5-1-2014

Evaluating the Impact of a Home-~Based Childhood Asthma Intervention Program in Clark County, Nevada

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EVALUATING THE IMPACT OF A HOME-BASED CHILDHOOD ASTHMA INTERVENTION PROGRAM IN CLARK COUNTY, NEVADA

By

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2010

A dissertation submitted in partial fulfillment
of the requirements for the

Doctor of Philosophy – Public Health

Department of Environmental and Occupational Health
School of Community Health Sciences
The Graduate College

University of Nevada, Las Vegas
May 2014

UNLV
UNIVERSITY OF NEVADA LAS VEGAS

THE GRADUATE COLLEGE

We recommend the dissertation prepared under our supervision by

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entitled

Evaluating the Impact of a Home-based Childhood Asthma Intervention Program in Clark County, Nevada

is approved in partial fulfillment of the requirements for the degree of

Doctor of Philosophy - Public Health

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May 2014

ABSTRACT

Evaluating the Impact of a Home-Based Childhood Asthma Intervention Program in Clark County, Nevada

An Abstract

by

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Asthma is a chronic, incurable, costly, and potentially life-threatening disease that affects an estimated 7 million children in the United States; further, more than 56,000 Nevada children are currently living with asthma. The literature suggests that a number of factors that contribute to either the development of asthma or the exacerbation of asthma symptoms in sensitive individuals can be traced to the home environment. Given that the majority of Americans spend over 90% of their time indoors, of which two-thirds are spent at home, a home-based childhood asthma intervention program represents a unique primary prevention opportunity. This pre-experimental study evaluated the impact of a home-based childhood asthma intervention program in Clark County, Nevada based on: 1) the presence of recognized environmental contributors to asthma within the home environment, 2) caregivers' general knowledge about asthma, and 3) the self-reported symptoms and burden of the disease. Self-report and observational data were collected from participants (N = 17 homes; N = 25 asthmatic children ≤17 years old) before and after the intervention for comparison. Non-parametric Wilcoxon signed ranks tests were performed to test hypotheses. Statistical analyses identified statistically

significant decreases ($p \leq 0.05$), post-intervention, in the areas of: frequency of self-reported and observed environmental asthma triggers; frequency of asthma symptoms experienced by the child (notably decreased use of short-acting medications) in the prior month; as well as frequency of missed school days due to asthma in the prior month. The study supports the findings in the literature that suggest that a multi-faceted home-based asthma intervention program may be an effective component of an overall pediatric asthma control strategy in Clark County, Nevada.

ACKNOWLEDGEMENTS

To the faculty, staff, and fellow students in the School of Community Health Sciences, especially the Department of Environmental and Occupational Health –

Thank you for making the past eight years of my education such an enjoyable experience. I am so grateful to have had the opportunity to learn and grow in an environment with such amazing and talented individuals. I am lucky to have so many great people as peers and even more fortunate to call many of you friends.

To Dr. Shawn Gerstenberger –

It is no exaggeration to say I would not be where I am today if it wasn't for your guidance and encouragement. I am so fortunate to have had you as my mentor. You are selfless in your dedication to your students and you have provided a great example for the kind of professor/advisor I can only hope to be one day. I am honored to be your first PhD graduate and I hope I can do you proud. For at least a few years now, "my dreams have aligned with your dreams" – hopefully they can continue to do so. Sincerely, thank you.

To my Dissertation Committee: Dr. Mark Buttner, Dr. Sheniz Moonie, and Dr. Jennifer Keene –

Thank you for contributing to the longest scholarly document I have ever written…and, perhaps, that you may have ever been forced to read! It was a pleasure to have each one of you on my committee and I thank you for your unique insights, questions, and expertise. I will always value the support and the patience you provided while I was on this incredible journey.

To the study contributors –

I would like to thank the Centers for Disease Control and Prevention for the grant funding that made this project possible. I hope the focus on home-based primary prevention can continue and that federal appropriations will follow. I would also like to thank all of the amazing community partners affiliated with the Nevada Healthy Homes Partnership – the Southern Nevada Health District, Rebuilding Together of Southern Nevada, HELP of Southern Nevada – to name a few. Your commitment to this community-wide collaboration contributed to the project's success.

To the Research Team –

Like most things in life, this dissertation, and the work that preceded it, was no one man show. This study would not have been possible without the tireless efforts of my incredible peers, who together are capable of achieving unbelievable feats! Erika – you are the dependable rock of our "work family" and I cannot thank you enough for all of your efforts. Jennifer Berger, Melissa Breunig, Michelle Ching, Tara Gregg, Sabrina La Monica, and Jonathon LaValley – your contributions to this project and all of our "other duties as assigned" are so very appreciated. I could not have asked for a better team to work with.

To my friends –

My best friend Meghan – I still cannot thank you enough for encouraging me to take a chance in Las Vegas. My life may have turned out so differently if it wasn't for you…and I'm quite happy with how it's turning out! Thank you for your years of

friendship, adventures, encouragement, and the opportunity to be an Auntie to your beautiful children. Karin – you may be one of my biggest fans…or at least that's how you make me feel! I only hope I can return the favor. I am truly grateful for your enduring support and I value your friendship so much. To the rest of the "wine night" crew – thank you for the laughs and the stress relief! To my bff Wade and all of my other dear friends (near and far) – thank you for keeping me in your thoughts and celebrating my successes with me. I would also like to thank my boyfriend Johnny. You have been so supportive of my goals and appreciative of me as a person. You truly make me feel special and I am extremely lucky to have you – I love you.

To my family: Dad, Mom, Kim, Britt, Mark, Andy, Brynn, and Ace –

First, I love you. Second, thank you. You would think after the practice of writing over 40,000 words for this dissertation that it would be easier to come up with the perfect thing to say about you all…but, the truth is, there are not enough words to say how much each of you means to me. I am blessed to be a part of this family and so grateful for how each of you has impacted my life – you all have a permanent place in my heart. Thank you for your unwavering support, enthusiasm, and love. I feel like I won both the "nature" and "nurture" lotteries. I am so fortunate that you are here to share my accomplishment with me…here's to many more together! Please never forget…I love you and thank you…always.

DEDICATION

To all aspiring medical school students who were rejected,

but who found another way to become a Doctor.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

Purpose of the Study

The primary purpose of the study was to evaluate the impact of a home-based asthma intervention program targeting children (≤17 years old in age) in Clark County, Nevada. The study examined the intervention program's impact on: caregivers' (i.e., participating parents or guardians of children with asthma) general knowledge of asthma; the presence of environmental contributors to asthma development and environmental triggers of asthma symptoms in the home; the frequency of symptoms experienced by the asthmatic child and the overall burden of the disease, which may be due to the home conditions. The study also served to educate participants on the importance of understanding pediatric asthma, the home-based triggers most associated with asthma, the need for effective asthma case management, and the benefits of home-based intervention programs.

Research Questions

- What is the impact of a home-based childhood asthma intervention program on the presence of recognized environmental contributors to asthma within a home environment?
- What is the impact of a home-based childhood asthma intervention program on caregivers' general knowledge about asthma?
- What is the impact of a home-based childhood asthma intervention program on the self-reported symptoms and burden of the disease?

Hypotheses

The study was pre-experimental (one group pre-test/post-test) by design and, therefore, sought to evaluate the impact of a home-based childhood asthma intervention

program by examining the difference between pre- and post-intervention measures within one study cohort followed over time. All study participants that met inclusion criteria (e.g., homes with asthmatic children aged ≤17 years old) received the intervention. The intervention included the delivery of asthma-specific education and household supplies intended to: reduce the presence of environmental asthma triggers in the home and ensure all participating homes met an equivalent, minimum standard in terms of asthma-related home health (i.e., all homes have adequate cleaning supplies; all homes have Integrated Pest Management supplies, if applicable; all asthmatic children sleep on allergen-reducing pillow and mattress covers; all homes have asthma-educated caregivers). All study participants had a number of measures collected (prior to the intervention and duplicated after the intervention was implemented); as such, the intervention group provided the sole data for analysis. A separate control group was not utilized in this study; instead, the participating cases served as their own controls.

The study tested a number of hypotheses to infer the impact of the home-based childhood asthma intervention program on the study participants. A number of tools had been developed to collect necessary data (APPENDIX A); data collected included both self-reported data from the study participants and observational data collected by the study investigators. It is important to note that the inherent biases associated with self-reported data (i.e., response bias, recall bias) may have subjectively skewed the data. As such, where data were collected from both self-report and observational sources, as in Hypothesis 1, the statistical analysis was conducted separately to test sub-hypotheses, as indicated below. Differences between the self-reported and observed data are discussed in CHAPTER 4 FINDINGS OF THE STUDY. Finally, a number of the self-report study

hypotheses are further divided into applicable sub-hypotheses, as demonstrated below; in such instances, the overarching hypothesis will be tested, as will each sub-hypothesis individually.

The intent of the study was to collect applicable data that were used to test the following alternate hypotheses:

$H_{1\text{-}1A}$: The median post-intervention frequency of self-reported types of environmental asthma triggers in the home, following participation in a home-based childhood asthma intervention program, will be lower than the median pre-intervention.
($Md_{\text{pre-int}} > Md_{\text{post-int}}$)

$H_{1\text{-}2A}$: The median post-intervention frequency of observed environmental asthma triggers in the home, following participation in a home-based childhood asthma intervention program, will be lower than the median pre-intervention.
($Md_{\text{pre-int}} > Md_{\text{post-int}}$)

H_{2A}: The median post-intervention score of caregivers' general knowledge about asthma, following participation in a home-based childhood asthma intervention program, will be higher than the median pre-intervention.
($Md_{\text{pre-int}} < Md_{\text{post-int}}$)

H_{3A}: The median post-intervention overall frequency of self-reported monthly asthma symptoms, following participation in a home-based childhood asthma intervention program, will be lower than the overall frequency pre-intervention
($Md_{\text{pre-int}} > Md_{\text{post-int}}$)

$H_{3\text{-}1A}$: The median post-intervention frequency of self-reported monthly daytime asthma symptoms, following participation in a home-based childhood asthma intervention program, will be lower than the monthly median pre-intervention.
($Md_{\text{pre-int}} > Md_{\text{post-int}}$)

$H_{3\text{-}2A}$: The median post-intervention frequency of self-reported monthly nighttime asthma symptoms, following participation in a home-based childhood asthma intervention program, will be lower than the monthly median pre-intervention.
($Md_{\text{pre-int}} > Md_{\text{post-int}}$)

$H_{3\text{-}3A}$: The median post-intervention frequency of self-reported monthly use of short-acting medications, following participation in a home-based childhood asthma intervention program, will be lower than the monthly median pre-intervention.
($Md_{\text{pre-int}} > Md_{\text{post-int}}$)

$H_{3\text{-}4A}$: The median post-intervention self-reported activity limitations, following participation in a home-based childhood asthma intervention program, will be lower than the median pre-intervention.
($Md_{\text{pre-int}} > Md_{\text{post-int}}$)

H_{4A}: The median post-intervention overall frequency of self-reported asthma-related health care visits per six month period, following participation in a home-based childhood asthma intervention program, will be lower than the median pre-intervention
($Md_{\text{pre-int}} > Md_{\text{post-int}}$)

$H_{4\text{-}1A}$: The median post-intervention frequency of self-reported asthma-related doctor's office visits per six month period, following participation in a home-based childhood asthma intervention program, will be lower than the median pre-intervention.
($Md_{\text{pre-int}} > Md_{\text{post-int}}$)

$H_{4\text{-}2A}$: The median post-intervention frequency of self-reported asthma-related emergency room/urgent care visits per six month period, following participation in a home-based childhood asthma intervention program, will be lower than the median pre-intervention.
($Md_{\text{pre-int}} > Md_{\text{post-int}}$)

$H_{4\text{-}3A}$: The median post-intervention frequency of self-reported asthma-related hospital admissions per six month period, following participation in a home-based childhood asthma intervention program, will be lower than the median pre-intervention.
($Md_{\text{pre-int}} > Md_{\text{post-int}}$)

H_{5A}: The median post-intervention frequency of self-reported asthma-related missed school days per month, following participation in a home-based childhood asthma intervention program, will be lower than the median pre-intervention.
($Md_{\text{pre-int}} > Md_{\text{post-int}}$)

H_{6A}: The median post-intervention frequency of self-reported asthma-related caregiver missed work days per month, following participation in a home-based childhood asthma intervention program, will be lower than the median pre-intervention. ($Md_{\text{pre-int}} > Md_{\text{post-int}}$)

Significance of the Study

Asthma is a chronic, incurable, and potentially life-threatening disease that affects an estimated 300 million people worldwide (National Heart, Lung, and Blood Institute [NHLBI], 2013). In the United States alone, it is estimated that as many as 7 million children have asthma, as well as nearly 19 million adults (Centers for Disease Control and Prevention [CDC], 2012; President's Task Force on Environmental Health Risks and Safety Risks to Children [Task Force], 2012). From the 1980s through the mid-1990s, the prevalence of asthma in the United States more than doubled; the peak of the spike was a prevalence rate of 7.5% in 1995 (Akinbami, 2006; Akinbami et al., 2009; Cohn, Elias, & Chupp, 2004). From 1980 – 1996, the prevalence of asthma in the United States grew approximately 4.6% annually (Akinbami et al., 2009). Additionally, although not at the same pace, the nationwide prevalence of asthma continues to slowly rise; it has grown nearly 15% in the last decade (Akinbami, 2006; CDC, 2012). Current asthma prevalence increased from 7.3% in 2001 to 8.4% in 2010 (Akinbami et al., 2012). Further, early release data from the 2012 National Health Interview Survey estimate the current prevalence of asthma in the United States for persons of all ages to be at an all-time high of 8.5% (National Center for Health Statistics [NCHS], 2013).

Asthma carries particular significance in Nevada. Data demonstrate that Nevada's lifetime adult asthma prevalence rate (14.5% in 2010) exceeds the national average (CDC, 2010); further, in 2010, the rate was at a ten year high, as seen below in Figure 1.

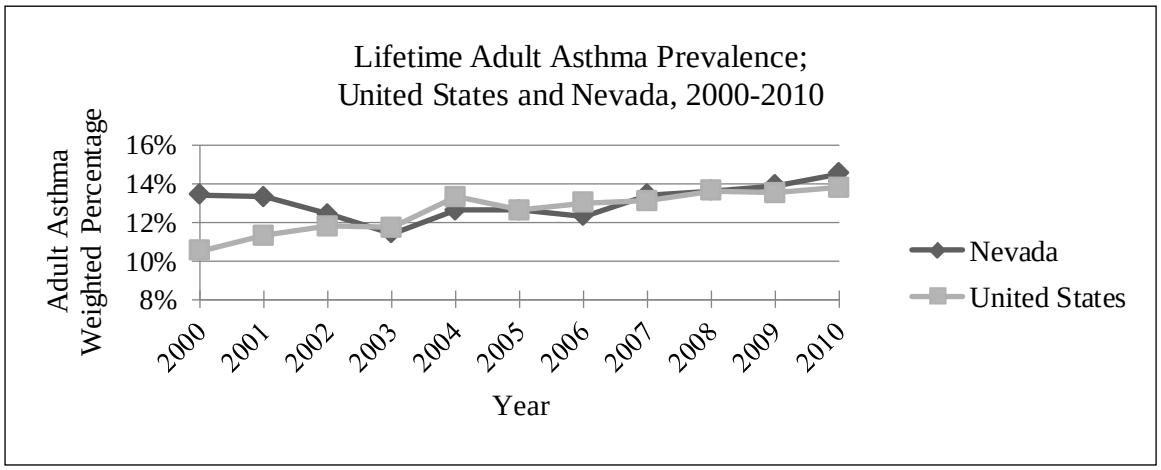
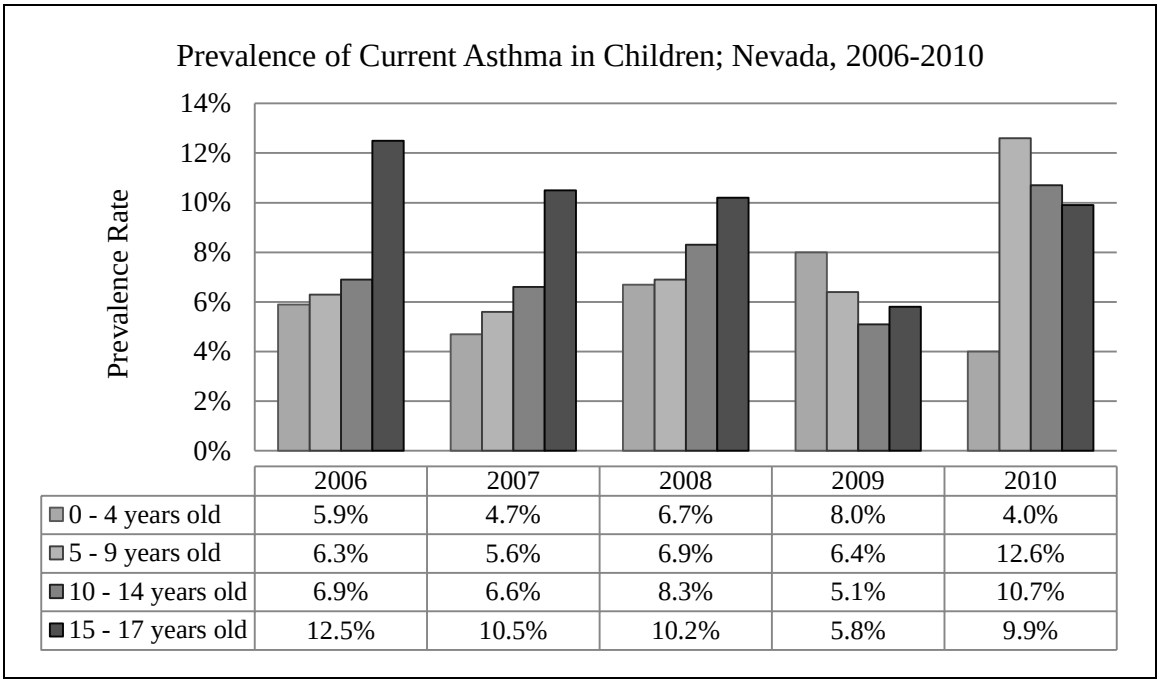


Figure 1: Lifetime Adult Asthma Prevalence; United States and Nevada, 2000-2010 (Figure created using data from: CDC, 2010)

In terms of childhood asthma, Nevada also exceeded averages in 2010 for current prevalence; Nevada's overall childhood prevalence rate was 8.6% in 2010, while the average rate of the 38 participating and reporting states was 8.4% (NCEH, 2011). Considering Nevada's population estimates for 2010 (2,700,551 people) and the percentage of children under age 18 in Nevada (24.4%), an 8.6% asthma prevalence rate indicates that more than 56,000 Nevada children are living with asthma (United States Census Bureau [USCB], 2013). Further, it is speculated that childhood asthma prevalence rates in Nevada may be understated; for example, in 2006, the asthma prevalence rate in the Clark County School District (the fourth largest school district in the nation), for children from kindergarten to high school, was 9.1%; a prevalence which in and of itself may be administratively underestimated (Moonie, Cross, Guillermo, & Gupta, 2010). Additionally, when childhood current asthma prevalence rates are further broken down into age categories, differences between ages and across time are also apparent. Figure 2 below demonstrates differences in current asthma prevalence among different age groups for the years of 2006 – 2010; these data highlight the fact that

asthma in Nevada continues to be a concern for a great number of children, particularly as prevalence rates for 5 – 14 year olds were at a five year high in 2010 (NCEH, 2011).



	2006	2007	2008	2009	2010
0 - 4 years old	5.9%	4.7%	6.7%	8.0%	4.0%
5 - 9 years old	6.3%	5.6%	6.9%	6.4%	12.6%
10 - 14 years old	6.9%	6.6%	8.3%	5.1%	10.7%
15 - 17 years old	12.5%	10.5%	10.2%	5.8%	9.9%

Figure 2: Prevalence of Current Asthma in Children; Nevada, 2006-2010
(Figure created using data from: NCEH, 2011)

Additionally, the burden of asthma is not felt simply through its prevalence; the burden in terms of health care expenditures, absenteeism from work and school, as well as mortality remains high (Akinbami, 2006; Cohn et al., 2004; Moonie, Sterling, Figgs, & Castro, 2008; Vork, Broadwin, & Blaisdell, 2007). It is estimated that asthma costs more than $50 billion annually in health care costs and lost productivity (CDC, 2012; Task Force, 2012). Further, asthma is the leading cause of hospitalization among young children and thousands of people die each year due to complications with asthma (CDC, 2012; Cohn et al., 2004).

