 'No'
                     3    = 'Looking for Work'
                    ;

VALUE fwrkst_p1z     1    = 'Full-Time Employment (21+ hrs/week)'
                     2    = 'Part-Time Employment (0-20 hrs/week)'
                     3    = 'Other Employed'
                     4    = 'Unemployed, Looking for Work'
                     5    = 'Unemployed, Not Looking for Work'
                    ;
```

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```
    VALUE f280          -9    = 'Not Ascertained'
                        -8    = 'Dont Know'
                        -7    = 'Refused'
                        -2    = 'Proxy Skipped'
                        -1    = 'Inapplicable'
                         1    = '<0.5 Years'
                         2    = '0.5 - 2 Years'
                         3    = '2 - 4 Years'
                         4    = '4 - 20 Years'
                         5    = '20+ Years'
                        ;

    VALUE ffamtyp_p      1    = 'Single Adult, 21+'
                         2    = 'Single Young Adult, 19-20'
                         3    = 'Married w/o Kids'
                         4    = 'Married w/ Kids'
                         5    = 'Single w/ Kids'
                         6    = 'Single 18 Years Old'
                        ;

RUN;
DATA CHIS.CHIS_DATA_RAW;
    SET CHIS.CHIS_DATA_RAW;
    FORMAT    ah33new   fah3nativity.;
    FORMAT    ah34new   fah3nativity.;
    FORMAT    ah35new   fah3nativity.;
    FORMAT    lnghm_p1  flnghm_p1z.;
    FORMAT    ah37      fah37z.;
    FORMAT    spk_eng   fspk_eng.;
    FORMAT    citizen2  fcitizen.;
    FORMAT    yrus_p1   fyrus_p1z.;
    FORMAT    pctlf_p   fpctlf_p.;
    FORMAT    ah43a     fCHISBool.;
    FORMAT    ahedc_p1  fahedc_p1z.;
    FORMAT    ag10      fag10z.;
    FORMAT    wrkst_p1  fwrkst_p1z.;
    FORMAT    ag22      fCHISBool.;
    FORMAT    served    fserved.;
    FORMAT    famtyp_p  ffamtyp_p.;
RUN;

/* FORMAT CHIS SECTION H: HEALTH INSURANCE */
PROC FORMAT LIBRARY=CHIS;
    VALUE    fai15z     -1    = 'Inapplicable'
                         1    = 'Covered by Another Plan'
                         2    = 'Too Expensive'
                         3    = 'Didnt Like Plan Offered'
                         4    = 'Dont Need or Believe in Health Insurance'
                         5    = 'In Process'
                         6    = 'Didnt Take Up - Other'
                         7    = 'Receive Extra Pay/Benefits Not to Enroll'
                         91   = 'Other'
                        ;

    VALUE    fai15a     -1    = 'Inapplicable'
                         1    = 'Havent Worked Here Long Enough'
                         2    = 'Contract or Temp Employee'
                        3     = 'Didnt Work Enough Hours per Week'
                         4    = 'Does Not Meet Age Requirements'
                         5    = 'Only Management Can Get Health Insurance'
```

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```
                        6     = 'Not Eligible - Other'
                        7     = 'Has Left Position / Retired / Laid Off'
                        91    = 'Other'
                       ;

VALUE    fai22a_p      -9     = 'Not Ascertained'
                       -8     = 'Dont Know'
                       -1     = 'Inapplicable'
                        1     = 'Kaiser'
                        2     = 'Blue Cross'
                        3     = 'United Healthcare'
                        4     = 'Blue Shield'
                        5     = 'Health Net'
                        6     = 'Aetna'
                        7     = 'Cigna Health Care'
                        8     = 'Other'
                       ;

VALUE    fhmo           1     = 'HMO'
                        2     = 'Non-HMO'
                        3     = 'Uninsured'
                       ;

VALUE    fai28z        -1     = 'Inapplicable'
                        1     = '1 to 3 Yrs Ago'
                        2     = 'More than 3 Yrs Ago'
                        3     = 'Never Had Health Insurance Coverage'
                       ;

VALUE    fah101_p      -1     = 'Inapplicable'
                        1     = 'Broker'
                        2     = 'Family Member / Friend'
                        3     = 'Internet'
                        4     = 'Other / Multiple Reasons'
                       ;

VALUE    funinsany     -1     = 'Skipped - Ages>=65'
                        1     = 'Uninsured All Year'
                        2     = 'Uninsured Part Year'
                        3     = 'Insured All Year'
                       ;

VALUE    fins64_p      -1     = 'Skipped - Age >= 65'
                        1     = 'Uninsured'
                        2     = 'Medi-Cal (Medicaid)'
                        3     = 'Medicare'
                        4     = 'Employment-Based'
                        5     = 'Privately Purchased'
                        6     = 'Chip/Other Public Prgm'
                       ;

VALUE    finsany        1     = 'Currently Uninsured'
                        2     = 'Unins. Any Past 12 mo'
                        3     = 'Insured All Past 12 mo'
                       ;

VALUE    finst_12z     -1     = 'Inapplicable-age>=65'
                        1     = 'Medi-Cal (Medicaid) Only'
                        2     = 'Employer-Based Coverage Only (EBI)'
                        3     = 'Private Coverage Only'
                        4     = 'Other Coverage Only'
```

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```
                        5    = 'Any 2 or More Types (Never Uninsured)'
                        6    = 'Uninsured Only'
                        7    = 'Uninsured + Employer-Based Only'
                        8    = 'Any 1 or More Types + Uninsured'
                       ;

    VALUE    fins65z   -1    = 'Skipped - Age < 65'
                        1    = 'Medicare + Medi-Cal (Medicaid)'
                        2    = 'Medicare + Other'
                        3    = 'Medicare Only'
                        4    = 'Other Only'
                        5    = 'Uninsured'
                       ;

    VALUE    finsps    -1    = 'Inapplicable'
                        1    = 'Primary'
                        2    = 'Secondary'
                        3    = 'Not Specified as Primary or Secondary'
                       ;

    VALUE    fofftk    -1    = 'Unemployed or Self-Employed'
                        1    = 'Accepted EBI'
                        2    = 'Not Accepted EBI, Offered & Eligible'
                        3    = 'Was Offered EBI, Not Eligible'
                        4    = 'Was Not Offered EBI'
                       ;
RUN;
DATA CHIS.CHIS_DATA_RAW;
    SET CHIS.CHIS_DATA_RAW;
    FORMAT    ai4       fCHISBool.;
    FORMAT    ah100     fCHISBool.;
    FORMAT    ah103     fCHISBool.;
    FORMAT    ai15      fai15z.;
    FORMAT    ai15a     fai15a.;
    FORMAT    ai22c     fCHISBool.;
    FORMAT    ai25new   fCHISBool.;
    FORMAT    ai25      fCHISBool.;
    FORMAT    ai22a_p   fai22a_p.;
    FORMAT    hmo       fhmo.;
    FORMAT    ah71_p1   fCHISBool.;
    FORMAT    ah72_p1   fCHISBool.;
    FORMAT    ah73B     fCHISBool.;
    FORMAT    ah74      fCHISBool.;
    FORMAT    ah75      fCHISBool.;
    FORMAT    ai28      fai28z.;
    FORMAT    ah14      fCHISBool.;
    FORMAT    ah101_p   fah101_p.;
    FORMAT    ah98_p1   fCHIS3Diffic.;
    FORMAT    ah99_p1   fCHIS3Diffic.;
    FORMAT    ins       FCHISBool.;
    FORMAT    uninsany  funinsany.;
    FORMAT    ins64_p   fins64_p.;
    FORMAT    insany    finsany.;
    FORMAT    inst_12   finst_12z.;
    FORMAT    ins65     fins65z.;
    FORMAT    insem     fCHISBool.;
    FORMAT    insmc     fCHISBool.;
    FORMAT    insmd     fCHISBool.;
    FORMAT    insog     fCHISBool.;
    FORMAT    inspr     fCHISBool.;
    FORMAT    insps     finsps.;
```

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```
    FORMAT    offtk     fofftk.;
RUN;

/* FORMAT CHIS SECTION J: HEALTH CARE UTILIZATION / ACCESS & DENTAL HEALTH */
PROC FORMAT LIBRARY=CHIS;
    VALUE    fah1z       1    = 'Yes'
                         2    = 'No'
                         3    = 'Doctor / My Doctor'
                         4    = 'Kaiser'
                         5    = 'More than One Place'
                        ;

    VALUE    fah3_p1z   -1    = 'Inapplicable'
                         1    = 'Doctors Office / Kasier / HMO'
                         2    = 'Clinic / Health Center / Hospital Clinic'
                         3    = 'Emergency Room'
                         4    = 'Some Other Place / No One Particular Place'
                        ;

    VALUE    fusual_tp   1    = 'Doctors Office / Kaiser / HMO'
                         2    = 'Commun/Gov Clin, Commun Hosp'
                         3    = 'Emergency Room'
                         5    = 'Some Other Place'
                         6    = 'No One Particular Place'
                         7    = 'No Usual Source of Care'
                        ;

    VALUE    fusual5tp   1    = 'Doctors Office / Kaiser / HMO'
                         2    = 'Commun/Gov Clin, Commun Hosp'
                         3    = 'Emergency Room / Urgent Care'
                         4    = 'Some Other Place / No One Particular Place'
                         5    = 'No Usual Source of Care'
                        ;

    VALUE    fah6z      -1    = 'Inapplicable'
                         0    = 'Within the Past Yr'
                         1    = '1 to 2 Yrs Ago'
                         2    = '2 to 5 Yrs Ago'
                         3    = 'More than 5 Yrs Ago'
                         4    = 'Never'
                        ;

    VALUE    facmdnum    0    = '0 Times'
                         1    = '1 Time'
                         2    = '2 Times'
                         3    = '3 Times'
                         4    = '4 Times'
                         5    = '5 Times'
                         6    = '6 Times'
                         7    = '7-8 Times'
                         8    = '9-12 Times'
                         9    = '13-24 Times'
                         10   = '25+ Times'
                        ;

    VALUE    faj114z    -1    = 'Inapplicable'
                         0    = 'One Year Ago or Less'
                         1    = '1 to 2 Years Ago'
                         2    = '2 to 5 Years Ago'
                         3    = 'More than 5 Years Ago'
                         4    = 'Never'
```

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```
                        ;

    VALUE    faj131_p1z -1    = 'Inapplicable'
                         1    = 'Couldnt Get Appointment'
                         2    = 'Cost, Insurance (Not Covrd/Accptd, No Ins)'
                         5    = 'Transportation Problems'
                         6    = 'Hours Not Convenient'
                         9    = 'I Didnt Have Time'
                         12   = 'Did Not Think Serious Enough/Needed'
                         13   = 'Not Satisfied with Health Care Received'
                         14   = 'Other Reason'
                         15   = 'Anxiety, Fear, Avoidance of Medical Care'
                        ;

    VALUE    frn_forgo  -1    = 'Inapplicable'
                         1    = 'Cost'
                         2    = 'Couldnt Get Appointment'
                         3    = 'Didnt Have Time'
                         4    = 'Others'
                        ;

    VALUE    fah95_p1z  -1    = 'Inapplicable'
                         0    = '0 Times'
                         1    = '1 Time'
                         2    = '2 Times'
                         3    = '3 Times'
                         4    = '4 Times'
                         5    = '5+ Times'
                        ;
RUN;
DATA CHIS.CHIS_DATA_RAW;
    SET CHIS.CHIS_DATA_RAW;
    FORMAT    ah1       fah1z.;
    FORMAT    ah3_p1    fah3_p1z.;
    FORMAT    usoc      fCHISBool.;
    FORMAT    usual     fCHISBool.;
    FORMAT    usual_tp  fusual_tp.;
    FORMAT    usual5tp  fusual5tp.;
    FORMAT    ah6       fah6z.;
    FORMAT    acmdnum   facmdnum.;
    FORMAT    doct_yr   fCHISBool.;
    FORMAT    aj77      fCHISBool.;
    FORMAT    aj9       fCHISBool.;
    FORMAT    aj10      fCHISBool.;
    FORMAT    ah16      fCHISBool.;
    FORMAT    aj19      fCHISBool.;
    FORMAT    ah22      fCHISBool.;
    FORMAT    aj20      fCHISBool.;
    FORMAT    aj102     fCHISBool.;
    FORMAT    aj103     fCHIS4NvrAlys.;
    FORMAT    timappt   fCHISBool.;
    FORMAT    aj105     fCHISBool.;
    FORMAT    aj106     fCHISBool.;
    FORMAT    aj107     fCHISBool.;
    FORMAT    aj108     fCHISBool.;
    FORMAT    aj112     fCHIS4NvrAlys.;
    FORMAT    aj113     fCHIS4NvrAlys.;
    FORMAT    aj114     faj114z.;
    FORMAT    aj129     fCHISBool.;
    FORMAT    aj131_p1  faj131_p1z.;
    FORMAT    care_pv   fCHISBool.;
```

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```
    FORMAT    rn_forgo  frn_forgo.;
    FORMAT    forgo     fCHISBool.;
    FORMAT    aj136     fCHISBool.;
    FORMAT    aj137     fCHISBool.;
    FORMAT    aj138     fCHISBool.;
    FORMAT    aj139     fCHISBool.;
    FORMAT    aj133     fCHISBool.;
    FORMAT    aj134     fCHISBool.;
    FORMAT    aj135     fCHISBool.;
    FORMAT    pc_ins    fCHISBool.;
    FORMAT    pc_newp   fCHISBool.;
    FORMAT    sc_ins    fCHISBool.;
    FORMAT    sc_newp   fCHISBool.;
    FORMAT    ah95_p1   fah95_p1z.;
    FORMAT    ah12      fCHISBool.;
    FORMAT    er        fCHISBool.;
RUN;

/* FORMAT CHIS SECTION K: EMPLOYMENT, INCOME, POVERTY STATUS & FOOD SECURITY */
PROC FORMAT LIBRARY=CHIS;
    VALUE    fak1z       1    = 'Working at a Job/Business'
                         2    = 'With a Job/Business but Not at Work'
                         3    = 'Looking for Work'
                         4    = 'Not Working Job / Business (Unemp)'
                        ;

    VALUE    fak2_p1z   -1    = 'Inapplicable'
                         2    = 'On Planned Vacation'
                         3    = 'Couldnt Find a Job'
                         4    = 'Going to School / Sudent'
                         5    = 'Retired'
                         6    = 'Physical Disability'
                         7    = 'Unable to Work Temporarily'
                         8    = 'On Layoff or Strike'
                         10   = 'Off Season'
                         11   = 'Sick'
                         91   = 'Other'
                        ;

    VALUE    fak4z      -1    = 'Inapplicable'
                         1    = 'Private Company, Non-Profit Org'
                         2    = 'Government'
                         3    = 'Self-Employed'
                         4    = 'Family Business or Farm'
                        ;

    VALUE    findmain2z -9    = 'Not Ascertained'
                        -8    = 'Dont Know'
                        -7    = 'Refused'
                        -1    = 'Inapplicable'
                         1    = 'Agriculture, Forestry, Fishing, Hunting'
                         2    = 'Construction'
                         3    = 'Manufacturing'
                         4    = 'Wholesale Trace'
                         5    = 'Retail Trade'
                         6    = 'Transportation, Warehousing, and Utilities'
                         7    = 'Information'
                         8    = 'Finance and Insurance, Real Estate, Rent'
                         9    = 'Professional, Scientific, Management'
                         10   = 'Educational Services, Healthcare and So'
                         11   = 'Arts, Entertainment, Recreation, Acommo'
```

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```
                    12   = 'Other Services, Except Public Administration'
                    13   = 'Public Administration'
                    14   = 'Military'
                    99   = 'Could Not be Coded'
                   ;

VALUE    foccmain2z -9   = 'Not Ascertained'
                   -8   = 'Dont Know'
                   -7   = 'Refused'
                   -1   = 'Inapplicable'
                    1   = 'Management, Busi8ness, and Financial Occu'
                    2   = 'Computer, Engineering, and Science Occup'
                    3   = 'Education, Legal, Communityu Service, Art'
                    4   = 'Healthcare Practitioners & Technical O'
                    5   = 'Services Occupations'
                    6   = 'Sales & Realted Occupations'
                    7   = 'Office & Administrative Support Occupa'
                    8   = 'Farming, Fishing, & Forestry Occupatio'
                    9   = 'Construction & Extraction Occupations'
                    10  = 'Installation, Maintenance, & Repair Oc'
                    11  = 'Production Occupations'
                    12  = 'Transportation & Material Moving Occup'
                    13  = 'Military Specific Occupations'
                    99  = 'Could Not be Coded'
                   ;

VALUE    fakwklngz  -1   = 'Inapplicable'
                    0   = '<1 Year'
                    1   = '1 Year'
                    2   = '2 Years'
                    3   = '3 Years'
                    4   = '4 Years'
                    5   = '5 Years'
                    6   = '6-9 Years'
                    7   = '10-14 Years'
                    8   = '15-19 Years'
                    9   = '20-29 Years'
                    10  = '30+ Years'
                   ;

VALUE    fak8z      -1   = 'Inapplicable'
                    1   = '1 or 2'
                    2   = '3 - 9'
                    3   = '10 - 24'
                    4   = '25 - 50'
                    5   = '51 - 100'
                    6   = '101 - 200'
                    7   = '201 - 999'
                    8   = '1,000 or More'
                   ;

VALUE    fak33_p1z  -1   = 'Inapplicable'
                    1   = '1'
                    2   = '2'
                    3   = '3'
                   ;

VALUE    fam3az     -1   = 'Inapplicable'
                    1   = 'Almost Every Month'
                    2   = 'Some Months but Not Every month'
                    3   = 'Only in 1 or 2 Months'
```

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```
                        ;

    VALUE    ffslev     -1    = 'Inapplicable / >=200% FPL'
                         1    = 'Food Security'
                         2    = 'Food Insecurity w/o Hunger'
                         3    = 'Food Insecurity w/ Hunger'
                        ;

    VALUE    ffpg        1    = 'FPG 0 - 138'
                         2    = 'FPG 139 - 200'
                         3    = 'FPG 201 - 400'
                         4    = 'FPG 400+'
                        ;

    VALUE    fpovll_aca  1    = '0-138% FPL'
                         2    = '139%-249% FPL'
                         3    = '250%-399% FPL'
                         4    = '400%+ FPL'
                        ;

    VALUE    fpovll      1    = '0-99% FPL'
                         2    = '100-199% FPL'
                         3    = '200-299% FPL'
                         4    = '300% FPL and Above'
                        ;
RUN;
DATA CHIS.CHIS_DATA_RAW;
    SET CHIS.CHIS_DATA_RAW;
    FORMAT    ak1       fak1z.;
    FORMAT    ak2_p1    fak2_p1z.;
    FORMAT    ak4       fak4z.;
    FORMAT    indmain2  findmain2z.;
    FORMAT    occmain2  foccmain2z.;
    FORMAT    akwklng   fakwklngz.;
    FORMAT    ak8       fak8z.;
    FORMAT    ak32      fCHISBool.;
    FORMAT    ak33_p1   fak33_p1z.;
    FORMAT    am1       fCHIS3Truth.;
    FORMAT    am2       fCHIS3Truth.;
    FORMAT    am3       fCHISBool.;
    FORMAT    am3a      fam3az.;
    FORMAT    am4       fCHISBool.;
    FORMAT    am5       fCHISBool.;
    FORMAT    fslev     ffslev.;
    FORMAT    fpg       ffpg.;
    FORMAT    povll_aca fpovll_aca.;
    FORMAT    povll     fpovll.;
RUN;

/* FORMAT CHIS SECTION L: PUBLIC PROGRAM PARETICIPATION */
DATA CHIS.CHIS_DATA_RAW;
    SET CHIS.CHIS_DATA_RAW;
    FORMAT    al2       fCHISBool.;
    FORMAT    al5       fCHISBool.;
    FORMAT    al6       fCHISBool.;
    FORMAT    al22      fCHISBool.;
    FORMAT    al32      fCHISBool.;
    FORMAT    al18a     fCHISBool.;
RUN;

/* FORMAT CHIS SECTION M: HOUSING & COMMUNITY INVOLVEMENT */
```

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```
PROC FORMAT LIBRARY=CHIS;
    VALUE    fak23z      1    = 'House'
                         2    = 'Duplex'
                         3    = 'Building with 3 or More Units'
                         4    = 'Mobile Home'
                        ;

    VALUE    fak25z     -9    = 'Not Ascertained'
                        -8    = 'Dont Know'
                        -7    = 'Refused'
                         1    = 'Own'
                         2    = 'Rent'
                         3    = 'Other Arrangement'
                        ;

RUN;
DATA CHIS.CHIS_DATA_RAW;
    SET CHIS.CHIS_DATA_RAW;
    FORMAT    ak23      fak23z.;
    FORMAT    ak25      fak25z.;
    FORMAT    am19      fCHIS4Lichert.;
    FORMAT    am20      fCHIS4Lichert.;
    FORMAT    am21      fCHIS4Lichert.;
    FORMAT    ak28      fCHIS4LichTim.;
    FORMAT    am36      fCHISBool.;
RUN;

/* FORMAT CHIS SECTION N: DEMOGRAPHIC INFORMATION / GEOGRAPHIC INFORMATION */
PROC FORMAT LIBRARY=CHIS;
    VALUE fam34z        -9    = 'Not Ascertained'
                        -8    = 'Dont Know'
                        -7    = 'Refused'
                        -1    = 'Inapplicable'
                         1    = 'All or Almost All Calls on Cell Phones'
                         2    = 'Some Calls on Cell, Some Regular Phones'
                         3    = 'Very Few or No Calls on Cell Phones'
                        ;

    VALUE fur_clrt2z    -1    = 'Inapplicable'
                         1    = 'Urban'
                         2    = 'Rural'
                        ;

    VALUE fur_clrt6z    -1    = 'Inapplicable'
                         1    = 'Urban'
                         2    = '2nd City'
                         3    = 'Mixed'
                         4    = 'Suburban'
                         5    = 'Town'
                         6    = 'Rural'
                        ;

    VALUE fur_clrt4z    -1    = 'Inapplicable'
                         1    = 'Urban'
                         2    = '2nd City'
                         3    = 'Suburban'
                         4    = 'Town & Rural'
                        ;
RUN;
DATA CHIS.CHIS_DATA_RAW;
    SET CHIS.CHIS_DATA_RAW;
```

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```
    FORMAT    am34      fam34z.;
    FORMAT    ur_clrt2  fur_clrt2z.;
    FORMAT    ur_ihs    fur_clrt2z.;
    FORMAT    ur_omb    fur_clrt2z.;
    FORMAT    ur_rhp    fur_clrt2z.;
    FORMAT    ur_clrt   fur_clrt4z.;
RUN;

/* FORMAT CHIS SECTION Q: SCREENING INFORMATION */
PROC FORMAT LIBRARY=CHIS;
    VALUE fintvlngc_p    1    = 'English'
                         2    = 'Spanish'
                         3    = 'Other'
                        ;
    VALUE fsrtenr        1    = 'Own'
                         2    = 'Rent/Other'
                        ;
RUN;
DATA CHIS.CHIS_DATA_RAW;
    SET CHIS.CHIS_DATA_RAW;
    FORMAT    intvlngc_p1   fintvlngc_p.;
    FORMAT    proxy         fCHISBool.;
    FORMAT    srtenr        fsrtenr.;
RUN;

/* VALIDATE RECODED DATASET CONTENTS */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
CONTENTS.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC CONTENTS DATA=CHIS.CHIS_DATA_RAW VARNUM;
        TITLE 'PROC CONTENTS - CHIS.CHIS_DATA_RAW';
    RUN;
ODS PDF CLOSE;

/* DISABLE SAS GRAPHICS */
ODS GRAPHICS OFF;

QUIT;
```

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Program: CHIS_11_DSTRSYR

```
/*******************************************************************************
**  Project Name    : Secondary Research of Asthma  Hospitalizations          **
**                    Masters of Science in Business Analytics Capstone Project **
**                    March / April 2019                                        **
**  Author          : Matthew C. Vanderbilt                                   **
**                    MSBA Candidate & NU Scholar, National University        **
**                    Director of Fiscal Affairs, Department of Medicine,     **
**                    UC San Diego School of Medicine                         **
**  ============================================================================ **
**  Date Created    : <not recorded>                                          **
**  Program Name    : CHIS_10_LoadData                                        **
**  Purpose         : Evaluate Pyyschological Distress Continuous Scale       **
**  Note            : Capitalized values represent SAS commands and unadjusted **
**                    variables; lower-case variables represent study-created **
**                    variables.                                              **
**                                                                            **
*******************************************************************************/

/* DISABLE SAS GRAPHICS */
ODS GRAPHICS OFF;

/* GLOBAL VARIABLES */
* Determine File Path for SAS EGP;
%LET localProjectPath = %SYSFUNC(SUBSTR(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH)), 1,
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH))) -
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTNAME))) ));

* Pull Secure File Path from Text
* Determine C:\MyDocuments Path to Raw Data;
FILENAME scrPath "&localProjectPath.RawDataPath.txt";
DATA _NULL_;
    LENGTH text $265;
    RETAIN text '';
    INFILE scrPath FLOWOVER DLMSTR='//' END=last;
    INPUT;
    text = CATS(text,_INFILE_);
    IF last THEN CALL SYMPUT('rawpath',text);
RUN;
%LET localRawDataPath =
%SYSFUNC(CAT(C:\Users\,%SYSFUNC(DEQUOTE(&_CLIENTUSERID)),%SYSFUNC(TRIM(%SYSFUNC(DEQUOT
E(&rawpath)))) ));

/* MASTER LIBRARIES */
LIBNAME CHIS "&localProjectPath.CHIS";

/* Determine PDF Password */
* Pull PDF Password from Text;
FILENAME scrPath "&localProjectPath.PDFPassword.txt";
DATA _NULL_;
    LENGTH text $265;
    RETAIN text '';
    INFILE scrPath FLOWOVER DLMSTR='//' END=last;
    INPUT;
    text = CATS(text,_INFILE_);
    IF last THEN CALL SYMPUT('rawpath',text);
RUN;
%LET pdfPassword = %SYSFUNC(TRIM(%SYSFUNC(DEQUOTE(&rawpath))));

/* DEFINE GLOBAL OPTIONS */
```

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```
ODS GRAPHICS OFF;
OPTIONS PDFSECURITY=HIGH;
OPTIONS PDFPASSWORD=(owner="&pdfPassword");

/* APPLY CHIS FORMATS */
OPTIONS fmtsearch=(CHIS);

/* PERFORM UNWEIGHTED PLOT OF PSCYHOLOGICAL DISTRESS SCALE */
ODS GRAPHICS ON;
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
FREQ.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
        ODS GRAPHICS ON;
    PROC FREQ DATA=CHIS.CHIS_DATA_RAW;
        TITLE 'PROC SURVEYFREQ - CHIS.CHIS_DATA_RAW -  DSTRSYR DETAIL';
        TABLES    DSTRSYR / PLOTS=ALL
                ;
    RUN;
ODS PDF CLOSE;

/* DISABLE SAS GRAPHICS */
ODS GRAPHICS OFF;

QUIT;
```

Program: CHIS_15_Recoding

```
/*******************************************************************************
**  Project Name    : Secondary Research of Asthma  Hospitalizations            **
**                    Masters of Science in Business Analytics Capstone Project  **
**                    March / April 2019                                         **
**  Author          : Matthew C. Vanderbilt                                    **
**                    MSBA Candidate & NU Scholar, National University           **
**                    Director of Fiscal Affairs, Department of Medicine,        **
**                    UC San Diego School of Medicine                            **
**  ========================================================================== **
**  Date Created    : 14 April 2019 08:22                                      **
**  Program Name    : CHIS_10_LoadData                                         **
**  Purpose         : Recodes variables identified with inconsistencies or too many **
**                    categories acros survey years                              **
**  Note            : Capitalized values represent SAS commands and unadjusted  **
**                    variables; lower-case variables represent study-created    **
**                    variables.                                                 **
**                                                                               **
*******************************************************************************/

/* DISABLE SAS GRAPHICS */
ODS GRAPHICS OFF;

/* GLOBAL VARIABLES */
* Determine File Path for SAS EGP;
%LET localProjectPath = %SYSFUNC(SUBSTR(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH)), 1,
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH))) -
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTNAME))) ));

/* MASTER LIBRARIES */
```

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```
LIBNAME CHIS "&localProjectPath.CHIS";

/* Determine PDF Password */
* Pull PDF Password from Text;
FILENAME scrPath "&localProjectPath.PDFPassword.txt";
DATA _NULL_;
    LENGTH text $265;
    RETAIN text '';
    INFILE scrPath FLOWOVER DLMSTR='//' END=last;
    INPUT;
    text = CATS(text,_INFILE_);
    IF last THEN CALL SYMPUT('rawpath',text);
RUN;
%LET pdfPassword = %SYSFUNC(TRIM(%SYSFUNC(DEQUOTE(&rawpath))));

/* DEFINE GLOBAL OPTIONS */
ODS GRAPHICS OFF;
OPTIONS PDFSECURITY=HIGH;
OPTIONS PDFPASSWORD=(owner="&pdfPassword");

/* CREATE CUSTOM FORMATS */
OPTIONS fmtsearch=(CHIS);

PROC FORMAT LIBRARY=CHIS;
    VALUE fhealthplan   -1    = 'Inapplicable'
                         1    = 'Kaiser'
                         2    = 'Blue Cross'
                         3    = 'United Healthcare'
                         4    = 'Blue Shield'
                         5    = 'Health Net'
                         6    = 'Aetna'
                         7    = 'Cigna Health Care'
                         8    = 'Other'
                         9    = 'Medicare/Medi-Cal'
                        ;

    VALUE fprilanguage   1    = 'English (Includes English & Other)'
                         2    = 'Spanish'
                         3    = 'Chinese'
                         4    = 'Vietnamese'
                         5    = 'Korean'
                         6    = 'Other'
                        ;

    VALUE fasthmastatus  1    = '1 Current Asthmatic'
                         2    = '2 Lifetime Asthmatic'
                         3    = '3 Non-Asthmatic'
                        ;

    VALUE ffamtype       1    = 'Single w/o Children'
                         2    = 'Single w/ Children'
                         3    = 'Married w/o Children'
                         4    = 'Married w/ Children'
                        ;

    VALUE fBoolean      -1    = 'NA'
                         0    = 'False'
                         1    = 'True'
                        ;

    VALUE fagegroup     -1    = 'NA'
```

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```
                        1     = 'Young Adult (18-39)'
                        2     = 'Middle Aged (40-64)'
                        3     = 'Later Adult (65+)'
                       ;

    VALUE flanguage    -1     = 'NA'
                        1     = 'English'
                        2     = 'Spanish'
                        3     = 'Other'
                       ;

    VALUE fmaritstat   -1     = 'NA'
                        1     = 'Married/Partnered'
                        2     = 'Widowed/Separated'
                        3     = 'Never Married'
                       ;
RUN;

/* APPLY RECODING & CUSTOM FORMATS */
DATA CHIS.CHIS_DATA_INTRM;
    SET CHIS.CHIS_DATA_RAW;

    *Combined Married / Partnered Categories;
    maritstat    = -1;
    IF marit2    IN(1,2)    THEN maritstat = 1;
    IF marit2    = 3        THEN maritstat = 2;
    IF marit2    = 4        THEN maritstat = 3;
    LABEL        maritstat  = 'marital status';
    FORMAT       maritstat  fmaritstat.;

    *Categorize Age to Three-Level Group;
    agegroup    = -1;
    IF srage_p1 >= 18 AND srage_p1 < 40    THEN agegroup = 1;
    IF srage_p1 >= 40 AND srage_p1 < 65    THEN agegroup = 2;
    IF srage_p1 >= 65                    THEN agegroup = 3;
    LABEL       agegroup    = 'age group';
    FORMAT      agegroup    fagegroup.;

    *Secondary English Proficiency;
    *Recode all N/A responses to Inapplicable;
    AH37 = AH37;
    IF AH37 < -1 THEN AH37 = -1;
    IF AH37 =  . THEN AH37 = -1;

    *Years of Armed Forces Service;
    *Recode all N/A responses to Inapplicable;
    SERVED = SERVED;
    IF SERVED < -1 THEN SERVED = -1;
    IF SERVED =  . THEN SERVED = -1;

    *Educational Atttainment;
    *Normalize MA/MS/PhD from differently-coded 2013 survey;
    AHEDC_P1 = AHEDC_P1;
    IF YEAR = 2013 AND AHEDC_P1 > 8 THEN AHEDC_P1 = AHEDC_P1-1;

    *Telephone Calls Received;
    *Recode all N/A responses to Inapplicable;
    AM34 = AM34;
    IF AM34 < -1 THEN AM34 = -1;
    IF AM34 = . THEN AM34 = -1;
```

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```
    *Family Type;
    *Collapse Three-Leavel Single Categories to One;
    famtype = FAMTYP_P;
    IF FAMTYP_P IN(1,2,6)   THEN famtype = 1;
    IF FAMTYP_P = 5         THEN famtype = 2;
    LABEL       famtype     = 'family type';
    FORMAT      famtype     ffamtype.;

    *Primary Language Spoken at Home;
    *Collapse all English & English + Other to Single Category;
    prilanguage = LNGHM_P1;
    IF LNGHM_P1 < -1                THEN prilanguage = -1;
    IF LNGHM_P1 IN(1,8,9,10,11,12) THEN prilanguage = 1;
    IF LNGHM_P1 IN(6,13)            THEN prilanguage = 6;
    LABEL       prilanguage         = 'primary spoken language';
    FORMAT      prilanguage         fprilanguage.;

    *Name of Health Plan;
    *Recode all N/A responses to Inapplicable;
    *Use INSMC to Add Medicare/Medi-Cal Category as 9;
    healthplan = AI22A_P;
    IF AI22A_P < -1             THEN    healthplan = -1;
    IF INSMC   = 1 OR INSMD = 1 THEN healthplan = 9;
    LABEL      healthplan       = 'name of health plan';
    FORMAT     healthplan       fhealthplan.;

    *Asthma Status;
    *Current Asthmatics = Identify or Rx/Symptoms Last 12 Months;
    *Previous Asthmatics = Diagnosed / No Current Issues;
    *AB108_P1 (Mgt Confidence) Excluded due to Unclear Responses;
    asthmastatus = 3;
    IF       AB17         = 1  /*Diagnosed*/
        OR   AB43         = 1  /*Given Mgt Plan*/
        OR   AB98         = 1  /*Have Mgt Plan*/
        THEN asthmastatus = 2; /*Previous Asthmatic*/
    IF       AB40         = 1  /*Still Has Ashtma*/
        OR   AB41         = 1  /*Episode w/in 12mos*/
        OR   ASTCUR       = 1  /*Current Asthma Status*/
        OR   ASTS         = 1  /*Symptoms w/in 12mos*/
        OR   ASTYR        = 1  /*Symptoms w/in 12mos*/
        OR   AB18         = 1  /*Daily Asthma Rx*/
        OR   AB19         = 1  /*Symptoms w/in 12mos = YES*/
        OR   AH13A        = 1  /*Asthma ED Visit w/in 12mos*/
        THEN asthmastatus = 1; /*Current Asthmat*/
    LABEL    asthmastatus = 'asthmatic status';
    FORMAT   asthmastatus fasthmastatus.;
RUN;

/* VIEW TABLE CONTENTS & STRUCTURE */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
CONTENTS.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC CONTENTS DATA=CHIS.CHIS_DATA_INTRM VARNUM;
        TITLE 'PROC CONTENTS - CHIS.CHIS_DATA_INTRM';
    RUN;
ODS PDF CLOSE;

/* EVALUATE & CONFIRM RECODED VARIABLE RESULTS */
```

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```
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
FREQ.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
        ODS GRAPHICS ON / WIDTH=1280px HEIGHT=960;
PROC FREQ DATA=CHIS.CHIS_DATA_INTRM;
    TITLE 'PROC FREQ - CHIS.CHIS_DATA_INTRM - RECODING VALIDATION';
    TABLES  maritstat*MARIT2
            agegroup*SRAGE_P1
            AH37
            SERVED
            AHEDC_P1
            AM34
            famtype*FAMTYP_P
            prilanguage*LNGHM_P1
            (INSMC
             INSMD
             AI22A_P
            )*healthplan
            (AB17
             AB18
             AB19
             AB40
             AB41
             AB43
             AB98
             AB108_P1
             AH13A
             ASTCUR
             ASTS
             ASTYR
            )*asthmastatus
            / PLOTS=ALL;
RUN;
ODS PDF CLOSE;

/* DISABLE SAS GRAPHICS */
ODS GRAPHICS OFF;

QUIT;
```

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Program: CHIS_20_ComVars

```
/*******************************************************************************
**  Project Name    : Secondary Research of Asthma  Hospitalizations          **
**                    Masters of Science in Business Analytics Capstone Project **
**                    March / April 2019                                        **
**  Author          : Matthew C. Vanderbilt                                   **
**                    MSBA Candidate & NU Scholar, National University        **
**                    Director of Fiscal Affairs, Department of Medicine,     **
**                    UC San Diego School of Medicine                         **
**  ========================================================================== **
**  Date Created    : 18 February 2019 14:30                                  **
**  Program Name    : CHIS_20_ComVars                                         **
**  Purpose         : Reduces tables to only those variables that were consistently **
**                    utilized across all survey years                        **
**  Note            : Capitalized values represent SAS commands and unadjusted **
**                    variables; lower-case variables represent study-created **
**                    variables.                                              **
**                                                                            **
*******************************************************************************/

/* DISABLE SAS GRAPHICS */
ODS GRAPHICS OFF;

/* GLOBAL VARIABLES */
* Determine File Path for SAS EGP;
%LET localProjectPath = %SYSFUNC(SUBSTR(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH)), 1,
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH))) -
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTNAME))) ));

/* MASTER LIBRARIES */
LIBNAME CHIS "&localProjectPath.CHIS";

/* Determine PDF Password */
* Pull PDF Password from Text;
FILENAME scrPath "&localProjectPath.PDFPassword.txt";
DATA _NULL_;
    LENGTH text $265;
    RETAIN text '';
    INFILE scrPath FLOWOVER DLMSTR='//' END=last;
    INPUT;
    text = CATS(text,_INFILE_);
    IF last THEN CALL SYMPUT('rawpath',text);
RUN;
%LET pdfPassword = %SYSFUNC(TRIM(%SYSFUNC(DEQUOTE(&rawpath))));

/* DEFINE GLOBAL OPTIONS */
ODS GRAPHICS OFF;
OPTIONS PDFSECURITY=HIGH;
OPTIONS PDFPASSWORD=(owner="&pdfPassword");

/* CREATE CUSTOM FORMATS */
OPTIONS fmtsearch=(CHIS);

/* MINIMIZE TO CROSS-YEAR COMMON VARIABLES */
DATA CHIS.CHIS_DATA_INTRM(KEEP = SRTENR
                                 SRAGE_P1
                                 SRSEX
                                 SRAS
                                 SRASO
                                 SRCH
```

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SRPH
SRH
SRO
OMBSRR_P1
RACECN_P1
RACEDF_P1
SRW
SRAA
SRAI
AA5C
MARIT
MARIT_45
MARIT2
LATIN2TP
AB1
AB17
AB40
AB41
ASTCUR
ASTS
ASTYR
AB18
AB19
AH13A
AB43
AB98
AB108_P1
AB22
AB99
AB24
AB25
AB63
AB112
AB114_P1
AB30
AB34
AB52
AB117
AB118
AB113
AB119
AD37W
AD40W
AD41W
AD42W
AC31_P1
AC11
AE_SODA
AESODA_P1
AE15
AE15A
AD32_P1
AE16_P1
SMKCUR
SMOKING
NUMCIG
AC42_P
AC44
HGHTI_P
HGHTM_P
HEIGHM_P

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WEIGHK_P
WGHTK_P
WGHTP_P
AD50
BMI_P
RBMI
AD57
OVRWT
AD51
AD52
AD53
AD54
DISABLE
AJ29
AF65
AF67
AF68
AF70B
AF71B
AF72B
AJ1
AJ31
AF62
AF63
DSTRS12
DSTRS30
CHORES2
SOCIAL2
FAMILY2
AH33NEW
AH34NEW
AH35NEW
LNGHM_P1
AH37
SPK_ENG
CITIZEN2
YRUS_P1
PCTLF_P
AH44
AH43A
AH44A
ACHLDC_P1
AG22
SERVED
AG10
WRKST_P1
AG8
AG11
AG9_P1
AHEDC_P1
FAMTYP_P
AI4
AI15
AI15A
AI22C
HMO
AI22A_P
AI25
AI25NEW
AH71_P1
AH72_P1

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AH74
AH75
AI28
AH14
AH96_P1
AH97_P1
INS
INS12M
INS65
INSANY
INSEM
INSMC
INSMD
INSOG
IHS
INSPR
INSPS
INST_12
UNINSANY
OFFTK
AH98_P1
AH99_P1
AH100
AH101_P
AH103
INS64_P
AH1
AH3_P1
USOC
USUAL
USUAL_TP
USUAL5TP
AH6
ACMDNUM
DOCT_YR
AJ77
AJ10
AJ50_P
AJ9
AJ11
AH16
AJ19
AH22
AJ20
AJ102
AJ103
AJ105
AJ106
AJ107
AJ108
AJ112
AJ113
AH12
ER
AH95_P1
AK1
AK2_P1
AK4
AKWKLNG
AK8
AK10_P

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```
                                    AK10A_P
                                    AM1
                                    AM2
                                    AM3
                                    AM3A
                                    AM4
                                    AM5
                                    FSLEV
                                    FSLEVCB
                                    POVGWD_P
                                    POVLL
                                    AL6
                                    AL22
                                    AL18A
                                    AK23
                                    AK25
                                    AM19
                                    AM21
                                    AM35
                                    AK28
                                    AM36
                                    AM39
                                    AM38_P1
                                    AM40
                                    AM34
                                    UR_CLRT
                                    UR_CLRT2
                                    UR_IHS
                                    UR_OMB
                                    UR_RHP
                                    UR_BG
                                    UR_TRACT
                                    RAKEDW0-RAKEDW80
                                    PUF1Y_ID
                                    HHSIZE_P1
                                    PROXY
                                    year
                                    fnwgt0-fnwgt160
                                    i
                                    maritstat
                                    agegroup
                                    healthplan
                                    asthmastatus
                                    prilanguage
                                    famtype
                                   );
    SET CHIS.CHIS_DATA_INTRM;
RUN;

/* Remove "Proxy Skippes" Observations */
DATA CHIS.CHIS_DATA_INTRM(    WHERE = (DSTRS30>-2));
    SET CHIS.CHIS_DATA_INTRM;
RUN;

/* VIEW TABLE CONTENTS & STRUCTURE */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
CONTENTS.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
```

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```
    PROC CONTENTS DATA=CHIS.CHIS_DATA_INTRM VARNUM;
        TITLE 'PROC CONTENTS - CHIS.CHIS_DATA_INTRM';
    RUN;
ODS PDF CLOSE;

/* DISABLE SAS GRAPHICS */
ODS GRAPHICS OFF;

QUIT;
```

Program: CHIS_30_FinalData

```
/*******************************************************************************
**  Project Name    : Secondary Research of Asthma  Hospitalizations           **
**                    Masters of Science in Business Analytics Capstone Project **
**                    March / April 2019                                        **
**  Author          : Matthew C. Vanderbilt                                   **
**                    MSBA Candidate & NU Scholar, National University          **
**                    Director of Fiscal Affairs, Department of Medicine,       **
**                    UC San Diego School of Medicine                           **
**  ========================================================================== **
**  Date Created    : 29 March 2019 16:36                                     **
**  Program Name    : CHIS_30_FinalData                                       **
**  Purpose         : Create final table for use thorughout analysis          **
**  Note            : Capitalized values represent SAS commands and unadjusted **
**                    variables; lower-case variables represent study-created **
**                    variables.                                                **
**                                                                              **
*******************************************************************************/

/* DISABLE SAS GRAPHICS */
ODS GRAPHICS OFF;

/* GLOBAL VARIABLES */
* Determine File Path for SAS EGP;
%LET localProjectPath = %SYSFUNC(SUBSTR(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH)), 1,
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH))) -
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTNAME))) ));

/* MASTER LIBRARIES */
LIBNAME CHIS "&localProjectPath.CHIS";

/* Determine PDF Password */
* Pull PDF Password from Text;
FILENAME scrPath "&localProjectPath.PDFPassword.txt";
DATA _NULL_;
    LENGTH text $265;
    RETAIN text '';
    INFILE scrPath FLOWOVER DLMSTR='//' END=last;
    INPUT;
    text = CATS(text,_INFILE_);
    IF last THEN CALL SYMPUT('rawpath',text);
RUN;
%LET pdfPassword = %SYSFUNC(TRIM(%SYSFUNC(DEQUOTE(&rawpath))));

/* DEFINE GLOBAL OPTIONS */
ODS GRAPHICS OFF;
OPTIONS PDFSECURITY=HIGH;
OPTIONS PDFPASSWORD=(owner="&pdfPassword");
```

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```
/* CREATE CUSTOM FORMATS */
OPTIONS fmtsearch=(CHIS);

DATA CHIS.CHIS_DATA_FINAL(KEEP = SRTENR
                                 SRSEX
                                 RACEDF_P1
                                 AB1
                                 AB17
                                 AB40
                                 AB41
                                 ASTCUR
                                 ASTS
                                 ASTYR
                                 AB18
                                 AB19
                                 AH13A
                                 AB43
                                 AB98
                                 AB108_P1
                                 AB22
                                 AB24
                                 AB25
                                 AB30
                                 AB34
                                 AB52
                                 AB117
                                 AD37W
                                 AD40W
                                 AESODA_P1
                                 AE15
                                 AE15A
                                 SMKCUR
                                 SMOKING
                                 NUMCIG
                                 AC42_P
                                 AC44
                                 AD50
                                 RBMI
                                 AF65
                                 AF63
                                 DSTRS12
                                 DSTRS30
                                 AH33NEW
                                 AH34NEW
                                 AH35NEW
                                 AH37
                                 CITIZEN2
                                 YRUS_P1
                                 PCTLF_P
                                 AG22
                                 SERVED
                                 AG10
                                 WRKST_P1
                                 AHEDC_P1
                                 HMO
                                 AI25
                                 AH71_P1
                                 AH72_P1
                                 AH14
                                 INS
```

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```
                                    AH1
                                    USUAL5TP
                                    AJ9
                                    AH16
                                    AJ19
                                    AH22
                                    AJ20
                                    AJ102
                                    AJ105
                                    AJ108
                                    AJ112
                                    AJ113
                                    AH12
                                    ER
                                    AK4
                                    FSLEV
                                    POVLL
                                    AL6
                                    AL22
                                    AL18A
                                    AK23
                                    AK25
                                    AM19
                                    AM21
                                    AK28
                                    AM36
                                    AM34
                                    UR_CLRT
                                    maritstat
                                    agegroup
                                    healthplan
                                    asthmastatus
                                    prilanguage
                                    famtype
                                    year
                                    fnwgt0-fnwgt160
                            );
    SET CHIS.CHIS_DATA_INTRM;
RUN;

/* VIEW TABLE CONTENTS & STRUCTURE */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
CONTENTS.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC CONTENTS DATA=CHIS.CHIS_DATA_FINAL VARNUM;
        TITLE 'PROC CONTENTS - CHIS.CHIS_DATA_FINAL';
    RUN;
ODS PDF CLOSE;

/* DISABLE SAS GRAPHICS */
ODS GRAPHICS OFF;

QUIT;
```

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Program: CHIS_35_MinerDS

```
/*******************************************************************************
**  Project Name    : Secondary Research of Asthma  Hospitalizations          **
**                    Masters of Science in Business Analytics Capstone Project **
**                    March / April 2019                                        **
**  Author          : Matthew C. Vanderbilt                                   **
**                    MSBA Candidate & NU Scholar, National University        **
**                    Director of Fiscal Affairs, Department of Medicine,     **
**                    UC San Diego School of Medicine                         **
**  ============================================================================ **
**  Date Created    : 15 April 2019 09:53                                     **
**  Program Name    : CHIS_35_MinerDS                                         **
**  Purpose         : Create data set for use with Enterprise Miner Decision Tree **
**  Note            : Capitalized values represent SAS commands and unadjusted **
**                    variables; lower-case variables represent study-created **
**                    variables.                                              **
**                                                                            **
*******************************************************************************/

/* DISABLE SAS GRAPHICS */
ODS GRAPHICS OFF;

/* GLOBAL VARIABLES */
* Determine File Path for SAS EGP;
%LET localProjectPath = %SYSFUNC(SUBSTR(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH)), 1,
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH))) -
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTNAME))) ));

/* MASTER LIBRARIES */
LIBNAME CHIS "&localProjectPath.CHIS";

/* Determine PDF Password */
* Pull PDF Password from Text;
FILENAME scrPath "&localProjectPath.PDFPassword.txt";
DATA _NULL_;
    LENGTH text $265;
    RETAIN text '';
    INFILE scrPath FLOWOVER DLMSTR='//' END=last;
    INPUT;
    text = CATS(text,_INFILE_);
    IF last THEN CALL SYMPUT('rawpath',text);
RUN;
%LET pdfPassword = %SYSFUNC(TRIM(%SYSFUNC(DEQUOTE(&rawpath))));

/* DEFINE GLOBAL OPTIONS */
ODS GRAPHICS OFF;
OPTIONS PDFSECURITY=HIGH;
OPTIONS PDFPASSWORD=(owner="&pdfPassword");

/* CREATE CUSTOM FORMATS */
OPTIONS fmtsearch=(CHIS);

/* CREATE DATA SET WITH LIMITED DESIRED FIELDS FOR MINER */
DATA CHIS.CHIS_DATA_MINER(KEEP = SRTENR
                                 SRSEX
                                 RACEDF_P1
                                 AH13A
                                 AB22
                                 AB24
                                 AB25
```