Asthma is a significant public health concern that warrants attention and action to improve the quality of life of all affected. The federal government has recognized this need and has developed specific asthma objectives for the *Healthy People 2020* agenda; *Healthy People 2020* strives to improve nationwide health through the establishment of a number of measurable and science-based objectives (United States Department of Health and Human Services [DHHS], 2013). The 2020 agenda identified eight objectives (many with sub-objectives) to address the problem of asthma in the nation; in summary, objectives are aimed at: reducing asthma mortality; reducing critical health care utilization; reducing activity limitations for asthmatics; reducing missed work and school days; increasing formal patient education and appropriate asthma care; as well as, increasing state-level comprehensive asthma surveillance (DHHS, 2013).

To add to these objectives, the President's Task Force on Environmental Health Risks and Safety Risks to Children has also developed an *Action Plan*, through the consensus of a number of federal agencies, to address asthma disparities that exist among poor and minority youth (Task Force, 2012). The *Action Plan* includes several strategies: 1) reduce barriers to the implementation of guidelines-based asthma management; 2) enhance capacity to deliver integrated, comprehensive asthma care to children in communities with racial and ethnic asthma disparities; 3) improve capacity to identify the children most impacted by asthma disparities; and 4) accelerate efforts to identify and test interventions that may prevent the onset of asthma among ethnic and racial minority children (Task Force, 2012). Each strategy also proposes a number of priority actions necessary to achieve the over-arching goals.

This research study is significant in that it aligns with federal priorities to reduce the overall burden of asthma on our nation's children. Specifically, the goals and activities of the study mirror many of those that are nationally proposed (e.g., reducing environmental exposures; utilizing a home-based health and housing program to identify opportunities to improve asthma management; re-enforcing asthma self-management education) (NHLBI, 2007; Task Force, 2012). The study will contribute to the overall field of public health and, specifically, to the areas of childhood asthma research and the healthy homes concept (discussed in later detail). Further, the study has the potential to identify the benefit of a home-based asthma intervention program specifically for Clark County, Nevada children. No current literature exists explicitly in this area; therefore, addressing this knowledge gap makes the study a novel and worthwhile endeavor.

CHAPTER 2

REVIEW OF RELATED LITERATURE

The Disease Asthma

Pathophysiology

Asthma is a common, chronic disease of the respiratory system, characterized by inflammation of the airways (Akinbami, Moorman, Garbe, & Sondik, 2009; American Lung Association [ALA], 2012; Breysse et al., 2004; Cohn et al., 2004; Homer & Elias, 2000; Institute of Medicine [IOM], 2000; NHLBI, 2007). The pathophysiology of asthma includes a complex immune response with involvement from a number of cell types and can follow allergic or non-allergic pathways (IOM, 2000; NHLBI, 2007). Inflammation of the airways limits airflow and contributes to airway hyperresponsiveness, sometimes referred to as "twitchy" airways (Cohn et al., 2004). This airway inflammation is persistent even when patients are asymptomatic, but also contributes to the expression of symptoms that are characteristic of the disease (Cohn et al., 2004; NHLBI, 2007). In many cases, airway structures are perpetually altered, due to: basement membrane fibrosis, mucus hypersecretion, injury to epithelial cells, smooth muscle hypertrophy or hyperplasia, angiogenesis, etc. (Busse & Lemanske, 2001; Cohn et al. 2004; Holgate, 2011; Homer & Elias, 2000; NHLBI, 2007). These permanent changes are referred to as airway remodeling (Busse & Lemanske, 2001; Cohn et al., 2004; IOM, 2000; NHLBI, 2007). Evidence of airway remodeling may exist even in mild cases of asthma, but is extremely common in severe cases; severe cases often present with airway thickening in almost all airways, including the smallest bronchioles

(Homer & Elias, 2000). Airway remodeling contributes to both the severity and the chronicity of the disease (Busse & Lemanske, 2001; Cohn et al., 2004; NHLBI, 2007).

Role of Inflammatory Cells. The cells involved in asthma pathophysiology are consistent, regardless of the severity of the disease (NHLBI, 2007). Characteristic asthma inflammation is a response to the presence and activities of a number of cell types (e.g., neutrophils, dendritic cells, macrophages); however, three cell types are considered largely responsible: mast cells, T cells, and eosinophils (IOM, 2004; NHLBI, 2007). The majority of asthmatics (approximately 80%) experience allergic asthma; the role of inflammatory cells in this type of asthma is discussed below (Cohn et al., 2004; IOM, 2000).

Mast Cells. Mast cells originate in the bone marrow, but are widely distributed throughout the tissues of the body (Brightling, Bradding, Pavord, & Wardlaw, 2003). Some studies have shown that the number of mast cells in asthmatic individuals is increased, as compared to controls, and that mast cells may be more localized in bronchial smooth muscle in asthmatics (Brightling et al., 2003). In general, mast cells' presence throughout the layers of airways allows for their response to inhaled stimuli. Activation of mast cells occurs when a cross-linkage of the inflammatory antibody Immunoglobulin E (IgE) and inhaled stimuli bind to the high-affinity receptors on mast cells (Holgate, 2011; NHLBI, 2007). In asthma sufferers, the majority of airway mast cells exist in this activated state (Busse & Lemanske, 2001). Activated mast cells are responsible for the production and secretion of mediators of inflammation and bronchoconstriction (i.e., histamine, prostaglandins, and leukotrienes) and pro-inflammatory cytokines, such as Interleukin (IL)-4, IL-5, and IL-13 (Brightling et al.,

2003; Busse & Lemanske, 2001). The release of these mediators has an effect on smooth muscle contraction, which increases airway hyperresponsiveness and also contributes to mucus secretion, both critical characteristics of asthma (Holgate, 2011; NHLBI, 2007).

T Cells. In human lymph fluid, there are two types of lymphocyte helper CD4+ T cells, referred to simply as type 1 helper T (Th1) cells and type 2 helper T (Th2) cells based on their cytokine-release profiles (Busse & Lemanske, 2001; IOM, 2000). T cells of both types are responsible for the body's cell-mediated immune response, with Th1 cells linked to antimicrobial defense and autoimmunity and Th2 cells linked to parasite defense and allergen response (Busse & Lemanske, 2001; Holgate, 2011). Th1 and Th2 cells act as reciprocal inhibitors of the other's pro-inflammatory cytokine production (Busse & Lemanske, 2001). As such, it has been suggested that an imbalance of Th1 and Th2 cells, with a skew towards Th2 cells, may contribute to the development and progression of atopic diseases such as asthma; Th1 cells do not appear to produce characteristics of asthma (Busse & Lemanske, 2001; Cohn et al., 2004; Hagendorens et al., 2004; IOM, 2000). As such, asthmatic inflammation is largely attributed to Th2 cells alone (Homer & Elias, 2000).

In asthmatics, the Th2 cells express a number of surface proteins, which demonstrates that, like mast cells, Th2 cells exist in the airways in an activated state (Corrigan & Kay, 1990). In this activated state, Th2 cells specifically produce cytokines (i.e., IL-4, IL-5, IL-13 granulocyte-macrophage colony-stimulating factor [GM-CSF]), which are the mediators of inflammation and which may contribute to airway remodeling (Busse & Lemanske, 2001; Cohn et al., 2004). Further, IL-4 and IL-13 from T cells are the first to signal synthesis of IgE by another type of lymphocyte, B cells (Busse & Lemanske,

2001). Through a complex process, B cells also become activated, then synthesize and release IgE (Busse & Lemanske, 2001). Once formed, IgE antibodies circulate in the bloodstream and become available to bind to a variety of receptors on target cells (e.g. mast cells, eosinophils); when bound to receptors and exposed to antigens, target cells themselves become activated and subsequently release inflammatory mediators (Busse & Lemanske, 2001). As such, the severity of asthma has been linked to IgE synthesis (Busse & Lemanske, 2001; Corrigan & Kay, 1990). Figure 3 below demonstrates the interaction between T cells and B cells that result in IgE synthesis and the subsequent physiological effects of asthma.

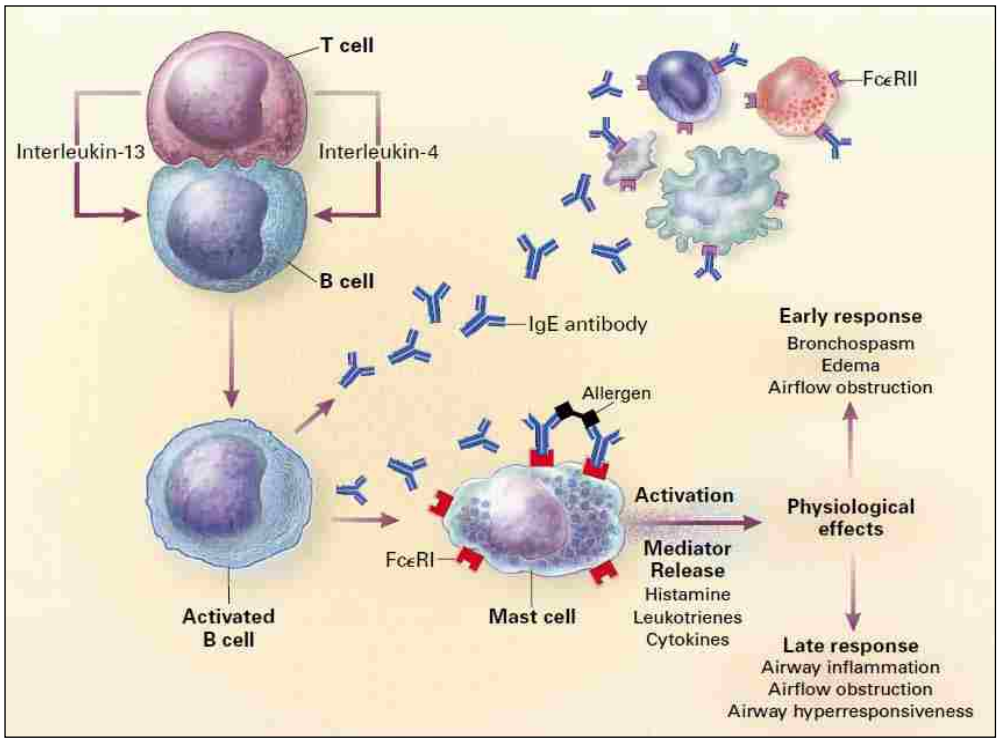


Figure 3: Asthma-Related Lymphocyte Interactions in IgE Synthesis
(Figure source: Busse & Lemanske, 2001)

Eosinophils. The release of IL-5 from mast cells, in combination with IL-3 and GM-CSF release from T cells, causes the differentiation and maturation of eosinophils in the bone marrow (Busse & Lemanske, 2001). Mature eosinophils then migrate from the bone marrow to the airways, through a series of steps that begins with cell rolling (Busse & Lemanske, 2001). Once in the airways, mature eosinophils release a number of dense intracellular granule proteins (e.g., major basic protein, peroxidase, cationic protein) (Busse & Lemanske, 2001; Holgate, 2011; IOM, 2000). These inflammatory proteins injure tissues and, like mast cells, release leukotrienes that further contribute to the smooth muscle hyperresponsiveness and vascular permeability associated with asthma (Busse & Lemanske, 2001; Homer & Elias, 2000). Figure 4 below demonstrates the interplay between eosinophils, mast cells, Th2 cells, and their associated mediators in the pathophysiology of asthma.

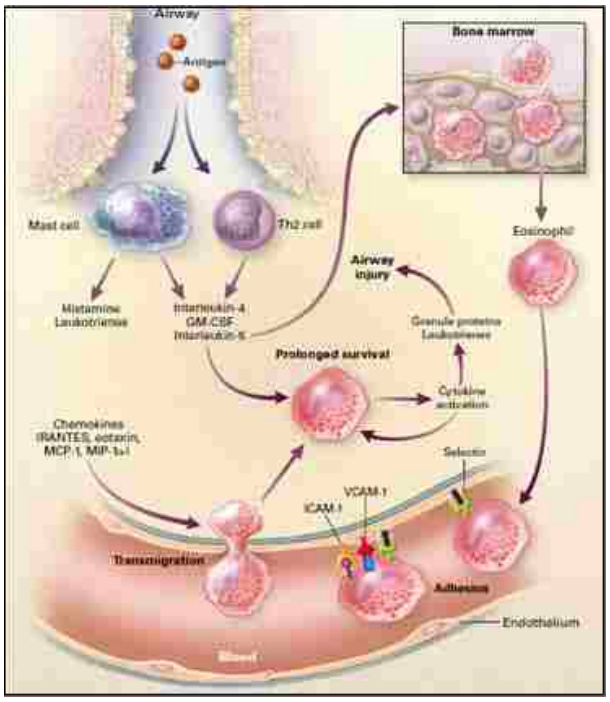


Figure 4: Role of Inflammatory Cells in Asthma
(Figure source: Busse & Lemanske, 2001)

Clinical Manifestations. Although asthma is a chronic disease, the clinical manifestations (or symptoms of asthma) can vary greatly between individuals and within the same individual over time, even to the point that they seem to effectively disappear (Cohn et al., 2004; NHBLI, 2007). As mentioned, asthma symptoms are the result of a number of physiologic changes to the airways, which may or may not be allergic in nature, including: bronchoconstriction (due to inflammation and smooth muscle constriction), edema (due to increased vascular permeability), and hyperresponsiveness to stimuli (Brightling et al., 2003; NHLBI, 2007; Miles, 2005). Often these structural changes to the airways precede the manifestation of asthma symptoms by years (Cohn et al. 2004).

Bronchoconstriction occurs when smooth muscle surrounding the bronchioles quickly contracts and narrows the airway in response to stimuli (e.g., allergens, irritants, physical activity) (NHLBI, 2007). This response is well-understood as it pertains to allergen-induced bronchoconstriction. Exposure to allergens results in the IgE-dependent release of mediators such as histamine, leukotrienes, and prostaglandins from mast cells that directly influence contraction (NHLBI, 2007). Airway edema is often the result of persistent inflammation, mucus hypersecretion, and hypertrophy of bronchiole smooth muscle – factors that may also contribute to permanent airway remodeling (NHLBI, 2007). As with edema, continued inflammation is also a major factor in determining the degree of airway hyperresponsiveness. Airway hyperresponsiveness is characterized by exaggerated bronchoconstriction in response to stimuli (IOM, 2000; NHLBI, 2007). The complex interaction of these physiologic changes is the hallmark of asthma.

As a result of these physiologic changes in the airways, clinical asthma symptoms generally present as: recurrent episodes of wheezing, shortness of breath (dyspnea), chest tightness or chest pain, and coughing (Akinbami, 2006; CDC, 2011; CDC, 2012; Holgate, 2011; EPA, 2008; IOM, 2004; NHLBI, 2007). Symptoms commonly occur at night or in the early morning, often disrupting sleep (NHLBI, 2007; NHLBI, 2012). Symptoms themselves may be acute or chronic and may or may not respond immediately to treatment (NHLBI, 2007). Asthma symptoms may also be temporal or location-specific, likely due to an increased presence of asthma triggers, discussed in later detail (NHLBI, 2012). In some scenarios, asthma symptoms become exacerbated; these occurrences are often referred to as asthma episodes or asthma attacks.

Asthma Attacks. Individuals with asthma may frequently experience periods of reversible airway obstruction known as an asthma attack (Akinbami et al., 2012). An asthma attack ("episode", "exacerbation", or "flare-up") occurs when the onset of symptoms gets acutely more intense or more frequent, usually in response to stimuli (Akinbami et al., 2012; ALA, 2012; IOM, 2004; NHLBI, 2012). The acute symptoms in an asthma attack are typically the result of a bronchospasm and can usually be resolved through the use of quick-relief medication; however, depending on the level of inflammation and the exposure to a trigger, an untreated asthma attack may last anywhere from minutes to days (American College of Allergy, Asthma & Immunology [ACAAI], 2010; NHLBI, 2007). While the symptoms of an asthma attack may subside with or without the use of medication, all asthma attacks should be taken seriously and should be addressed immediately (NHLBI, 2007). Severe attacks may require hospitalization and can sometimes be fatal (ALA, 2012; EPA, 2008; NHLBI, 2012). Figure 5 below

demonstrates the physiologic differences between a normal airway and the features of an airway during an asthma attack. In the figure, A) shows the location of the lungs and airways in the body, B) shows a cross-section of a normal airway, and C) shows a cross-section of an airway during asthma symptoms.

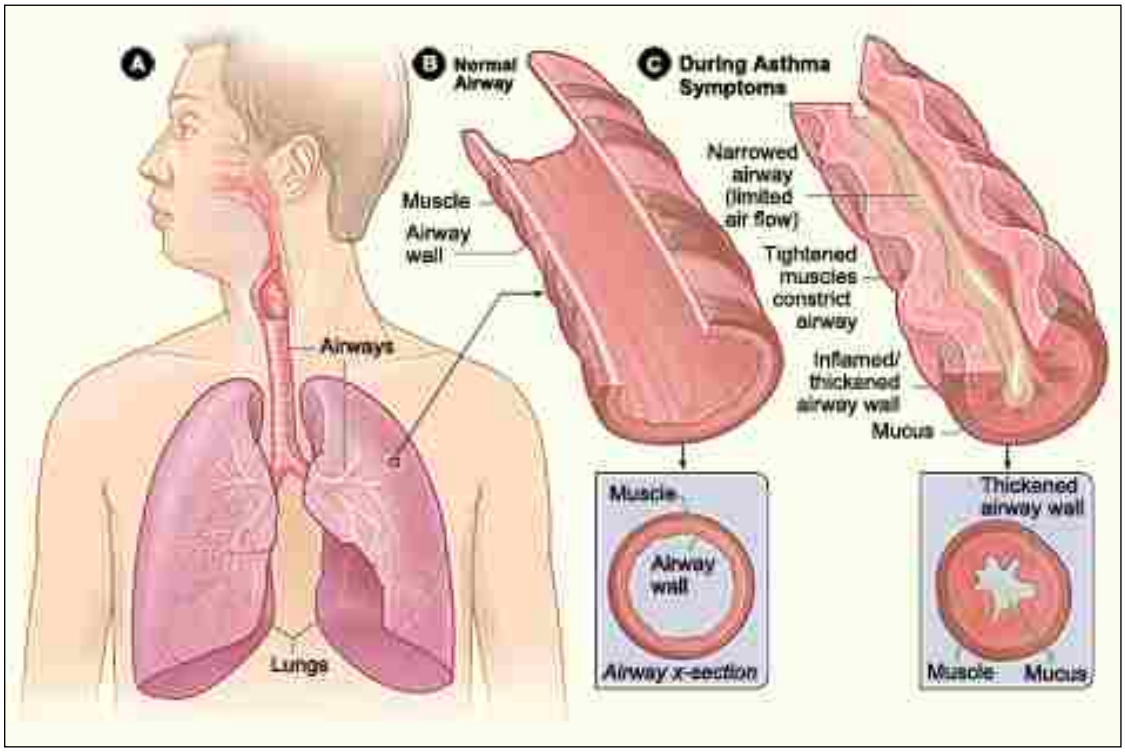


Figure 5: Normal and Asthmatic Airways
(Figure source: NHLBI, 2012)

The prevalence of asthma attacks in the United States has increased with the overall disease prevalence. In 2008, nearly 12 million asthma sufferers (approximately 50% of asthmatics) experienced an asthma attack, the majority of whom (57%) were children (CDC, 2011). The asthma attack frequency increased in 2011, when an estimated 13.2 million Americans had an asthma attack; of these, more than four million asthma attacks were had by children (ALA, 2012). Since 1999, asthmatic children between the ages of 5 to 17 years old have been at greatest risk of having an asthma attack (ALA, 2012).

Further risk factors for increased asthma attack prevalence include being female and being of non-Hispanic black race (ALA, 2012).

Asthma Diagnosis, Management, and Treatment

Asthma Diagnosis. The diagnosis of asthma is somewhat complex and has been shown to vary amongst medical professionals, across locations, and over time (IOM, 2000; Strachan, 1999). Generally, diagnosis of asthma by a medical professional typically involves: a discussion of medical history, a physical examination, and diagnostic lung function tests (NHLBI, 2012). The medical history includes a discussion of characteristic symptoms (including any trends or identified triggers) and any family history of asthma or other allergic conditions (NHLBI, 2007). While the symptoms of asthma themselves are objective, the self-reporting of symptoms by patients or caregivers may complicate diagnosis (Strachan, 1999).