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```
                                    AB30
                                    AB34
                                    AB52
                                    AD37W
                                    AD40W
                                    AESODA_P1
                                    AE15
                                    AE15A
                                    SMKCUR
                                    SMOKING
                                    NUMCIG
                                    AC42_P
                                    AC44
                                    AD50
                                    RBMI
                                    AF65
                                    AF63
                                    DSTRS12
                                    AH33NEW
                                    AH34NEW
                                    AH35NEW
                                    AH37
                                    CITIZEN2
                                    YRUS_P1
                                    PCTLF_P
                                    AG22
                                    SERVED
                                    AG10
                                    WRKST_P1
                                    AHEDC_P1
                                    AK4
                                    FSLEV
                                    POVLL
                                    AL6
                                    AL22
                                    AL18A
                                    AK23
                                    AK25
                                    AM19
                                    AM21
                                    AK28
                                    AM36
                                    AM34
                                    UR_CLRT
                                    maritstat
                                    agegroup
                                    asthmastatus
                                    prilanguage
                                    famtype
                                    year
                            );
    SET CHIS.CHIS_DATA_FINAL;
RUN;

/* VIEW TABLE CONTENTS & STRUCTURE */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
CONTENTS-EM-All.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
```

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```
    PROC CONTENTS DATA=CHIS.CHIS_DATA_MINER VARNUM;
        TITLE 'PROC CONTENTS - CHIS.CHIS_DATA_MINER';
    RUN;
ODS PDF CLOSE;

/* CREATE MINER DATA SET WITH OF CURRENT ASTHMATICS ONLY */
DATA CHIS.CHIS_DATA_MINERCA;
    SET CHIS.CHIS_DATA_MINER (WHERE=(asthmastatus=1));
RUN;

/* VIEW TABLE CONTENTS & STRUCTURE */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
CONTENTS-EM-CurrAsth.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC CONTENTS DATA=CHIS.CHIS_DATA_MINERCA VARNUM;
        TITLE 'PROC CONTENTS - CHIS.CHIS_DATA_MINERCA';
    RUN;
ODS PDF CLOSE;

/* DISABLE SAS GRAPHICS */
ODS GRAPHICS OFF;

QUIT;
```

Program: CHIS_40_SubjectChar

```
/*******************************************************************************
**  Project Name    : Secondary Research of Asthma  Hospitalizations           **
**                    Masters of Science in Business Analytics Capstone Project **
**                    March / April 2019                                        **
**  Author          : Matthew C. Vanderbilt                                   **
**                    MSBA Candidate & NU Scholar, National University          **
**                    Director of Fiscal Affairs, Department of Medicine,       **
**                    UC San Diego School of Medicine                           **
**  ========================================================================== **
**  Date Created    : 23 March 2019 22:31                                     **
**  Program Name    : CHIS_40_SubjectChar                                     **
**  Purpose         : Investigates Characteristics of Sample                  **
**  Note            : Capitalized values represent SAS commands and unadjusted **
**                    variables; lower-case variables represent study-created **
**                    variables.                                                **
**                                                                              **
*******************************************************************************/

/* DISABLE SAS GRAPHICS */
ODS GRAPHICS OFF;

/* GLOBAL VARIABLES */
* Determine File Path for SAS EGP;
%LET localProjectPath = %SYSFUNC(SUBSTR(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH)), 1,
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH))) -
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTNAME))) ));

/* MASTER LIBRARIES */
LIBNAME CHIS "&localProjectPath.CHIS";
```

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```
/* Determine PDF Password */
* Pull PDF Password from Text;
FILENAME scrPath "&localProjectPath.PDFPassword.txt";
DATA _NULL_;
    LENGTH text $265;
    RETAIN text '';
    INFILE scrPath FLOWOVER DLMSTR='//' END=last;
    INPUT;
    text = CATS(text,_INFILE_);
    IF last THEN CALL SYMPUT('rawpath',text);
RUN;
%LET pdfPassword = %SYSFUNC(TRIM(%SYSFUNC(DEQUOTE(&rawpath))));

/* DEFINE GLOBAL OPTIONS */
ODS GRAPHICS OFF;
OPTIONS PDFSECURITY=HIGH;
OPTIONS PDFPASSWORD=(owner="&pdfPassword");

/* CREATE CUSTOM FORMATS */
OPTIONS fmtsearch=(CHIS);

/* PERFORM WEIGHTED UNIVARIATE ANALYSIS FOR RECODED BINOMIAL DATASET */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYFREQ-Demographics.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
        ODS GRAPHICS ON;
    PROC SURVEYFREQ DATA=CHIS.CHIS_DATA_FINAL VARMETHOD=JACKKNIFE;
        TITLE 'PROC SURVEYFREQ - CHIS.CHIS_DATA_FINAL -  Demographic Information';
        WEIGHT    FNWGT0;
        REPWEIGHT FNWGT1-FNWGT160 / jkcoefs = 1;
        TABLES    SRSEX       /*SELF-REPORTED GENDER*/
                  agegroup    /*age group*/
                  RACEDF_P1   /*RACE - FORMER DOF RACE-ETHNICITY(PUF 1 YR RECODE)*/
                  AH33NEW     /*BORN IN U.S.*/
                  AH34NEW     /*MOTHER BORN IN U.S.*/
                  AH35NEW     /*FATHER BORN IN U.S.*/
                  CITIZEN2    /*CITIZENSHIP STATUS (3 LVLS)*/
                  YRUS_P1     /*YEARS LIVED IN THE U.S.(PUF 1 YR RECODE)*/
                  PCTLF_P     /*PERCENT LIFE IN US (PUF RECODE)*/
                  prilanguage /*primary spoken language*/
                  AH37        /*LEVEL OF ENGLISH PROFICIENCY: GENERAL*/
                  maritstat   /*marital status*/
                  famtype     /*family type*/
                  SRTENR      /*SELF-REPORTED HOUSEHOLD TENURE (HH)*/
                  AHEDC_P1    /*ADULT EDUCATIONAL ATTAINMENT(PUF 1 YR RECODE)*/
                  AG22        /*EVER SERVE IN U.S. ARMED FORCES*/
                  SERVED      /*LENGTH OF TIME SERVED IN ACTIVE DUTY*/
                  AG10        /*RESPONDENT USUALLY WORKS*/
                  WRKST_P1    /*WORK STATUS(PUF 1 YR RECODE)*/
                  AM34        /*TELEPHONE CALLS RECEIVED*/
                  UR_CLRT     /*RURAL AND URBAN - CLARITAS (BY ZIPCODE) (4 LVLS)*/
                  / PLOTS=ALL;
    RUN;
ODS PDF CLOSE;

/* PERFORM WEIGHTED UNIVARIATE ANALYSIS FOR RECODED BINOMIAL DATASET */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYFREQ-Health.pdf"
```

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```
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
        ODS GRAPHICS ON;
    PROC SURVEYFREQ DATA=CHIS.CHIS_DATA_FINAL VARMETHOD=JACKKNIFE;
        TITLE 'PROC SURVEYFREQ - CHIS.CHIS_DATA_FINAL -  Health';
        WEIGHT    FNWGT0;
        REPWEIGHT FNWGT1-FNWGT160 / jkcoefs = 1;
        TABLES    AB1          /*GENERAL HEALTH CONDITION*/
                  RBMI         /*BMI DESCRIPTIVE*/
                  asthmastatus/*asthmatic status*/
                  AB17         /*DOCTOR EVER TOLD HAVE ASTHMA*/
                  AB43         /*HEALTH PROFESSIONAL EVER GAVE ASTHMA MANAGEMENT PLAN*/
                  AB98         /*HAVE WRITTEN COPY OF ASTHMA CARE PLAN*/
                  AB108_P1     /*CONFIDENCE TO CONTROL AND MANAGE ASTHMA*/
                  AB40         /*STILL HAS ASTHMA*/
                  AB41         /*ASTHMA EPISODE/ATTACK IN PAST 12 MOS*/
                  ASTCUR       /*CURRENT ASTHMA STATUS*/
                  ASTS         /*ASTHMA SYMPTOMS PAST 12 MOS FOR DIAGOSED ASTHMATICS*/
                  ASTYR        /*ASTHMA SYMPTOMS PAST 12 MOS FOR CURRENT ASTHAMTICS*/
                  AB18         /*TAKING DAILY MEDICATION TO CONTROL ASTHMA*/
                  AB19         /*ASTHMA SYMPT FREQ PAST 12 MOS: CURRENT ASTHMATICS*/
                  AH13A        /*ER/URGENT CRE FOR ASTHMA PAST 12 MOS: CURRENT ASTHM*/
                  AB22         /*DOCTOR EVER TOLD HAVE DIABETES*/
                  AB24         /*CURRENTLY TAKING INSULIN*/
                  AB25         /*CURRENTLY TAKING DIABETIC RX TO LOWER BLOOD SUGAR*/
                  AB34         /*DOCTOR EVER TOLD HAVE ANY KIND OF HEART DISEASE*/
                  AB52         /*EVER TOLD HAVE HEART FAILURE/CONGESTIVE*/
                  AB30         /*CURRENTLY TAKING RX TO CONTROL HIGH BLOOD PRESSURE*/
                  AB117        /*ADMITTED TO HOSPITAL FOR HEART DX PAST 12 MOS*/
                  DSTRS12      /*LIKELY HAS PSYCHOLOGICAL DISTRESS IN LAST YEAR*/
                  DSTRS30      /*LIKELY HAS PSYCHOLOGICAL DISTRESS IN PAST MONTH*/
                  AF65         /*FEEL RESTLESS WORST MONTH*/
                  AF63         /*FEEL NERVOUS WORST MONTH*/
                  AD50         /*BLIND/DEAF OR HAS SEVERE VISION/HEARING PROBLEM*/
                  AE15         /*SMOKED 100 OR MORE CIGARETTES IN ENTIRE LIFETIME*/
                  AE15A        /*SMOKES CIGARETTES EVERYDAY, SOME DAYS OR NOT AT ALL*/
                  SMKCUR       /*CURRENT SMOKER*/
                  SMOKING      /*CURRENT SMOKING HABITS*/
                  NUMCIG       /*# OF CIGARETTES PER DAY*/
                  AD37W        /*WALKED AT LEAST 10 MIN FOR TRANSPORT PAST 7 DAYS*/
                  AD40W        /*WALKED AT LEAST 10 MIN FOR LEISURE PAST 7 DAYS*/
                  AESODA_P1    /*# OF TIMES DRINKING SODA PER WEEK (PUF 1 YR RECODE)*/
                  AC42_P       /*HOW OFTEN FIND FRESH FRUIT/VEG IN NEIGHB (PUF
RECODE)*/
                  AC44         /*NEIGHBORHOOD FRUIT/VEG AFFORDABLE*/
                  / PLOTS=ALL;
    RUN;
ODS PDF CLOSE;

/* PERFORM WEIGHTED UNIVARIATE ANALYSIS FOR RECODED BINOMIAL DATASET */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYFREQ-HealthAccess.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
        ODS GRAPHICS ON;
    PROC SURVEYFREQ DATA=CHIS.CHIS_DATA_FINAL VARMETHOD=JACKKNIFE;
```

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```
        TITLE 'PROC SURVEYFREQ - CHIS.CHIS_DATA_FINAL -  Health Care Access &
Insurance';
        WEIGHT    FNWGT0;
        REPWEIGHT    FNWGT1-FNWGT160 / jkcoefs = 1;
        TABLES    INS         /*CURRENTLY INSURED*/
                  healthplan  /*name of health plan*/
                  HMO         /*HMO STATUS*/
                  AH71_P1     /*HEALTH PLAN DEDUCTIBLE MORE THAN $1,000*/
                  AH72_P1     /*HEALTH PLAN DEDUCTIBLE MORE THAN $2,000*/
                  AI25        /*COVERED FOR PRESCRIPTION DRUGS*/
                  AH1         /*HAVE USUAL SOURCE OF HEALTH CARE*/
                  USUAL5TP    /*USUAL SOURCE OF CARE (5 LVLS)*/
                  AH16        /*DELAY/NOT GET PRESCRIPTION IN PAST 12 MO*/
                  AJ19        /*COST/NO INSUR DELAYED GETTING PRESCRIPTION*/
                  AH22        /*DELAY/NOT GET OTHER MEDICAL CARE IN PAST 12 MOS*/
                  AJ20        /*COST/NO INSR DELAYED GETTING NEEDED CARE*/
                  AJ102       /*SOUGHT APPNT W/DOC IN 2 DAYS PAST YR*/
                  AJ112       /*HOW OFTEN DOC LISTENS CAREFULLY*/
                  AJ113       /*HOW OFTEN DOC CLEARLY EXPLAINS WHAT TO DO*/
                  AJ105       /*KNOW RIGHTS TO INTERPRETOR DURING MED VISIT*/
                  AJ9         /*MD LANGUAGE REASON WHY DIFFICULT TO UNDERSTAND*/
                  AH14        /*PATIENT IN HOSP OVERNIGHT DURING PAST 12 MOS*/
                  AH12        /*VISITED EMERGENCY ROOM FOR OWN HEALTH PAST 12 MOS*/
                  ER          /*ER VISIT WITHIN THE PAST YEAR*/
                  AJ108       /*EVER USED INTERNET*/
                ;
    RUN;
ODS PDF CLOSE;

/* PERFORM WEIGHTED UNIVARIATE ANALYSIS FOR RECODED BINOMIAL DATASET */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYFREQ-Socioeconomics.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
        ODS GRAPHICS ON;
    PROC SURVEYFREQ DATA=CHIS.CHIS_DATA_FINAL VARMETHOD=JACKKNIFE;
        TITLE 'PROC SURVEYFREQ - CHIS.CHIS_DATA_FINAL -  Socioeconomic Status';
        WEIGHT    FNWGT0;
        REPWEIGHT    FNWGT1-FNWGT160 / jkcoefs = 1;
        TABLES    POVLL       /*POVERTY LEVEL*/
                  FSLEV       /*FOOD SECURITY STATUS LEVEL*/
                  AL6         /*RECEIVING SSI (SUPPLEMENTAL SECURITY INCOME)*/
                  AL22        /*RECEIVING SOCIAL SECURITY DISABILITY INS*/
                  AL18A       /*RECVD SOCIAL SECURITY OR PENSION LAST MONTH*/
                  AK4         /*TYPE OF EMPLOYER AT MAIN JOB*/
                  AM36        /*DID VOLUNTEER WORK OR COMMUNITY SERVICES PAST YR*/
                  AK23        /*LIVE IN HOUSE, DUPLEX, ETC*/
                  AK25        /*OWN OR RENT HOME*/
                  AM19        /*PEOPLE IN NEIGHBORHOOD WILLING TO HELP EACH OTHER*/
                  AM21        /*PEOPLE IN NEIGHBORHOOD CAN BE TRUSTED*/
                  AK28        /*HOW OFTEN FEEL SAFE IN NEIGHBORHOOD*/
                ;
    RUN;
ODS PDF CLOSE;

/* DISABLE SAS GRAPHICS */
ODS GRAPHICS OFF;

QUIT;
```

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Program: CHIS_45_AsthmaChar

```
/*******************************************************************************
**  Project Name    : Secondary Research of Asthma  Hospitalizations          **
**                    Masters of Science in Business Analytics Capstone Project **
**                    March / April 2019                                        **
**  Author          : Matthew C. Vanderbilt                                   **
**                    MSBA Candidate & NU Scholar, National University        **
**                    Director of Fiscal Affairs, Department of Medicine,     **
**                    UC San Diego School of Medicine                         **
**  ========================================================================== **
**  Date Created    : 31 March 2019 09:59                                     **
**  Program Name    : CHIS_45_AsthmaChar                                      **
**  Purpose         : Investigates Characteristics of Asthmat Sample          **
**  Note            : Capitalized values represent SAS commands and unadjusted **
**                    variables; lower-case variables represent study-created **
**                    variables.                                              **
**                                                                            **
*******************************************************************************/

/* DISABLE SAS GRAPHICS */
ODS GRAPHICS OFF;

/* GLOBAL VARIABLES */
* Determine File Path for SAS EGP;
%LET localProjectPath = %SYSFUNC(SUBSTR(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH)), 1,
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH))) -
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTNAME))) ));

/* MASTER LIBRARIES */
LIBNAME CHIS "&localProjectPath.CHIS";

/* Determine PDF Password */
* Pull PDF Password from Text;
FILENAME scrPath "&localProjectPath.PDFPassword.txt";
DATA _NULL_;
    LENGTH text $265;
    RETAIN text '';
    INFILE scrPath FLOWOVER DLMSTR='//' END=last;
    INPUT;
    text = CATS(text,_INFILE_);
    IF last THEN CALL SYMPUT('rawpath',text);
RUN;
%LET pdfPassword = %SYSFUNC(TRIM(%SYSFUNC(DEQUOTE(&rawpath))));

/* DEFINE GLOBAL OPTIONS */
ODS GRAPHICS OFF;
OPTIONS PDFSECURITY=HIGH;
OPTIONS PDFPASSWORD=(owner="&pdfPassword");

/* CREATE CUSTOM FORMATS */
OPTIONS fmtsearch=(CHIS);

/* PERFORM WEIGHTED UNIVARIATE ANALYSIS FOR RECODED BINOMIAL DATASET */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYFREQ.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
```

DocuSign Envelope ID: 47DDAAF8-F05F-49C5-94C0-59245F12E441


```
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
        ODS GRAPHICS ON;
    PROC SURVEYFREQ DATA=CHIS.CHIS_DATA_FINAL VARMETHOD=JACKKNIFE;
        TITLE 'PROC SURVEYFREQ - CHIS.CHIS_DATA_FINAL -  Asthma Variables';
        WEIGHT    FNWGT0;
        REPWEIGHT FNWGT1-FNWGT160 / jkcoefs = 1;
        TABLES    (AB17       /*DOCTOR EVER TOLD HAVE ASTHMA*/
                   AB43       /*HEALTH PROFESSIONAL EVER GAVE ASTHMA MANAGEMENT PLAN*/
                   AB98       /*HAVE WRITTEN COPY OF ASTHMA CARE PLAN*/
                   AB108_P1   /*CONFIDENCE TO CONTROL AND MANAGE ASTHMA*/
                   AB40       /*STILL HAS ASTHMA*/
                   AB41       /*ASTHMA EPISODE/ATTACK IN PAST 12 MOS*/
                   ASTCUR     /*CURRENT ASTHMA STATUS*/
                   ASTS       /*ASTHMA SYMPTOMS PAST 12 MOS FOR DIAGNOSED ASTHMATICS*/
                   ASTYR      /*ASTHMA SYMPTOMS PAST 12 MOS FOR CURRENT ASTHMATICS*/
                   AB18       /*TAKING DAILY MEDICATION TO CONTROL ASTHMA*/
                   AB19       /*ASTHMA SYMPT FREQ PAST 12 MOS: CURRENT ASTHMATICS*/
                   AH13A      /*ER/URGENT CRE FOR ASTHMA PAST 12 MOS: CURRENT ASTHM*/
                  )*asthmastatus
                ;
    RUN;
ODS PDF CLOSE;

/* DISABLE SAS GRAPHICS */
ODS GRAPHICS OFF;

QUIT;
```

Program: CHIS_50_EDA

```
/*******************************************************************************
**  Project Name    : Secondary Research of Asthma  Hospitalizations            **
**                    Masters of Science in Business Analytics Capstone Project **
**                    March / April 2019                                        **
**  Author          : Matthew C. Vanderbilt                                   **
**                    MSBA Candidate & NU Scholar, National University          **
**                    Director of Fiscal Affairs, Department of Medicine,       **
**                    UC San Diego School of Medicine                           **
**  ========================================================================== **
**  Date Created    : 04 April 2019 13:37                                     **
**  Program Name    : CHIS_50_AsthmaChar                                      **
**  Purpose         : Additional Categorical Exploratory Data Analysis        **
**  Note            : Capitalized values represent SAS commands and unadjusted **
**                    variables; lower-case variables represent study-created **
**                    variables.                                                **
**                                                                              **
*******************************************************************************/

/* DISABLE SAS GRAPHICS */
ODS GRAPHICS OFF;

/* GLOBAL VARIABLES */
* Determine File Path for SAS EGP;
%LET localProjectPath = %SYSFUNC(SUBSTR(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH)), 1,
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH))) -
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTNAME))) ));

/* MASTER LIBRARIES */
```

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```
LIBNAME CHIS "&localProjectPath.CHIS";

/* Determine PDF Password */
* Pull PDF Password from Text;
FILENAME scrPath "&localProjectPath.PDFPassword.txt";
DATA _NULL_;
    LENGTH text $265;
    RETAIN text '';
    INFILE scrPath FLOWOVER DLMSTR='//' END=last;
    INPUT;
    text = CATS(text,_INFILE_);
    IF last THEN CALL SYMPUT('rawpath',text);
RUN;
%LET pdfPassword = %SYSFUNC(TRIM(%SYSFUNC(DEQUOTE(&rawpath))));

/* DEFINE GLOBAL OPTIONS */
ODS GRAPHICS OFF;
OPTIONS PDFSECURITY=HIGH;
OPTIONS PDFPASSWORD=(owner="&pdfPassword");

/* CREATE CUSTOM FORMATS */
OPTIONS fmtsearch=(CHIS);

/* PERFORM WEIGHTED UNIVARIATE ANALYSIS */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYFREQ-Demographics.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC SURVEYFREQ DATA=CHIS.CHIS_DATA_FINAL VARMETHOD=JACKKNIFE;
        TITLE 'PROC SURVEYFREQ - CHIS.CHIS_DATA_FINAL - Demographic Information';
        WEIGHT    FNWGT0;
        REPWEIGHT FNWGT1-FNWGT160 / jkcoefs = 1;
        TABLES    (SRSEX
                   agegroup
                   RACEDF_P1
                   AH33NEW
                   AH34NEW
                   AH35NEW
                   CITIZEN2
                   YRUS_P1
                   PCTLF_P
                   prilanguage
                   AH37
                   maritstat
                   famtype
                   SRTENR
                   AHEDC_P1
                   AG22
                   SERVED
                   AG10
                   WRKST_P1
                   AM34
                   UR_CLRT
                  )*asthmastatus
                  / CHISQ;
    RUN;
ODS PDF CLOSE;

/* PERFORM WEIGHTED UNIVARIATE ANALYSIS */
```

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```
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYFREQ-Health.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC SURVEYFREQ DATA=CHIS.CHIS_DATA_FINAL VARMETHOD=JACKKNIFE;
        TITLE 'PROC SURVEYFREQ - CHIS.CHIS_DATA_FINAL - Health';
        WEIGHT    FNWGT0;
        REPWEIGHT FNWGT1-FNWGT160 / jkcoefs = 1;
        TABLES    (AB1
                   RBMI        /*BMI DESCRIPTIVE*/
                   AB17
                   AB43
                   AB98
                   AB108_P1
                   AB40
                   AB41
                   ASTCUR
                   ASTS
                   ASTYR
                   AB18
                   AB19
                   AH13A
                   AB22
                   AB24
                   AB25
                   AB34
                   AB52
                   AB30
                   AB117
                   DSTRS12
                   DSTRS30
                   AF65
                   AF63
                   AD50
                   AE15
                   AE15A
                   SMKCUR
                   SMOKING
                   NUMCIG
                   AD37W
                   AD40W
                   AESODA_P1
                   AC42_P
                   AC44
                  )*asthmastatus
                  / CHISQ;
    RUN;
ODS PDF CLOSE;

/* PERFORM WEIGHTED UNIVARIATE ANALYSIS */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYFREQ-HealthInsurance.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC SURVEYFREQ DATA=CHIS.CHIS_DATA_FINAL VARMETHOD=JACKKNIFE;
        TITLE 'PROC SURVEYFREQ - CHIS.CHIS_DATA_FINAL - Health Care Access &
Insurance';
```

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```
        WEIGHT    FNWGT0;
        REPWEIGHT FNWGT1-FNWGT160 / jkcoefs = 1;
        TABLES    (INS
                   healthplan
                   HMO
                   AH71_P1
                   AH72_P1
                   AI25
                   AH1
                   USUAL5TP
                   AH16
                   AJ19
                   AH22
                   AJ20
                   AJ102
                   AJ112
                   AJ113
                   AJ105
                   AJ9
                   AH14
                   AH12
                   ER
                   AJ108
                  )*asthmastatus
                  / CHISQ;
    RUN;
ODS PDF CLOSE;

/* PERFORM WEIGHTED UNIVARIATE ANALYSIS */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYFREQ-Socioeconomics.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC SURVEYFREQ DATA=CHIS.CHIS_DATA_FINAL VARMETHOD=JACKKNIFE;
        TITLE 'PROC SURVEYFREQ - CHIS.CHIS_DATA_FINAL - Socioeconomic Status';
        WEIGHT    FNWGT0;
        REPWEIGHT FNWGT1-FNWGT160 / jkcoefs = 1;
        TABLES    (POVLL
                   FSLEV
                   AL6
                   AL22
                   AL18A
                   AK4
                   AM36
                   AK23
                   AK25
                   AM19
                   AM21
                   AK28
                  )*asthmastatus
                  / CHISQ;
    RUN;
ODS PDF CLOSE;

/* PERFORM WEIGHTED UNIVARIATE ANALYSIS */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYFREQ-Asthma.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
```