Alternatively, the physical examination is better standardized and is focused primarily on the upper respiratory tract, chest, and skin (NHLBI, 2007). Lung function is often tested via spirometry; spirometry measures both the volume of air taken in and forced out of the lungs after a complete inhalation, as well as the speed with which one can expel air (NHLBI, 2012). Common spirometry measures include: forced expiratory volume in 1 second (FEV_1), forced expiratory volume in 6 seconds (FEV_6; often used in diagnosing older adults), forced vital capacity (FVC), as well as the proportion of FEV_1/FVC, which is an indicator of airway obstruction (NHLBI, 2007). Additional diagnostic tests may include: allergy testing, bronchoprovocation tests (a specialized type of repeated-measure spirometry under challenge), chest x-rays, bronchoalveloar lavage, etc. to rule out

differential diagnoses (NHLBI, 2012; Warner, Pohunek, Marguet, Roche, & Clough, 2000).

Asthma affects people of all ages, but symptoms often begin in childhood (IOM, 2000; NHLBI, 2012). However, diagnosing children with asthma can sometimes be difficult. It is especially challenging to diagnose asthma in children less than five years of age, as asthma symptoms may be similar to those of other respiratory conditions and physiologically smaller airways may contribute to wheezing (Akinbami, 2006; CDC, 2013; IOM, 2000; NHLBI, 2012; Martinez et al., 1995; Warner et al., 2000). Differentiating asthma from other wheezing conditions that are common in young children is important; as wheezing is not always indicative of future asthma development (Martinez et al., 1995; Strachan, 1999). Although it may be difficult to diagnose asthma in young children, it is viewed as a critical window. Recognizing and beginning treatment for asthma before age five may reduce later lung function decline (Busse & Lemanske, 2001; Martinez et al. 1995). As lung function tests are often difficult to perform on such young children, a reliance on medical history and the presence of symptoms are used most frequently as diagnostic tools for early childhood asthma (NHLBI, 2012). Regardless of age, once a patient has been diagnosed with asthma, the focus switches to classifying the severity of the disease, to better inform treatment decisions.

Severity of Asthma. Classifying the severity of asthma (the intrinsic intensity of the disease) is an important step to determining an effective treatment strategy (NHLBI, 2007). The complex pathophysiology of asthma includes an interaction between airflow obstruction, bronchial hyperresponsiveness, inflammation, as well as the associated

cytokine mediators (e.g., IL-4, IL-5, IL-13), and the degree of this interaction dictates the eventual severity of the disease (Busse & Lemanske, 2001; NHLBI, 2007). The diagnostic procedures and tests, described above, assist clinicians with the classification of asthma severity. Phenotypic patterns of asthma severity include: intermittent or persistent, with sub-classifications of mild, moderate, and severe (NHLBI, 2007). Table 1 below identifies the characteristics of each severity phenotype, dependent on the patient's age; severity is assigned to the most severe category in which any impairment occurs (NHLBI, 2007). The table highlights impairment areas of distinction between age groups.

Table 1: Classification Guidelines for Asthma Severity Based on Impairment (Table created using data from: NHLBI, 2007)

IMPAIRMENT	AGE (YEARS)	CLASSIFICATION OF ASTHMA SEVERITY			
		INTERMITTENT	PERSISTENT		
			MILD	MODERATE	SEVERE
SYMPTOMS	0 – 4	≤2 days/week	>2 days/week, not daily	Daily	Throughout the day
	5 – 11				
	≥12				
NIGHTTIME AWAKENINGS	0 – 4	0	1 – 2x/month	3 – 4x/month	>1x/week
	5 – 11	≤2x/month	3 – 4x/month	>1x week, not nightly	Often 7x/week
	≥12				
USE OF SHORT-ACTING MEDICATION	0 – 4	≤2 days/week	>2 days/week, not daily	Daily	Throughout the day
	5 – 11				
	≥12				
INTERFERENCE WITH NORMAL ACTIVITY	0 – 4	None	Minor limitation	Some limitation	Extremely limited
	5 – 11				
	≥12				
LUNG FUNCTION	0 – 4	N/A	N/A	N/A	N/A
	5 – 11	▪ Normal FEV_1 between attacks ▪ FEV_1 >80% predicted ▪ FEV_1/FVC >85%	▪ FEV_1 >80% predicted ▪ FEV_1/FVC >80%	▪ FEV_1 = 60 – 80% predicted ▪ FEV_1/FVC = 75 – 80%	▪ FEV_1 <60% predicted ▪ FEV_1/FVC <75%
	≥12	▪ Normal FEV_1 between attacks ▪ FEV_1 >80% predicted ▪ FEV_1/FVC normal	▪ FEV_1 >80% predicted ▪ FEV_1/FVC normal	▪ FEV_1 >60 – <80% predicted ▪ FEV_1/FVC reduced 5%	▪ FEV_1 <60 predicted ▪ FEV_1/FVC reduced >5%

Asthma Management. Asthma cannot be cured and may not be fully prevented, but it can be managed and controlled (CDC, 2012; EPA, 2006; Nathan et al., 2004; NHLBI, 2012). Well-controlled asthma eliminates the symptoms and the burden of the disease (e.g., missed school or work, the inability to partake in physical activities, frequent trips to emergency departments), as well as helps patients maintain good lung function and reduces the need for quick-acting medications (CDC, 2013; Nathan et al., 2004; NHLBI, 2012). Controlling asthma involves: working with medical professionals to treat any conditions that may adversely affect asthma management, avoiding asthma triggers, as well as developing and following an Asthma Action Plan (NHLBI, 2007; NHLBI, 2012).

An Asthma Action Plan, developed under the supervision of a medical professional, provides guidance and instruction on: taking medications properly (i.e., quantity and frequency), avoiding personal asthma triggers, tracking the level of asthma control, how to respond to worsening symptoms, and when one should seek additional or emergency care (NHLBI, 2012). For children with asthma, all caregivers or adults involved in the child's activities should be aware of the Asthma Action Plan (NHLBI, 2012) Further, as the level of asthma control can vary over time and with changes in environments, the Asthma Action Plan should be regularly reviewed by a medical professional (NHLBI, 2012). An example Asthma Action Plan can be seen in APPENDIX B.

Keeping asthma under control also involves tracking symptoms, checking peak flow numbers (with a hand-held meter, to determine expiratory function), and regularly getting asthma check-ups (NHLBI, 2012). Asthma is considered to be well-controlled when: symptoms are no more frequent than twice a week and do not impede sleep more than one or two nights a month; quick-relief medications are needed no more than twice a

week; no more than one asthma attack per year requires oral corticosteroids; and peak flow does not drop below 80% of personal best (NHLBI, 2012). Regular asthma check-ups allow medical professionals to assess the level of asthma control across a number of dimensions (e.g., measures of lung function, presence of symptoms, effects on quality of life) (NHLBI, 2012). However, when time-constraints or other factors limit a physician's ability to assess asthma control effectively on all measures, a quantitative Asthma Control Test may be reliably used to determine asthma control (Nathan et al., 2004).

The questionnaire items on the Asthma Control Test assess asthma control in critical areas (e.g., asthma symptoms, use of quick-relief medications, impact of asthma on regular activities), based on the NHLBI National Asthma Education and Prevention Program's asthma management guidelines (Nathan et al., 2004; NHLBI, 2007; Schatz et al., 2006). The five-item questionnaire (as seen in APPENDIX C) has been proven to be a rapid, valid, and reliable tool for use in a variety of settings; using an Asthma Control Test may actually provide a more reliable assessment of asthma control, as without the questionnaire, both patients and physicians tend overestimate (Nathan et al., 2004; Schatz et al., 2006). Proper assessments of the level of asthma control can inform and adjust treatment options as necessary to effectively manage asthma.

Asthma Treatment. Effective treatment of asthma, particularly in the early stages, may reduce the impact of airway remodeling and subsequent lung function decline (Warner et al., 2000). In general, asthma is treated with two types of medication groups: long-term control and quick-relief; treatment options are decided based on the severity of the asthma (NHLBI, 2007; NHLBI, 2012). Some medications are available orally, in a pill form, but most are distributed directly into the airways with an inhaler, sometimes

with an added spacer for proper delivery (Holgate, 2011; NHLBI, 2007; NHLBI, 2012). Alternatively, some medications are administered through the use of a nebulizer; a nebulizer ensures that a fine mist of medication enters the airways (NHLBI, 2012). In severe cases, an injection of anti-IgE medication may be provided bi-weekly or once per month (NHLBI, 2012). The development of antibodies against IgE has been shown to be an effective asthma treatment (NHLBI, 2007). The options for asthma treatment continue to grow as there is more and more understanding of the immunologically-mediated actions of asthma (Busse & Lemanske, 2001); however, presently, the two traditional pharmacotherapies remain the most common and the combination of a long-term control medication and a quick-relief medication effectively treats most mild-to-moderate asthmatics (Holgate, 2011).

Long-Term Control Medication. The primary purpose of long-term control medications is to reduce inflammation and eliminate symptoms; most long-term control medications are taken daily (NHLBI, 2007: NHLBI, 2012). Inhaled corticosteroids (synthetic versions of hormones synthesized in the adrenal cortex) are the preferred long-term control medication for asthma; corticosteroids act to inhibit inflammatory mediators and up-regulate anti-inflammatory mediators (Corrigan & Kay, 1990; NHLBI, 2007; van der Velden, 1998). Reducing inflammation, in turn, can reduce symptoms of airway hyperresponsiveness and can improve overall asthma control (NHLBI, 2007). When taken daily, corticosteroids dramatically reduce inflammation; however, inflammation and the associated asthma symptoms generally recur whenever treatment is ceased (Cohn et al., 2004; van der Velden, 1998). Additionally, although corticosteroid medications are effective at controlling inflammation, there is limited evidence that they can reverse

airway remodeling; thus, supporting the fact that asthma can be controlled but, as yet, not cured (Cohn et al., 2004). Further, as with all medications, long-term control asthma medications can have side effects (e.g., increased risk for thrush, cataracts, or osteoporosis); however, the benefits to asthmatics are considered to greatly outweigh the risks (NHLBI, 2007; NHLBI, 2012).

Quick-Relief Medication. In addition to long-term control medications, asthmatics are also often prescribed quick-relief (or "rescue") medications. These quick-relief medications are intended to be used, via an inhaler, only during an exacerbation of asthma symptoms (NHLBI, 2012). Quick-relief medications should not be used as a substitute for long-term control medications, as they have no effect on inflammation (NHLBI, 2012). Instead, quick-relief medications (also referred to as bronchodialators) act to rapidly relax the bronchoconstriction associated with an asthma attack, which subsequently opens the airways (Busse & Lemanske, 2001; NHLBI, 2007; NHLBI, 2012). All asthmatics should have quick-relief medications readily available to them at all times, in case of emergency; it is particularly important for school staff to have access to these medications in the case of an asthmatic child (NHLBI, 2012).

Burden of Asthma

Morbidity. Asthma is a major cause of disability in the United States, particularly for children (Akinbami, 2006; Akinbami et al., 2009). The morbidity caused by asthma is largely associated with airway remodeling and inflammation, which ultimately result in lung function decline (Homer & Elias, 2000). Lung function decline is generally determined using FVC and FEV_1 measurements (Priftis et al., 2009). Lung function decline is greater in asthmatic children than in non-asthmatic children and the lung

function decline occurs more rapidly in asthmatic adults than in non-asthmatics; these observations contribute to the understanding of asthma as both a chronic and progressive disease (Busse & Lemanske, 2001; Homer & Elias, 2000; Lange, Parner, Vestbo, Schnohr, & Jensen, 1998; Martinez et al. 1995). Nonetheless, even minor asthma symptoms that do not contribute drastically to airway remodeling can negatively impact an individual's overall quality of life (Akinbami, 2006; Akinbami et al., 2009). Asthma is a leading cause of activity limitation, as nearly 60% of asthmatics are forced to limit regular, daily activities due to asthma (ALA, 2012; CDC, 2012).

Mortality. In the United States during the1980s through 1990s, mortality attributed to asthma spiked; however, in recent years asthma mortality rates have declined (Akinbami, 2006; Holgate, 2011). Down from the peak of 4 deaths per million children with asthma, the mortality rate for childhood asthma was 2.5 deaths per one million asthmatic children in 2004; there were 186 childhood asthma-related deaths in 2004 (Akinbami, 2006). In 2005, there were 167 asthma-related childhood deaths, representing a mortality rate of 2.3 deaths per one million asthmatic children (Akinbami et al., 2009). However, when one considers the contribution of adult asthma fatalities as well, although still declining, mortality rates are substantially higher. For the period from 2007 – 2009, the total asthma mortality rate in the United States was approximately 150 deaths per one million asthmatics (Akinbami et al., 2012). In both 2007 and 2009, nearly 3,500 deaths were attributed to asthma, representing approximately nine asthma-related deaths per day in the United States (CDC, 2011; CDC, 2012).

In general, the risk of asthma death is higher for females than males and higher for adults than children (Akinbami et al., 2012; ALA, 2012). From 2007 – 2009, adults were

seven times more likely to die of asthma than were children, with asthmatic adults over age 65 demonstrating the highest mortality rate (580 deaths per million asthmatics) (Akinbami et al., 2012). Although the risk of asthma death is higher for adults, certain characteristics may increase a child's risk. The risk of asthma death remains the highest for children with: uncontrolled disease, a previous life-threatening attack, or frequent hospitalization and intubation (Akinbami, 2006). Further, non-Hispanic black children with asthma are at greatest risk (Task Force, 2012). The death rate for non-Hispanic black children remained nearly five times that of non-Hispanic white children in 2004 (a mortality rate of approximately ten deaths per one million children); a trend that has not decreased with the overall mortality rate decline, nor simply with time (Akinbami, 2006; Akinbami et al., 2012). Although the mortality rate of asthma is not exorbitantly high, understanding the associated risks are pertinent, as all asthma deaths are seen as preventable (IOM, 2000).

Health Care Burden. Research has demonstrated an increasing prevalence of asthma worldwide; this burden has manifested largely in an increased use of medical care services (IOM, 2000; Strachan, 1999). In the United States, ambulatory care for asthma was on the rise until 2004; since then, the rate of health care encounters per person with asthma has remained relatively stable (Akinbami, 2006; Akinbami et al., 2012). At a peak in 2004, at least 6.5 million non-urgent visits were conducted in physician's offices and hospital outpatient facilities for asthma (Akinbami, 2006). Trends in the prevalence of ambulatory care visits have remained relatively stable from 2000 – 2009; they have risen in proportion with the prevalence of asthma (Akinbami et al., 2012). In 2009, there

were nearly 9 million ambulatory care visits for asthma, with a slight increase to 10.6 million visits in 2010 (ALA, 2012; CDC, 2012)

While non-urgent asthma visits were previously on the rise, trends in the use of emergency departments for asthma management have remained relatively stable at approximately 100 visits per 1,000 children, from 1992 – 2010 (Akinbami, 2006; Akinbami et al., 2012). Nonetheless, in 2009 alone, there were 1.9 million asthma-related emergency department visits; nearly 1 in 5 children with asthma went to the emergency department in 2009 (CDC, 2012). Children with asthma continue to be more likely to be seen in emergency departments than adults, with minority children having the highest emergency department visit rate of all groups (Akinbami et al., 2012; CDC, 2012).

Minority children, particularly non-Hispanic black children, are also admitted to hospitals for their asthma with increased frequency (Akinbami et al., 2012; CDC, 2012). In 2004, there were 198,000 hospitalizations for childhood asthma in the United States (a rate of 27 hospitalizations per 10,000 children) (Akinbami, 2006). Although increased prevalence contributed to a relatively stable rate of hospitalizations, in 2009, the number of hospital admissions for both child and adult asthma reached nearly 480,000 (Akinbami et al., 2012; CDC, 2012; EPA, 2006). Around the world, hundreds of thousands of people are admitted to hospitals for asthma annually (Warner et al., 2000). Hospital admittance is indicative of severe asthma exacerbation, but is often seen as an avoidable burden should asthma be effectively controlled (Akinbami, 2006; Warner et al., 2000).

Economic Burden. In addition to the health consequences, there are direct and indirect economic burdens imposed by asthma as well. The increased prevalence of

asthma and subsequent increase in the use of health care services carry extreme financial consequences. It is estimated that medical expenses for asthma cost the United States approximately $3,300 annually per asthmatic individual for the years from 2002 – 2007 (CDC, 2011). In 2007 alone, it was estimated that direct medical costs associated with asthma totaled $50.1 billion (CDC, 2011). This financial burden is often shared by the entire health care system, as both insured and uninsured patients often have difficulty affording asthma medications (11% and 40%, respectively) (CDC, 2011). More than 25% of non-Hispanic black adults cannot afford their medications or regular physician's visits; also, an additional 20% of Hispanic adults cannot afford their asthma medications and approximately 14% also cannot afford routine physician's visits (CDC, 2012). Cost is often prohibitive for many adults in need of primary care to effectively manage their asthma, which contributes to a costly cycle; poorly controlled asthma may lead to more severe exacerbations and the subsequent increased need for expensive emergency care (CDC, 2012).

In addition to the direct costs of health care, the symptoms of asthma also indirectly burden the economy by limiting earning potential and productivity (Wu & Takaro, 2007). Asthma symptoms that keep children awake at night contribute to an inability to learn effectively (Akinbami, 2006; Akinbami et al., 2009; Moonie, Sterling, Figgs, & Castro, 2006; Task Force, 2012). Further, severe symptoms and sleep deprivation often result in children missing school days entirely (Akinbami, 2006; Akinbami et al., 2009). Asthmatic children are more apt to miss school than non-asthmatic students, with persistent asthma sufferers being at greater risk for missing more school days (Moonie et al, 2006; Moonie et al., 2008; Moonie et al., 2010). Further, more children miss school

due to asthma than any other chronic disease, with up to 35% of absences due to asthma (Moonie et al., 2006). In 2003 alone, more than 12.8 million missed school days were attributed to asthma symptoms (Akinbami, 2006; Moonie et al., 2010). Between 50 – 60% of asthmatic children miss at least one day of school per year due to asthma (CDC, 2012; Moonie et al., 2006). On average in 2008, asthmatic children missed four days of school, for as many as 14.4 million total missed school days (ALA, 2012; CDC, 2011; CDC, 2012). Some studies have associated this increased absenteeism with higher risk of grade retention, as well as with poor academic performance in both the classroom and on standardized tests, with even brief but frequent absences being seen as disruptive to performance (Moonie et al., 2006; Moonie et al., 2008; Moonie et al., 2010). The burden of asthma on school children often extends to their families as well.

Caregivers of asthmatic children, in addition to adult asthmatics, also often miss work due to asthma (Akinbami, 2006; Akinbami et al., 2009). Nearly one-third of adults miss work annually due to asthma (CDC, 2012). On average in 2008, adults missed five days of work due to asthma, for a total of 14.2 million missed work days (ALA, 2012; CDC, 2011; CDC, 2012). Although quantifying the total economic burden of asthma is difficult, when one considers direct medical costs, as well as lost school and work days, the burden of asthma costs the United States approximately $56 billion annually (CDC, 2011; CDC, 2012).

Status of Childhood Asthma

Childhood asthma is a global public health concern. Worldwide, the prevalence of childhood asthma is increasing in many locations and it remains the most frequent childhood chronic disease in developed countries, including the United States (Akinbami

et al., 2009; Hansen, Evjenth, & Holt, 2013; IOM, 2000; Rauh, Landrigan, & Claudio, 2008). The International Study of Asthma and Allergies in Childhood (ISAAC) program was established in 1991 to gain understanding about the prevalence and severity of asthma, and other allergic conditions, throughout the world (Asher et al., 2006). The ISAAC program collected data from over one hundred centers across the globe during the years from 1992 – 1998 (Phase One) and again for Phase Three in the years from 1999 – 2004, with a mean time between data collection of seven years (Asher et al., 2006). In terms of asthma symptoms specifically, the ISAAC data demonstrated that asthma continues to be a global concern. Increases in asthma prevalence were observed and were more frequent for children in the 6-7 year age group than for the 13-14 year age group, although 42 participating centers did see asthma prevalence increases in this older age group as well (Asher et al., 2006). Figure 6 below highlights the changes observed across Phase One and Phase Three in the ISAAC data for the 6-7 year age group.