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```
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC SURVEYFREQ DATA=CHIS.CHIS_DATA_FINAL VARMETHOD=JACKKNIFE;
        TITLE 'PROC SURVEYFREQ - CHIS.CHIS_DATA_FINAL -  Asthma Variables';
        WEIGHT    FNWGT0;
        REPWEIGHT FNWGT1-FNWGT160 / jkcoefs = 1;
        TABLES    (AB17
                   AB43
                   AB98
                   AB108_P1
                   AB40
                   AB41
                   ASTCUR
                   ASTS
                   ASTYR
                   AB18
                   AB19
                   AH13A
                  )*asthmastatus
                  / CHISQ;
    RUN;
ODS PDF CLOSE;

/* DISABLE SAS GRAPHICS */
ODS GRAPHICS OFF;

QUIT;
```

Program: CHIS_51_EDA_Severity

```
/*******************************************************************************
**  Project Name    : Secondary Research of Asthma  Hospitalizations          **
**                    Masters of Science in Business Analytics Capstone Project **
**                    March / April 2019                                        **
**  Author          : Matthew C. Vanderbilt                                   **
**                    MSBA Candidate & NU Scholar, National University          **
**                    Director of Fiscal Affairs, Department of Medicine,       **
**                    UC San Diego School of Medicine                           **
**  ========================================================================== **
**  Date Created    : 3 May 2019 07:50                                        **
**  Program Name    : CHIS_51_EDA_Severity                                    **
**  Purpose         : CHIS Respondent Characteristics by Severe Asthma        **
**  Note            : Capitalized values represent SAS commands and unadjusted **
**                    variables; lower-case variables represent study-created **
**                    variables.                                                **
**                                                                              **
*******************************************************************************/

/* DISABLE SAS GRAPHICS */
ODS GRAPHICS OFF;

/* GLOBAL VARIABLES */
* Determine File Path for SAS EGP;
%LET localProjectPath = %SYSFUNC(SUBSTR(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH)), 1,
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH))) -
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTNAME))) ));

/* MASTER LIBRARIES */
LIBNAME CHIS "&localProjectPath.CHIS";
```

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```
/* Determine PDF Password */
* Pull PDF Password from Text;
FILENAME scrPath "&localProjectPath.PDFPassword.txt";
DATA _NULL_;
    LENGTH text $265;
    RETAIN text '';
    INFILE scrPath FLOWOVER DLMSTR='//' END=last;
    INPUT;
    text = CATS(text,_INFILE_);
    IF last THEN CALL SYMPUT('rawpath',text);
RUN;
%LET pdfPassword = %SYSFUNC(TRIM(%SYSFUNC(DEQUOTE(&rawpath))));

/* DEFINE GLOBAL OPTIONS */
ODS GRAPHICS OFF;
OPTIONS PDFPASSWORD=(owner="&pdfPassword");
OPTIONS PDFSECURITY=HIGH;

/* CREATE CUSTOM FORMATS */
OPTIONS fmtsearch=(CHIS);

/* DEFINE FORMATS FOR NEWLY RECODED VARIABLES */
PROC FORMAT LIBRARY=CHIS;
    VALUE fasthmaesc3c  1    = '1 Severe Asthmatic'
                        2    = '2 Standard Asthmatic'
                        3    = '3 Non-Asthmatic'
                        ;

RUN;

/* CREATE DATASET FOR REVIEW */
DATA CHIS.CHISSEVERITY;
    SET CHIS.CHIS_DATA_FINAL;

    * Recode ED/Urgent Care Asthmatic Variable;
    asthmaesc3 = 3; *3 = Non-Asthmatic;
    IF asthmastatus = 1 THEN
        DO;
            IF AH13A = 1 THEN asthmaesc3 = 1; *1 = ED/UC;
            IF AH13A = 2 THEN asthmaesc3 = 2; *2 = No ED/UC;
        END;
    LABEL     asthmaesc3 = 'ED/UC Asthma Visit';
    FORMAT    asthmaesc3 fasthmaesc3c.;

RUN;

/* PERFORM WEIGHTED UNIVARIATE ANALYSIS */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYFREQ-Demographics.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC SURVEYFREQ DATA=CHIS.CHISSEVERITY VARMETHOD=JACKKNIFE;
        TITLE 'PROC SURVEYFREQ - CHIS.CHISSEVERITY - Demographic Information';
        WEIGHT    FNWGT0;
        REPWEIGHT FNWGT1-FNWGT160 / jkcoefs = 1;
        TABLES    (SRSEX
                   agegroup
                   RACEDF_P1
```

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```
                    AH33NEW
                    AH34NEW
                    AH35NEW
                    CITIZEN2
                    YRUS_P1
                    PCTLF_P
                    prilanguage
                    AH37
                    maritstat
                    famtype
                    SRTENR
                    AHEDC_P1
                    AG22
                    SERVED
                    AG10
                    WRKST_P1
                    AM34
                    UR_CLRT
                   )*asthmaesc3
                   / CHISQ;
    RUN;
ODS PDF CLOSE;

/* PERFORM WEIGHTED UNIVARIATE ANALYSIS */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYFREQ-Health.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC SURVEYFREQ DATA=CHIS.CHISSEVERITY VARMETHOD=JACKKNIFE;
        TITLE 'PROC SURVEYFREQ - CHIS.CHISSEVERITY - Health';
        WEIGHT    FNWGT0;
        REPWEIGHT FNWGT1-FNWGT160 / jkcoefs = 1;
        TABLES    (AB1
                   RBMI        /*BMI DESCRIPTIVE*/
                   AB17
                   AB43
                   AB98
                   AB108_P1
                   AB40
                   AB41
                   ASTCUR
                   ASTS
                   ASTYR
                   AB18
                   AB19
                   AH13A
                   AB22
                   AB24
                   AB25
                   AB34
                   AB52
                   AB30
                   AB117
                   DSTRS12
                   DSTRS30
                   AF65
                   AF63
                   AD50
                   AE15
```

DocuSign Envelope ID: 47DDAAF8-F05F-49C5-94C0-59245F12E441


```
                    AE15A
                    SMKCUR
                    SMOKING
                    NUMCIG
                    AD37W
                    AD40W
                    AESODA_P1
                    AC42_P
                    AC44
                   )*asthmaesc3
                   / CHISQ;
    RUN;
ODS PDF CLOSE;

/* PERFORM WEIGHTED UNIVARIATE ANALYSIS */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYFREQ-HealthInsurance.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC SURVEYFREQ DATA=CHIS.CHISSEVERITY VARMETHOD=JACKKNIFE;
        TITLE 'PROC SURVEYFREQ - CHIS.CHISSEVERITY - Health Care Access & Insurance';
        WEIGHT    FNWGT0;
        REPWEIGHT FNWGT1-FNWGT160 / jkcoefs = 1;
        TABLES    (INS
                    healthplan
                    HMO
                    AH71_P1
                    AH72_P1
                    AI25
                    AH1
                    USUAL5TP
                    AH16
                    AJ19
                    AH22
                    AJ20
                    AJ102
                    AJ112
                    AJ113
                    AJ105
                    AJ9
                    AH14
                    AH12
                    ER
                    AJ108
                   )*asthmaesc3
                   / CHISQ;
    RUN;
ODS PDF CLOSE;

/* PERFORM WEIGHTED UNIVARIATE ANALYSIS */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYFREQ-Socioeconomics.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC SURVEYFREQ DATA=CHIS.CHISSEVERITY VARMETHOD=JACKKNIFE;
        TITLE 'PROC SURVEYFREQ - CHIS.CHISSEVERITY - Socioeconomic Status';
        WEIGHT    FNWGT0;
```

DocuSign Envelope ID: 47DDAAF8-F05F-49C5-94C0-59245F12E441


```
        REPWEIGHT FNWGT1-FNWGT160 / jkcoefs = 1;
        TABLES    (POVLL
                   FSLEV
                   AL6
                   AL22
                   AL18A
                   AK4
                   AM36
                   AK23
                   AK25
                   AM19
                   AM21
                   AK28
                  )*asthmaesc3
                  / CHISQ;
    RUN;
ODS PDF CLOSE;

/* PERFORM WEIGHTED UNIVARIATE ANALYSIS */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYFREQ-Asthma.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC SURVEYFREQ DATA=CHIS.CHISSEVERITY VARMETHOD=JACKKNIFE;
        TITLE 'PROC SURVEYFREQ - CHIS.CHISSEVERITY -  Asthma Variables';
        WEIGHT    FNWGT0;
        REPWEIGHT FNWGT1-FNWGT160 / jkcoefs = 1;
        TABLES    (AB17
                   AB43
                   AB98
                   AB108_P1
                   AB40
                   AB41
                   ASTCUR
                   ASTS
                   ASTYR
                   AB18
                   AB19
                   AH13A
                  )*asthmaesc3
                  / CHISQ;
    RUN;
ODS PDF CLOSE;

/* DELETE TEMPORARY TABLE */
PROC DELETE DATA = CHIS.CHISSEVERITY;
RUN;

/* DISABLE SAS GRAPHICS */
ODS GRAPHICS OFF;

QUIT;
```

DocuSign Envelope ID: 47DDAAF8-F05F-49C5-94C0-59245F12E441

Program: CHIS_55_Corr

```
/*******************************************************************************
**  Project Name    : Secondary Research of Asthma  Hospitalizations          **
**                    Masters of Science in Business Analytics Capstone Project **
**                    March / April 2019                                        **
**  Author          : Matthew C. Vanderbilt                                   **
**                    MSBA Candidate & NU Scholar, National University        **
**                    Director of Fiscal Affairs, Department of Medicine,     **
**                    UC San Diego School of Medicine                         **
**  ============================================================================ **
**  Date Created    : 04 April 2019 13:37                                     **
**  Program Name    : CHIS_55_Corr                                            **
**  Purpose         : Correlation Exploratory Data Analysis                   **
**  Note            : Capitalized values represent SAS commands and unadjusted **
**                    variables; lower-case variables represent study-created **
**                    variables.                                                **
**                                                                              **
*******************************************************************************/

/* DISABLE SAS GRAPHICS */
ODS GRAPHICS OFF;

/* GLOBAL VARIABLES */
* Determine File Path for SAS EGP;
%LET localProjectPath = %SYSFUNC(SUBSTR(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH)), 1,
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH))) -
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTNAME))) ));

/* MASTER LIBRARIES */
LIBNAME CHIS "&localProjectPath.CHIS";

/* Determine PDF Password */
* Pull PDF Password from Text;
FILENAME scrPath "&localProjectPath.PDFPassword.txt";
DATA _NULL_;
    LENGTH text $265;
    RETAIN text '';
    INFILE scrPath FLOWOVER DLMSTR='//' END=last;
    INPUT;
    text = CATS(text,_INFILE_);
    IF last THEN CALL SYMPUT('rawpath',text);
RUN;
%LET pdfPassword = %SYSFUNC(TRIM(%SYSFUNC(DEQUOTE(&rawpath))));

/* DEFINE GLOBAL OPTIONS */
ODS GRAPHICS OFF;
OPTIONS PDFSECURITY=HIGH;
OPTIONS PDFPASSWORD=(owner="&pdfPassword");

/* CREATE CUSTOM FORMATS */
OPTIONS fmtsearch=(CHIS);

/* PERFORM DATA CORRELATION */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
CORR.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
        ODS GRAPHICS ON;
```

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```
    PROC CORR DATA=CHIS.CHIS_DATA_FINAL PLOTS=SCATTER;
        VAR SRSEX            /*SELF-REPORTED GENDER*/
            RACEDF_P1      /*RACE - FORMER DOF RACE-ETHNICITY*/
            AB22           /*DOCTOR EVER TOLD HAVE DIABETES*/
            AB24           /*CURRENTLY TAKING INSULIN*/
            AB25           /*CURRENTLY TAKING DIABETIC PILLS TO LOWER BLOOD SUGAR*/
            AB30           /*CURRENTLY TAKING RX TO CONTROL HIGH BLOOD PRESSURE*/
            AB34           /*DOCTOR EVER TOLD HAVE ANY KIND OF HEART DISEASE*/
            AB52           /*EVER TOLD HAVE HEART FAILURE/CONGESTIVE*/
            AD37W          /*WALKED AT LEAST 10 MIN FOR TRANSPORT PAST 7 DAYS*/
            AD40W          /*WALKED AT LEAST 10 MIN FOR LEISURE PAST 7 DAYS*/
            AESODA_P1      /*# OF TIMES DRINKING SODA PER WEEK (PUF 1 YR RECODE)*/
            AE15           /*SMOKED 100 OR MORE CIGARETTES IN ENTIRE LIFETIME*/
            AE15A          /*SMOKES CIGARETTES EVERYDAY, SOME DAYS OR NOT AT ALL*/
            SMKCUR         /*CURRENT SMOKER*/
            SMOKING        /*CURRENT SMOKING HABITS*/
            NUMCIG         /*# OF CIGARETTES PER DAY*/
            AC42_P         /*HOW OFTEN FIND FRESH FRUIT/VEG IN NEIGHB */
            AC44           /*NEIGHBORHOOD FRUIT/VEG AFFORDABLE*/
            AD50           /*BLIND/DEAF OR HAS SEVERE VISION/HEARING PROBLEM*/
            RBMI           /*BMI DESCRIPTIVE*/
            AF65           /*FEEL RESTLESS WORST MONTH*/
            AF63           /*FEEL NERVOUS WORST MONTH*/
            DSTRS12        /*LIKELY HAS HAD PSYCHOLOGICAL DISTRESS IN THE LAST YEAR*/
            AH33NEW        /*BORN IN U.S.*/
            AH34NEW        /*MOTHER BORN IN U.S.*/
            AH35NEW        /*FATHER BORN IN U.S.*/
            AH37           /*LEVEL OF ENGLISH PROFICIENCY: GENERAL*/
            CITIZEN2       /*CITIZENSHIP STATUS (3 LVLS)*/
            YRUS_P1        /*YEARS LIVED IN THE U.S.(PUF 1 YR RECODE)*/
            PCTLF_P        /*PERCENT LIFE IN US (PUF RECODE)*/
            AG22           /*EVER SERVE IN U.S. ARMED FORCES*/
            WRKST_P1       /*WORK STATUS(PUF 1 YR RECODE)*/
            AHEDC_P1       /*ADULT EDUCATIONAL ATTAINMENT(PUF 1 YR RECODE)*/
            AK4            /*TYPE OF EMPLOYER AT MAIN JOB*/
            FSLEV          /*FOOD SECURITY STATUS LEVEL*/
            POVLL          /*POVERTY LEVEL*/
            AL6            /*RECEIVING SSI (SUPPLEMENTAL SECURITY INCOME)*/
            AL22           /*RECEIVING SOCIAL SECURITY DISABILITY INS*/
            AL18A          /*RECVD SOCIAL SECURITY OR PENSION LAST MONTH*/
            AM19           /*PEOPLE IN NEIGHBORHOOD WILLING TO HELP EACH OTHER*/
            AM21           /*PEOPLE IN NEIGHBORHOOD CAN BE TRUSTED*/
            AK28           /*HOW OFTEN FEEL SAFE IN NEIGHBORHOOD*/
            AM36           /*DID VOLUNTEER WORK OR COMMUNITY SERVICES PAST YR*/
            AM34           /*TELEPHONE CALLS RECEIVED*/
            UR_CLRT        /*RURAL AND URBAN - CLARITAS (BY ZIPCODE) (4 LVLS)*/
            maritstat      /*marital status*/
            agegroup       /*age group*/
            asthmastatus   /*asthmatic status*/
            prilanguage    /*primary spoken language*/
            famtype        /*family type*/
            ;
    RUN;
ODS PDF CLOSE;

/* DISABLE SAS GRAPHICS */
ODS GRAPHICS OFF;

QUIT;
```

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Program: CHIS_60_Regression

```
/*******************************************************************************
**  Project Name    : Secondary Research of Asthma  Hospitalizations          **
**                    Masters of Science in Business Analytics Capstone Project **
**                    March / April 2019                                        **
**  Author          : Matthew C. Vanderbilt                                   **
**                    MSBA Candidate & NU Scholar, National University        **
**                    Director of Fiscal Affairs, Department of Medicine,     **
**                    UC San Diego School of Medicine                         **
**  ============================================================================ **
**  Date Created    : 04 April 2019 13:37                                     **
**  Program Name    : CHIS_60_Regression                                      **
**  Purpose         : Additional Categorical Exploratory Data Analysis        **
**  Note            : Capitalized values represent SAS commands and unadjusted **
**                    variables; lower-case variables represent study-created **
**                    variables.                                              **
**                                                                            **
*******************************************************************************/

/* DISABLE SAS GRAPHICS */
ODS GRAPHICS OFF;

/* GLOBAL VARIABLES */
* Determine File Path for SAS EGP;
%LET localProjectPath = %SYSFUNC(SUBSTR(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH)), 1,
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH))) -
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTNAME))) ));

/* MASTER LIBRARIES */
LIBNAME CHIS "&localProjectPath.CHIS";

/* Determine PDF Password */
* Pull PDF Password from Text;
FILENAME scrPath "&localProjectPath.PDFPassword.txt";
DATA _NULL_;
    LENGTH text $265;
    RETAIN text '';
    INFILE scrPath FLOWOVER DLMSTR='//' END=last;
    INPUT;
    text = CATS(text,_INFILE_);
    IF last THEN CALL SYMPUT('rawpath',text);
RUN;
%LET pdfPassword = %SYSFUNC(TRIM(%SYSFUNC(DEQUOTE(&rawpath))));

/* DEFINE GLOBAL OPTIONS */
ODS GRAPHICS OFF;
OPTIONS PDFSECURITY=HIGH;
OPTIONS PDFPASSWORD=(owner="&pdfPassword");

/* CREATE CUSTOM FORMATS */
OPTIONS fmtsearch=(CHIS);

/* PERFORM MULTINOMIAL LOGISTIC REGRESSION */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYLOGISTIC-FULL.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC SURVEYLOGISTIC DATA=CHIS.CHIS_DATA_FINAL VARMETHOD=JACKKNIFE;
```

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```
TITLE  'PROC SURVEYLOGISTIC - CHIS.CHIS_DATA_FINAL - Full Association';
WEIGHT     FNWGT0;
REPWEIGHTS FNWGT1-FNWGT160 / jkcoefs = 1;
CLASS      SRSEX(REF='Male')
           RACEDF_P1(REF='White')
           AB22(REF='No')
           AB24(REF='No')
           AB25(REF='No')
           AB30(REF='No')
           AB34(REF='No')
           AB52(REF='No')
           AD37W(REF='No')
           AD40W(REF='No')
           AESODA_P1(REF='0 Times')
           AE15(REF='No')
           AE15A(REF='Not at All')
           SMKCUR(REF='Not Current Smoker')
           SMOKING(REF='Never Smoked Regularly')
           NUMCIG(REF='None')
           AC42_P(REF='Always')
           AC44(REF='Always')
           AD50(REF='No')
           RBMI(REF='Normal 18.5-24.99')
           AF65(REF='Not at All')
           AF63(REF='Not at All')
           DSTRS12(REF='No')
           AH33NEW(REF='Born in U.S.')
           AH34NEW(REF='Born in U.S.')
           AH35NEW(REF='Born in U.S.')
           AH37(REF='Very Well')
           CITIZEN2(REF='US-Born Citizen')
           YRUS_P1(REF='Inapplicable')
           PCTLF_P(REF='81+')
           AG22(REF='No')
           WRKST_P1(REF='Full-Time Employment (21+ hrs/week)')
           AHEDC_P1(REF='Bachelors Degree')
           AK4(REF='Government')
           FSLEV(REF='Inapplicable / >=200% FPL')
           POVLL(REF='300% FPL and Above')
           AL6(REF='No')
           AL22(REF='No')
           AL18A(REF='No')
           AM19(REF='Strongly Agree')
           AM21(REF='Strongly Agree')
           AK28(REF='All of the Time')
           AM36(REF='No')
           AM34(REF='All or Almost All Calls on Cell Phones')
           UR_CLRT(REF='Town & Rural')
           maritstat(REF='Married/Partnered')
           agegroup(REF='Young Adult (18-39)')
           asthmastatus(REF='1 Current Asthmatic')
           prilanguage(REF='English (Includes English & Other)')
           famtype(REF='Married w/ Children')
           ;
MODEL asthmastatus = SRSEX
                     RACEDF_P1
                     AB22
                     AB24
                     AB25
                     AB30
                     AB34
```

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```
                                AB52
                                AD37W
                                AD40W
                                AESODA_P1
                                AE15
                                AE15A
                                SMKCUR
                                SMOKING
                                NUMCIG
                                AC42_P
                                AC44
                                AD50
                                RBMI
                                AF65
                                AF63
                                DSTRS12
                                AH33NEW
                                AH34NEW
                                AH35NEW
                                AH37
                                CITIZEN2
                                YRUS_P1
                                PCTLF_P
                                AG22
                                WRKST_P1
                                AHEDC_P1
                                AK4
                                FSLEV
                                POVLL
                                AL6
                                AL22
                                AL18A
                                AM19
                                AM21
                                AK28
                                AM36
                                AM34
                                UR_CLRT
                                maritstat
                                agegroup
                                prilanguage
                                famtype
                                / LINK=GLOGIT CTABLE PPROB = (0.148)
                                     CORRB COVB RSQUARE STB
                                   ;/*CA Asthma Rate*/
    RUN;
ODS PDF CLOSE;

/* PERFORM MULTINOMIAL LOGISTIC REGRESSION */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYLOGISTIC-BASIC.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC SURVEYLOGISTIC DATA=CHIS.CHIS_DATA_FINAL VARMETHOD=JACKKNIFE;
        TITLE 'PROC SURVEYLOGISTIC - CHIS.CHIS_DATA_FINAL - Basic Association';
        WEIGHT     FNWGT0;
        REPWEIGHTS FNWGT1-FNWGT160 / jkcoefs = 1;
        CLASS      asthmastatus(REF='1 Current Asthmatic')
                   srsex(REF='Male')
```

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```
                    dstrs12(REF='No')
                    rbmi(REF='Normal 18.5-24.99')
                    citizen2(REF='US-Born Citizen')
                    povll(REF='300% FPL and Above');
        MODEL asthmastatus = srsex
                             dstrs12
                             rbmi
                             citizen2
                             povll
                             / LINK=GLOGIT CTABLE PPROB = (0.148)
                                  CORRB COVB RSQUARE STB
                                ;/*CA Asthma Rate*/
    RUN;
ODS PDF CLOSE;

/* PERFORM MULTINOMIAL LOGISTIC REGRESSION */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYLOGISTIC-PRUNED.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC SURVEYLOGISTIC DATA=CHIS.CHIS_DATA_FINAL VARMETHOD=JACKKNIFE;
        TITLE 'PROC SURVEYLOGISTIC - CHIS.CHIS_DATA_FINAL - Pruned Association';
        WEIGHT     FNWGT0;
        REPWEIGHTS FNWGT1-FNWGT160 / jkcoefs = 1;
        CLASS      asthmastatus(REF='1 Current Asthmatic')
                   SRSEX(REF='Male')
                   agegroup(REF='Young Adult (18-39)')
                   CITIZEN2(REF='US-Born Citizen')
                   famtype(REF='Married w/ Children')
                   UR_CLRT(REF='Town & Rural')
                   RBMI(REF='Normal 18.5-24.99')
                   SMOKING(REF='Never Smoked Regularly')
                   DSTRS12(REF='No')
                   POVLL(REF='300% FPL and Above')
                   FSLEV(REF='Inapplicable / >=200% FPL')
                   AK4(REF='Government')
                   healthplan(REF='Inapplicable')
                   ;
        MODEL asthmastatus = SRSEX
                             agegroup
                             CITIZEN2
                             famtype
                             UR_CLRT
                             RBMI
                             SMOKING
                             DSTRS12
                             POVLL
                             FSLEV
                             AK4
                             healthplan
                             / LINK=GLOGIT CTABLE PPROB = (0.148)
                                  CORRB COVB RSQUARE STB
                                ;/*CA Asthma Rate*/
    RUN;
ODS PDF CLOSE;

/* DISABLE SAS GRAPHICS */
ODS GRAPHICS OFF;
```

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```
QUIT;
```

Program: CHIS_61_PovFood

```
/*******************************************************************************
**  Project Name    : Secondary Research of Asthma  Hospitalizations          **
**                    Masters of Science in Business Analytics Capstone Project **
**                    March / April 2019                                        **
**  Author          : Matthew C. Vanderbilt                                   **
**                    MSBA Candidate & NU Scholar, National University         **
**                    Director of Fiscal Affairs, Department of Medicine,      **
**                    UC San Diego School of Medicine                          **
**  ========================================================================== **
**  Date Created    : 15 April 2019                                           **
**  Program Name    : CHIS_61_PovFood                                         **
**  Purpose         : Analysis of Effects of Food Access on POVLL and RBMI    **
**  Note            : Capitalized values represent SAS commands and unadjusted **
**                    variables; lower-case variables represent study-created **
**                    variables.                                                **
**                                                                              **
*******************************************************************************/

/* DISABLE SAS GRAPHICS */
ODS GRAPHICS OFF;

/* GLOBAL VARIABLES */
* Determine File Path for SAS EGP;
%LET localProjectPath = %SYSFUNC(SUBSTR(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH)), 1,
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH))) -
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTNAME))) ));

/* MASTER LIBRARIES */
LIBNAME CHIS "&localProjectPath.CHIS";

/* Determine PDF Password */
* Pull PDF Password from Text;
FILENAME scrPath "&localProjectPath.PDFPassword.txt";
DATA _NULL_;
    LENGTH text $265;
    RETAIN text '';
    INFILE scrPath FLOWOVER DLMSTR='//' END=last;
    INPUT;
    text = CATS(text,_INFILE_);
    IF last THEN CALL SYMPUT('rawpath',text);
RUN;
%LET pdfPassword = %SYSFUNC(TRIM(%SYSFUNC(DEQUOTE(&rawpath))));
/* CREATE CUSTOM FORMATS */
OPTIONS fmtsearch=(CHIS);

/* PERFORM MULTINOMIAL LOGISTIC REGRESSION */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYLOGISTIC-FPLtoFood-A.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC SURVEYLOGISTIC DATA=CHIS.CHIS_DATA_FINAL VARMETHOD=JACKKNIFE;
        TITLE 'PROC SURVEYLOGISTIC - CHIS.CHIS_DATA_FINAL - Full Association';
        WEIGHT     FNWGT0;
        REPWEIGHTS FNWGT1-FNWGT160 / jkcoefs = 1;
```

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```
        CLASS      POVLL(REF='300% FPL and Above') /*POVERTY LEVEL*/
                   AC42_P(REF='Always')            /*HOW OFTEN FIND FRESH FRUIT*/
                   AC44(REF='Always')              /*FRUIT/VEG AFFORDABLE*/
                   ;
        MODEL POVLL = AC42_P
                      AC44
                      / LINK=GLOGIT;
    RUN;
ODS PDF CLOSE;

/* PERFORM MULTINOMIAL LOGISTIC REGRESSION */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYLOGISTIC-FPLtoFood-B.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC SURVEYLOGISTIC DATA=CHIS.CHIS_DATA_FINAL VARMETHOD=JACKKNIFE;
        TITLE 'PROC SURVEYLOGISTIC - CHIS.CHIS_DATA_FINAL - Full Association';
        WEIGHT     FNWGT0;
        REPWEIGHTS FNWGT1-FNWGT160 / jkcoefs = 1;
        CLASS      POVLL(REF='300% FPL and Above') /*POVERTY LEVEL*/
                   AC42_P(REF='Always')            /*HOW OFTEN FIND FRESH FRUIT*/
                   AC44(REF='Always')              /*FRUIT/VEG AFFORDABLE*/
                   ;
        MODEL POVLL = AC42_P*
                      AC44
                      / LINK=GLOGIT;
    RUN;
ODS PDF CLOSE;

/* PERFORM MULTINOMIAL LOGISTIC REGRESSION */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYLOGISTIC-BMItoFood-A.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC SURVEYLOGISTIC DATA=CHIS.CHIS_DATA_FINAL VARMETHOD=JACKKNIFE;
        TITLE 'PROC SURVEYLOGISTIC - CHIS.CHIS_DATA_FINAL - Full Association';
        WEIGHT     FNWGT0;
        REPWEIGHTS FNWGT1-FNWGT160 / jkcoefs = 1;
        CLASS      RBMI(REF='Normal 18.5-24.99')   /*BMI DESCRIPTIVE*/
                   AC42_P(REF='Always')            /*HOW OFTEN FIND FRESH FRUIT*/
                   AC44(REF='Always')              /*FRUIT/VEG AFFORDABLE*/
                   ;
        MODEL RBMI = AC42_P
                     AC44
                     / LINK=GLOGIT;
    RUN;
ODS PDF CLOSE;

/* PERFORM MULTINOMIAL LOGISTIC REGRESSION */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYLOGISTIC-BMItoFood-B.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC SURVEYLOGISTIC DATA=CHIS.CHIS_DATA_FINAL VARMETHOD=JACKKNIFE;
        TITLE 'PROC SURVEYLOGISTIC - CHIS.CHIS_DATA_FINAL - Full Association';
```

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```
        WEIGHT     FNWGT0;
        REPWEIGHTS FNWGT1-FNWGT160 / jkcoefs = 1;
        CLASS      RBMI(REF='Normal 18.5-24.99')   /*BMI DESCRIPTIVE*/
                   AC42_P(REF='Always')            /*HOW OFTEN FIND FRESH FRUIT*/
                   AC44(REF='Always')              /*FRUIT/VEG AFFORDABLE*/
                   ;
        MODEL RBMI = AC42_P*
                     AC44
                     / LINK=GLOGIT;
    RUN;
ODS PDF CLOSE;

/* DISABLE SAS GRAPHICS */
ODS GRAPHICS OFF;

QUIT;
```

Program: CHIS_70_BinomRegress

```
/*******************************************************************************
**  Project Name    : Secondary Research of Asthma  Hospitalizations           **
**                    Masters of Science in Business Analytics Capstone Project **
**                    March / April 2019                                        **
**  Author          : Matthew C. Vanderbilt                                   **
**                    MSBA Candidate & NU Scholar, National University          **
**                    Director of Fiscal Affairs, Department of Medicine,       **
**                    UC San Diego School of Medicine                           **
**  ========================================================================== **
**  Date Created    : 22 April 2019                                           **
**  Program Name    : CHIS_70_BinomRegress                                    **
**  Purpose         : Performs Binomial Regression Model A                    **
**  Note            : Capitalized values represent SAS commands and unadjusted **
**                    variables; lower-case variables represent study-created **
**                    variables.                                                **
**                                                                              **
*******************************************************************************/

/* GLOBAL VARIABLES */
* Determine File Path for SAS EGP;
%LET localProjectPath = %SYSFUNC(SUBSTR(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH)), 1,
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH))) -
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTNAME))) ));

/* MASTER LIBRARY */
LIBNAME CHIS "&localProjectPath.CHIS";

/* Determine PDF Password */
* Pull PDF Password from Text;
FILENAME scrPath "&localProjectPath.PDFPassword.txt";
DATA _NULL_;
    LENGTH text $265;
    RETAIN text '';
    INFILE scrPath FLOWOVER DLMSTR='//' END=last;
    INPUT;
    text = CATS(text,_INFILE_);
    IF last THEN CALL SYMPUT('rawpath',text);
RUN;
%LET pdfPassword = %SYSFUNC(TRIM(%SYSFUNC(DEQUOTE(&rawpath))));
```

DocuSign Envelope ID: 47DDAAF8-F05F-49C5-94C0-59245F12E441


```
/* DEFINE GLOBAL OPTIONS */
ODS GRAPHICS OFF;
OPTIONS PDFSECURITY=HIGH;
OPTIONS PDFPASSWORD=(owner="&pdfPassword");

/* APPLY CHIS FORMATS */
OPTIONS fmtsearch=(CHIS);

/* CREATE BINOMIAL ANALYSIS DATASET */
DATA CHIS.CHIS_DATA_BINOMIAL_A;
    SET CHIS.CHIS_DATA_FINAL (WHERE=(asthmastatus IN(1,3)));

RUN;

/* PERFORM BINOMIAL LOGISTIC REGRESSION */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYLOGISTIC.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC SURVEYLOGISTIC DATA=CHIS.CHIS_DATA_BINOMIAL_A VARMETHOD=JACKKNIFE;
        TITLE 'PROC SURVEYLOGISTIC - CHIS.CHIS_DATA_BINOMIAL_A';
        WEIGHT     FNWGT0;
        REPWEIGHTS FNWGT1-FNWGT160 / jkcoefs = 1;
        CLASS      asthmastatus(REF='1 Current Asthmatic')
                   SRSEX(REF='Male')
                   agegroup(REF='Young Adult (18-39)')
                   CITIZEN2(REF='US-Born Citizen')
                   famtype(REF='Married w/ Children')
                   UR_CLRT(REF='Town & Rural')
                   RBMI(REF='Normal 18.5-24.99')
                   SMOKING(REF='Never Smoked Regularly')
                   DSTRS12(REF='No')
                   POVLL(REF='300% FPL and Above')
                   FSLEV(REF='Inapplicable / >=200% FPL')
                   AK4(REF='Government')
                   healthplan(REF='Inapplicable')
                   ;
        MODEL    asthmastatus = SRSEX
                                agegroup
                                CITIZEN2
                                famtype
                                UR_CLRT
                                RBMI
                                SMOKING
                                DSTRS12
                                POVLL
                                FSLEV
                                AK4
                                healthplan
                                / LINK=GLOGIT CTABLE PPROB = (.148) /*1 - CA Asthma
Rate*/
                                  CORRB COVB RSQUARE STB
                                ;
    RUN;
ODS PDF CLOSE;

/* DISABLE SAS GRAPHICS */
ODS GRAPHICS OFF;
```

DocuSign Envelope ID: 47DDAAF8-F05F-49C5-94C0-59245F12E441


```
QUIT;
```

Program: CHIS_71_BinomRegress

```
/*******************************************************************************
**  Project Name    : Secondary Research of Asthma  Hospitalizations          **
**                    Masters of Science in Business Analytics Capstone Project **
**                    March / April 2019                                        **
**  Author          : Matthew C. Vanderbilt                                   **
**                    MSBA Candidate & NU Scholar, National University          **
**                    Director of Fiscal Affairs, Department of Medicine,       **
**                    UC San Diego School of Medicine                           **
**  ========================================================================== **
**  Date Created    : 23 April 2019                                           **
**  Program Name    : CHIS_71_BinomRegress                                    **
**  Purpose         : Performs Binomial Regression Model B                    **
**  Note            : Capitalized values represent SAS commands and unadjusted **
**                    variables; lower-case variables represent study-created **
**                    variables.                                                **
**                                                                              **
*******************************************************************************/

/* GLOBAL VARIABLES */
* Determine File Path for SAS EGP;
%LET localProjectPath = %SYSFUNC(SUBSTR(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH)), 1,
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH))) -
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTNAME))) ));

/* MASTER LIBRARY */
LIBNAME CHIS "&localProjectPath.CHIS";

/* Determine PDF Password */
* Pull PDF Password from Text;
FILENAME scrPath "&localProjectPath.PDFPassword.txt";
DATA _NULL_;
    LENGTH text $265;
    RETAIN text '';
    INFILE scrPath FLOWOVER DLMSTR='//' END=last;
    INPUT;
    text = CATS(text,_INFILE_);
    IF last THEN CALL SYMPUT('rawpath',text);
RUN;
%LET pdfPassword = %SYSFUNC(TRIM(%SYSFUNC(DEQUOTE(&rawpath))));

/* DEFINE GLOBAL OPTIONS */
ODS GRAPHICS OFF;
OPTIONS PDFSECURITY=HIGH;
OPTIONS PDFPASSWORD=(owner="&pdfPassword");

/* APPLY CHIS FORMATS */
OPTIONS fmtsearch=(CHIS);

/* DEFINE FORMATS FOR NEWLY RECODED VARIABLES */
PROC FORMAT LIBRARY=CHIS;

    VALUE frace         1    = 'Latino'
                        3    = 'American Indian / Alaska Native'
                        4    = 'Asian'
                        5    = 'African American'
```

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```
                        6    = 'White'
                        9    = 'Multiracial / Other'
                        ;

    VALUE fchildhh      1    = 'Children in HH'
                        2    = 'No Children in HH'
                        ;

    VALUE fnonasthmatic 1    = '1 Non-Asthmatic'
                        2    = '2 Current Asthmatic'
                        ;

    VALUE flateradult   1    = 'Later Adult'
                        2    = 'Young / Middle Aged'
                        ;

    VALUE frcbmi        0    = 'Not Overweight 0-24.99'
                        3    = 'Overweight 25.0-29.99'
                        4    = 'Obese 30.0+'
                        ;

    VALUE fpfpl         1    = '0-99% FPL'
                        5    = '100% FPL and Above'
                        ;

RUN;

/* CREATE BINOMIAL ANALYSIS DATASET WITH RECODED VARIABLES */
DATA CHIS.CHIS_DATA_BINOMIAL_B;
    SET CHIS.CHIS_DATA_FINAL (WHERE=(asthmastatus IN(1,3)));

    * Collapse Race/Ethnicity Categories;
    race = RACEDF_P1;
    IF RACEDF_P1 IN(2,8) THEN race = 9;     *Collapse Other with Multiracial;
    LABEL    race    = 'race';
    FORMAT    race    frace.;

    * Collapse Family Type to Children-in-Household;
    IF famtype IN(1,3) THEN childhh = 2;
    IF famtype IN(2,4) THEN childhh = 1;
    LABEL    childhh    = 'Child Household';
    FORMAT    childhh    fchildhh.;

    * Invert Asthma Status to Boolean Non-Asthmatic;
    nonasthmatic = 1;
    IF asthmastatus = 1 THEN nonasthmatic = 2;
    LABEL    nonasthmatic = 'Non-Asthmatic';
    FORMAT    nonasthmatic fnonasthmatic.;

    * Collapse Tri-Category Age to Dichotomous;
    lateradult = 2;
    IF agegroup = 3 THEN lateradult = 1;
    LABEL    lateradult    = 'Later Adult';
    FORMAT    lateradult    flateradult.;

    * Collapse Underweight/Normal to Single Category;
    rcbmi = RBMI;
    IF RBMI IN(1,2) THEN rcbmi = 0;
    LABEL    rcbmi    = 'descriptive BMI';
    FORMAT    rcbmi    frcbmi.;
```

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```
    * Collapse FPL to Under vs At Least;
    pfpl = POVLL;
    IF POVLL IN(2,3,4) THEN pfpl = 5;
    LABEL    pfpl    = 'percentage of FPL';
    FORMAT    pfpl    fpfpl.;

RUN;

/* VALIDATE RECODED DATASET CONTENTS */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
CONTENTS.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC CONTENTS DATA=CHIS.CHIS_DATA_INTRM VARNUM;
        TITLE 'PROC CONTENTS - CHIS.CHIS_DATA_INTRM';
    RUN;
ODS PDF CLOSE;

/* TEST MODEL VARIABLES FOR MULTICOLLINEARITY */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
REG.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC REG DATA=CHIS.CHIS_DATA_BINOMIAL_B ;
        TITLE 'PROC REG - CHIS.CHIS_DATA_BINOMIAL_B - Model B Multicollinearity Test';
        MODEL    nonasthmatic = SRSEX
                                lateradult
                                CITIZEN2
                                race
                                childhh
                                rcbmi
                                DSTRS12
                                pfpl
                                INS
                                / TOL VIF COLLIN;
                                ;
    RUN;
ODS PDF CLOSE;

/* PERFORM WEIGHTED UNIVARIATE ANALYSIS FOR RECODED BINOMIAL DATASET */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYFREQ.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
        ODS GRAPHICS ON;
    PROC SURVEYFREQ DATA=CHIS.CHIS_DATA_BINOMIAL_B VARMETHOD=JACKKNIFE;
        TITLE 'PROC SURVEYFREQ - CHIS.CHIS_DATA_FINAL - Univarites for Model B';
        WEIGHT    FNWGT0;
        REPWEIGHT FNWGT1-FNWGT160 / jkcoefs = 1;
        TABLES    (SRSEX
                   lateradult
                   CITIZEN2
                   race
                   childhh
                   rcbmi
```

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```
                    DSTRS12
                    pfpl
                    INS
                   )*nonasthmatic
                   / CHISQ PLOTS=ALL;
    RUN;
ODS PDF CLOSE;

/* PERFORM BINOMIAL LOGISTIC REGRESSION */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYLOGISTIC.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC SURVEYLOGISTIC DATA=CHIS.CHIS_DATA_BINOMIAL_B VARMETHOD=JACKKNIFE;
        TITLE 'PROC SURVEYLOGISTIC - CHIS.CHIS_DATA_BINOMIAL_B - Model B';
        WEIGHT     FNWGT0;
        REPWEIGHTS FNWGT1-FNWGT160 / jkcoefs = 1;
        CLASS      nonasthmatic(REF='1 Non-Asthmatic')
                   SRSEX(REF='Male')
                   lateradult(REF='Later Adult')
                   CITIZEN2(REF='Naturalized Citizen')
                   race(REF='White')
                   childhh(REF='Children in HH')
                   rcbmi(REF='Not Overweight 0-24.99')
                   DSTRS12(REF='No')
                   pfpl(REF='100% FPL and Above')
                   INS(REF='No')
                   ;
        MODEL    nonasthmatic = SRSEX
                                lateradult
                                CITIZEN2
                                race
                                childhh
                                rcbmi
                                DSTRS12
                                pfpl
                                INS
                                / LINK=GLOGIT CTABLE PPROB = (0.852) /*1 - CA Asthma
Rate*/
                                  CORRB COVB RSQUARE STB
                                ;
    RUN;
ODS PDF CLOSE;

/* DISABLE SAS GRAPHICS */
ODS GRAPHICS OFF;

QUIT;
```

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Program: CHIS_72_BinomRegress

```
/*******************************************************************************
**  Project Name    : Secondary Research of Asthma  Hospitalizations          **
**                    Masters of Science in Business Analytics Capstone Project **
**                    March / April 2019                                        **
**  Author          : Matthew C. Vanderbilt                                   **
**                    MSBA Candidate & NU Scholar, National University        **
**                    Director of Fiscal Affairs, Department of Medicine,     **
**                    UC San Diego School of Medicine                         **
**  ============================================================================ **
**  Date Created    : 24 April 2019 14:54                                     **
**  Program Name    : CHIS_72_BinomRegress                                    **
**  Purpose         : Performs Binomial Regression Model B - Census           **
**  Note            : Capitalized values represent SAS commands and unadjusted **
**                    variables; lower-case variables represent study-created **
**                    variables.                                              **
**                                                                            **
*******************************************************************************/

/* GLOBAL VARIABLES */
* Determine File Path for SAS EGP;
%LET localProjectPath = %SYSFUNC(SUBSTR(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH)), 1,
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH))) -
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTNAME))) ));

/* MASTER LIBRARY */
LIBNAME CHIS "&localProjectPath.CHIS";

/* Determine PDF Password */
* Pull PDF Password from Text;
FILENAME scrPath "&localProjectPath.PDFPassword.txt";
DATA _NULL_;
    LENGTH text $265;
    RETAIN text '';
    INFILE scrPath FLOWOVER DLMSTR='//' END=last;
    INPUT;
    text = CATS(text,_INFILE_);
    IF last THEN CALL SYMPUT('rawpath',text);
RUN;
%LET pdfPassword = %SYSFUNC(TRIM(%SYSFUNC(DEQUOTE(&rawpath))));

/* DEFINE GLOBAL OPTIONS */
ODS GRAPHICS OFF;
OPTIONS PDFSECURITY=HIGH;
OPTIONS PDFPASSWORD=(owner="&pdfPassword");

/* APPLY CHIS FORMATS */
OPTIONS fmtsearch=(CHIS);

/* DEFINE FORMATS FOR NEWLY RECODED VARIABLES */
PROC FORMAT LIBRARY=CHIS;
    VALUE frace         1    = 'Latino'
                        3    = 'American Indian / Alaska Native'
                        4    = 'Asian'
                        5    = 'African American'
                        6    = 'White'
                        9    = 'Multiracial / Other'
                        ;

    VALUE fchildhh      1    = 'Children in HH'
```

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```
                        2    = 'No Children in HH'
                        ;

    VALUE fnonasthmatic 1    = '1 Non-Asthmatic'
                        2    = '2 Current Asthmatic'
                        ;

    VALUE flateradult   1    = 'Later Adult'
                        2    = 'Young / Middle Aged'
                        ;

    VALUE frcbmi        0    = 'Not Overweight 0-24.99'
                        3    = 'Overweight 25.0-29.99'
                        4    = 'Obese 30.0+'
                        ;

    VALUE fpfpl         1    = '0-99% FPL'
                        5    = '100% FPL and Above'
                        ;

RUN;

/* CREATE BINOMIAL ANALYSIS DATASET WITH RECODED VARIABLES */
DATA CHIS.CHIS_DATA_BINOMIAL_BC;
    SET CHIS.CHIS_DATA_FINAL (WHERE=(asthmastatus IN(1,3)));

    * Collapse Race/Ethnicity Categories;
    race = RACEDF_P1;
    IF RACEDF_P1 IN(2,8) THEN race = 9;     *Collapse Other with Multiracial;
    LABEL    race    = 'race';
    FORMAT    race    frace.;

    * Collapse Family Type to Children-in-Household;
    IF famtype IN(1,3) THEN childhh = 2;
    IF famtype IN(2,4) THEN childhh = 1;
    LABEL    childhh    = 'Child Household';
    FORMAT    childhh    fchildhh.;

    * Invert Asthma Status to Boolean Non-Asthmatic;
    nonasthmatic = 1;
    IF asthmastatus = 1 THEN nonasthmatic = 2;
    LABEL    nonasthmatic = 'Non-Asthmatic';
    FORMAT    nonasthmatic fnonasthmatic.;

    * Collapse Tri-Category Age to Dichotomous;
    lateradult = 2;
    IF agegroup = 3 THEN lateradult = 1;
    LABEL    lateradult    = 'Later Adult';
    FORMAT    lateradult    flateradult.;

    * Collapse Underweight/Normal to Single Category;
    rcbmi = RBMI;
    IF RBMI IN(1,2) THEN rcbmi = 0;
    LABEL    rcbmi    = 'descriptive BMI';
    FORMAT    rcbmi    frcbmi.;

    * Collapse FPL to Under vs At Least;
    pfpl = POVLL;
    IF POVLL IN(2,3,4) THEN pfpl = 5;
    LABEL    pfpl    = 'percentage of FPL';
    FORMAT    pfpl    fpfpl.;
```

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```
RUN;

/* VALIDATE RECODED DATASET CONTENTS */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
CONTENTS.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC CONTENTS DATA=CHIS.CHIS_DATA_INTRM VARNUM;
        TITLE 'PROC CONTENTS - CHIS.CHIS_DATA_INTRM';
    RUN;
ODS PDF CLOSE;

/* TEST MODEL VARIABLES FOR MULTICOLLINEARITY */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
REG.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC REG DATA=CHIS.CHIS_DATA_BINOMIAL_BC;
        TITLE1 "%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))";
        TITLE2 "%SYSFUNC(TRIM(&SYSDSN))";
        TITLE3 "PROC REG - %LEFT(%QSYSFUNC(DATE(), WORDDATE18.))";
        MODEL    nonasthmatic = SRSEX
                                lateradult
                                CITIZEN2
                                race
                                childhh
                                pfpl
                                INS
                                / TOL VIF COLLIN;
                                ;
    RUN;
ODS PDF CLOSE;

/* PERFORM WEIGHTED UNIVARIATE ANALYSIS FOR RECODED BINOMIAL DATASET */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYFREQ.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
        ODS GRAPHICS ON;
    PROC SURVEYFREQ DATA=CHIS.CHIS_DATA_BINOMIAL_BC VARMETHOD=JACKKNIFE;
        TITLE 'PROC SURVEYFREQ - CHIS.CHIS_DATA_FINAL - Univarites for Model B -
Census';
        WEIGHT    FNWGT0;
        REPWEIGHT FNWGT1-FNWGT160 / jkcoefs = 1;
        TABLES    (SRSEX
                   lateradult
                   CITIZEN2
                   race
                   childhh
                   pfpl
                   INS
                  )*nonasthmatic
                  / CHISQ PLOTS=ALL;
    RUN;
```

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```
    ODS GRAPHICS OFF;
ODS PDF CLOSE;

/* PERFORM BINOMIAL LOGISTIC REGRESSION */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYLOGISTIC.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC SURVEYLOGISTIC DATA=CHIS.CHIS_DATA_BINOMIAL_BC VARMETHOD=JACKKNIFE;
        TITLE 'PROC SURVEYLOGISTIC - CHIS.CHIS_DATA_BINOMIAL_BC - Model B - Census';
        WEIGHT     FNWGT0;
        REPWEIGHTS FNWGT1-FNWGT160 / jkcoefs = 1;
        CLASS      nonasthmatic(REF='1 Non-Asthmatic')
                   SRSEX(REF='Male')
                   lateradult(REF='Later Adult')
                   CITIZEN2(REF='Naturalized Citizen')
                   race(REF='White')
                   childhh(REF='Children in HH')
                   pfpl(REF='100% FPL and Above')
                   INS(REF='No')
                   ;
        MODEL    nonasthmatic = SRSEX
                                lateradult
                                CITIZEN2
                                race
                                childhh
                                pfpl
                                INS
                                / LINK=GLOGIT CTABLE PPROB = (0.852)
                                  CORRB COVB RSQUARE STB
                                ;/*1 - CA Asthma Rate*/
    RUN;
ODS PDF CLOSE;

/* DISABLE SAS GRAPHICS */
ODS GRAPHICS OFF;

QUIT;
```