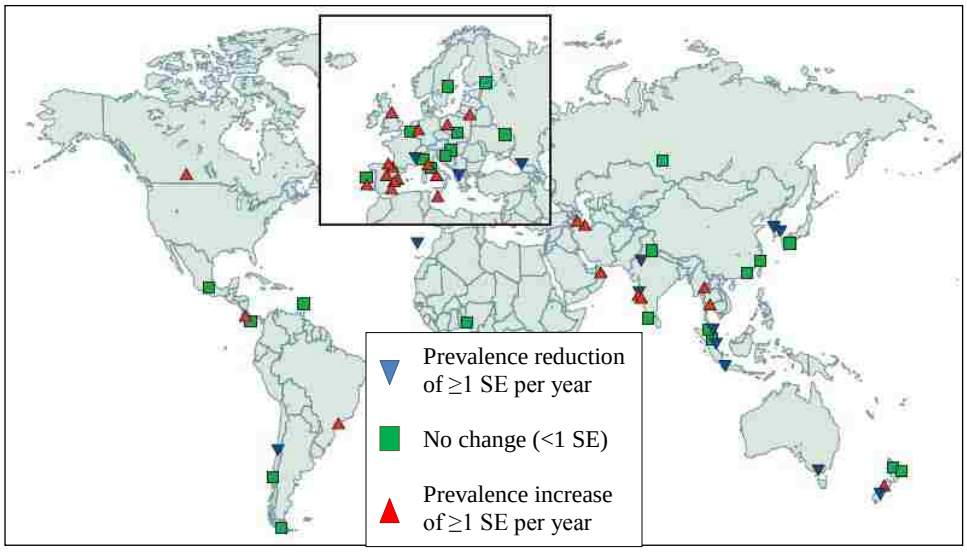


Figure 6: Direction of Change for Asthma Symptom Prevalence in 6-7 Years Olds; Worldwide Centers for the ISAAC
(Figure source: Asher et al., 2006)

In the United States alone, childhood asthma affects nearly 1 in 11 children (CDC, 2012; Task Force, 2012). In 2011, 8.7 million children between the ages of 5 – 17 years old had been diagnosed with asthma at some point in their life; children in this age group consistently have the highest rates of asthma prevalence (ALA, 2012). From 2008 – 2010, American children were 23% more likely to have asthma than adults over age 18 and children were also more likely to use health care services for their asthma (Akinbami et al., 2012). Although the prevalence of childhood asthma has recently plateaued, it has done so at a historic high (Akinbami, 2006; Warner, et al., 2000). Early release data from the 2012 National Health Interview Survey provide insight into the current state of asthma in American children (NCHS, 2013). The prevalence of asthma in children under age 15 for 2012, organized into selected categories, can be seen below in Figure 7.

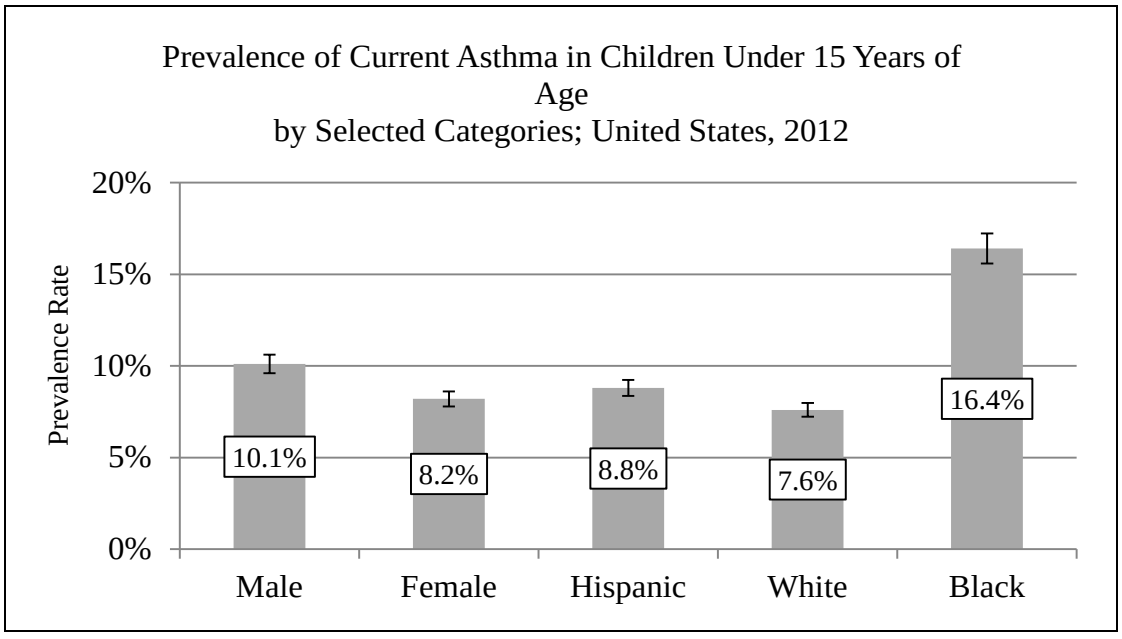


Figure 7: Prevalence of Current Asthma in Children Under 15 Years of Age by Selected Categories; United States, 2012
(Figure created using data from: NCHS, 2013)

These data highlight a number of disparities seen in the distribution of childhood asthma (Task Force, 2012). In the United States, young boys frequently suffer from asthma more frequently than young girls; however, this pattern shifts near the age of puberty and continues into adulthood, which calls into question the uncertain contribution of sex hormones to the persistence of asthma (Akinbami et al., 2009; ALA, 2012; IOM, 2000; NCHS, 2013; NHLBI, 2007; NHLBI, 2012). Boys also tend to have higher asthma-related death rates than do their female counterparts (Akinbami, 2006).

Racial/ethnic disparities in asthma prevalence have also been observed across time (EPA, 2006; IOM, 2000). This is evident in 2012 data, where non-Hispanic black youth were more than twice as likely as non-Hispanic white children to suffer from asthma; further, prevalence in non-Hispanic black children increased from 2001 – 2009 by nearly 50% (CDC, 2011; NCHS, 2013). Across time, non-Hispanic black children have also been more likely to visit emergency rooms or be admitted to the hospital for their asthma, and, in 2012 alone, were also 500% more likely to die of the disease (Akinbami, 2006; Akinbami et al., 2012; NCHS, 2013; Task Force, 2012). In 2012, available asthma data categorized race and ethnicity as simply non-Hispanic white, non-Hispanic black, or Hispanic; however, data from 2005 provide additional insight into other racial/ethnic groups. In 2005, American Indian or Alaskan Native youth were 25% more likely than non-Hispanic white children to suffer from asthma, while Asian children had the lowest prevalence rates of all groups; these trends were also observed in 2008 – 2010 data (Akinbami, 2006; Akinbami et al., 2012).

Further, in 2012, young Hispanic children were at increased risk for asthma as compared to non-Hispanic white children, with a reported asthma prevalence of 8.8%

(NCHS, 2013). However, when Hispanic children are viewed as a heterogeneous group, additional disparities become apparent. Puerto Rican children have significantly higher asthma prevalence rates than Cuban, Dominican, or Mexican children; the differences remain even after adjusting for other risk factors (Akinbami, 2006; Akinbami et al., 2012; ALA, 2012; IOM, 2000; Lara et al., 2006).

The literature also identifies a number of additional differences among asthma prevalence in American children. For example, there are geographic discrepancies in asthma prevalence. In particular, children living in high population-density urban areas tend to be at greater risk of developing asthma; it is hypothesized that children living in rural areas may be exposed to unique protective factors (e.g., regular close animal contact, repeated early exposure to outdoor allergens, increased microbial exposures) that may defend against asthma development (Goodwin & Cowles, 2008; IOM, 2000; Priftis, Mantzouranis, & Anthracopoulos, 2009; Rauh et al., 2008). Another proposed explanation for the geographic differences in asthma prevalence associates asthma with increased regional tobacco smoking rates (Goodwin & Cowles, 2008).

Additionally, American children of lower socioeconomic status (SES), particularly low-SES minority children, are also more likely to develop and be living with the symptoms of asthma; this is especially true in low-SES children living in public housing (IOM, 2000; Northridge, Ramirez, Stingone, & Claudio, 2010; Priftis et al., 2009; Rauh et al., 2008; Task Force, 2012). From 2008 – 2010, asthma prevalence for those whose household incomes fell below the poverty line was 11.2%; those with incomes between 100% - 200% of the poverty level had asthma prevalence rates of 8.7%; and those whose incomes exceed the poverty level by more than 200% had asthma prevalence rates of

7.3% (Akinbami et al., 2012). This inverse relationship continued into 2012, where asthma prevalence rates were 12.2%, 9.9%, and 8.2%, for those <100% of poverty, between 100 – 200% of poverty, and >200% of poverty, respectively (Task Force, 2012).

Further, asthma prevalence has also been associated with overweight or obesity in children (Ahmad, Biswas, Bae, Meador, Huang, & Singh, 2009; Kusunoki et al., 2008; Task Force, 2012; Visness et al., 2010). However, it remains unclear whether shared genetics or an unhealthy lifestyle contribute to both asthma and obesity concurrently, or whether obesity-related inflammation may lead to the development of asthma in children (Ahmad et al., 2009; Visness et al., 2010).

In terms of recent asthma episodes (within the 12 months prior to being surveyed), disparities also exist. In 2005, 5.2% of children (3.8 million children) experienced an asthma attack in the year prior to data collection (Akinbami, 2006). Data from 2012 indicated that the attack rate had grown to 5.4% for children under age 15 and that children in this age group were at higher risk for an asthma attack than older persons (4.1% attack rate for persons 15-34 and 4.1% attack rate for persons 35 and older) (Akinbami, 2006; NCHS, 2013). As with prevalence rates, 2012 asthma attack rates in children under age 15 are also more frequent in boys (6.4%) than in girls (4.3%) and more frequent in non-Hispanic black children (10.1%, gender-adjusted prevalence rate) than in other racial/ethnic groups (NCHS, 2013).

Pathogenesis

A single cause of asthma has not been found, yet a number of factors have been associated with the development of the disease (Akinbami, 2006). The development of asthma is thought to be a complex interaction of both genetic and environmental factors,

with the assumption that this interplay results in the characteristic inflammation and structural airway changes observed in asthmatics (Basic Asthma Research Strategy II [BARS II], 2006; Breysse et al., 2004; Busse & Lemanske, 2001; IOM, 2000; NHLBI, 2007; NHLBI, 2012; Priftis et al., 2009). However, neither the relative contribution of genetics (estimated to be anywhere between 30 – 80% of asthma risk) and the environment (estimated in one study to account for up to 35% of the disease), nor the direct pathway to asthma development is entirely clear (BARS II, 2006; Cohn et al., 2004; IOM, 2000; Landrigan, Schechter, Lipton, Fahs, & Schwartz, 2002; NHLBI, 2007; Priftis et al., 2009). For any individual, the exact cause and time for the pathogenesis of asthma cannot be ascertained, but is likely initiated in early in life and begins as a combination of the factors discussed below (IOM, 2000; NHLBI, 2007).

Genetic Factors. A number of studies have demonstrated that the development of asthma has a strong genetic component (e.g., a child has three times the odds of developing asthma if one biologic parent is asthmatic, which increases to six times the odds of developing asthma if both parents are asthmatic), with maternal asthma seeming to be a greater risk factor than paternal asthma (Bracken et al., 2002). Asthma does not appear to follow monogenic patterns of inheritance; rather, many genes have been found that are associated with asthma in a variety of ways (Bracken et al., 2002). One of the strongest predisposing factors for the development of asthma in an individual is the presence of atopy (Bracken et al., 2002; Busse & Lemanske, 2001; Hansen et al., 2013; NHLBI, 2007). Atopy is the genetic predisposition for the development of an immediate hypersensitivity reaction in response to environmental allergens; the hypersensitivity reaction is mediated by IgE (IOM, 2000; NHLBI, 2007). When both parents exhibit

atopy, their children have a 60% increased risk of atopy themselves (Bracken et al., 2002). Atopy may be predictive of asthma development, but may also manifest as other allergic sensitization (e.g., food allergies, allergic rhinitis, or atopic dermatitis) (NHLBI, 2007). In contrast, while atopy may be predictive of asthma development in some cases, it is not a requirement of the pathogenesis of the disease (Corrigan & Kay, 1990).

Additional genetic contributors to asthma development have also been proposed. Some researchers hypothesize that the immune system of newborns inherently leans towards an overabundance of Th2 cells (Busse & Lemanske, 2001; Mattes & Karmaus, 1999). The overabundance of Th2 cells may be the result of an overexpression of Th2 or an under-expression of Th1, or some combination of the two (NHLBI, 2007). In either case, this imbalance towards Th2 cells is a marker for inflammation. A family history of atopic disease seems to further skew this Th2 phenotype; essentially, having parents with asthma is a risk factor for a child's ultimate development of the disease (Mattes & Karmaus, 1999; NHLBI, 2012; Rao & Phipatanakul, 2011).

The genetic contribution to asthma development is further complicated when one considers the "hygiene hypothesis". The "hygiene hypothesis" proposes that a Western lifestyle, focused heavily on sanitation, has resulted in a decline in environmental exposures and infections in young children (Akinbami et al., 2009; BARS II, 2006; Goodwin & Cowles, 2008; Hesselmar, Åberg, Eriksson, Björkstén, & Åberg, 2005; NHLBI, 2007; NHLBI, 2012; Rauh et al., 2008). Exposures to certain infections, exposures to other children at an early age (either siblings or in daycare environments), and infrequent use of antibiotics seem to be protective against the development of asthma (NHLBI, 2007). Without stimuli such as these, it is believed that an infant's immune

system is unable to adapt and develop a balanced response that could overcome the inherent tendency towards Th2 cell overproduction (Busse & Lemanske, 2001).

Environmental Factors. In addition to genetics, environmental factors also contribute to the development of asthma and actually represent the easiest targets for asthma intervention strategies (BARS II, 2006; Busse & Lemanske, 2001; Mattes & Karmaus, 1999). When exposed to an environmental factor at a critical time (as yet undefined), a genetically-predisposed individual may develop asthma or other allergic disease (Rao & Phipatanakul, 2011). There is insufficient evidence at this time to link outdoor air pollution (e.g., ozone), indoor particulate matter (particularly $PM_{2.5}$), diet, and other environmental factors to asthma development, but the associations are being explored (NHLBI, 2007; McCormack et al., 2009; Miles, 2005; Priftis et al., 2009). In contrast, there is some evidence that links viral respiratory infections, environmental tobacco smoke (in some instances), and allergens to the development of asthma (NHLBI, 2007). It is suspected that exposure to respiratory infections and other environmental factors may interact in a complex fashion to contribute to the ultimate development of asthma, although this relationship is also not entirely understood (NHLBI, 2007).

Viral Respiratory Infections. Viral respiratory infections, particularly infections with respiratory syncytial virus (RSV), have been found to contribute to the development of asthma (NHLBI 2007; NHLBI, 2012). In fact, young children with frequent respiratory infections are at higher risk for developing asthma (Mattes & Karmaus, 1999; NHLBI, 2007; NHLBI, 2012). Rhinovirus infections and parainfluenza virus infections early in life have also been linked to asthma development (Holgate, 2011; IOM, 2000; NHLBI, 2007). Conversely, according to the "hygiene hypothesis" exposure to viral infections,

such as the measles, hepatitis A, and even RSV, may actually be protective against the development of asthma (IOM, 2000; NHLBI, 2007). Therefore, it is speculated that exposure to respiratory viruses and a genetic predisposition towards atopy may combine to contribute to asthma development; as such, the causal link has yet to be clearly defined (IOM, 2000; NHLBI, 2007).

Environmental Tobacco Smoke (ETS). Environmental tobacco smoke (ETS), also known as secondhand smoke or passive smoking, is a combination of chemical gases and particulates that are formed at the burning end of a cigar, cigarette, or pipe, as well as from the exhalation of a person smoking tobacco (EPA, n.d.; EPA, 2008; EPA, 2013; IOM, 2000). ETS contains thousands of chemicals that are known to be irritants, toxicants, mutagens and carcinogens (IOM, 2000). There is also sufficient evidence to conclude that there is a causal link between ETS exposure and the development of asthma, specifically in pre-school age children (EPA, 2013; IOM, 2000; Rauh et al., 2008). There appears to be a dose-response relationship between exposure to ETS and asthma prevalence in young children (IOM, 2000). Evidence is suggestive that ETS may also be linked to asthma development in older children (Goodwin & Cowles, 2008; Vork et al., 2007).

Allergens. Research has identified two common indoor biologic allergens associated with the development of asthma; evidence suggests that indoor allergens are a stronger risk factor for the development of asthma than outdoor allergens (Rao & Phipatanakul, 2011; Wu, Jacobs, Mitchell, Miller, & Karol, 2007; Wu & Takaro, 2007). In particular, there is sufficient evidence to link allergens of microscopic house dust mites (HDM) to asthma development, while there is suggestive evidence to causally link cockroach

allergen to the development of asthma, but only in pre-school aged children (EPA, 2013; Gergen et al., 1999; IOM, 2000; Krieger et al., 2010; NHLBI, 2007). The body parts and droppings of HDMs contain allergens that stimulate a dose-response sensitization; this sensitization is associated with an increased risk of asthma development (EPA, n.d.; EPA, 2013; Hagendorens et al., 2004; Rao & Phipatanakul, 2011). A similar dose-response relationship occurs in regards to cockroach allergen sensitization (IOM, 2000). As such, exposure to cockroach allergen, via their body parts or droppings, may also increase the risk of asthma development (EPA, n.d.; EPA, 2013; IOM, 2000).

Still other allergens (e.g. mold spores and animal dander) are also suspected to contribute to the development of asthma, but evidence is not sufficient to causally link them to pathogenesis of the disease (IOM, 2000). Further, as with viral respiratory infections, some research identifies that exposure to dog and cat allergens early in life may actually be protective against asthma development (NHLBI, 2007). Hereto, it is likely that the gene-environment interaction is what dictates the ultimate pathogenesis of asthma (NHLBI, 2007). Figure 8 on the following page is a schematic representation of the possible contributors to asthma pathogenesis from the 2000 Institute of Medicine Report *Clearing the Air: Asthma and Indoor Air Exposures*; bold lines are used to illustrate where there is sufficient evidence for a relationship, regular lines where the relationships are at least strongly suggested, and dashed lines where relationships are likely to exist, but sufficient evidence is lacking (IOM, 2000).

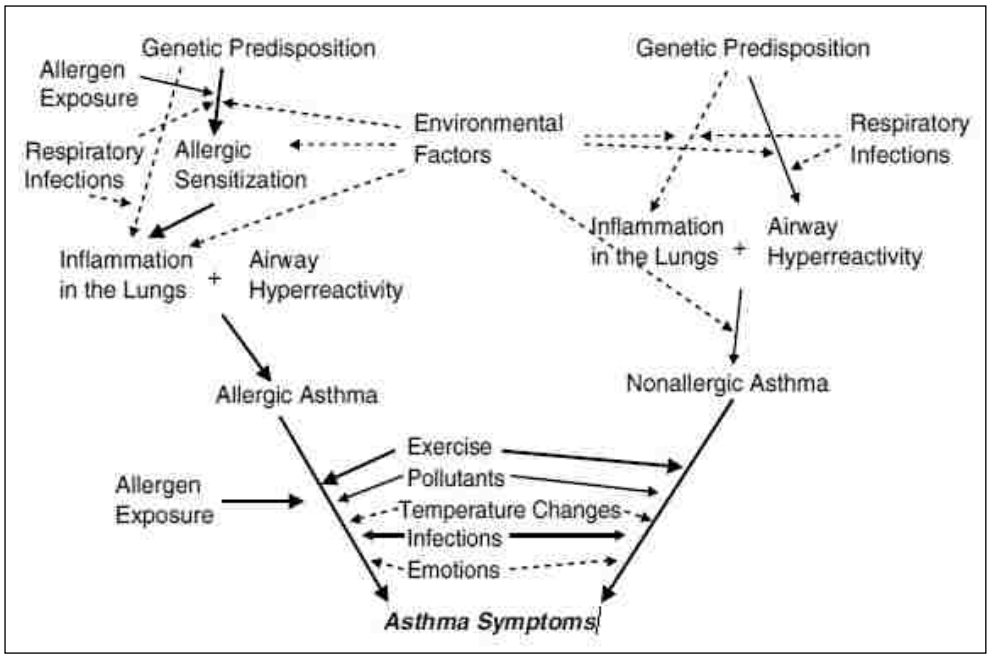


Figure 8: Interrelationship of Factors Associated with Asthma Pathogenesis (Figure source: IOM, 2000)

Factors Contributing to the Exacerbation of Asthma

As with asthma development, a number of factors (biological, chemical, or otherwise) have been found to contribute to the exacerbation of asthma in sensitive individuals (Breysse et al., 2004; Rauh et al., 2008; Wu et al., 2007). Factors that may result in the clinical manifestation of asthma symptoms in susceptible individuals are commonly referred to as asthma triggers (NHLBI, 2012; Takaro, Krieger, & Song, 2004). While not all triggers will affect all asthmatics, a variety of recognized, potential asthma triggers are discussed below.

Allergens. It is speculated that modern indoor environments (with their higher indoor temperatures, increased humidity and excess moisture, and increased amount of furnishings), allow for increased exposure to indoor allergens that have been shown to contribute to the exacerbation of asthma symptoms (CDC, 2012; Krieger et al., 2010; Rao

& Phipatanakul, 2011). Exposure to multiple allergens in the home environment is commonplace in the United States and, frequently, the homes of asthmatics contain greater allergen concentrations than homes without asthmatics (National Institute of Environmental Health Sciences [NIEHS], 2013). Further, at least 50% of asthmatics are sensitized to three or more allergens, making asthma exacerbations all the more likely (Breysse et al., 2004).

House Dust Mite (HDM) Allergens. HDMs are the major contributors of allergens in house dust, with quantities in homes ranging from <0.2 - ≥100 ng/m^3 (Hagendorens et al., 2004; IOM, 2000). Most homes harbor dust mites and at least 85% of homes surveyed for the National Survey of Lead and Allergens in Housing (NSLAH) contained detectable levels of HDM allergen (EPA, n.d.; NIEHS, 2013). Both the allergen Der p1 from the European house dust mite (*Dermatophagoides pteronyssimus*) and the allergen Der f1 from the American house dust mite (*D. farinae)* have been associated with both the development of asthma and the exacerbation of asthma symptoms (Hesselmar et al., 2005; IOM, 2000; Krieger et al., 2010). Exposure to HDM allergens has also been associated with increased use of asthma medications and unscheduled health care visits, due to the promotion of asthma symptoms (Rao & Phipatanakul, 2011). HDM allergen exposures as low as 2 µg/g (micrograms of allergen per gram of dust) have been shown to cause sensitization, while exposures of 10 µg/g usually result in the exacerbation of asthma symptoms (Gergen et al., 1999; Krieger et al., 2010).

Pest Allergens. A number of insects have been associated with allergic responses; however, cockroaches are repeatedly recognized as a substantial contributor to indoor allergens (IOM, 2000). Although there are many species of cockroach, the most common

indoor species in North America are the American (*Periplaneta americana*), German (*Blattella germanica*), and Oriental (*Blatta orientalis*) cockroaches (IOM, 2000). Droppings and body parts of cockroaches contain the allergens: Bla g1, Bla g2, Bla g4, Bla g5 or Per a1; all of which have also been associated with asthma exacerbation (EPA, 2013; IOM, 2000; Rao & Phipatanakul, 2011). Like with HDM allergen, cockroach allergen sensitization occurs with exposures as low as 2 µg/g, but asthma symptoms may result from exposures as low as 8 µg/g (Gergen et al., 1999). One study found that, even in homes without evidence of current cockroach infestation, 20% of homes have detectable levels of cockroach allergen (IOM, 2000).

Rats, mice, and other rodents also represent potential pests that contribute to indoor allergen levels (EPA, n.d.). Rodent allergens have been found to trigger asthma symptoms; some studies have found that higher exposures to mice allergens are associated with higher rates of missed school days due to asthma (Breysse et al., 2004; Rao & Phipatanakul, 2011). Other important allergens that have been identified and associated with asthma exacerbation include: Mus m1 and Mus m2 from mice and Rat n1 from rats (IOM, 2000).

Domestic Animal Allergens. Some individuals are exposed to rodent allergens (e.g., Cav p1 and Cav p2 from guinea pigs) because they keep them as pets (IOM, 2000). In fact, all warm-blooded domestic animals (e.g., dogs, cats, guinea pigs, hamsters, birds) contain potential allergens in their hair, skin flakes, feces, urine, and other secretions (Breysse et al., 2004; EPA, 2013; IOM, 2000). Specifically, the primary dog allergen (Can f1) and the primary cat allergen (Fel d1) have been sufficiently linked to asthma exacerbation (Hesselmar et al., 2005; IOM, 2000). Cats are pets in more than one-quarter

of American households, while dogs are kept as pets in close to one-third of U.S. households (IOM, 2000). Interestingly, allergens associated with domestic animals are themselves highly mobile, so they are also often found in homes that do not have such pets (Hesselmar et al., 2005; Miles, 2005). In fact, the NSLAH found that cat and dog allergens were two of the most common allergens present in American homes, regardless of pet ownership (NIEHS, 2013).

Molds. Molds are microscopic fungi that are ubiquitous in our environment and found nearly anywhere moisture is present, although fewer than 50 species are commonly found indoors (EPA, n.d.; EPA, 2013; IOM, 2000; IOM, 2004). Inhalation of mold spores or components of fungal cell walls have been shown to trigger asthma symptoms, via both allergic and non-allergic pathways (Breysse et al., 2004; EPA, n.d.; EPA, 2013; IOM, 2004; Rauh et al., 2008). A number of specific mold species have been connected to the exacerbation of asthma symptoms, particularly: *Alternaria alternata*, *Aspergillus* spp., *Cladosporium herbarum*, *Malassezia furfur*, *Penicillium* spp., *Psilocybe cubenis*, and *Trichophyton tonsurans* (IOM, 2000; Rao & Phipatanakul, 2011). Data from the NSLAH also suggested that nearly 100% of homes sampled had detectable levels of *Alternaria* spp. (NIEHS, 2013). Evidence also suggests that a damp indoor environment suitable for mold growth can exacerbate asthma symptoms, even when visible mold growth is not apparent (Breysse et al., 2004; IOM, 2004). In general, sensitivity to molds and the associated ability to trigger asthma symptoms may be present for up to 40% of asthmatics (IOM, 2000).

Irritants.

Environmental Tobacco Smoke (ETS). In addition to being a contributor to asthma development in pre-school age children, exposure to ETS has also been identified as a prominent trigger of asthma symptoms for asthmatics of all ages (Akinbami et al., 2012; CDC, 2012; EPA, 2013; Rao & Phipatanakul, 2011; Vork et al., 2007). In general, parental smoking is associated with more severe symptoms in asthmatic children (IOM, 2000). Further, chronic exposure to ETS has been associated with the exacerbation of asthma in older children and adults, with limited evidence associating acute ETS exposure and asthma symptoms (IOM, 2000).

Nitrogen Dioxide and Volatile Organic Compounds (VOCs). Nitrogen dioxide (NO_2) is an odorless gas, produced through the high-temperature combustion of fuels (e.g., gas, kerosene, and wood) (EPA, n.d.; EPA, 2008; EPA, 2013; IOM, 2000). NO_2 is often created in homes through the use of fuel-burning appliances; for example, on average nearly 50% of American homes use gas-burning stoves or ovens (EPA, 2013; IOM, 2000; Wu et al., 2007). Exposures to NO_2 generally cause eye, nose, and throat irritation, but have also been shown to trigger asthma symptoms, typically due to acute, high-levels of exposure (EPA, n.d.; EPA, 2013; IOM, 2000; Rauh et al., 2008).

Other volatile organic compounds (VOCs), which include any number of gaseous chemicals volatized from liquids and solids, are often respiratory irritants as well (EPA, 2008; EPA, 2013). More than 300 VOCs have been measured indoors, originating from sources like: paints, cleaning agents, adhesives, pesticides, air fresheners, etc.; and, a number of VOCs (e.g., chlorinated, aromatic, and aliphatic compounds) from these sources may also exacerbate asthma symptoms (EPA, 2008; EPA, 2013; IOM, 2000). In

particular, there is some evidence to suggest that high-level exposure to pesticides may trigger asthma symptoms; this is an important potential association, given that nearly 85% of American homes utilize pesticides indoors (IOM, 2000).

Physical Activity and Obesity. Physical activity may serve as an asthma trigger for some individuals (CDC, 2012; NHLBI, 2012; Visness et al., 2010). However, unlike the other triggers mentioned, physical activity should not be avoided by asthmatics (Akinbami et al., 2012; NHLBI, 2012). Proper diet and the avoidance of a sedentary lifestyle are paramount to the prevention of childhood obesity (BARS II, 2006). Obesity and a sedentary lifestyle have themselves been linked to the exacerbation of asthma, as well as many other diseases (BARS II, 2006; Kusunoki et al., 2012). It is hypothesized that obesity may contribute to airway hyperresponsiveness and smooth muscle constriction and that it may also contribute to a net decrease in anti-inflammatory mediators that could otherwise benefit asthma sufferers (Kusunoki et al., 2012).

Other Factors. In addition to their association with asthma development, viral respiratory infections are also considered an important cause of asthma exacerbation (Akinbami et al., 2012; CDC, 2012; Corrigan & Kay, 1990; NHLBI, 2007). Viral infections like the common cold, the flu, and RSV, as well as bacterial infections (e.g., those caused by *Chlamydia* spp., *Mycoplasma pneumonia*), may trigger an asthma attack in some individuals (CDC, 2013; NHLBI, 2007; IOM, 2000). Although evidence is lacking, it is possible that for some asthmatics, other allergies or illnesses (e.g., acid reflux, sinus infection); strong chemical odors or fragrances; weather (e.g., high humidity, cold air); outdoor air pollution (e.g. ozone, sulfur dioxide) or poor indoor air quality (usually the result of inadequate ventilation); high pollen, outdoor mold spore, or

outdoor particulate matter counts; medications (e.g., aspirin, nonselective beta-blockers); psychosocial stress; and sulfites in foods or beverages may also be asthma triggers (Akinbami et al., 2012; Breysse et al., 2004; CDC, 2013; Hesselmar et al., 2005; IOM, 2000; McCormack et al., 2009; NHLBI, 2007; NHLBI, 2012; Northridge et al., 2010). For some individuals, it is theorized that even strong emotions that result in hyperventilation may also bring about an asthma attack (CDC, 2013). Further research is required to confidently make associations between any number of environmental factors and the exacerbation of asthma.

Health and Housing

The connection between health and housing has long been established, as witnessed by the health impact of housing-related changes, such as the sanitation movement and the advancement of lead-based paint prevention policies (Jacobs, 2011; Jacobs, Kelly, & Sobolewski, 2007; Miles, 2005). Despite this understanding, changes to the home environment over the past several decades have focused more on improved durability and security, energy conservation, and aesthetics rather than on improving the health of occupants (Jacobs, Wilson, Dixon, Smith, & Evens, 2009). As such, disparities in housing, which also negatively impact health, continue to exist (Jacobs et al., 2009; Northridge et al., 2010). Disparities in housing represent an important environmental justice concern, particularly as poor and minority persons are more likely to live in homes of lower quality and are less likely to have the means to control the quality of their homes (Jacobs et al., 2009; Northridge et al., 2010; Rauh et al., 2008; Wu & Takaro, 2007). Although more frequent in public and low-income housing, markers of deterioration exist for all types of American housing stock (Northridge et al., 2010). This prevalence of

substandard housing in the United States contributes to the disproportionate prevalence of environmentally-linked diseases, including asthma (Jacobs, 2011; Rauh et al., 2008).

Status of Housing

The status of American housing stock is best generalized through the American Housing Survey (AHS). Conducted jointly by the U.S. Department of Housing and Urban Development (HUD) and the United States Census Bureau (USCB), the AHS is a comprehensive, longitudinal national housing survey that collects data every two years (USCB, 2012a). Data are available from the 2011 AHS, which provide generalizable insight into the current status of nearly 115 million housing units in the United States (USCB, 2012a). The AHS collects self-reported data on a large number of measures; however, a small selection of housing characteristics most applicable to asthma development or exacerbation is highlighted in Table 2 on the following page.

Table 2: Selected Characteristics of American Housing Units
(Table created using data from: USCB, 2012a)

HOUSING CHARACTERISTICS	NUMBER OF UNITS
SELECTED PHYSICAL PROBLEMS	
Severe physical problems (with plumbing, heating, electric, upkeep)	2,125,000
Moderate physical problems (with plumbing, heating, electric, upkeep)	4,199,000
Open cracks or holes (interior)	5,949,000
MAIN HEATING EQUIPMENT	
Floor, wall, or other built-in hot-air units without ducts	5,182,000
Room heaters without flue	1,291,000
Cooking stove	97,000
Main heating fuel: Piped gas	63,791,000
PEST INFESTATIONS	
Signs of rats in last 12 months	1,171,000
Signs of mice in last 12 months	12,743,000
Signs of cockroaches in last 12 months	13,157,000
SELECTED MOISTURE-RELATED PROBLEMS	
Water leakage from inside structure	9,686,000
Water leakage from outside structure	12,461,000
Units with mold in the last 12 months	4,023,000
TOBACCO SMOKE	
Households with smokers	13,685,000
Households where visitors smoke	2,517,000
Secondhand smoke entering home - daily	1,753,000
Secondhand smoke entering home - weekly	2,648,000
CHILDREN'S HEALTH AND SAFETY	
Children 6 – 17 years old, diagnosed with asthma	5,517,000
Visited emergency room in the past 12 months because of asthma	625,000
Has taken daily medicines for asthma in the past 12 months	2,004,000

As the AHS data demonstrate, a number of housing-based hazards exist in American housing stock (USCB, 2012a). The distribution of these hazards is also disproportionate; data demonstrate that poor and minority occupants are as much as three times more likely to live in substandard housing (Wu et al., 2007). The presence of moderate or severe physical problems (homes without: heat, hot water, or electricity, or homes with significant upkeep problems and structural defects) is often used as a proxy for declaring

substandard housing (DHHS, 2009; Jacobs, 2011). The 2011 AHS data demonstrate that nearly one-quarter of homes with severe and moderate physical problems are occupied by non-Hispanic black families (23% and 24%, respectively), while another 17% of homes with severe problems and another 18% of homes with moderate problems are occupied by Hispanic families (USCB, 2012a). In addition, 28% of homes with severe physical problems and 32% of homes with moderate physical problems are occupied by families living below the poverty line (USCB, 2012a). Considering that non-Hispanic black households account for just 13% of the total housing stock, Hispanic households account for just 12% of the housing stock, and low-income households account for just 16% of American housing stock, the disproportionate burden of substandard housing on these groups becomes apparent (USCB, 2012a). These disparities have persisted over the past three decades and likely contribute to the disproportionate prevalence rates of asthma in minority and low-income groups (Jacobs, 2011).

Connecting Housing Conditions to Asthma

The literature demonstrates the connection between asthma and environmental contributors to both the development and exacerbation of the disease; further, the literature connects these exposures to substandard home environments (Krieger et al., 2010; Miles, 2005; Northridge et al., 2010). Exposure to substandard housing is a sizable concern, as the majority of Americans spend over 90% of their time indoors. Additionally, of the time spent indoors, approximately two-thirds is spent in the home environment; children under age two, the elderly, and those with chronic conditions may spend even greater proportions of their time in the home (Breysse et al., 2004; EPA, 2008; McCormack et al., 2009; Miles, 2005; Priftis et al., 2009; Wu et al., 2007; Wu &

Takaro, 2007). Overall, on average, children >2 years old spend approximately 21 hours indoors (88% of their day), two hours outdoors, and one hour in enclosed transit each day (IOM, 2000). Further, while indoors, occupants are generally exposed to pollutants at levels two to five times greater than outdoors; at times, pollutant concentrations may exceed 100 times outdoor concentrations (Jacobs et al., 2007).

Indoor air pollutants from: combustion fuels; improperly vented heating, ventilation, and air conditioning (HVAC) systems; tobacco smoking, and the off-gassing of VOCs (e.g., formaldehyde, chloroform, toluene) from building materials can negatively affect the indoor air quality in a home and have been associated with asthma (EPA, 2008; Jacobs et al., 2009; Priftis et al., 2009). Improper ventilation in homes fails to remove pollutants and allergens from indoor air (and may actually concentrate them), which may trigger asthma symptoms; improper ventilation also contributes to increased interior humidity levels, which in turn creates additional issues (Miles, 2005; Northridge et al., 2010).

Increased indoor humidity has been associated with an increase in: HDMs, off-gassing of VOCs in building materials, pest infestations, and the growth of microorganisms (e.g., mold), all of which are also associated with asthma (Hesselmar et al., 2005; Krieger et al., 2010; Miles, 2005; Quansah et al., 2012). Ideally, indoor humidity should be kept between 30 – 50% to minimize these effects (EPA, 2008). When indoor humidity is excessive, asthma triggers proliferate. One study found that as many as 80% of American homes had detectable HDM allergen levels, with 24% exceeding the levels associated with triggering asthma symptoms (Krieger et al., 2010).

In addition to exacerbating asthma symptoms, increased humidity may also create structural deficiencies in homes.

In turn, the poor structural quality of homes may also contribute to the prevalence of asthma (Miles, 2005). For example, poor housing structure has been found to contribute to pest infestation, which itself is associated with asthma (Krieger et al., 2010; Miles, 2005; Rauh et al., 2008). Housing deficiencies serve as entrance points for pests and contribute to more severe pest infestations (Northridge et al., 2010). One study found that cockroach allergen is present in more than 60% of American homes, while mouse allergen is detectable in 82% of homes in the United States (Krieger et al., 2010; Rauh et al., 2008). Pest allergens are recognized to trigger asthma symptoms in sensitive individuals. Further, in addition to inviting pest infestation, structural deficiencies in homes may also contribute to increased water intrusion and other moisture-related problems (Krieger et al., 2010; Miles, 2005).

In fact, nearly all buildings will experience issues with excess moisture sometime during their existence (IOM, 2004). Indoor dampness and the associated mold growth are some of the most prevalent housing problems (Quansah, Jaakola, Hugg, Heikkinen, & Jaakola, 2012). The literature suggests that moisture-related problems may be present in up to 60% of homes; however, excess moisture is more common in low-income and minority homes (Jacobs, 2011; Quansah et al., 2012). Further, moisture-related housing issues may themselves increase the risk of developing or exacerbating asthma; one study found that excess moisture was associated with an estimated 50% increased risk of asthma (Northridge et al., 2010; Quansah et al., 2012). Much like the disease itself, the

connection between asthma and housing condition is quite complex and integrated. As such, reducing the prevalence and burden of asthma demands a holistic approach.

The Healthy Homes Concept

The healthy homes concept is the holistic and multi-faceted framework best suited to manage environmental contributors to asthma. The healthy homes concept is based on the ideology that homes should be sited, designed, built, maintained, and renovated in ways that support the health of occupants (DHHS, 2009). The healthy homes concept gained momentum with the *2009 Surgeon General's Call to Action to Promote Healthy Homes*; this document outlines the scientifically-proven steps that Americans should take to protect themselves from hazardous home environments that contribute to disease (DHHS, 2009). The goal of the *Call to Action* is to provide guidance for a comprehensive, nationwide approach to healthy homes that will reduce disparities and improve public health (DHHS, 2009).

In line with the *Call to Action*, the National Center for Healthy Housing (NCHH) developed its Seven Principles of Healthy Homes to provide easy to understand recommendations based on the scientific literature. The Seven Principles of Healthy Homes include: Keep it Dry, Keep it Clean, Keep it Pest-Free, Keep it Safe, Keep it Contaminant-Free, Keep it Ventilated, and Keep it Maintained (National Center for Healthy Housing [NCHH], 2008). Table 3 on the following page provides examples of how the some of the Seven Principles address healthy homes issues and how the issues relate specifically to asthma.

Table 3: Connecting Healthy Homes Principles, Healthy Homes Issues, and Asthma (NCHH, 2008)

HEALTHY HOMES PRINCIPLE	EXAMPLE ISSUES ADDRESSED	RELATIONSHIP TO ASTHMA
KEEP IT DRY	▪ Damp homes support the growth and sustenance of HDM, pests, and molds ▪ Damp homes may create further structural decay	There is evidence to suggest that the identified allergens or irritants in a home contribute to either the development of asthma or the exacerbation of asthma symptoms in sensitive individuals
KEEP IT CLEAN	▪ Clutter serves as pest harborage and may provide food for pests	
KEEP IT PEST-FREE	▪ Pest infestations serve as reservoirs for allergens ▪ The use of pesticides to control infestations may produce VOCs	
KEEP IT VENTILATED	▪ Poor ventilation contributes to increased indoor humidity ▪ Poor ventilation concentrates air pollutants	
KEEP IT MAINTAINED	▪ Poorly maintained homes are at risk for structural, moisture, and pest-related problems	

Despite the growing acceptance throughout the public health community of the healthy homes concept and the Principles of a Healthy Home, policies governing healthy homes issues are lacking and are generally restricted to basic habitability requirements of building codes, housing codes, and laws governing landlord-tenant responsibilities; for example, there has yet to be national consensus to support indoor air quality measures (Jacobs et al., 2007; Miles, 2005). As such, there is a push to contribute to the body of research on healthy homes-related issues that may inform future policy (DHHS, 2009). The hope is that, by eliminating knowledge gaps, policy may be implemented that will further support and strengthen the primary prevention of housing-related health and safety problems (Miles, 2005). Ultimately, healthy housing policy is seen as a means to address the inherent factors that influence substandard housing and the disproportionate distribution of housing-related diseases like asthma (Jacobs et al., 2007; Rauh et al., 2008). One such area of research that, if proven effective, may inform future policy is the use of home-based intervention strategies to address asthma.