DocuSign Envelope ID: 47DDAAF8-F05F-49C5-94C0-59245F12E441

Program: CHIS_73_BinomRegress

```
/*******************************************************************************
**  Project Name    : Secondary Research of Asthma  Hospitalizations          **
**                    Masters of Science in Business Analytics Capstone Project **
**                    March / April 2019                                        **
**  Author          : Matthew C. Vanderbilt                                   **
**                    MSBA Candidate & NU Scholar, National University        **
**                    Director of Fiscal Affairs, Department of Medicine,     **
**                    UC San Diego School of Medicine                         **
**  ============================================================================ **
**  Date Created    : 24 April 2019 20:30                                     **
**  Program Name    : CHIS_73_BinomRegress                                    **
**  Purpose         : Performs Binomial Regression Model B - Census/3-Level Age **
**  Note            : Capitalized values represent SAS commands and unadjusted **
**                    variables; lower-case variables represent study-created **
**                    variables.                                              **
**                                                                            **
*******************************************************************************/

/* GLOBAL VARIABLES */
* Determine File Path for SAS EGP;
%LET localProjectPath = %SYSFUNC(SUBSTR(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH)), 1,
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH))) -
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTNAME))) ));

/* MASTER LIBRARY */
LIBNAME CHIS "&localProjectPath.CHIS";

/* Determine PDF Password */
* Pull PDF Password from Text;
FILENAME scrPath "&localProjectPath.PDFPassword.txt";
DATA _NULL_;
    LENGTH text $265;
    RETAIN text '';
    INFILE scrPath FLOWOVER DLMSTR='//' END=last;
    INPUT;
    text = CATS(text,_INFILE_);
    IF last THEN CALL SYMPUT('rawpath',text);
RUN;
%LET pdfPassword = %SYSFUNC(TRIM(%SYSFUNC(DEQUOTE(&rawpath))));

/* DEFINE GLOBAL OPTIONS */
ODS GRAPHICS OFF;
OPTIONS PDFSECURITY=HIGH;
OPTIONS PDFPASSWORD=(owner="&pdfPassword");

/* APPLY CHIS FORMATS */
OPTIONS fmtsearch=(CHIS);

/* DEFINE FORMATS FOR NEWLY RECODED VARIABLES */
PROC FORMAT LIBRARY=CHIS;
    VALUE frace         1    = 'Latino'
                        3    = 'American Indian / Alaska Native'
                        4    = 'Asian'
                        5    = 'African American'
                        6    = 'White'
                        9    = 'Multiracial / Other'
                        ;

    VALUE fchildhh      1    = 'Children in HH'
```

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```
                        2l    = 'No Children in HH'
                        ;

    VALUE fnonasthmatic 1    = '1 Non-Asthmatic'
                        2    = '2 Current Asthmatic'
                        ;

    VALUE frcbmi        0    = 'Not Overweight 0-24.99'
                        3    = 'Overweight 25.0-29.99'
                        4    = 'Obese 30.0+'
                        ;

    VALUE fpfpl         1    = '0-99% FPL'
                        5    = '100% FPL and Above'
                        ;

RUN;

/* CREATE BINOMIAL ANALYSIS DATASET WITH RECODED VARIABLES */
DATA CHIS.CHIS_DATA_BINOMIAL_BC2;
    SET CHIS.CHIS_DATA_FINAL;

    analyzeData = 0;
    IF asthmastatus IN(1,3) THEN analyzeData = 1;

    * Collapse Race/Ethnicity Categories;
    race = RACEDF_P1;
    IF RACEDF_P1 IN(2,8) THEN race = 9;     *Collapse Other with Multiracial;
    LABEL    race    = 'race';
    FORMAT    race    frace.;

    * Collapse Family Type to Children-in-Household;
    IF famtype IN(1,3) THEN childhh = 2;
    IF famtype IN(2,4) THEN childhh = 1;
    LABEL    childhh    = 'Child Household';
    FORMAT    childhh    fchildhh.;

    * Invert Asthma Status to Boolean Non-Asthmatic;
    nonasthmatic = 1;
    IF asthmastatus = 1 THEN nonasthmatic = 2;
    LABEL    nonasthmatic = 'Non-Asthmatic';
    FORMAT    nonasthmatic fnonasthmatic.;

    * Collapse Underweight/Normal to Single Category;
    rcbmi = RBMI;
    IF RBMI IN(1,2) THEN rcbmi = 0;
    LABEL    rcbmi    = 'descriptive BMI';
    FORMAT    rcbmi    frcbmi.;

    * Collapse FPL to Under vs At Least;
    pfpl = POVLL;
    IF POVLL IN(2,3,4) THEN pfpl = 5;
    LABEL    pfpl    = 'percentage of FPL';
    FORMAT    pfpl    fpfpl.;

RUN;

/* VALIDATE RECODED DATASET CONTENTS */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
CONTENTS.pdf"
        AUTHOR="Matthew C. Vanderbilt"
```

DocuSign Envelope ID: 47DDAAF8-F05F-49C5-94C0-59245F12E441


```
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC CONTENTS DATA=CHIS.CHIS_DATA_BINOMIAL_BC2 (WHERE=(analyzeData=1)) VARNUM;
        TITLE1 "%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))";
        TITLE2 "%SYSFUNC(TRIM(&SYSDSN))";
        TITLE3 "PROC CONTENTS - %LEFT(%QSYSFUNC(DATE(), WORDDATE18.))";
    RUN;
ODS PDF CLOSE;

/* TEST MODEL VARIABLES FOR MULTICOLLINEARITY */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
REG.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC REG DATA=CHIS.CHIS_DATA_BINOMIAL_BC2 (WHERE=(analyzeData=1));
        TITLE1 "%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))";
        TITLE2 "%SYSFUNC(TRIM(&SYSDSN))";
        TITLE3 "PROC REG - %LEFT(%QSYSFUNC(DATE(), WORDDATE18.))";
        MODEL    nonasthmatic = SRSEX
                                agegroup
                                CITIZEN2
                                race
                                childhh
                                pfpl
                                INS
                                / TOL VIF COLLIN;
                                ;
    RUN;
ODS PDF CLOSE;

/* PERFORM WEIGHTED UNIVARIATE ANALYSIS FOR RECODED BINOMIAL DATASET */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYFREQ.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
        ODS GRAPHICS ON / WIDTH=1280px HEIGHT=960;
    PROC SURVEYFREQ DATA=CHIS.CHIS_DATA_BINOMIAL_BC2 VARMETHOD=JACKKNIFE;
        TITLE1 "%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))";
        TITLE2 "%SYSFUNC(TRIM(&SYSDSN))";
        TITLE3 "PROC SURVEYFREQ - %LEFT(%QSYSFUNC(DATE(), WORDDATE18.))";
        WEIGHT    FNWGT0;
        CLUSTER    analyzeData;
        REPWEIGHT FNWGT1-FNWGT160 / jkcoefs = 1;
        TABLES    (SRSEX
                   agegroup
                   CITIZEN2
                   race
                   childhh
                   pfpl
                   INS
                  )*nonasthmatic
                  / CHISQ PLOTS=ALL;
    RUN;
    ODS GRAPHICS OFF;
ODS PDF CLOSE;
```

DocuSign Envelope ID: 47DDAAF8-F05F-49C5-94C0-59245F12E441


```
/* PERFORM BINOMIAL LOGISTIC REGRESSION */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYLOGISTIC.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC SURVEYLOGISTIC DATA=CHIS.CHIS_DATA_BINOMIAL_BC2 VARMETHOD=JACKKNIFE;
        TITLE1 "%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))";
        TITLE2 "%SYSFUNC(TRIM(&SYSDSN))";
        TITLE3 "PROC SURVEYLOGISTIC - %LEFT(%QSYSFUNC(DATE(), WORDDATE18.))";
        WEIGHT     FNWGT0;
        DOMAIN     analyzeData;
        REPWEIGHTS FNWGT1-FNWGT160 / jkcoefs = 1;
        CLASS      nonasthmatic(REF='1 Non-Asthmatic')
                   SRSEX(REF='Male')
                   agegroup(REF='Later Adult (65+)')
                   CITIZEN2(REF='Naturalized Citizen')
                   race(REF='White')
                   childhh(REF='Children in HH')
                   pfpl(REF='100% FPL and Above')
                   INS(REF='No')
                   ;
        MODEL    nonasthmatic = SRSEX
                                agegroup
                                CITIZEN2
                                race
                                childhh
                                pfpl
                                INS
                                / LINK=GLOGIT CTABLE PPROB = (0.852)
                                  CORRB COVB RSQUARE STB
                                ;/*1 - CA Asthma Rate*/
    RUN;
ODS PDF CLOSE;

/* PERFORM UNWEIGHTED BINOMIAL LOGISTIC REGRESSION */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
LOGISTIC.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
        ODS GRAPHICS ON / WIDTH=1280px HEIGHT=960;
    PROC LOGISTIC DATA=CHIS.CHIS_DATA_BINOMIAL_BC2 (WHERE=(analyzeData=1)) PLOTS=ALL;
        TITLE1 "%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))";
        TITLE2 "%SYSFUNC(TRIM(&SYSDSN))";
        TITLE3 "PROC SURVEYLOGISTIC - %LEFT(%QSYSFUNC(DATE(), WORDDATE18.))";
        WEIGHT     FNWGT0;
        CLASS      nonasthmatic(REF='1 Non-Asthmatic')
                   SRSEX(REF='Male')
                   agegroup(REF='Later Adult (65+)')
                   CITIZEN2(REF='Naturalized Citizen')
                   race(REF='White')
                   childhh(REF='Children in HH')
                   pfpl(REF='100% FPL and Above')
                   INS(REF='No')
                   ;
        MODEL    nonasthmatic = SRSEX
                                agegroup
                                CITIZEN2
```

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```
                                    race
                                    childhh
                                    pfpl
                                    INS
                                    / LINK=GLOGIT CTABLE PPROB = (0.852)
                                      CORRB COVB RSQUARE STB
                                    ;/*1 - CA Asthma Rate*/
    RUN;
ODS PDF CLOSE;


/* DISABLE SAS GRAPHICS */
ODS GRAPHICS OFF;

QUIT;
```

Program: CHIS_74_BinomRegress

```
/*******************************************************************************
**  Project Name    : Secondary Research of Asthma  Hospitalizations           **
**                    Masters of Science in Business Analytics Capstone Project **
**                    March / April 2019                                        **
**  Author          : Matthew C. Vanderbilt                                   **
**                    MSBA Candidate & NU Scholar, National University          **
**                    Director of Fiscal Affairs, Department of Medicine,       **
**                    UC San Diego School of Medicine                           **
**  ========================================================================== **
**  Date Created    : 24 April 2019 20:30                                     **
**  Program Name    : CHIS_74_BinomRegress                                    **
**  Purpose         : Performs Binomial Regression Model C - Census/3-Level Age **
**  Note            : Capitalized values represent SAS commands and unadjusted **
**                    variables; lower-case variables represent study-created   **
**                    variables.                                                **
**                                                                              **
*******************************************************************************/

/* GLOBAL VARIABLES */
* Determine File Path for SAS EGP;
%LET localProjectPath = %SYSFUNC(SUBSTR(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH)), 1,
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH))) -
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTNAME))) ));

/* MASTER LIBRARY */
LIBNAME CHIS "&localProjectPath.CHIS";

/* Determine PDF Password */
* Pull PDF Password from Text;
FILENAME scrPath "&localProjectPath.PDFPassword.txt";
DATA _NULL_;
    LENGTH text $265;
    RETAIN text '';
    INFILE scrPath FLOWOVER DLMSTR='//' END=last;
    INPUT;
    text = CATS(text,_INFILE_);
    IF last THEN CALL SYMPUT('rawpath',text);
RUN;
%LET pdfPassword = %SYSFUNC(TRIM(%SYSFUNC(DEQUOTE(&rawpath))));

/* DEFINE GLOBAL OPTIONS */
```

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```
ODS GRAPHICS OFF;
OPTIONS PDFSECURITY=HIGH;
OPTIONS PDFPASSWORD=(owner="&pdfPassword");

/* APPLY CHIS FORMATS */
OPTIONS fmtsearch=(CHIS);

/* DEFINE FORMATS FOR NEWLY RECODED VARIABLES */
PROC FORMAT LIBRARY=CHIS;
    VALUE frace         1    = 'Latino'
                        3    = 'American Indian / Alaska Native'
                        4    = 'Asian'
                        5    = 'African American'
                        6    = 'White'
                        9    = 'Multiracial / Other'
                        ;

    VALUE fchildhh      1    = 'Children in HH'
                        2l    = 'No Children in HH'
                        ;

    VALUE fnonasthmatic 1    = '1 Non-Asthmatic'
                        2    = '2 Current Asthmatic'
                        ;

    VALUE frcbmi        0    = 'Not Overweight 0-24.99'
                        3    = 'Overweight 25.0-29.99'
                        4    = 'Obese 30.0+'
                        ;

    VALUE fpfpl         1    = '0-99% FPL'
                        5    = '100% FPL and Above'
                        ;

RUN;

/* CREATE BINOMIAL ANALYSIS DATASET WITH RECODED VARIABLES */
DATA CHIS.CHIS_DATA_BINOMIAL_C;
    SET CHIS.CHIS_DATA_FINAL;

    analyzeData = 0;
    IF asthmastatus IN(1,3) THEN analyzeData = 1;

    * Collapse Race/Ethnicity Categories;
    race = RACEDF_P1;
    IF RACEDF_P1 IN(2,8) THEN race = 9;     *Collapse Other with Multiracial;
    LABEL    race    = 'race';
    FORMAT    race    frace.;

    * Collapse Family Type to Children-in-Household;
    IF famtype IN(1,3) THEN childhh = 2;
    IF famtype IN(2,4) THEN childhh = 1;
    LABEL    childhh    = 'Child Household';
    FORMAT    childhh    fchildhh.;

    * Invert Asthma Status to Boolean Non-Asthmatic;
    nonasthmatic = 1;
    IF asthmastatus = 1 THEN nonasthmatic = 2;
    LABEL    nonasthmatic = 'Non-Asthmatic';
    FORMAT    nonasthmatic fnonasthmatic.;
```

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```
    * Collapse Underweight/Normal to Single Category;
    rcbmi = RBMI;
    IF RBMI IN(1,2) THEN rcbmi = 0;
    LABEL    rcbmi    = 'descriptive BMI';
    FORMAT    rcbmi    frcbmi.;

    * Collapse FPL to Under vs At Least;
    pfpl = POVLL;
    IF POVLL IN(2,3,4) THEN pfpl = 5;
    LABEL    pfpl    = 'percentage of FPL';
    FORMAT    pfpl    fpfpl.;

RUN;

/* VALIDATE RECODED DATASET CONTENTS */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
CONTENTS.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC CONTENTS DATA=CHIS.CHIS_DATA_BINOMIAL_C (WHERE=(analyzeData=1)) VARNUM;
        TITLE1 "%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))";
        TITLE2 "%SYSFUNC(TRIM(&SYSDSN))";
        TITLE3 "PROC CONTENTS - %LEFT(%QSYSFUNC(DATE(), WORDDATE18.))";
    RUN;
ODS PDF CLOSE;

/* TEST MODEL VARIABLES FOR MULTICOLLINEARITY */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
REG.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC REG DATA=CHIS.CHIS_DATA_BINOMIAL_C (WHERE=(analyzeData=1));
        TITLE1 "%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))";
        TITLE2 "%SYSFUNC(TRIM(&SYSDSN))";
        TITLE3 "PROC REG - %LEFT(%QSYSFUNC(DATE(), WORDDATE18.))";
        MODEL    nonasthmatic = SRSEX
                                CITIZEN2
                                race
                                childhh
                                pfpl
                                INS
                                / TOL VIF COLLIN;
                                ;
    RUN;
ODS PDF CLOSE;

/* PERFORM WEIGHTED UNIVARIATE ANALYSIS FOR RECODED BINOMIAL DATASET */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYFREQ.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
        ODS GRAPHICS ON / WIDTH=1280px HEIGHT=960;
    PROC SURVEYFREQ DATA=CHIS.CHIS_DATA_BINOMIAL_C VARMETHOD=JACKKNIFE;
        TITLE1 "%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))";
        TITLE2 "%SYSFUNC(TRIM(&SYSDSN))";
```

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```
        TITLE3 "PROC SURVEYFREQ - %LEFT(%QSYSFUNC(DATE(), WORDDATE18.))";
        WEIGHT    FNWGT0;
        CLUSTER    analyzeData;
        REPWEIGHT FNWGT1-FNWGT160 / jkcoefs = 1;
        TABLES    (SRSEX
                   CITIZEN2
                   race
                   childhh
                   pfpl
                   INS
                  )*nonasthmatic
                  / CHISQ PLOTS=ALL;
    RUN;
    ODS GRAPHICS OFF;
ODS PDF CLOSE;

/* PERFORM BINOMIAL LOGISTIC REGRESSION */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYLOGISTIC.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC SURVEYLOGISTIC DATA=CHIS.CHIS_DATA_BINOMIAL_C VARMETHOD=JACKKNIFE;
        TITLE1 "%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))";
        TITLE2 "%SYSFUNC(TRIM(&SYSDSN))";
        TITLE3 "PROC SURVEYLOGISTIC - %LEFT(%QSYSFUNC(DATE(), WORDDATE18.))";
        WEIGHT     FNWGT0;
        DOMAIN     analyzeData;
        REPWEIGHTS FNWGT1-FNWGT160 / jkcoefs = 1;
        CLASS      nonasthmatic(REF='1 Non-Asthmatic')
                   SRSEX(REF='Male')
                   CITIZEN2(REF='Naturalized Citizen')
                   race(REF='White')
                   childhh(REF='Children in HH')
                   pfpl(REF='100% FPL and Above')
                   INS(REF='No')
                   ;
        MODEL    nonasthmatic = SRSEX
                                CITIZEN2
                                race
                                childhh
                                pfpl
                                INS
                                / LINK=GLOGIT CTABLE PPROB = (0.852)
                                  CORRB COVB RSQUARE STB
                                ;/*1 - CA Asthma Rate*/
    RUN;
ODS PDF CLOSE;

/* PERFORM UNWEIGHTED BINOMIAL LOGISTIC REGRESSION */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
LOGISTIC.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
        ODS GRAPHICS ON / WIDTH=1280px HEIGHT=960;
    PROC LOGISTIC DATA=CHIS.CHIS_DATA_BINOMIAL_C (WHERE=(analyzeData=1)) PLOTS=ALL;
        TITLE1 "%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))";
        TITLE2 "%SYSFUNC(TRIM(&SYSDSN))";
```

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```
        TITLE3 "PROC SURVEYLOGISTIC - %LEFT(%QSYSFUNC(DATE(), WORDDATE18.))";
        WEIGHT     FNWGT0;
        CLASS      nonasthmatic(REF='1 Non-Asthmatic')
                   SRSEX(REF='Male')
                   CITIZEN2(REF='Naturalized Citizen')
                   race(REF='White')
                   childhh(REF='Children in HH')
                   pfpl(REF='100% FPL and Above')
                   INS(REF='No')
                   ;
        MODEL    nonasthmatic = SRSEX
                                CITIZEN2
                                race
                                childhh
                                pfpl
                                INS
                                / LINK=GLOGIT CTABLE PPROB = (0.852)
                                  CORRB COVB RSQUARE STB
                                ;/*1 - CA Asthma Rate*/
    RUN;
ODS PDF CLOSE;

/* DISABLE SAS GRAPHICS */
ODS GRAPHICS OFF;

QUIT;
```

Program: CHIS_75_BinomRegress

```
/*****************************************************************************
**  Project Name    : Secondary Research of Asthma  Hospitalizations         **
**                    Masters of Science in Business Analytics Capstone Project **
**                    March / April 2019                                      **
**  Author          : Matthew C. Vanderbilt                                 **
**                    MSBA Candidate & NU Scholar, National University        **
**                    Director of Fiscal Affairs, Department of Medicine,     **
**                    UC San Diego School of Medicine                         **
**  ========================================================================= **
**  Date Created    : 2 May 2019 13:52                                      **
**  Program Name    : CHIS_75_BinomRegress                                  **
**  Purpose         : Performs Binomial Regression Model D - Census/3-Level Age **
**  Note            : Capitalized values represent SAS commands and unadjusted **
**                    variables; lower-case variables represent study-created **
**                    variables.                                              **
**                                                                            **
*****************************************************************************/

/* GLOBAL VARIABLES */
* Determine File Path for SAS EGP;
%LET localProjectPath = %SYSFUNC(SUBSTR(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH)), 1,
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH))) -
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTNAME))) ));

/* MASTER LIBRARY */
LIBNAME CHIS "&localProjectPath.CHIS";

/* Determine PDF Password */
* Pull PDF Password from Text;
FILENAME scrPath "&localProjectPath.PDFPassword.txt";
```

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```
DATA _NULL_;
    LENGTH text $265;
    RETAIN text '';
    INFILE scrPath FLOWOVER DLMSTR='//' END=last;
    INPUT;
    text = CATS(text,_INFILE_);
    IF last THEN CALL SYMPUT('rawpath',text);
RUN;
%LET pdfPassword = %SYSFUNC(TRIM(%SYSFUNC(DEQUOTE(&rawpath))));

/* DEFINE GLOBAL OPTIONS */
ODS GRAPHICS OFF;
OPTIONS PDFPASSWORD=(owner="&pdfPassword");
OPTIONS PDFSECURITY=HIGH;

/* APPLY CHIS FORMATS */
OPTIONS fmtsearch=(CHIS);

/* DEFINE FORMATS FOR NEWLY RECODED VARIABLES */
PROC FORMAT LIBRARY=CHIS;
    VALUE frace         1    = 'Latino'
                        3    = 'American Indian / Alaska Native'
                        4    = 'Asian'
                        5    = 'African American'
                        6    = 'White'
                        9    = 'Multiracial / Other'
                        ;

    VALUE fnonasthmatic 1    = '1 Non-Asthmatic'
                        2    = '2 Current Asthmatic'
                        ;

    VALUE frcbmi        0    = 'Not Overweight 0-24.99'
                        3    = 'Overweight 25.0-29.99'
                        4    = 'Obese 30.0+'
                        ;

    VALUE fpfpl         1    = '0-99% FPL'
                        5    = '100% FPL and Above'
                        ;

RUN;

/* CREATE BINOMIAL ANALYSIS DATASET WITH RECODED VARIABLES */
DATA CHIS.CHIS_DATA_BINOMIAL_D;
    SET CHIS.CHIS_DATA_FINAL;

    analyzeData = 0;
    IF asthmastatus IN(1,3) THEN analyzeData = 1;

    * Collapse Race/Ethnicity Categories;
    race = RACEDF_P1;
    IF RACEDF_P1 IN(2,8) THEN race = 9;     *Collapse Other with Multiracial;
    LABEL    race    = 'race';
    FORMAT    race    frace.;

    * Invert Asthma Status to Boolean Non-Asthmatic;
    nonasthmatic = 1;
    IF asthmastatus = 1 THEN nonasthmatic = 2;
    LABEL    nonasthmatic = 'Non-Asthmatic';
    FORMAT    nonasthmatic fnonasthmatic.;
```

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```
    * Collapse Underweight/Normal to Single Category;
    rcbmi = RBMI;
    IF RBMI IN(1,2) THEN rcbmi = 0;
    LABEL    rcbmi    = 'descriptive BMI';
    FORMAT    rcbmi    frcbmi.;

    * Collapse FPL to Under vs At Least;
    pfpl = POVLL;
    IF POVLL IN(2,3,4) THEN pfpl = 5;
    LABEL    pfpl    = 'percentage of FPL';
    FORMAT    pfpl    fpfpl.;

RUN;

/* VALIDATE RECODED DATASET CONTENTS */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
CONTENTS.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC CONTENTS DATA=CHIS.CHIS_DATA_BINOMIAL_D (WHERE=(analyzeData=1)) VARNUM;
        TITLE1 "%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))";
        TITLE2 "%SYSFUNC(TRIM(&SYSDSN))";
        TITLE3 "PROC CONTENTS - %LEFT(%QSYSFUNC(DATE(), WORDDATE18.))";
    RUN;
ODS PDF CLOSE;

/* TEST MODEL VARIABLES FOR MULTICOLLINEARITY */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
REG.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC REG DATA=CHIS.CHIS_DATA_BINOMIAL_D (WHERE=(analyzeData=1));
        TITLE1 "%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))";
        TITLE2 "%SYSFUNC(TRIM(&SYSDSN))";
        TITLE3 "PROC REG - %LEFT(%QSYSFUNC(DATE(), WORDDATE18.))";
        MODEL    nonasthmatic = SRSEX
                                CITIZEN2
                                race
                                pfpl
                                INS
                                / TOL VIF COLLIN;
                                ;
    RUN;
ODS PDF CLOSE;

/* PERFORM WEIGHTED UNIVARIATE ANALYSIS FOR RECODED BINOMIAL DATASET */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYFREQ.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
        ODS GRAPHICS ON / WIDTH=1280px HEIGHT=960;
    PROC SURVEYFREQ DATA=CHIS.CHIS_DATA_BINOMIAL_D VARMETHOD=JACKKNIFE;
        TITLE1 "%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))";
        TITLE2 "%SYSFUNC(TRIM(&SYSDSN))";
```

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```
        TITLE3 "PROC SURVEYFREQ - %LEFT(%QSYSFUNC(DATE(), WORDDATE18.))";
        WEIGHT    FNWGT0;
        CLUSTER    analyzeData;
        REPWEIGHT FNWGT1-FNWGT160 / jkcoefs = 1;
        TABLES    (SRSEX
                   CITIZEN2
                   race
                   pfpl
                   INS
                  )*nonasthmatic
                  / CHISQ PLOTS=ALL;
    RUN;
    ODS GRAPHICS OFF;
ODS PDF CLOSE;

/* PERFORM BINOMIAL LOGISTIC REGRESSION */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYLOGISTIC.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC SURVEYLOGISTIC DATA=CHIS.CHIS_DATA_BINOMIAL_D VARMETHOD=JACKKNIFE;
        TITLE1 "%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))";
        TITLE2 "%SYSFUNC(TRIM(&SYSDSN))";
        TITLE3 "PROC SURVEYLOGISTIC - %LEFT(%QSYSFUNC(DATE(), WORDDATE18.))";
        WEIGHT     FNWGT0;
        DOMAIN     analyzeData;
        REPWEIGHTS FNWGT1-FNWGT160 / jkcoefs = 1;
        CLASS      nonasthmatic(REF='1 Non-Asthmatic')
                   SRSEX(REF='Male')
                   CITIZEN2(REF='Naturalized Citizen')
                   race(REF='White')
                   pfpl(REF='100% FPL and Above')
                   INS(REF='No')
                   ;
        MODEL    nonasthmatic = SRSEX
                                CITIZEN2
                                race
                                pfpl
                                INS
                                / LINK=GLOGIT CTABLE PPROB = (0.852)
                                  CORRB COVB RSQUARE STB
                                ;/*1 - CA Asthma Rate*/
        ODS OUTPUT ParameterEstimates=CHIS.MLE_CurrentAsthma;
    RUN;
ODS PDF CLOSE;

/* PERFORM UNWEIGHTED BINOMIAL LOGISTIC REGRESSION */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
LOGISTIC.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
        ODS GRAPHICS ON / WIDTH=1280px HEIGHT=960;
    PROC LOGISTIC DATA=CHIS.CHIS_DATA_BINOMIAL_D (WHERE=(analyzeData=1)) PLOTS=ALL;
        TITLE1 "%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))";
        TITLE2 "%SYSFUNC(TRIM(&SYSDSN))";
        TITLE3 "PROC SURVEYLOGISTIC - %LEFT(%QSYSFUNC(DATE(), WORDDATE18.))";
        WEIGHT     FNWGT0;
```

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```
        CLASS      nonasthmatic(REF='1 Non-Asthmatic')
                   SRSEX(REF='Male')
                   CITIZEN2(REF='Naturalized Citizen')
                   race(REF='White')
                   pfpl(REF='100% FPL and Above')
                   INS(REF='No')
                   ;
        MODEL    nonasthmatic = SRSEX
                                CITIZEN2
                                race
                                pfpl
                                INS
                                / LINK=GLOGIT CTABLE PPROB = (0.852)
                                  CORRB COVB RSQUARE STB
                                ;/*1 - CA Asthma Rate*/
    RUN;
ODS PDF CLOSE;

/* DISABLE SAS GRAPHICS */
ODS GRAPHICS OFF;

QUIT;
```

Program: CHIS_80_Exacerbations

```
/*******************************************************************************
**  Project Name    : Secondary Research of Asthma  Hospitalizations           **
**                    Masters of Science in Business Analytics Capstone Project **
**                    March / April 2019                                        **
**  Author          : Matthew C. Vanderbilt                                   **
**                    MSBA Candidate & NU Scholar, National University          **
**                    Director of Fiscal Affairs, Department of Medicine,       **
**                    UC San Diego School of Medicine                           **
**  ========================================================================== **
**  Date Created    : 28 April 2019 18:44                                     **
**  Program Name    : CHIS_80_Exacerbations                                   **
**  Purpose         : Performs Binomial Regression Model - ED/UC for Asthma   **
**  Note            : Capitalized values represent SAS commands and unadjusted **
**                    variables; lower-case variables represent study-created **
**                    variables.                                                **
**                                                                              **
*******************************************************************************/

/* GLOBAL VARIABLES */
* Determine File Path for SAS EGP;
%LET localProjectPath = %SYSFUNC(SUBSTR(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH)), 1,
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH))) -
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTNAME))) ));

/* MASTER LIBRARY */
LIBNAME CHIS "&localProjectPath.CHIS";

/* Determine PDF Password */
* Pull PDF Password from Text;
FILENAME scrPath "&localProjectPath.PDFPassword.txt";
DATA _NULL_;
    LENGTH text $265;
    RETAIN text '';
    INFILE scrPath FLOWOVER DLMSTR='//' END=last;
    INPUT;
```

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```
    text = CATS(text,_INFILE_);
    IF last THEN CALL SYMPUT('rawpath',text);
RUN;
%LET pdfPassword = %SYSFUNC(TRIM(%SYSFUNC(DEQUOTE(&rawpath))));

/* DEFINE GLOBAL OPTIONS */
ODS GRAPHICS OFF;
OPTIONS PDFSECURITY=HIGH;
OPTIONS PDFPASSWORD=(owner="&pdfPassword");

/* APPLY CHIS FORMATS */
OPTIONS fmtsearch=(CHIS);

/* DEFINE FORMATS FOR NEWLY RECODED VARIABLES */
PROC FORMAT LIBRARY=CHIS;
    VALUE frace         1    = 'Latino'
                        3    = 'American Indian / Alaska Native'
                        4    = 'Asian'
                        5    = 'African American'
                        6    = 'White'
                        9    = 'Multiracial / Other'
                        ;

    VALUE fchildhh      1    = 'Children in HH'
                        2    = 'No Children in HH'
                        ;

    VALUE fnonasthmatic 1    = '1 Non-Asthmatic'
                        2    = '2 Current Asthmatic'
                        ;

    VALUE flateradult   1    = 'Later Adult'
                        2    = 'Young / Middle Aged'
                        ;

    VALUE frcbmi        0    = 'Not Overweight 0-24.99'
                        3    = 'Overweight 25.0-29.99'
                        4    = 'Obese 30.0+'
                        ;

    VALUE fpfpl         1    = '0-99% FPL'
                        5    = '100% FPL and Above'
                        ;

    VALUE fasthmaesc    1    = '1 Asthmatic Escalation'
                        2    = '2 No Asthma Escalation'
                        ;

RUN;

/* CREATE BINOMIAL ANALYSIS DATASET WITH RECODED VARIABLES */
DATA CHIS.CHIS_DATA_BINOMIAL_ED;
    SET CHIS.CHIS_DATA_FINAL;

    analyzeData = 0;
    IF asthmastatus = 1 THEN analyzeData = 1;

    * Recode ED/Urgent Care Asthmatic Variable;
    asthmaesc = 2;
    IF asthmastatus = 1 THEN
        DO;
```

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```
            IF AH13A = 1 THEN asthmaesc = 1; *1 = ED/UC;
            IF AH13A = 2 THEN asthmaesc = 2; *2 = No ED/UC;
        END;
    LABEL     asthmaesc = 'ED/UC Asthma Visit';
    FORMAT    asthmaesc fasthmaesc.;

    * Collapse Race/Ethnicity Categories;
    race = RACEDF_P1;
    IF RACEDF_P1 IN(2,8) THEN race = 9;     *Collapse Other with Multiracial;
    LABEL     race    = 'race';
    FORMAT    race    frace.;

    * Collapse Family Type to Children-in-Household;
    IF famtype IN(1,3) THEN childhh = 2;
    IF famtype IN(2,4) THEN childhh = 1;
    LABEL     childhh    = 'Child Household';
    FORMAT    childhh    fchildhh.;

    * Invert Asthma Status to Boolean Non-Asthmatic;
    nonasthmatic = 1;
    IF asthmastatus = 1 THEN nonasthmatic = 2;
    LABEL     nonasthmatic = 'Non-Asthmatic';
    FORMAT    nonasthmatic fnonasthmatic.;

    * Collapse Tri-Category Age to Dichotomous;
    lateradult = 2;
    IF agegroup = 3 THEN lateradult = 1;
    LABEL     lateradult    = 'Later Adult';
    FORMAT    lateradult    flateradult.;

    * Collapse Underweight/Normal to Single Category;
    rcbmi = RBMI;
    IF RBMI IN(1,2) THEN rcbmi = 0;
    LABEL     rcbmi    = 'descriptive BMI';
    FORMAT    rcbmi    frcbmi.;

    * Collapse FPL to Under vs At Least;
    pfpl = POVLL;
    IF POVLL IN(2,3,4) THEN pfpl = 5;
    LABEL     pfpl    = 'percentage of FPL';
    FORMAT    pfpl    fpfpl.;

RUN;

/* VALIDATE RECODED DATASET CONTENTS */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
CONTENTS.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC CONTENTS DATA=CHIS.CHIS_DATA_BINOMIAL_ED (WHERE=(analyzeData=1)) VARNUM;
        TITLE1 "%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))";
        TITLE2 "%SYSFUNC(TRIM(&SYSDSN))";
        TITLE3 "PROC CONTENTS - %LEFT(%QSYSFUNC(DATE(), WORDDATE18.))";
    RUN;
ODS PDF CLOSE;

/* TEST MODEL VARIABLES FOR MULTICOLLINEARITY */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
REG.pdf"
```

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```
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC REG DATA=CHIS.CHIS_DATA_BINOMIAL_ED (WHERE=(analyzeData=1));
        TITLE1 "%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))";
        TITLE2 "%SYSFUNC(TRIM(&SYSDSN))";
        TITLE3 "PROC REG - %LEFT(%QSYSFUNC(DATE(), WORDDATE18.))";
        MODEL    asthmaesc = SRSEX
                             lateradult
                             CITIZEN2
                             race
                             childhh
                             pfpl
                             INS
                             / TOL VIF COLLIN;
                             ;
    RUN;
ODS PDF CLOSE;

/* PERFORM WEIGHTED UNIVARIATE ANALYSIS FOR RECODED BINOMIAL DATASET */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYFREQ.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
        ODS GRAPHICS ON / WIDTH=1280px HEIGHT=960;
    PROC SURVEYFREQ DATA=CHIS.CHIS_DATA_BINOMIAL_ED VARMETHOD=JACKKNIFE;
        TITLE1 "%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))";
        TITLE2 "%SYSFUNC(TRIM(&SYSDSN))";
        TITLE3 "PROC SURVEYFREQ - %LEFT(%QSYSFUNC(DATE(), WORDDATE18.))";
        WEIGHT    FNWGT0;
        CLUSTER   analyzeData;
        REPWEIGHT FNWGT1-FNWGT160 / jkcoefs = 1;
        TABLES    (SRSEX
                   lateradult
                   CITIZEN2
                   race
                   childhh
                   pfpl
                   INS
                  )*asthmaesc
                  / CHISQ PLOTS=ALL;
    RUN;
    ODS GRAPHICS OFF;
ODS PDF CLOSE;

/* PERFORM BINOMIAL LOGISTIC REGRESSION */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYLOGISTIC.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC SURVEYLOGISTIC DATA=CHIS.CHIS_DATA_BINOMIAL_ED VARMETHOD=JACKKNIFE;
        TITLE1 "%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))";
        TITLE2 "%SYSFUNC(TRIM(&SYSDSN))";
        TITLE3 "PROC SURVEYLOGISTIC - %LEFT(%QSYSFUNC(DATE(), WORDDATE18.))";
        WEIGHT     FNWGT0;
        DOMAIN     analyzeData;
```

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```
        REPWEIGHTS FNWGT1-FNWGT160 / jkcoefs = 1;
        CLASS      asthmaesc(REF='2 No Asthma Escalation')
                   SRSEX(REF='Male')
                   lateradult(REF='Later Adult')
                   CITIZEN2(REF='Naturalized Citizen')
                   race(REF='White')
                   childhh(REF='Children in HH')
                   pfpl(REF='100% FPL and Above')
                   INS(REF='No')
                   ;
        MODEL    asthmaesc = SRSEX
                             lateradult
                             CITIZEN2
                             race
                             childhh
                             pfpl
                             INS
                             / LINK=GLOGIT CTABLE PPROB = (0.852)
                               CORRB COVB RSQUARE STB
                             ;/*1 - CA Asthma Rate*/
    RUN;
ODS PDF CLOSE;

/* PERFORM UNWEIGHTED BINOMIAL LOGISTIC REGRESSION */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
LOGISTIC.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
        ODS GRAPHICS ON / WIDTH=1280px HEIGHT=960;
    PROC LOGISTIC DATA=CHIS.CHIS_DATA_BINOMIAL_ED (WHERE=(analyzeData=1)) PLOTS=ALL;
        TITLE1 "%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))";
        TITLE2 "%SYSFUNC(TRIM(&SYSDSN))";
        TITLE3 "PROC SURVEYLOGISTIC - %LEFT(%QSYSFUNC(DATE(), WORDDATE18.))";
        WEIGHT     FNWGT0;
        CLASS      asthmaesc(REF='2 No Asthma Escalation')
                   SRSEX(REF='Male')
                   lateradult(REF='Later Adult')
                   CITIZEN2(REF='Naturalized Citizen')
                   race(REF='White')
                   childhh(REF='Children in HH')
                   pfpl(REF='100% FPL and Above')
                   INS(REF='No')
                   ;
        MODEL    asthmaesc = SRSEX
                             lateradult
                             CITIZEN2
                             race
                             childhh
                             pfpl
                             INS
                             / LINK=GLOGIT CTABLE PPROB = (0.852)
                               CORRB COVB RSQUARE STB
                             ;/*1 - CA Asthma Rate*/
    RUN;
ODS PDF CLOSE;

/* DISABLE SAS GRAPHICS */
ODS GRAPHICS OFF;
```

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```
QUIT;
```

Program: CHIS_81_Exacerbations

```
/*******************************************************************************
**  Project Name    : Secondary Research of Asthma  Hospitalizations          **
**                    Masters of Science in Business Analytics Capstone Project **
**                    March / April 2019                                        **
**  Author          : Matthew C. Vanderbilt                                   **
**                    MSBA Candidate & NU Scholar, National University         **
**                    Director of Fiscal Affairs, Department of Medicine,      **
**                    UC San Diego School of Medicine                          **
**  ========================================================================== **
**  Date Created    : 28 April 2019 21:45                                     **
**  Program Name    : CHIS_81_Exacerbations                                   **
**  Purpose         : Performs Binomial Regression Model - ED/UC for Asthma #2 **
**  Note            : Capitalized values represent SAS commands and unadjusted **
**                    variables; lower-case variables represent study-created  **
**                    variables.                                               **
**                                                                             **
*******************************************************************************/

/* GLOBAL VARIABLES */
* Determine File Path for SAS EGP;
%LET localProjectPath = %SYSFUNC(SUBSTR(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH)), 1,
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH))) -
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTNAME))) ));

/* MASTER LIBRARY */
LIBNAME CHIS "&localProjectPath.CHIS";

/* Determine PDF Password */
* Pull PDF Password from Text;
FILENAME scrPath "&localProjectPath.PDFPassword.txt";
DATA _NULL_;
    LENGTH text $265;
    RETAIN text '';
    INFILE scrPath FLOWOVER DLMSTR='//' END=last;
    INPUT;
    text = CATS(text,_INFILE_);
    IF last THEN CALL SYMPUT('rawpath',text);
RUN;
%LET pdfPassword = %SYSFUNC(TRIM(%SYSFUNC(DEQUOTE(&rawpath))));

/* DEFINE GLOBAL OPTIONS */
ODS GRAPHICS OFF;
OPTIONS PDFSECURITY=HIGH;
OPTIONS PDFPASSWORD=(owner="&pdfPassword");

/* APPLY CHIS FORMATS */
OPTIONS fmtsearch=(CHIS);

/* DEFINE FORMATS FOR NEWLY RECODED VARIABLES */
PROC FORMAT LIBRARY=CHIS;
    VALUE frace         1    = 'Latino'
                        3    = 'American Indian / Alaska Native'
                        4    = 'Asian'
                        5    = 'African American'
                        6    = 'White'
                        9    = 'Multiracial / Other'
```

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```
                        ;

    VALUE fchildhh      1    = 'Children in HH'
                        2    = 'No Children in HH'
                        ;

    VALUE fnonasthmatic 1    = '1 Non-Asthmatic'
                        2    = '2 Current Asthmatic'
                        ;

    VALUE flateradult   1    = 'Later Adult'
                        2    = 'Young / Middle Aged'
                        ;

    VALUE frcbmi        0    = 'Not Overweight 0-24.99'
                        3    = 'Overweight 25.0-29.99'
                        4    = 'Obese 30.0+'
                        ;

    VALUE fpfpl         1    = '0-99% FPL'
                        5    = '100% FPL and Above'
                        ;

    VALUE fasthmaesc    1    = '1 Asthmatic Escalation'
                        2    = '2 No Asthma Escalation'
                        ;

RUN;

/* CREATE BINOMIAL ANALYSIS DATASET WITH RECODED VARIABLES */
DATA CHIS.CHIS_DATA_BINOMIAL_ED2;
    SET CHIS.CHIS_DATA_FINAL;

    analyzeData = 0;
    IF asthmastatus = 1 THEN analyzeData = 1;

    * Recode ED/Urgent Care Asthmatic Variable;
    asthmaesc = 2;
    IF asthmastatus = 1 THEN
        DO;
            IF AH13A = 1 THEN asthmaesc = 1; *1 = ED/UC;
            IF AH13A = 2 THEN asthmaesc = 2; *2 = No ED/UC;
        END;
    LABEL     asthmaesc = 'ED/UC Asthma Visit';
    FORMAT    asthmaesc fasthmaesc.;

    * Collapse Race/Ethnicity Categories;
    race = RACEDF_P1;
    IF RACEDF_P1 IN(2,8) THEN race = 9;     *Collapse Other with Multiracial;
    LABEL     race    = 'race';
    FORMAT    race    frace.;

    * Collapse Family Type to Children-in-Household;
    IF famtype IN(1,3) THEN childhh = 2;
    IF famtype IN(2,4) THEN childhh = 1;
    LABEL     childhh    = 'Child Household';
    FORMAT    childhh    fchildhh.;

    * Invert Asthma Status to Boolean Non-Asthmatic;
    nonasthmatic = 1;
    IF asthmastatus = 1 THEN nonasthmatic = 2;
```

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```
    LABEL     nonasthmatic = 'Non-Asthmatic';
    FORMAT    nonasthmatic fnonasthmatic.;

    * Collapse Tri-Category Age to Dichotomous;
    lateradult = 2;
    IF agegroup = 3 THEN lateradult = 1;
    LABEL     lateradult    = 'Later Adult';
    FORMAT    lateradult    flateradult.;

    * Collapse Underweight/Normal to Single Category;
    rcbmi = RBMI;
    IF RBMI IN(1,2) THEN rcbmi = 0;
    LABEL     rcbmi    = 'descriptive BMI';
    FORMAT    rcbmi    frcbmi.;

    * Collapse FPL to Under vs At Least;
    pfpl = POVLL;
    IF POVLL IN(2,3,4) THEN pfpl = 5;
    LABEL     pfpl    = 'percentage of FPL';
    FORMAT    pfpl    fpfpl.;

RUN;

/* VALIDATE RECODED DATASET CONTENTS */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
CONTENTS.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC CONTENTS DATA=CHIS.CHIS_DATA_BINOMIAL_ED2 (WHERE=(analyzeData=1)) VARNUM;
        TITLE1 "%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))";
        TITLE2 "%SYSFUNC(TRIM(&SYSDSN))";
        TITLE3 "PROC CONTENTS - %LEFT(%QSYSFUNC(DATE(), WORDDATE18.))";
    RUN;
ODS PDF CLOSE;

/* TEST MODEL VARIABLES FOR MULTICOLLINEARITY */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
REG.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC REG DATA=CHIS.CHIS_DATA_BINOMIAL_ED2 (WHERE=(analyzeData=1));
        TITLE1 "%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))";
        TITLE2 "%SYSFUNC(TRIM(&SYSDSN))";
        TITLE3 "PROC REG - %LEFT(%QSYSFUNC(DATE(), WORDDATE18.))";
        MODEL    asthmaesc = SRSEX
                             CITIZEN2
                             race
                             pfpl
                             INS
                             / TOL VIF COLLIN;
                             ;
    RUN;
ODS PDF CLOSE;

/* PERFORM WEIGHTED UNIVARIATE ANALYSIS FOR RECODED BINOMIAL DATASET */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYFREQ.pdf"
```

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```
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
        ODS GRAPHICS ON / WIDTH=1280px HEIGHT=960;
    PROC SURVEYFREQ DATA=CHIS.CHIS_DATA_BINOMIAL_ED2 VARMETHOD=JACKKNIFE;
        TITLE1 "%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))";
        TITLE2 "%SYSFUNC(TRIM(&SYSDSN))";
        TITLE3 "PROC SURVEYFREQ - %LEFT(%QSYSFUNC(DATE(), WORDDATE18.))";
        WEIGHT    FNWGT0;
        CLUSTER   analyzeData;
        REPWEIGHT FNWGT1-FNWGT160 / jkcoefs = 1;
        TABLES    (SRSEX
                   CITIZEN2
                   race
                   pfpl
                   INS
                  )*asthmaesc
                  / CHISQ PLOTS=ALL;
    RUN;
    ODS GRAPHICS OFF;
ODS PDF CLOSE;

/* PERFORM BINOMIAL LOGISTIC REGRESSION */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYLOGISTIC.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC SURVEYLOGISTIC DATA=CHIS.CHIS_DATA_BINOMIAL_ED2 VARMETHOD=JACKKNIFE;
        TITLE1 "%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))";
        TITLE2 "%SYSFUNC(TRIM(&SYSDSN))";
        TITLE3 "PROC SURVEYLOGISTIC - %LEFT(%QSYSFUNC(DATE(), WORDDATE18.))";
        WEIGHT     FNWGT0;
        DOMAIN     analyzeData;
        REPWEIGHTS FNWGT1-FNWGT160 / jkcoefs = 1;
        CLASS      asthmaesc(REF='2 No Asthma Escalation')
                   SRSEX(REF='Male')
                   CITIZEN2(REF='Naturalized Citizen')
                   race(REF='White')
                   pfpl(REF='100% FPL and Above')
                   INS(REF='No')
                   ;
        MODEL    asthmaesc = SRSEX
                             CITIZEN2
                             race
                             pfpl
                             INS
                             / LINK=GLOGIT CTABLE PPROB = (0.852)
                               CORRB COVB RSQUARE STB
                             ;/*1 - CA Asthma Rate*/
    RUN;
ODS PDF CLOSE;

/* PERFORM UNWEIGHTED BINOMIAL LOGISTIC REGRESSION */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
LOGISTIC.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
```

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```
        STYLE=StatDoc;
        ODS GRAPHICS ON / WIDTH=1280px HEIGHT=960;
    PROC LOGISTIC DATA=CHIS.CHIS_DATA_BINOMIAL_ED2 (WHERE=(analyzeData=1)) PLOTS=ALL;
        TITLE1 "%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))";
        TITLE2 "%SYSFUNC(TRIM(&SYSDSN))";
        TITLE3 "PROC SURVEYLOGISTIC - %LEFT(%QSYSFUNC(DATE(), WORDDATE18.))";
        WEIGHT     FNWGT0;
        CLASS      asthmaesc(REF='2 No Asthma Escalation')
                   SRSEX(REF='Male')
                   CITIZEN2(REF='Naturalized Citizen')
                   race(REF='White')
                   pfpl(REF='100% FPL and Above')
                   INS(REF='No')
                   ;
        MODEL    asthmaesc = SRSEX
                             CITIZEN2
                             race
                             pfpl
                             INS
                             / LINK=GLOGIT CTABLE PPROB = (0.852)
                               CORRB COVB RSQUARE STB
                             ;/*1 - CA Asthma Rate*/
    RUN;
ODS PDF CLOSE;