Home-Based Interventions

There is mounting evidence that, similar to the environmental approach taken to reduce childhood lead poisoning, a home-based approach may also effectively reduce the burden of asthma; specifically, that a multi-faceted healthy homes program could effectively manage environmental contributors to asthma (Jacobs et al., 2007; Jacobs et al., 2009; Jacobs, 2011; Krieger et al., 2010; Miles, 2005; Takaro et al., 2004). An ideal home-based asthma intervention program based on the healthy homes concepts would include: the assessment of exposures to asthma triggers, education about exposure avoidance and asthma control (including the proper use of medications), as well as providing low-cost tools and strategies to reduce exposures (EPA, 2006; Krieger, Takaro, Song, & Weaver, 2005; NHLBI, 2007). This type of approach has been gaining interest, as individual asthma case management is often ineffective at reaching all individuals in need of care and the direct health care costs are often prohibitive (Miles, 2005). Since it is believed that the origins of asthma may have early connections to the home environment, reducing exposure sources at home is seen as a viable method to address the increasing asthma prevalence (Rao & Phipatanakul, 2011). As such, a number of strategies to reduce home exposure sources have been implemented in the literature and are briefly discussed below.

For HDM control, various researchers have attempted to: increase the use of HDM-impermeable pillow and mattress casings, increase weekly washing and high heat drying of bed linens, promote the avoidance of carpeting and upholstery, increase regular vacuuming, decrease indoor humidity levels to below 50%, as well as combine any number of the strategies listed to reduce exposure to HDM allergens (Rao &

Phipatanakul, 2011; Wu & Takaro, 2007). Results from related studies are variable; some HDM prevention techniques have been associated with the reduction of HDM allergen levels in homes and the reduction in asthma symptoms, but others have not (Rao & Phipatanakul, 2011). Despite mixed results, the National Asthma Education and Prevention Program (NAEPP) still recommends the encasement of pillows and mattress with allergen-impermeable covers, as well as regular laundering of all bed linens in hot water (>130 °F) to control exposure to HDM allergen (NHLBI, 2007).

In contrast, there is generally only one primary method of reducing exposure to pest allergens that is written about in the literature. Controlling the populations of cockroaches and other pests (e.g., rodents) is best accomplished through the use of Integrated Pest Management (IPM). IPM is a combination of pest control strategies, which focuses on eliminating pest access (for the purposes of harborage and food) and the judicious use of low-toxicity pesticides, typically in areas of highest infestation (Gergen et al., 1999; Rao & Phipatanakul, 2011). In addition to eliminating pests, IPM strategies have the added benefits of limiting exposure to pesticides as well (Krieger et al., 2010). The immediate effectiveness of IPM techniques is largely supported; however, long-term efficacy of IPM has been called into question by some study results in the literature (Gergen et al., 1999; Rao & Phipatanakul, 2011).

The most effective way to manage exposure to domestic pet allergens is also a source of debate in the literature. Generally, the standard of care for asthmatics includes the recommendation of domestic pet removal from the home (EPA, 2013; IOM, 2000; NHLBI, 2007; Rao & Phipatanakul, 2011). However, some studies suggest that early exposure to domestic pet allergens may decrease allergic sensitization and may be

protective against later asthma development (Rao & Phipatanakul, 2011). Despite the controversy, isolation from domestic pets is commonly recommended, which includes not allowing pets indoors or, at minimum, not allowing pets in asthmatics' sleeping areas (EPA, 2013; NHLBI, 2007).

In contrast, the connection between damp conditions, mold, and asthma exacerbation is well-established and accepted; however, the impact of mold remediation in homes on asthma burden is less understood. Approaches to managing mold in the literature have included: installing air exhaust systems, leak repairs, removal of water-damaged materials, etc. (Rao & Phipatanakul, 2011). While controlling mold is seen as an important exposure reduction technique, it is frequently more costly than other strategies and is less frequently employed as a technique of home-based asthma intervention programs (Rao & Phipatanakul, 2011).

Like mold, it is well-known that environmental tobacco smoke (ETS) can be a trigger for asthma symptoms. However, home-based approaches to eliminating ETS exposure, described in the literature, have often been found to be ineffective (Rao & Phipatanakul, 2011). Methods to reduce ETS exposure have included: the use of air filtration, particularly with high-efficiency particulate air (HEPA) cleaners, as well as incorporating tobacco cessation techniques into home-visit programs (Rao & Phipatanakul, 2011). Despite the challenges associated with behavior change, promoting tobacco-free homes is still the method of choice for protecting asthmatics (Rao & Phipatanakul, 2011).

Despite some conflicting results in the literature, experts in the field of asthma still encourage home exposure reduction as a current standard of care. As both the development and the exacerbation of asthma are complex, addressing every possible

exposure in or outside the home environment is unlikely (Rao & Phipatanakul, 2011). Nonetheless, the literature supports multi-faceted, home-based approaches to exposure prevention, as they provide the most evidence for effectively managing asthma (Jacobs et al., 2009; Krieger at al., 2005; Krieger et al., 2010; NHLBI, 2007; Rao & Phipatanakul, 2011; Takaro et al., 2004; Wu & Takaro, 2007). Additional strategies (i.e., improving home insulation, repeated dry-steam cleaning and vacuuming, the use of air cleaning devices, and home dehumidification) show promise in reducing environmental exposures, but will require additional research to determine efficacy (Krieger et al., 2010; Wu & Takaro, 2007). While both research questions and challenges in large-scale implementation remain, the benefits of a home-based primary prevention approach to target asthma are believed to far outweigh the costs (Miles, 2005; Rao & Phipatanakul, 2011). When a multi-disciplinary healthy homes approach is applied to manage asthma, costs are less than those that are incurred when problems are addressed independently (Miles, 2005).

One study estimated that the cost of a tailored home-based asthma intervention program would be just under $1500 per family or essentially a cost of $100 per symptom free day achieved through participation in the program (Kattan et al., 2005). In another small case study, one health plan saw savings of nearly $75 per month in direct health care expenditures (i.e., primary care or specialists visits for asthma, emergency department visits, and in-patient hospital admission) within six months after the institution of an asthma home visit program, after subtracting per month costs of the home visits themselves (EPA, 2006). Further, using the estimate that the environmental contributors to asthma could account for up to 35% of the disease, it can be speculated

that 35% of the $56 billion spent on asthma in the United States could be saved ($19.6 billion minus the cost of program implementation) if environmental asthma exposures were completely eliminated (Landrigan et al., 2002). It is unlikely that all environmental asthma exposures could be eliminated, but research suggests that it is feasible and potentially cost-beneficial to attempt to reduce exposures. As such, any research which explores the efficacy of a home-based asthma intervention program contributes to the knowledge gap in this area and potentially contributes to the reduction of the heavy and costly burden of asthma.

CHAPTER 3

METHODOLOGY

Collection of Data

Prior to the start of data collection, the University of Nevada, Las Vegas (UNLV) Institutional Review Board (IRB) granted approval for the use of human subjects in this study (IRB Approved Protocol#: 1008-3565; APPENDIX D). This study was conducted as part of a program funded by the Centers for Disease Control and Prevention (CDC) *Healthy Homes and Lead Poisoning Prevention Program* grant (Funding Opportunity #: NCEH CDC-RFA EH11-1102; Award #: 1UE1EH000824-01).

Background of the Nevada Healthy Homes Partnership (NVHHP)

Participants for the home-based childhood asthma intervention study were selected from the pool of qualified participants of the larger Nevada Healthy Homes Partnership (NVHHP) program. The NVHHP is a collaboration between the UNLV Department of Environmental and Occupational Health (DEOH), the Southern Nevada Health District (SNHD), and other local health and housing agencies in Southern Nevada (e.g., Rebuilding Together of Southern Nevada; HELP of Southern Nevada; St. Rose Dominican Hospitals; City of Henderson Neighborhood Services Division). The primary goal of the NVHHP is to improve the health and quality of life of economically-disadvantaged Nevada residents, by identifying and addressing hazardous conditions in the home environment (Nevada Healthy Homes Partnership [NVHHP], 2011).

The NVHHP was created in 2009, when grant-funding was procured from the CDC to develop plans for the creation of a program intending to reduce or eliminate housing-related health hazards and, generally, to promote safe and healthy housing (*Building*

Strategic Alliances for Healthy Housing Pilot; Funding Opportunity #: CDC-RFA-EH09-903; Award #: 1U88EH000569-01). The NVHHP program was designed to be a home-based intervention program aimed towards identifying, assessing, and remediating a variety of health and housing-related hazards; the primary interests being the prevention of: lead poisoning, unintentional injuries, and asthma. The pilot NVHHP program operated for two years, during which: protocols, educational materials, and assessment tools were developed; community partners and referral networks were established; and preliminary home assessments and data collection were completed. In 2011, the NVHHP submitted their program plan to the CDC in an application for the subsequent healthy homes production grant (*Healthy Homes and Lead Poisoning Prevention Program*; Funding Opportunity #: NCEH CDC-RFA EH11-1102). The NVHHP program plan was approved by the CDC and the program was granted additional funds to begin production in August 2011 (Award #: 1UE1EH000824-01).

Beginning in August 2011, participants in the NVHHP Healthy Homes Program were recruited via several channels, either: directly through community partners submitting referrals; directly through community outreach efforts of the NVHHP focused on enrolling participants; or indirectly through the program's website (www.nvhhp.org), where any website visitor could submit an online request. Interested participants were qualified according to NVHHP eligibility criteria; eligibility criteria required that:

1) Participants met the U.S. Department of Housing and Urban Development (HUD) income and family size criteria (as seen in Table 4 on the following page)

Table 4: 2012 Department of Housing and Urban Development (HUD) Income Guidelines: Clark County, NV
(Source: HUD 2012)

2012 DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT (HUD) INCOME GUIDELINES: CLARK COUNTY, NV								
# OF HOUSEHOLD MEMBERS	1	2	3	4	5	6	7	8
INCOME LIMIT	$37,000	$42,250	$47,550	$52,800	$57,050	$61,250	$65,500	$69,700

2) Homes had as a permanent resident either: at least one child under age 18, with diagnosed or suspected asthma; at least one child under age 6; or at least one adult over age 65

3) Priority was given to owner-occupied residences in the program's target zip codes (i.e., 89030, 89101, 89104, 89106, 89107, 89109, 89110, 89119, or 89121), although owner-occupied residences outside target zip codes were not excluded

Once qualified according to the criteria above, and after providing informed consent, participants proceeded through the program production process; a visualization of the production process for the NVHHP program can be found in APPENDIX E. In total, 92 households fully completed participation in the NVHHP Healthy Homes Program from August 2011 through April 2013, at which time federal funding became unavailable.

Home-Based Childhood Asthma Intervention Study

A sub-sample of the 92 program participants who enrolled in the NVHHP Healthy Homes Program were used for the home-based childhood asthma intervention study. The home-based childhood asthma intervention study included NVHHP program participants with at least one asthmatic child (as self-reported) aged ≤17 years old permanently residing in the home; study participants were the parent or legal guardian of the asthmatic child. In addition to the exclusions of the NVHHP program (e.g., income qualification, home ownership), this study further excluded: 1) any participating homes without an

asthmatic child; 2) any participants that did not complete the required *Healthy Homes Consent Form* and *Consent to Participate in "Healthy Homes" Program and General Release of Liability* form (APPENDIX F); and 3) any participants that did not provide both pre- and post-intervention data for comparison. Participants that met all inclusion criteria comprised the study population and, subsequently, had their data used for analysis. After exclusions, the sample size for the childhood asthma intervention study was 17 unique dwellings, home to 25 asthmatic children (as some dwellings were home to multiple asthmatic children). All participants enrolled in the NVHHP Healthy Homes Program between January 2012 and April 2013.

Once deemed eligible, the interested participants were scheduled for a home inspection. The home inspection protocol for the childhood asthma intervention study followed the NVHHP *Protocol for Conducting a Residential, Owner-Occupied Healthy Homes Investigation (HHI)*, found in its entirety in APPENDIX G. In brief, the home inspection protocol involved three separate visits by a minimum of two study investigators, spread across an approximately four to six month time period. The three-visit protocol allows for the collection of baseline, pre-intervention data during visit one, followed by the intervention administration during visit two, and the collection of post-intervention data during visit three. All activities conducted, and supplies provided, by the childhood asthma intervention program were at no-cost to the study participants.

At each of the three visits to the participating home, at least one study investigator was certified by the National Environmental Health Association (NEHA) as a Healthy Homes Specialist (HHS). The HHS credential is one of eight credentials offered by NEHA; the credential was developed in conjunction with the National Center for Healthy

Housing (NCHH) and the National Healthy Homes Training Center & Network to ensure practitioners understand the connection between health and housing. To receive the HHS credential, practitioners must demonstrate their understanding of key health and housing concepts on a standardized exam; the exam also includes a practical visual inspection component (National Environmental Health Association [NEHA], 2007; NEHA, 2013). The HHS credential requirement ensured that study investigators were able to holistically identify and suggest resolutions to healthy homes problems, as well as limited issues regarding inter-rater reliability, as all study investigators were similarly trained and held to the same test standard. To further support the reliability of collected data, as well as for the purpose of continuity, one HHS was assigned as the Case Manager for a given participant and was, subsequently, present at all three home visits.

Visit One: Pre-Intervention. At the start of visit one, an explanation of the study was provided, as well as details of participation, to ensure the potential participant had adequate information to provide informed consent. After signifying consent, one study investigator was responsible for collecting all of the self-reported data from the participant; for the purposes of this study, the consenting caregiver (i.e., parent or legal guardian) provided data about all asthmatic children that permanently resided in the home. Study investigators had the option of reading the tools to the participant or allowing the participant to read and record answers on their own. The study tools were designed to be understood by those with Limited English Proficiency (LEP) and were also available in either English or Spanish.

The tools used to collect data included: the Resident Questionnaire (one per household); at least one Health Questionnaire (one for each asthmatic child in the home);

at least one Asthma Supplement (one for each asthmatic child in the home); and the Asthma Assessment (one per household). For complete versions of the study tools, see APPENDIX A. The NVHHP developed the study tools using available literature to formulate questions to capture relevant data (no existing, validated tools could be found at the time of the study). However, the study tools were tested and modified during the NVHHP pilot program to further ensure the applicability of the data collected. Not all data collected from every NVHHP tool was used for analysis in this home-based asthma intervention study; descriptions of the data selected as relevant to this study are found later in this section, under the heading Data Selection.

Also during visit one, a visual inspection of the home was conducted. The investigator responsible for the visual inspection (typically the Case Manager) was required to be certified as a HHS. To complete the home inspection, the investigator followed the aforementioned protocol to complete a room-by-room inspection of the home, looking for health and safety hazards (also known as: healthy homes issues). All physically accessible rooms and room equivalents (e.g., hallways and stairways) were documented on a floor plan sketch and were examined, unless the study participant requested exclusion; rooms that were inaccessible for any reason were also documented. The investigator recorded their room-by-room observations on the Visual Assessment Checklist (Appendix A); the Visual Assessment Checklist documented multiple health and safety hazards, per NVHHP protocol, but only observations pertaining to environmental contributors to asthma were analyzed for this study. Completion of all applicable forms, data collection tools, and visual inspection activities marked the end of visit one.

All data collected during visit one were transcribed into secure, electronic databases; databases were designed and coded specifically for NVHHP tools. To ensure accurate data collection, a second investigator separately checked the data for discrepancies. Data collected during visit one was analyzed as pre-intervention data; the Case Manager was also responsible for interpreting data collected during visit one (as self-reported or observed by the HHS) that identify either problem behaviors or conditions that may contribute to the exacerbation of asthma symptoms.

Once problems have been identified, the Case Manager used the information to develop an intervention plan (for study investigators; recorded on the Case Management Plan, found in APPENDIX H) and an accompanying Healthy Homes Assessment (HHA) Report (to be provided to study participants; example provided in APPENDIX J). The intervention plan included the preparation of targeted educational talking points to be discussed at visit two, as well as the selection of supplies, for delivery at visit two, that may reduce exposure to environmental asthma triggers in the home. The HHA Report provided study participants with: general recommendations for maintaining a safe and healthy home, based on the NCHH Seven Principles of Healthy Homes; recommendations for how to improve the healthy homes issues identified specifically in their home; as well as a list of supplies and referrals provided by the NVHHP to address identified issues. The HHA Report was provided to study participants during the second visit, which was scheduled a minimum of two weeks after visit one.

Visit Two: Intervention. The second visit in the three-part home visit series was designed to be the intervention point for the study; the intervention included the delivery of household supplies intended to reduce the presence of environmental asthma triggers

in the home and targeted, asthma-specific education intended to increase caregiver knowledge that may subsequently influence positive behavior change. The ultimate goal of the intervention was to ensure that all post-intervention homes exist at the same minimum standard in terms of asthma-related home health (i.e., all homes have adequate cleaning supplies; all homes have Integrated Pest Management supplies, if applicable; all asthmatic children sleep on allergen-reducing pillow and mattress covers, all homes have educated caregivers). As such, while each intervention may have been slightly different (because it was tailored to the needs of the participant), at the conclusion of the intervention, all participants had the same types of trigger-reducing supplies present in the home, as well as the same level of caregiver knowledge about asthma.

Participants in the home-based childhood asthma intervention study also received necessary supplies intended to directly influence asthma outcomes (i.e., cleaning supplies; Integrated Pest Management supplies; allergen-reducing pillow and mattress covers); the provided supplies are described in APPENDIX L. While every home was not expected to require the same intervention in terms of supplies, all post-intervention homes had the same trigger-reducing resources available to them.

In addition to providing the suitable supplies, as part of the intervention, the study investigators also provided education. The goal of the educational component of the intervention was the same as that of the supply component – all post-intervention participants should have the same level of knowledge regarding asthma concepts (e.g., symptoms, triggers, prevention). The study investigators accomplished this task by using the home's observable healthy homes issues, as well as deficiencies in knowledge (based on the participant's scores on the Asthma Assessment, and key responses on the other

data collection tools) to guide a targeted discussion. The investigator used the *Creating a Healthy Home* educational booklet, created by the NVHHP, to highlight relevant insufficiencies (APPENDIX J).

The booklet was designed to go through the NCHH Seven Principles of Healthy Homes in a format that: 1) identifies the problem (e.g., why excess moisture in the home can be hazardous); 2) identifies how the healthy homes issue may occur (e.g., plumbing leaks, condensation on mechanical equipment); and 3) provides recommendations for how the problem can be addressed (e.g., eliminate standing water, point sprinklers away from the home). In addition to the Seven Principles, the NVHHP also added separate sections to address issues with weatherization/energy efficiency ("Keep it Green") and asthma, specifically. The booklet was discussed in detail during the second visit, but was also left with the study participant for future reference; several sections of the educational booklet also had activities that the participant could complete (e.g., making "green" cleaning supplies, making a home maintenance checklist, completing an Asthma Control Test) to reinforce important concepts.

Once study investigators delivered the essential supplies and provided the study participant with a targeted education session, the second visit was deemed complete. As after the first visit, all data pertaining to the second visit were entered into databases and checked for accuracy by additional study personnel. These intervention data are descriptively discussed in CHAPTER 4 FINDINGS OF THE STUDY.

Visit Three: Post-Intervention. The third and final visit of the home-based childhood asthma intervention program was scheduled for some time between four to six months after the initial visit. The time-lapse was intended to ensure that post-intervention

data could be collected and to ensure that changes from pre- to post-intervention were lasting and not the result of a one-time inoculation of information. The third visit was an exact replication of visit one, in that, all applicable self-report data collection tools completed at visit one were completed again at visit three, and a visual inspection of the home was also repeated.

At the close of visit three activities, study investigators provided participants with additional compensation for complete participation in the entire study (a Wal-Mart® gift card valued at either $25 or $50, depending on their enrollment date, per NVHHP program protocol); study investigators were required to comply with the IRB compensation policies at UNLV. After the visual inspection of the home was completed, all necessary forms were collected, and compensation was provided, the third visit was concluded.