/* DISABLE SAS GRAPHICS */
ODS GRAPHICS OFF;

QUIT;
```

Program: CENSUS_10_Processing

```
/*****************************************************************************
**  Project Name    : Secondary Research of Asthma  Hospitalizations          **
**                    Masters of Science in Business Analytics Capstone Project **
**                    March / April 2019                                       **
**  Author          : Matthew C. Vanderbilt                                  **
**                    MSBA Candidate & NU Scholar, National University         **
**                    Director of Fiscal Affairs, Department of Medicine,      **
**                    UC San Diego School of Medicine                          **
**  ========================================================================== **
**  Date Created    : 23 April 2019 10:51                                    **
**  Program Name    : CENSUS_10_Processing                                   **
**  Purpose         : Load and Analyze Census Data                           **
**  Note            : Capitalized values represent SAS commands and unadjusted **
**                    variables; lower-case variables represent study-created **
**                    variables.                                               **
**                                                                             **
*****************************************************************************/

/* DISABLE SAS GRAPHICS */
ODS GRAPHICS OFF;

/* GLOBAL VARIABLES */
* Determine File Path for SAS EGP;
%LET localProjectPath = %SYSFUNC(SUBSTR(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH)), 1,
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH))) -
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTNAME))) ));
```

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```
* Pull Secure File Path from Text - Adapted from Hemedinger, 2016;
* Determine C:\ MyDocuments Path to Raw Data;
FILENAME scrPath "&localProjectPath.RawDataPath.txt";
DATA _NULL_;
    LENGTH text $265;
    RETAIN text '';
    INFILE scrPath FLOWOVER DLMSTR='//' END=last;
    INPUT;
    text = CATS(text,_INFILE_);
    IF last THEN CALL SYMPUT('rawpath',text);
RUN;
%LET localRawDataPath =
%SYSFUNC(CAT(C:\Users\,%SYSFUNC(DEQUOTE(&_CLIENTUSERID)),%SYSFUNC(TRIM(%SYSFUNC(DEQUOT
E(&rawpath)))) ));

/* MASTER LIBRARIES */
LIBNAME CENSUS "&localProjectPath.Census";
LIBNAME RCENSUS "&localRawDataPath.\Census_ACS5PUMS_CA";

/* Determine PDF Password */
* Pull PDF Password from Text;
FILENAME scrPath "&localProjectPath.PDFPassword.txt";
DATA _NULL_;
    LENGTH text $265;
    RETAIN text '';
    INFILE scrPath FLOWOVER DLMSTR='//' END=last;
    INPUT;
    text = CATS(text,_INFILE_);
    IF last THEN CALL SYMPUT('rawpath',text);
RUN;
%LET pdfPassword = %SYSFUNC(TRIM(%SYSFUNC(DEQUOTE(&rawpath))));

/* DEFINE GLOBAL OPTIONS */
ODS GRAPHICS OFF;
OPTIONS PDFSECURITY=HIGH;
OPTIONS PDFPASSWORD=(owner="&pdfPassword");

/* APPLY CENSUS FORMATS */
OPTIONS fmtsearch=(CENSUS);

PROC FORMAT LIBRARY=CENSUS;

    VALUE fbnrysex       1    = 'Male'
                         2    = 'Female'
                        ;

    VALUE fcitizen       1    = 'US-Born Citizen'
                         2    = 'Naturalized Citizen'
                         3    = 'Non-Citizen'
                        ;

    VALUE frac1p         1    = 'White Alone'
                         2    = 'Black or African American Alone'
                         3    = 'American Indian Alone'
                         4    = 'Alaska Native Alone'
                         5    = 'American Indian and/or Alaska Native'
                         6    = 'Asian'
                         7    = 'Native Hawaiian and Other Pacific Islander ALone'
                         8    = 'Some Other Race ALone'
                         9    = 'Two or More Races'
                         ;
```

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```
    VALUE frace         1    = 'Latino'
                        3    = 'American Indian / Alaska Native'
                        4    = 'Asian'
                        5    = 'African American'
                        6    = 'White'
                        9    = 'Multiracial / Other'
                        ;

    VALUE fpfpl         1    = '0-99% FPL'
                        5    = '100% FPL and Above'
                        ;

    VALUE fhicov        1    = 'With Health Insurance Coverage'
                        2    = 'No Health Insurance Coverage'
                        ;

    VALUE fCHISBool     -9    = 'Not Ascertained'
                        -8    = 'Dont Know'
                        -7    = 'Refused'
                        -2    = 'Proxy Skipped'
                        -1    = 'Inapplicable'
                         1    = 'Yes'
                         2    = 'No'
                        ;

RUN;

/* VALIDATE RECODED DATASET CONTENTS */
ODS PDF FILE="&localProjectPath.Census\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
CONTENTS-RawCensus.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC CONTENTS DATA=RCENSUS.psam_p06 VARNUM;
        TITLE1 "%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))";
        TITLE2 "%SYSFUNC(TRIM(&SYSDSN))";
        TITLE3 "PROC CONTENTS - %LEFT(%QSYSFUNC(DATE(), WORDDATE18.))";
    RUN;
ODS PDF CLOSE;

DATA CENSUS.ACS5;
    SET RCENSUS.psam_p06;

    *Identify Adult Domain;
    adult = 1;
    IF AGEP < 18 THEN adult = 2;
    LABEL  adult        = 'Adult';
    FORMAT adult        fCHISBool.;

    *Recode Sex and Label;
    IF INPUT(SEX, 8.) = 1 THEN srsex = 1;
    IF INPUT(SEX, 8.) = 2 THEN srsex = 2;
    LABEL  srsex        = 'Sex';
    FORMAT srsex        fbnrysex.;

    *Recode Citizenship;
    citizen2 = 3;
    IF CIT IN(1,2,3) THEN citizen2 = 1;
    IF CIT = 4       THEN citizen2 = 2;
```

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```
IF CIT = 5       THEN citizen2 = 3;
LABEL  citizen2   = 'citizenship';
FORMAT citizen2   fcitizen.;

*Recode Race;
race = 9;
IF RAC1P = 1        THEN race = 6;
IF RAC1P = 2        THEN race = 5;
IF RAC1P IN(3,4,5)  THEN race = 3;
IF RAC1P IN(6,7)    THEN race = 4;
IF RAC1P IN(8,9)    THEN race = 9;
IF HISP ^= '01'     THEN race = 1;
LABEL  race         = 'race';
FORMAT race         frace.;

*Recode Income as Percent of FPL;
pfpl = 5;
IF POVPIP=. THEN pfpl = 1;
IF INPUT(POVPIP, 8.) < 100 THEN pfpl = 1;
IF INPUT(POVPIP, 8.) >= 100 THEN pfpl = 5;
LABEL  pfpl    = 'percentage of FPL';
FORMAT pfpl    fpfpl.;

*Recode Health Insurance;
ins = 2;
IF HICOV = 1 THEN ins = 1;
IF HICOV = 2 THEN ins = 2;
LABEL  ins      = 'Insured for Health Care';
FORMAT ins      FCHISBool.;

*Recode Missing Replicate Weights to -0-;
ARRAY a_pwgtp[80] PWGTP1-PWGTP80;
DO i = 1 to 80;
    IF a_pwgtp[i] = . THEN a_pwgtp[i] = 0;
    IF a_pwgtp[i] < 0 THEN a_pwgtp[i] = 0;
END;

*Recode New Vars to Character Fields;
IF adult    = 1 THEN c_adult    = 'Adult';
IF adult    = 2 THEN c_adult    = 'Child';
IF srsex    = 1 THEN c_srsex    = 'Male  ';
IF srsex    = 2 THEN c_srsex    = 'Female';
IF citizen2 = 1 THEN c_citizen2 = 'US-Born Citizen    ';
IF citizen2 = 2 THEN c_citizen2 = 'Naturalized Citizen';
IF citizen2 = 3 THEN c_citizen2 = 'Non-Citizen        ';
IF race     = 1 THEN c_race     = 'Latino                          ';
IF race     = 3 THEN c_race     = 'American Indian / Alaska Native';
IF race     = 4 THEN c_race     = 'Asian                           ';
IF race     = 5 THEN c_race     = 'African American                ';
IF race     = 6 THEN c_race     = 'White                           ';
IF race     = 9 THEN c_race     = 'Multiracial / Other             ';
IF pfpl     = 1 THEN c_pfpl     = '0-99% FPL         ';
IF pfpl     = 5 THEN c_pfpl     = '100% FPL and Above';
IF ins      = 1 THEN c_ins      = 'Covered by Health Insurance    ';
IF ins      = 2 THEN c_ins      = 'Not Covered by Health Insurance';

*Combine Variables into Single Field;
modelvars = CAT(PUMA,
                '|',
                c_adult,
                '|',
```

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```
                    c_srsex,
                    '|',
                    c_citizen2,
                    '|',
                    c_race,
                    '|',
                    c_pfpl,
                    '|',
                    c_ins
                   );

RUN;

/* VALIDATE RECODED DATASET CONTENTS */
ODS PDF FILE="&localProjectPath.Census\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
CONTENTS-RecodedCensus.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC CONTENTS DATA=CENSUS.ACS5 VARNUM;
        TITLE1 "%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))";
        TITLE2 "%SYSFUNC(TRIM(&SYSDSN))";
        TITLE3 "PROC CONTENTS - %LEFT(%QSYSFUNC(DATE(), WORDDATE18.))";
    RUN;
ODS PDF CLOSE;

ODS PDF FILE="&localProjectPath.Census\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
FREQ.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
        ODS GRAPHICS ON / WIDTH=1280px HEIGHT=960;
        PROC FREQ DATA=CENSUS.ACS5;
        TITLE1  "%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))";
        TITLE2  "%SYSFUNC(TRIM(&SYSDSN))";
        TITLE3  "PROC FREQ - %LEFT(%QSYSFUNC(DATE(), WORDDATE18.))";
        TABLES  SEX / PLOTS =  ALL;
        TABLES  CIT*citizen2 / PLOTS = ALL;
        TABLES  RAC1P*race / PLOTS = ALL;
        TABLES  HISP*race / PLOTS = ALL;
        TABLES  POVPIP*pfpl / PLOTS = ALL;
        TABLES  HICOV*ins / PLOTS = ALL;
RUN;
ODS PDF CLOSE;

/* PERFORM WEIGHTED UNIVARIATE ANALYSIS FOR RECODED BINOMIAL DATASET */
ODS PDF FILE="&localProjectPath.Census\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYFREQ.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
        *ODS GRAPHICS OFF;
        *ODS GRAPHICS ON / WIDTH=1280px HEIGHT=960;
    PROC SURVEYFREQ DATA=CENSUS.ACS5 VARMETHOD=BRR(FAY);
        TITLE1 "%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))";
        TITLE2 "%SYSFUNC(TRIM(&SYSDSN))";
        TITLE3 "PROC SURVEYFREQ - %LEFT(%QSYSFUNC(DATE(), WORDDATE18.))";
        TABLES     modelvars;
```

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```
        ODS OUTPUT OneWay=ResponseTable;
        WEIGHT     PWGTP;
        REPWEIGHT  PWGTP1-PWGTP80;
    RUN;
    ODS GRAPHICS OFF;
ODS PDF CLOSE;

/* CREATE PERMATABLE FOR WEIGHTED REPLICATES BY PUMA */
DATA CENSUS.Results;
    SET ResponseTable;

    *Split Modeled Variable;
    puma       = SCAN(modelvars, 1, '|');
    c_adult    = TRIM(SCAN(modelvars, 2, '|'));
    c_srsex    = TRIM(SCAN(modelvars, 3, '|'));
    c_citizen2 = TRIM(SCAN(modelvars, 4, '|'));
    c_race     = TRIM(SCAN(modelvars, 5, '|'));
    c_pfpl     = TRIM(SCAN(modelvars, 6, '|'));
    c_ins      = TRIM(SCAN(modelvars, 7, '|'));

    *Recode New Vars to Character Fields;
    IF c_adult    = 'Adult'                          THEN adult    = 1;
    IF c_adult    = 'Child'                          THEN adult    = 2;
    LABEL  adult  = 'Adult';
    FORMAT adult  fCHISBool.;

    IF c_srsex    = 'Male'                           THEN srsex    = 1;
    IF c_srsex    = 'Female'                         THEN srsex    = 2;
    LABEL  srsex  = 'Sex';
    FORMAT srsex  fbnrysex.;

    IF c_citizen2 = 'US-Born Citizen'                THEN citizen2 = 1;
    IF c_citizen2 = 'Naturalized Citizen'            THEN citizen2 = 2;
    IF c_citizen2 = 'Non-Citizen'                    THEN citizen2 = 3;
    LABEL  citizen2 = 'citizenship';
    FORMAT citizen2 fcitizen.;

    IF c_race     = 'Latino'                         THEN race     = 1;
    IF c_race     = 'American Indian / Alaska Native' THEN race     = 3;
    IF c_race     = 'Asian'                          THEN race     = 4;
    IF c_race     = 'African American'               THEN race     = 5;
    IF c_race     = 'White'                          THEN race     = 6;
    IF c_race     = 'Multiracial / Other'            THEN race     = 9;
    LABEL  race   = 'race';
    FORMAT race   frace.;

    IF c_pfpl     = '0-99% FPL'                      THEN pfpl     = 1;
    IF c_pfpl     = '100% FPL and Above'             THEN pfpl     = 5;
    LABEL  pfpl   = 'percentage of FPL';
    FORMAT pfpl   fpfpl.;

    IF c_ins      = 'Covered by Health Insurance'    THEN ins      = 1;
    IF c_ins      = 'Not Covered by Health Insurance' THEN ins      = 2;
    LABEL  ins    = 'Insured for Health Care';
    FORMAT ins    FCHISBool.;

RUN;

/* REVIEW PUMA REPLICATE TABLE */
ODS PDF FILE="&localProjectPath.Census\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
CONTENTS-RawCensus.pdf"
```

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```
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC CONTENTS DATA=RCENSUS.psam_p06 VARNUM;
        TITLE1 "%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))";
        TITLE2 "%SYSFUNC(TRIM(&SYSDSN))";
        TITLE3 "PROC CONTENTS - %LEFT(%QSYSFUNC(DATE(), WORDDATE18.))";
    RUN;
ODS PDF CLOSE;

/* DISABLE SAS GRAPHICS */
ODS GRAPHICS OFF;

QUIT;
```

Program: FinalModeling

```
/*******************************************************************************
**  Project Name    : Secondary Research of Asthma  Hospitalizations           **
**                    Masters of Science in Business Analytics Capstone Project **
**                    March / April 2019                                        **
**  Author          : Matthew C. Vanderbilt                                   **
**                    MSBA Candidate & NU Scholar, National University          **
**                    Director of Fiscal Affairs, Department of Medicine,       **
**                    UC San Diego School of Medicine                           **
**  ========================================================================== **
**  Date Created    : 2 May 2019 16:12                                        **
**  Program Name    : FinalModeling                                           **
**  Purpose         : Performs Final Logistic Modeling for Input to Tableau   **
**  Note            : Capitalized values represent SAS commands and unadjusted **
**                    variables; lower-case variables represent study-created **
**                    variables.                                                **
**                                                                              **
*******************************************************************************/

/* GLOBAL VARIABLES */
* Determine File Path for SAS EGP;
%LET localProjectPath = %SYSFUNC(SUBSTR(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH)), 1,
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTPATH))) -
%LENGTH(%SYSFUNC(DEQUOTE(&_CLIENTPROJECTNAME))) ));

/* MASTER LIBRARY */
LIBNAME CHIS "&localProjectPath.CHIS";

/* Determine PDF Password */
* Pull PDF Password from Text;
FILENAME scrPath "&localProjectPath.PDFPassword.txt";
DATA _NULL_;
    LENGTH text $265;
    RETAIN text '';
    INFILE scrPath FLOWOVER DLMSTR='//' END=last;
    INPUT;
    text = CATS(text,_INFILE_);
    IF last THEN CALL SYMPUT('rawpath',text);
RUN;
%LET pdfPassword = %SYSFUNC(TRIM(%SYSFUNC(DEQUOTE(&rawpath))));

/* DEFINE GLOBAL OPTIONS */
```

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```
ODS GRAPHICS OFF;
OPTIONS PDFPASSWORD=(owner="&pdfPassword");
OPTIONS PDFSECURITY=HIGH;

/* APPLY CHIS FORMATS */
OPTIONS fmtsearch=(CHIS);

/* PERFORM BINOMIAL LOGISTIC REGRESSION */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYLOGISTIC-Asthma.pdf"
        AUTHOR="Matthew C. Vanderbilt"
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC SURVEYLOGISTIC DATA=CHIS.CHIS_DATA_BINOMIAL_C VARMETHOD=JACKKNIFE;
            TITLE1 "%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))";
            TITLE2 "%SYSFUNC(TRIM(&SYSDSN))";
            TITLE3 "PROC SURVEYLOGISTIC - %LEFT(%QSYSFUNC(DATE(), WORDDATE18.))";
            WEIGHT     FNWGT0;
            DOMAIN     analyzeData;
            REPWEIGHTS FNWGT1-FNWGT160 / jkcoefs = 1;
            CLASS      nonasthmatic(REF='1 Non-Asthmatic')
                       ;
            MODEL    nonasthmatic = SRSEX
                                    CITIZEN2
                                    race
                                    pfpl
                                    INS
                                    / LINK=GLOGIT CTABLE PPROB = (0.852)
                                      CORRB COVB RSQUARE STB
                                    ;/*1 - CA Asthma Rate*/
            ODS OUTPUT ParameterEstimates=CHIS.MLE_CurrentAsthma;
        RUN;
ODS PDF CLOSE;

PROC TRANSPOSE DATA=CHIS.MLE_CURRENTASTHMA (WHERE=(analyzeData=1))
OUT=CHIS.MLE_CURRENTASTHMA_FLAT NAME=MLEValue;
RUN;

DATA CHIS.MLE_CURRENTASTHMA_FLAT (WHERE=(MLEVALUE='Estimate'));
    SET CHIS.MLE_CURRENTASTHMA_FLAT;

    RENAME col1 = intercept;
    RENAME col2 = SRSEX;
    RENAME col3 = CITIZEN2;
    RENAME col4 = race;
    RENAME col5 = pfpl;
    RENAME col6  = ins;

RUN;

PROC PRINT DATA=CHIS.MLE_CURRENTASTHMA;
RUN;

PROC PRINT DATA=CHIS.MLE_CURRENTASTHMA_FLAT;
RUN;

/* PERFORM BINOMIAL LOGISTIC REGRESSION */
ODS PDF FILE="&localProjectPath.CHIS\%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))_PROC-
SURVEYLOGISTIC-AsthmaEsc.pdf"
        AUTHOR="Matthew C. Vanderbilt"
```

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```
        TITLE="Targeting Reduced Asthma Hospitalizations"
        SUBJECT="MS Business Analytics Thesis"
        STYLE=StatDoc;
    PROC SURVEYLOGISTIC DATA=CHIS.CHIS_DATA_BINOMIAL_ED2 VARMETHOD=JACKKNIFE;
            TITLE1 "%SYSFUNC(DEQUOTE(&_CLIENTTASKLABEL))";
            TITLE2 "%SYSFUNC(TRIM(&SYSDSN))";
            TITLE3 "PROC SURVEYLOGISTIC - %LEFT(%QSYSFUNC(DATE(), WORDDATE18.))";
            WEIGHT     FNWGT0;
            DOMAIN     analyzeData;
            REPWEIGHTS FNWGT1-FNWGT160 / jkcoefs = 1;
            CLASS      asthmaesc(REF='2 No Asthma Escalation')
                       ;
            MODEL    asthmaesc = SRSEX
                                 CITIZEN2
                                 race
                                 pfpl
                                 INS
                                 / LINK=GLOGIT CTABLE
                                   CORRB COVB RSQUARE STB;
            ODS OUTPUT ParameterEstimates=CHIS.MLE_ASTHMAESCALATION;
        RUN;
ODS PDF CLOSE;

PROC TRANSPOSE DATA=CHIS.MLE_ASTHMAESCALATION (WHERE=(analyzeData=1))
OUT=CHIS.MLE_ASTHMAESCALATION_FLAT NAME=MLEValue;
RUN;

DATA CHIS.MLE_ASTHMAESCALATION_FLAT (WHERE=(MLEValue='Estimate'));
    SET CHIS.MLE_ASTHMAESCALATION_FLAT;

    RENAME col1 = intercept;
    RENAME col2 = SRSEX;
    RENAME col3 = CITIZEN2;
    RENAME col4 = race;
    RENAME col5 = pfpl;
    RENAME col6  = ins;

RUN;

PROC PRINT DATA=CHIS.MLE_AsthmaEscalation;
RUN;

PROC PRINT DATA=CHIS.MLE_ASTHMAESCALATION_FLAT;
RUN;

/* DISABLE SAS GRAPHICS */
ODS GRAPHICS OFF;

QUIT;
```

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Appendix J: Human Research Protection Approval

181438

UNIVERSITY OF CALIFORNIA, SAN DIEGO
HUMAN RESEARCH PROTECTIONS PROGRAM

Date: April 11, 2019

To: Dr. Praveen Akuthota

Re: Project #181438
Pre-Screening Protocol for Asthma of Varying Severity

Dear Dr. Akuthota:

Your March 18, 2019 request to amend Project 181438 has been reviewed and approved using the expedited review process. This amendment included the following:

1. Addition of a Medical Record Review Component.
2. Item 7 of the Research Plan, Background, was revised to include the following: "By conducting a medical record review, we could potentially identify other risk factors and locations for outreach in order to reduce preventable hospitalizations and severe outcomes".
3. Inclusion of approximately 5000 medical charts to be reviewed for the Medical Record Review Component part of this research.
4. Added identification of patients via EPIC medical records for the Medical Record Review
5. Component.
6. Request of waiver of Consent and HIPAA Authorization for the Medical Record Review Component.
7. Outlined patients from the Medical Record Review Component will not have alternative towards participation in this portion of the study.
8. Included risk of loss of confidentiality to the Medical Record Review Component.
9. Addition of statement for participants whom declined consent for the Prospective Consent Component whose data has already been collected for the Medical Record Review Component.
10. Addition of Matthew C. Vanderbilt, as co-investigator.

The IRB reviewed this study and determined that a waiver of informed consent was granted for the recruitment component of this project as this component of the research meets the following requirements as outlined in 45 CFR 46.116(d). This component is minimal risk; the waiver or alteration will not adversely affect the rights and welfare of the subjects; this component could not practicably carried out without the waiver or alteration; and whenever appropriate, the subjects will be provided with additional pertinent information after participation. In addition, a partial waiver of individual authorization for use of Protected Health Information (PHI) was granted for the recruitment component of this research by the IRB as this component meets the requirements outlined by the HIPAA Privacy Rule, 45 CFR 164 section 512(I). The PHI determined necessary includes the following: name, medical record number, geographic subdivisions, date of birth, and medical record dates, asthma diagnosis, treatment, medical notes, laboratory and imaging data; prevalence of hospitalizations, unscheduled office visits, scheduled office visits and emergency departments visits.

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The PI indicates that the amendment does not alter the risk/benefit ratio of the study, nor does the amendment require changes to the study consent. As such, re-consenting will not be required.

The documents submitted for review included the following: Amendment Request Cover Letter form; Signed Biomedical Facesheets; revised Research Plan, clean and tracked changes.

Please note that the amendment approval date does not alter the study expiration date. A modification is given approval only to the expiration date that was received at the most recent initial or continuing review. Also, please check your most recent initial or continuing review approval letter and ensure that continuing review materials are submitted approximately 45 days prior to that expiration.

In addition, IRB amendment approval does not constitute **other institutional required "approvals."** Should your study involve other review entities/committees such as Office of Clinical Trials Administration; Office of Coverage Analysis Administration; Independent Review Committee; Protocol Review Monitoring Committee; committees under Environmental Health & Safety such as Institutional Biosafety Committee and Human Exposure Review Committee; and/or Rady Children's Hospital – San Diego, Research Administration; it is the researchers responsibility to ensure that these entities/committees have been informed of the amendment request, as appropriate.

Should you have questions regarding this, please contact the "B" analyst who drafted this letter, Joel Stinson, at (858) 822-1338 or jstinson@ucsd.edu.

Thank you for keeping us informed.

On behalf of the UCSD Institutional Review Boards,

/js

Anthony Magit, M.D.
Director
UCSD Human Research Protections Program
858-246-HRPP (858-246-4777); hrpp@ucsd.edu

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