As with each visit before, all data collected during the third visit were transcribed into secure databases and further checked for accuracy. Once all data for a particular case were collected, entered into databases, and checked for accuracy, the Case Manager closed the case. Figure 9 on the following page summarizes the home visit production process from start-to-completion.

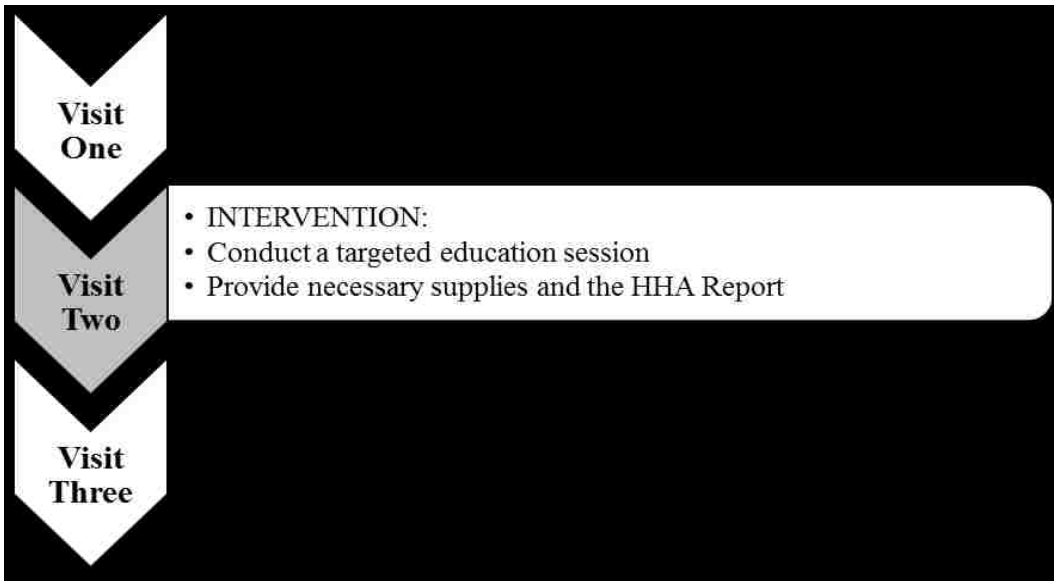


Figure 9: Home-Based Childhood Asthma Intervention Visit Production Process

Treatment of Data

All data collected during the course of the study was maintained in secure research files. Research files contained all related materials collected as part of participation in the program, including: *Healthy Homes Consent* and *Consent to Participate in "Healthy Homes" Program and General Release of Liability* forms; completed data collection tools; applicable photographs; copies of provided reports, etc.. In an effort to maintain the security and confidentiality of research files, study investigators completed UNLV's Office for the Protection of Research Subjects Collaborative Institutional Training Initiative (CITI) program (APPENDIX K). Information from the research files was accessible only to investigators. Physical research files were maintained in locked offices and cabinets in designated UNLV offices, while electronic data were entered directly into secure databases through the use of password-protected computers. Further, the

electronic files and databases were accessible only via an additional password-protected UNLV server.

Data Selection

The larger NVHHP program collected data on a number of measures, which were not applicable to the research questions of the home-based childhood asthma intervention study. As such, the study utilized only relevant portions of the NVHHP tools to collect data necessary for hypotheses testing. Any tools or portions of tools that did not relate specifically to asthma (i.e., development, exacerbation, symptoms, burden, prevention, and management) were excluded. As mentioned, a copy of the complete tools used by the NVHHP can be found in APPENDIX A. However, the data selected for use in the asthma intervention study are summarized below; data collection questions specifically used for the testing of hypotheses are identified in the following Tables 5 – 9. It is important to note that the question format among and between tools varied; some questions allowed for write in responses, others required dichotomous yes/no or true/false responses, and still others had set ordinal responses from which participants select the most applicable. All responses are discussed in detail in CHAPTER 4 FINDINGS OF THE STUDY.

Resident Questionnaire

The Resident Questionnaire (APPENDIX A) was designed to collect self-reported data about characteristics of the home itself and basic demographics of the occupants, as well as general behaviors of the occupants that may contribute, positively or negatively, to the healthy homes concepts. Overarching sections of the Resident Questionnaire included: Household Information, Indoor Air Quality, Poisoning Prevention, Injury

Prevention, Structural Elements of the Home, Pests, and Energy Efficiency. Questions from the Resident Questionnaire and the type of data collected that were used for the home-based childhood asthma intervention study are listed in Table 5 below.

Table 5: Data Collection Questions from the Resident Questionnaire

	VARIABLE DESCRIPTION	VARIABLE TYPE	HYPOTHESIS TESTED	STATISTICAL ANALYSIS
Household Information	City and zip code	Nominal	N/A	Descriptive Frequencies
	Primary language spoke in the home			
	Total number of occupants in the home	Continuous		
	Type of home (including owner-occupied or rental)	Nominal		
	How many years have you lived in the home?	Continuous		
	What was the household's total income last year?			
Indoor Air Quality	Does the home have a working central heating/air conditioning unit?	Dichotomous		
	If yes, are air filters replaced at least every three months?			
	Can mold or mildew be seen or smelled in the home?	Dichotomous*	Hypothesis 1-1	Wilcoxon signed ranks test
	If yes, where in the home can mold or mildew be seen?	Nominal	N/A	Descriptive Frequencies
	Are there pets inside the home?	Dichotomous		
	If yes, are pets allowed in the bedroom?			
Poisoning Prevention	Are any of the following products used in the home: Bleach, ammonia, cleaners or detergents Paints, stains, paint thinners, adhesives, or glues Air fresheners, air purifiers, or candles			
	How do you usually clean your home?	Nominal		
Pests	Is all food stored in airtight containers?	Dichotomous*	Hypothesis 1-1	Wilcoxon signed ranks test
	Is pet food stored in airtight containers and/or off the floor?			
	Is garbage contained in a sealable indoor trashcan?	Dichotomous*	Hypothesis 1-1	Wilcoxon signed ranks test
	Have cockroaches, other insects, rodents, or their feces been seen in the home?			

* Dichotomous variables used for hypotheses testing were cumulated into continuous variables, prior to statistical analysis

Health Questionnaire

The Health Questionnaire (APPENDIX A) was designed to collect data about the general health of the household members. For the purposes of the childhood asthma intervention study, selected responses from the Health Questionnaires collected on behalf of all pediatric occupants with diagnosed asthma were used for analysis. General components of the Health Questionnaire included: Demographic Data, Health Care, General Health, Preventative Care, Injury Prevention, Quality of Life, and Asthma Diagnosis. Selections for the study are indicated in Table 6 below.

Table 6: Data Collection Questions from the Health Questionnaire

	VARIABLE DESCRIPTION	VARIABLE TYPE	HYPOTHESIS TESTED	STATISTICAL ANALYSIS
DEMO DATA	What is your relationship to the child?	Nominal	N/A	Descriptive Frequencies
	What is your child's race? If the child is of Hispanic, Latino, or Spanish origin, what is their ethnicity?			
HEALTH CARE	Does the child currently have health (medical) insurance?	Dichotomous		
	What type of health insurance does the child have?	Nominal		
GENERAL HEALTH	On a scale of 1 (worst) to 10 (best), how would you rate the child's overall health?	Ordinal		
	Does the child's health currently limit their ability to perform vigorous physical activities?			
	Does the child's health currently limit their ability to perform moderate physical activities?			
	On a scale of 1 (worst) to 10 (best), how would you rate the healthiness of the child's diet?			
	How many times per week does the child usually exercise?			
	When the child does exercise, how many minutes are spent?			
	Does anyone who lives in the home smoke cigarettes, cigars, or other tobacco products?	Dichotomous*	Hypothesis 1-1	Wilcoxon signed ranks test
	Do visitors ever smoke cigarettes, cigars, or other tobacco products in your home?			

* Dichotomous variables used for hypotheses testing were cumulated into continuous variables, prior to statistical analysis

Asthma Supplement

The Asthma Supplement (APPENDIX A) was designed to collect additional data pertaining to any occupants with a self-reported medical diagnosis of asthma. While the Asthma Supplement was used for all NVHHP participating asthmatics, only those tools completed on behalf of asthmatic children aged ≤17 years old were used for the childhood asthma intervention study. General topics covered by the Asthma Supplement included: Asthma Diagnosis, Asthma Symptoms, Burden of Asthma, Asthma Medication, and Asthma Control. Specific questions used by the study are listed in Table 7 on the following page.

Table 7: Data Collection Questions from the Asthma Supplement

VARIABLE DESCRIPTION		VARIABLE TYPE	HYPOTHESIS TESTED	STATISTICAL ANALYSIS
ASTHMA DIAGNOSIS	Approximately when was the child's asthma diagnosis?	Continuous	N/A	Descriptive Frequencies
	Does the child use an Asthma Action/Control Plan, provided from a medical professional?	Ordinal		
	What was the classification of asthma severity on the Asthma Action/Control Plan?			
	Is the child's school nurse aware of the diagnosis?	Dichotomous		
ASTHMA SYMPTOMS	In the past month, how often has the child had daytime coughing, wheezing, or shortness of breath?	Ordinal	Hypothesis 3-1	Wilcoxon signed ranks test
	In the past month, how often has the child woken up at night due to coughing, wheezing, or shortness of breath?		Hypothesis 3-2	
	In the past month, how many times has the child needed to use short-acting medication to control symptoms of coughing, wheezing, or shortness of breath?		Hypothesis 3-3	
	How much do symptoms of coughing, wheezing, or shortness of breath interfere with the child's normal activities?		Hypothesis 3-4	
	Does physical activity cause the child's asthma symptoms to worsen?	Dichotomous	N/A	Descriptive Frequencies
	Does the child have more trouble with asthma during certain times of year?			
BURDEN OF ASTHMA	In the past month, how many days of school has the child missed due to asthma?	Continuous	Hypothesis 5	Wilcoxon signed ranks test
	If the child has missed school (in the past month), how many days of work have you or another adult caregiver missed because of the child's asthma?		Hypothesis 6	
	During the past 6 months, how many times has the child been seen in a doctor's office because of asthma?		Hypothesis 4-1	
	During the past 6 months, how many times has the child been seen in the emergency room or urgent care center because of asthma?		Hypothesis 4-2	
	During the past 6 months, how many times has the child been admitted to the hospital overnight because of asthma?		Hypothesis 4-3	
	In the past month, approximately how much money has been spent on the child's medications related to asthma?		N/A	Descriptive Frequencies
	Does the child's school nurse have the asthma medication?	Dichotomous	N/A	Descriptive Frequencies
	Does the child take medications for asthma even without symptoms?			
	Does the child take medications for asthma only when symptoms occur?			
ASTHMA CONTROL	Does the child's sleeping pillow have a special allergen-reducing, dust-proof cover?	Dichotomous*	Hypothesis 1-1	Wilcoxon signed ranks test
	Does the child's sleeping mattress have a special allergen-reducing, dust-proof cover?			

* Dichotomous variables used for hypotheses testing were cumulated into continuous variables, prior to statistical analysis

Asthma Assessment

The Asthma Assessment was designed as a supplemental 20-point, true/false test to assess the knowledge of asthma concepts, specifically for asthmatics or, as was the case for this study, to test the knowledge of caregivers of asthmatic children. The questions were divided equally among four categories: Asthma Symptoms, Asthma Triggers, Asthma Management, and Asthma Prevention. All of the questions on the Asthma Assessment were used by the study and can be seen in Table 8 below.

Table 8: Data Collection Questions from the Asthma Assessment

VARIABLE DESCRIPTION		VARIABLE TYPE	HYPOTHESIS TESTED	STATISTICAL ANALYSIS
Asthma Symptoms	Wheezing, coughing, chest tightness and shortness of breath are symptoms of asthma.	Dichotomous*	Hypothesis 2	Wilcoxon signed ranks test
	It is best to wait and see if asthma symptoms go away on their own before taking "as needed" medications.			
	During an asthma attack, it is hard to breathe.			
	Nighttime coughing and early morning coughing are symptoms of asthma.			
	Not all asthma episodes need to be taken seriously.			
Asthma Triggers	Tobacco smoke can relieve asthma symptoms and DOES NOT cause attacks.			
	Pets can trigger asthma symptoms or attacks.			
	Mold in your home DOES NOT trigger asthma symptoms or attacks.			
	Dust mites can trigger asthma symptoms or attacks.			
	Cockroaches DO NOT trigger asthma symptoms or attacks.			
Asthma Management	Asthma cannot be cured, but it can be controlled.			
	Someone with asthma only needs to see a doctor about asthma when he or she is having an asthma attack.			
	The best way to manage asthma is to deal with it yourself, without consulting a doctor.			
	Contact with environmental allergens and contaminants early in life may contribute to the development of asthma.			
	An inhaler will deliver a useful dose of medication, no matter how it is used.			
Asthma Prevention	Washing bed sheets in hot water, covering mattresses and pillows with dust-proof covers, and not allowing pets in the bedroom, can reduce allergens in a home.			
	There is nothing a person with asthma can do to keep from getting an asthma attack.			
	People with asthma should not exercise.			
	People with asthma can still live normal and healthy lives.			
	Asthma may result from both genetic and environmental factors.			

* Dichotomous variables used for hypotheses testing were cumulated into continuous variables, prior to statistical analysis

Visual Assessment Checklist

The Visual Assessment Checklist (APPENDIX A) was designed as an objective measure to collect data pertaining to the presence of healthy homes issues. As indicated in the Collection of Data section, the Visual Assessment Checklist was the tool used by the certified-Healthy Homes Specialist (HHS) as they conducted the room-by-room visual inspection of the participant's home. For the general categories of Indoor Air Quality, Lead Poisoning Prevention, Structural Elements, Pests, and Energy Efficiency, the study investigator simply indicated on the Visual Assessment Checklist whether the healthy homes issue in question was present in the home. A number of other categories on the Visual Assessment Checklist required additional inputs (e.g., designations of cleanliness and clutter, condition of smoke or carbon monoxide detectors, incident counts for child safety concerns). However, as with the other self-report tools, not all components of the Visual Assessment Checklist were utilized in the childhood asthma intervention study; components that were used are indicated in Table 9 below.

Table 9: Data Collection from the Visual Assessment Checklist

VARIABLE DESCRIPTION		VARIABLE TYPE	HYPOTHESIS TESTED	STATISTICAL ANALYSIS
INDOOR AIR QUALITY	Unvented gas appliance	Dichotomous*	Hypothesis 1-2	Wilcoxon signed ranks test
	Mold or Mildew: Obvious source of moisture			
	Mold or Mildew: No obvious source of moisture			
	Evidence of tobacco smoke or other usage			
PESTS	Improperly stored foods or pet foods			
	Improperly stored garbage			
	Evidence of cockroaches			
	Evidence of rodents			
	Evidence of pest control products			
CLEAN	Cleanliness	Ordinal	N/A	Descriptive Frequencies
	Clutter			

* Dichotomous variables used for hypotheses testing were cumulated into continuous variables, prior to statistical analysis

Data collected from all study tools, as indicated above, were used for the home-based childhood asthma intervention study. Data were cleaned and coded, variables were transformed when appropriate, and all data were transferred into statistical software. The data collected by the study allowed for the reporting of descriptive statistics, as well as statistical analysis required for hypotheses testing.

Hypotheses Testing

The purpose of data collection for the home-based childhood asthma intervention study was largely to test hypotheses relating to the impact of the intervention among participants. Some of the data collected by the study was purely descriptive in nature. In those instances, frequency tables and figures are presented and discussed in CHAPTER 4 FINDINGS OF THE STUDY to demonstrate basic characteristics of the study population. Questions identified in the Data Selection section above that do not have a hypotheses number associated with them are depicted in this fashion and were otherwise excluded from data analysis.

Data of interest (identified by hypotheses numbers above) were selected and organized to test alternate study hypotheses as identified in CHAPTER 1 INTRODUCTION; hypotheses were tested using statistical software. All hypotheses were tested for statistical significance against a one-tailed significance level of $\alpha = .05$, as the hypotheses were directional. All hypotheses were analyzed by comparing the frequency of applicable responses on the appropriate tools, both pre- and post-intervention.

Due to the small sample size of the study, parametric statistical tests were not likely to be used to test hypotheses; small samples often violate the assumptions of parametric

statistical tests. Additionally, using non-parametric statistical tests should have increased the statistical power and reduced type II errors, in which there could have been a failure to reject false null hypotheses (Pett, 1997). Further due to the small sample size, the data in the study were not likely to be normally distributed. Therefore, non-parametric statistical analyses were expected to be used to test study hypotheses.

The selection of the appropriate non-parametric statistical test was dependent on the type of data collected. As indicated in Tables 5 – 9, the variables measured by this study were dependent and were either continuous variables (e.g., the number of self-reported missed school days); ordinal variables (e.g., daytime asthma symptoms in the past month, valued at 1 = zero symptoms, 2 = twice a week or less, 3 = more than twice a week, but not daily, 4 = daily, 5 = multiple times throughout the day); or transformed into continuous variables (e.g., cumulating the number of observed environmental asthma triggers; summing the knowledge score on the Asthma Assessment ranging from 1 – 20 correct responses). Based on the type of data collected, the Wilcoxon signed ranks test was used to test study Hypotheses.

The Wilcoxon signed ranks test is an appropriate statistical test for paired data collected from small samples sizes. The Wilcoxon test allowed for the detection of changes in median values pre- to post-intervention and allowed for an assessment of the magnitude of change. The study was expected to meet the generous assumptions of the Wilcoxon test: 1) data must be paired; 2) data must be ordinal at minimum; and 3) there must be symmetry around true medians, although the distribution need not be normal (Pett, 1997). An explanation of how data were treated prior to hypotheses testing with

the Wilcoxon test is briefly described below and is elaborated on in CHAPTER 4 FINDINGS OF THE STUDY.

To test the change in the overall frequency of environmental asthma triggers in the home following intervention, data were collected on the presence/absence of known (or suspected) environmental asthma triggers, as identified in the literature. Using the identified tools above, this study collected both self-reported and observational presence/absence data pertaining to: mold; pest infestations; environmental tobacco smoke exposure; as well as unvented gas appliances (a proxy for VOCs). Changes in pre- and post-intervention self-reported and observational data were tested separately via Hypotheses 1-1 and 1-2.

To test changes in self-reported environmental asthma triggers, the frequency of responses for the selected questions on the Resident Questionnaire and the Health Questionnaire for Hypothesis 1-1 was summed pre- and post-intervention. Affirmative ("Yes") responses to some of the selected questions were considered indicative of the presence of an environmental asthma trigger, while in some cases negative ("No") responses to other questions were considered indicative of the presence of environmental asthma triggers; this distinction is discussed in detail in CHAPTER 4 FINDINGS OF THE STUDY. All instances where the presence of an environmental asthma trigger was identified were assigned a value of one; opposing responses were assigned a value of zero. The frequencies were summed for each individual case, the median was calculated for all cases, and the Wilcoxon signed ranks test was conducted.

To test changes in observed environmental asthma triggers, the frequency of responses for the pertinent line items on the Visual Assessment Checklist was summed

pre- and post-intervention. For the purposes of this study, the absence of the selected line item being observed in any room in the home was assigned a frequency of zero, while the presence of the selected line item being observed in the home was assigned a frequency of one, for each instance. Here again, the frequencies were summed for each individual case, the median was calculated for all cases, and the Wilcoxon signed ranks test was conducted. Further, the difference between the median environmental asthma trigger frequencies according to self-reported data and according to observed data was also explored.

To test the change in caregivers' general knowledge about asthma following intervention, knowledge about pertinent topics must have been ascertained both pre- and post- the educational intervention portion of the study. This knowledge was assessed entirely through the use of data generated from the Asthma Assessment tool. Topics of concern included understanding: characteristic asthma symptoms and the risks associated with symptoms; common environmental asthma triggers found in home environments; recommended asthma treatment strategies; characteristics of the disease; as well as asthma attack prevention strategies. The cumulative score of correct responses (each scored as one point) on the Asthma Assessment was individually summed for each case; median scores were then be calculated and compared pre- and post-intervention to either accept or reject the null for Hypothesis 2.

Hypotheses 3 – 6 were entirely dependent on self-reported data collected from the Asthma Supplement tool. To test the change in self-reported asthma symptoms experienced per month following intervention, data collected from the Asthma Symptoms section of the Asthma Supplement were analyzed. Specifically, the frequency of daytime

symptoms, nighttime symptoms, use of short-acting medications, and activity limitations due to asthma were compared both individually and cumulatively. For each of these metrics, the scale increased numerically in connection with increased symptom frequency (although the differences between levels on the scale were not equivalent). As the scale is ordinal, the value assigned to represent the range of symptom frequencies was summed; medians were calculated for each of the four sub-categories above, as well as for all symptoms combined to allow for hypotheses testing.

To test the change in the number of self-reported asthma-related medical visits per six month period following intervention, data from the Burden of Asthma section of the Asthma Supplement was analyzed. The number of self-reported visits to doctor's offices, emergency room/urgent care facilities, and hospital admittances was analyzed pre- and post-intervention, both individually and cumulatively. As these data were continuous in nature, the raw data were used to sum frequencies, calculate medians, and test the hypotheses with Wilcoxon signed ranks tests.

To test the change in the self-reported number of school days missed per month due to asthma following intervention and to test the change in the self-reported number of missed work days per month (by caregivers of children with asthma symptoms) following intervention, data from the Burden of Asthma section of the Asthma Supplement was again analyzed. Both of these hypotheses had only one respective data point pertaining to the respective hypothesis. As such, pre- and post-intervention changes were analyzed individually. The continuous variable provided for each hypothesis was cumulated for all cases; medians were calculated, and Wilcoxon signed ranks tests were conducted.

Detailed discussion of the statistical analysis of all hypotheses and the results of hypotheses testing is discussed in detail in the following chapter: CHAPTER 4 FINDINGS OF THE STUDY.

CHAPTER 4

FINDINGS OF THE STUDY

Analysis of Data

Enrollment in the NVHHP Healthy Homes Program began in August 2011; however, the first participant for the home-based childhood asthma intervention study was not enrolled until January 2012. The final participant of the home-based childhood asthma intervention program was enrolled in April 2013; with the last post-intervention visit for participants was conducted on June 27, 2013. The average time of participation from participant enrollment at the pre-intervention visit to case closure at the post-intervention visit was 25 ± 7 weeks.

From January 2012 through April 2013, 36 participants enrolled in the NVHHP Healthy Homes Program. Of those participants, 22 homes qualified for the home-based childhood asthma intervention study, as they were permanent residences of at least one child with asthma aged ≤17 years old, at the time of enrollment. Of the 22 qualified homes, 17 households provided both pre- and post-intervention paired data and were subsequently included in study analyses (representing a 77.3% inclusion rate). Of the five households that withdrew from the study, one did so because the asthmatic child was no longer a resident of the home; the other four households were administratively dropped from the study, due to an inability to make contact after the pre-intervention visit, despite several attempts to each participant via telephone and mail.

The 17 unique, included households were home to 25 asthmatic children ≤17 years old, while the five excluded households were home to nine asthmatic children ≤17 years old (with a range of 1 – 4 asthmatic children per excluded household). The excluded

children had nearly similar age and gender profiles as the participating children (mean age of 9.11 ± 4.76 years and 9.36 ± 3.82 years, respectively; 44.4% male and 56.0% male, respectively); however, the excluded children were more likely to be of black race (88.9% versus 0.16%, respectively). The age and gender distribution of the 25 participants can be seen below in Figure 10 below.

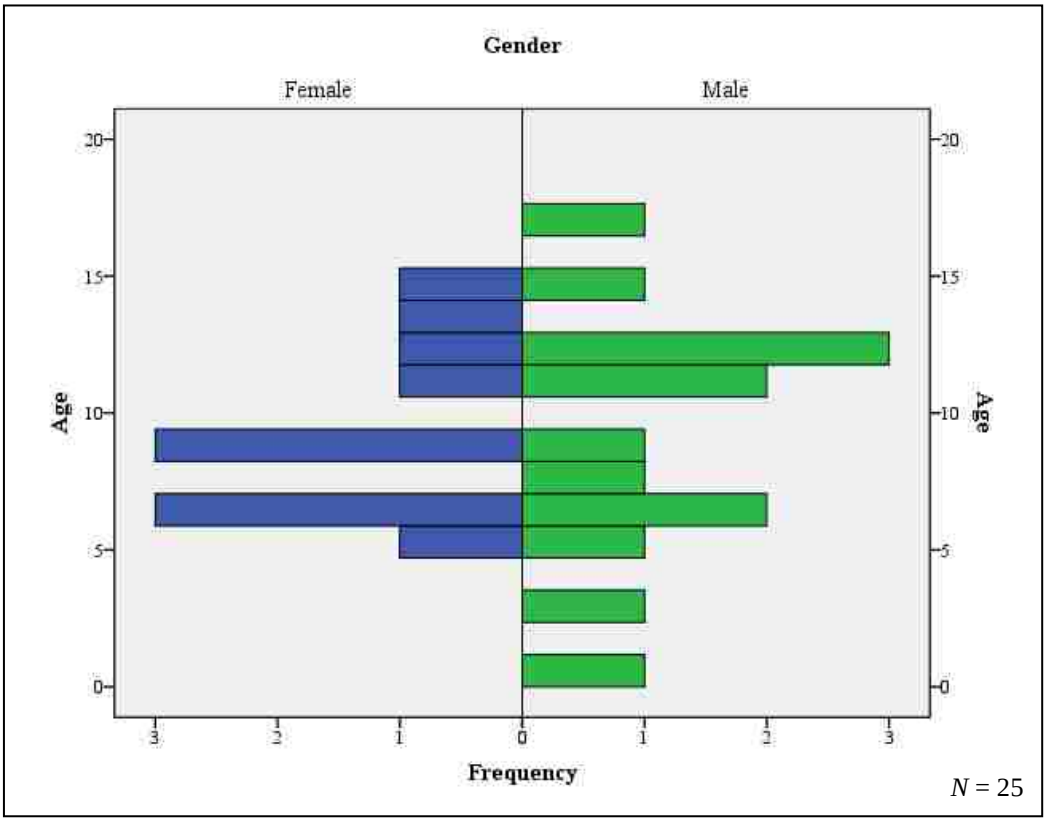


Figure 10: Age/Gender Distribution of Study Participants

The large majority of the 25 asthmatic children participants were of Hispanic race (72.0%, *n* = 18), all of whom further identified their ethnic background as Mexican, Mexican-American, Chicano, or Chicana. The 18 Hispanic children resided in 11 unique households, as some participants were siblings living in the same residence. Of the 11

Hispanic households, the majority identified Spanish as the primary language spoken in the home (n = 7, representing 63.6% of the Hispanic households and 41.2% of the total study population). The six non-Hispanic households were home to the remaining seven participating children; of which, three children were identified as white (12.0% of the study population) and four children were identified as being of black descent (16.0% of the study population).

Data Collection Tool Results

Resident Questionnaire. The Resident Questionnaire (APPENDIX A) incited self-report data from each of the 17 participating homes' head of household. The Resident Questionnaire captured relevant information about: the household; critical behaviors of the occupants, which could be linked to the exacerbation of asthma; and self-reported environmental asthma triggers (which were mirrored by study investigator observations).

Household Information. Of the 17 participating homes, ten were located within the city of Las Vegas, six were located in the city of North Las Vegas, and one was located in the city of Henderson. The ten Las Vegas homes were located within eight zip codes: 89103, 89107, 89117, 89121, 89122, 89138, 89144, and 89169 (n = 1, n = 2, n = 1, n = 2, n = 1, n = 1, n = 1, and n = 1, respectively). The six North Las Vegas homes were located within zip codes 89030 (n = 5) and 89032 (n = 1), while the one participating Henderson home was located in zip code 89052. The year of construction for each participating home was verified by an online Real Property Records search (http://www.clarkcountynv.gov/Depts/assessor/Pages/PropertyRecords.aspx) via the Clark County Assessor; records were available for 16 homes. The mean year of home construction was 1978 (Range: 1955 – 2003). The slight majority of participating homes

were single family residences (n = 7, 41.2% of participating homes); of the seven single family residences, five were owner-occupied (71.4% of single family residences) and two were rental homes (28.6% of single family residences). Six participants were living in a unit in an apartment or condominium (35.3% of participating homes); of which, all but one were being rented. Two participants were residing in rental townhouses (11.8% of participating homes), while the remaining two participants were residing in mobile homes that were owned (11.8% of participating homes).

At the pre-intervention visit, participants were asked how long (in years) that they had resided in their home. The mean number of years participants had resided in their current home was 3.81 ± 5.29 years (Range: 5 months – 20 years). The mean number of occupants per participating home during pre-intervention was 5.65 ± 2.18 occupants (Range: 2 – 11); three participating residences were home to more than seven occupants. Participating homes were most likely to have three children ≤17 years old living in the home (n = 5, 29.4% of participants), with the mean number of child occupants for participants equal to 3.29 ± 1.53 children.

During the pre-intervention visit, participants were also asked to report their total household income for the prior year; an ordinal scale with income ranges was provided to participants. Only one participant failed to report their total household income for the prior year. Of the 16 participants that reported total household income for the prior year, the mean income range was $15,000 - $24,999 annually; an equal number of participants (n = 4) reported total household income in this mean range or the one directly above ($25,000 - $34,999). At the extremes, two participants reported prior year household incomes of less than $9,999 annually, while two other participants reported prior year

household incomes of greater than $50,000 annually; however, even the homes with greater household incomes had a sizable number of household members (household sizes of four and six occupants, respectively).

Occupant Behaviors. During the pre-intervention visit, all participants reported that their home had a central heating/ventilation/air conditioning (HVAC) system; however, five participants (29.4%) reported that the system was not currently functioning. Post-intervention, only three of the 17 participating homes had non-functioning HVAC systems (two of the non-functional units during pre-intervention remained inoperable, while one previously functioning unit became inoperable during the time form pre- to post-intervention). During the pre-intervention visit, 16 participants (94.1%) reported that they change their HVAC system's air filters at least once every three months (one participant failed to respond to this question). This behavior decreased during post-intervention, as only 14 participants (82.4%) reported that they regularly changed their air filters at least once every three months.

Of the 17 participating homes, nine (52.9%) reported that they were also home to domestic pets during the pre-intervention visits. The residences were home to four dogs, eight cats, and four other types of pets (only one pet was further identified as a parrot); the mean number of domestic pets was 0.94 ± 1.14 pets (Range: 0 – 4) during pre-intervention. During post-intervention visits, the same nine households reported keeping pets; however, the number of pets increased to 19, with a mean number of 1.12 ± 1.58 pets (Range: 0 – 6). The 19 identified pets included: three dogs, ten cats, and six other types of pets (two turtles, two birds, one rabbit, and one tortoise). Five of the nine homes

with pets reported that they allowed their pets inside the bedrooms during the pre-intervention visit, but only two reported this behavior during the post-intervention visit.

In terms of the use of household products, participants were asked to report whether or not they used three broad categories of products within their home: 1) bleach, ammonia, cleaners, or detergents; 2) paints, stains, paint thinners, adhesives, or glues; and 3) air fresheners, air purifiers, or candles. All participants (N = 17) during pre-intervention visits, and 16 participants post-intervention, reported household use of bleach, ammonia, cleaners, or detergents. Five participants reported household use of paints, stains, paint thinners, adhesives, or glues during pre-intervention visits; five participants also reported use of these products during post-intervention (three participants who also reported pre-intervention use and two reports of new use). The large majority of participants (n = 14, 82.4%) also reported use of air fresheners, air purifiers, or candles during the pre-intervention visit. During post-intervention visits, two participants reported that they had ceased using air fresheners, air purifiers, and candles in the home; however, one participant began use of these products, for a total of 13 participants who reported post-intervention use.

Both pre- and post-intervention, participants were also asked to report on their cleaning methods. During the pre-intervention visits, 16 participants reported that they damp mop their home and 14 participants reported that they vacuum their home (these cleaning methods were not mutually exclusive). During the post-intervention visits, all 17 participants reported that they damp mop their home to keep it clean, while the same 14 participants reported that they continued to vacuum their homes; the three participants

that did not vacuum their homes reported that they did not own a vacuum cleaner. A case-by-case summary of pertinent occupant behaviors can be seen in Table 10 below.

Table 10: Self-Reported Occupant Behavior Data from the Resident Questionnaire

CASE	AIR FILTERS CHANGED EVERY 1 - 3 MONTHS		PETS ALLOWED IN BEDROOMS		HOUSEHOLD PRODUCT TYPES USED						CLEANING METHOD			
					BLEACH, AMMONIA, CLEANERS, OR DETERGENT		PAINTS, STAINS, PAINT THINNERS, ADHESIVES, OR GLUES		AIR FRESH, AIR PURIFIERS, OR CANDLES		DAMP MOPPING		VACUUM	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes
2	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
3	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	NA	NA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5	Yes	Yes	Yes	No	Yes	Yes	No	No	No	No	Yes	Yes	Yes	Yes
6	Yes	No	NA	NA	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No
7	Yes	No	NA	NA	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes
8	Yes	Yes	Yes	No	Yes	Yes	No	No	Yes	Yes	Yes	Yes	NA	NA
9	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes
10	Yes	Yes	No	No	Yes	Yes	No	No	Yes	No	Yes	Yes	Yes	Yes
11	Yes	Yes	NA	NA	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes
12	Yes	No	No	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes
13	Yes	Yes	NA	NA	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes
14	NA	Yes	NA	NA	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
15	Yes	Yes	NA	NA	Yes	No	No	No	No	No	Yes	Yes	Yes	Yes
16	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No
17	Yes	Yes	NA	NA	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes

Self-Reported Environmental Asthma Triggers. The Resident Questionnaire also collected data pertaining to self-reported environmental asthma triggers. Participants in the home-based childhood asthma intervention study were asked to report: whether mold could be seen or smelled in the home; whether or not food and pet food were stored properly; whether or not garbage was properly stored in sealable trashcans; and whether pests or their feces had been seen in the home. These data, in combination with selected

data collected via the Health Questionnaire, were used to characterize the presence of environmental asthma triggers in the home as perceived by the participant. These data are further discussed with the Health Questionnaire data below.

Health Questionnaire. The Health Questionnaire (APPENDIX A) was completed during both pre- and post-intervention visits to ascertain general health information about the asthmatic child; the questionnaires were completed by the child's parent/legal guardian. During the pre-intervention visit, parents/legal guardians reported that the majority of asthmatic children (N = 25) had medical insurance coverage (n = 18, 72.0%); the majority of insured children were covered by Medicaid (n = 11, 61.1% of insured participants, 44.0% of the total population). The additional insured children (n = 7) were covered by private insurance companies. These results remained the same during the post-intervention visit.

Participants were also asked to rate the asthmatic child's overall health on a scale from: 1 (poor) to 10 (excellent). During pre-intervention visits, asthmatic children were identified as having a mean overall health rating of 6.76 ± 2.35 (Range: 1 – 10); this rating was slightly above 5, which was identified as average. Overall self-reported health ratings had increased post intervention to a mean rating of 7.20 ± 1.44 (Range: 5 – 10). Further, when asked how the child's health was currently, as compared to the pre-intervention visit, nearly half of participants reported "much better" (n = 12, 48.0%), while only one child's health was reported as worse than before study participation.

As a component of health, participants were also asked to report on the child's activity limitations due to their overall health, which considered the child's asthma as well as other factors. During pre-intervention, the majority of participants reported that

the asthmatic child had no health-related limitations to performing either moderate (e.g. climbing a flight of stairs) or vigorous (e.g. running or lifting heavy objects) activities (*n* = 19, 76.0% and *n* = 16, 64.0%, respectively); however, one child reportedly had "a lot" of health-related limitation with both types of activities and two additional children had "a lot" of health-related limitations with performing only vigorous activities. By post-intervention, the large majority of children reportedly had no health-related issues performing either moderate or vigorous physical activities (*n* = 23, 92.0% and *n* = 18, 72.0%, respectively) and no children were reported as having more than just "a little" health-related limitation.

Pre-intervention, most children (*n* = 12, 48.0%) were reported to participate in physical activity more than five times per week, for an average of 30 – 59 minutes per physical activity session; nine additional children (36.0%) also reported average physical activity session times between 30 – 59 minutes, although they did not participate in as many weekly sessions. Post-intervention, the number of children participating in physical activity five or more times per week increased to 14 children (56.0%); nine children reported the same results as they did during pre-intervention, three children reduced their physical activity frequency from pre- to post-intervention, and five children increased their physical activity frequency from pre- to post-intervention. During post-intervention, most children (*n* = 13, 52.0%) were again reported to participate in physical activity for an average of 30 – 59 minutes per session.

In addition to physical activity measures, participants were also asked to report on their perception of the healthiness of the asthmatic child's diet on a scale of: 1 (unhealthy) to 10 (healthy), with 5 (average). Pre-intervention, the mean diet rating was

6.58 ± 2.17, indicating slightly above average diets in terms of health (*n* = 24; one child did not provide pre-intervention diet data). To expand on the concept of healthy eating, participants were also asked to report the number of servings of fruit and vegetables the child ate in a typical day and the number of times per week that the child ate fast food. Pre-intervention Health Questionnaires identified that a large number of children (*n* = 10, 40.0%) were eating only one to two servings of fruit and vegetables per day and ate fast food (*n* = 15, 60.0%) one to two times per week. A summary of selected data from participant's Health Questionnaires can be seen in Table 11 on the following page.

Table 11: Self-Reported Health Data from the Health Questionnaire

CASE	MEDICAL INSURANCE		MODERATE PHYSICAL ACTIVITIES[1]		VIGOROUS PHYSICAL ACTIVITIES[1]		PHYSICAL ACTIVITY PER WEEK[2]		DAILY FRUIT/VEG INTAKE[3]		WEEKLY FAST FOOD INTAKE[2]	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	Yes	Yes	NA	1	NA	1	NA	NA	NA	2	NA	3
2	Yes	Yes	1	1	1	1	2	3	2	2	2	3
3	No	Yes	1	1	1	1	4	3	3	3	1	1
4	Yes	Yes	1	1	1	2	4	4	3	3	2	2
5	Yes	Yes	1	1	1	1	4	3	4	3	1	1
6	Yes	Yes	1	1	1	1	4	3	3	3	2	1
7	Yes	Yes	1	1	1	1	4	4	2	3	2	2
8	Yes	Yes	1	1	1	1	2	3	2	2	2	2
9	Yes	Yes	1	2	1	2	4	4	2	3	2	4
10	Yes	Yes	1	1	2	2	2	4	2	4	2	2
11	Yes	Yes	1	1	3	2	3	4	1	1	2	4
12	No	No	3	2	3	2	3	4	3	3	2	2
13	No	No	2	1	2	1	4	4	2	2	2	2
14	No	No	1	1	1	1	3	4	1	2	2	2
15	Yes	Yes	2	1	2	1	3	3	3	2	3	2
16	Yes	Yes	2	1	2	2	2	3	1	2	3	2
17	No	No	1	1	1	1	3	4	2	3	2	2
18	No	No	1	1	1	1	4	4	3	2	1	1
19	Yes	Yes	1	1	1	1	4	4	3	2	1	1
20	Yes	Yes	1	1	1	1	4	4	3	2	1	1
21	Yes	Yes	1	1	3	1	4	4	2	2	1	1
22	No	No	1	1	1	1	3	3	3	3	1	1
23	Yes	Yes	2	1	2	1	4	4	4	4	2	2
24	Yes	Yes	1	1	1	2	3	1	2	2	2	2
25	Yes	Yes	1	1	1	1	3	1	2	2	2	2

[1] 1 = No limitation, 2 = A little limitation, 3 = A lot of limitation

[2] 1 = 0 times per week, 2 = 1-2 times per week, 3 = 3-4 times per week, 4 = 5 or more times per week

[3] 1 = 0 servings per day, 2 = 1-2 servings per day, 3 = 3-4 servings per day, 4 = 5 or more servings per day

In addition to overall health questions, the Health Questionnaire also asked participants to provide self-report data on one known asthma trigger: environmental tobacco smoke. Participants were asked to report whether or not anyone living in the home smokes tobacco products, as well as were asked whether or not visitors were allowed to smoke tobacco products in the home. During the pre-intervention visit, 13

participants reported that their homes were smoke free (76.5%), where neither residents nor visitors smoke tobacco products; the remaining four households either permitted both occupants and visitors to smoke tobacco products in the home (*n* = 1, 5.9%) or reported that either occupants smoke (*n* = 2, 11.8%) or visitors smoke (*n* = 1, 5.9%). During the post-intervention visit, the number of smoke-free homes increased by one household (*n* = 14, 82.4% of households). Of the three remaining smoking households, two reported that only the occupants smoked tobacco products (11.8% of households), while one household reported that only visitors smoke in the home (5.9% of households).

A summary of self-reported environmental asthma triggers, including the use of tobacco products, as reported on the Resident Questionnaires and the Health Questionnaires can be seen in Table 12 on the following page.

Table 12: Frequency of Self-Reported Environmental Asthma Triggers – by Case and Observation Type

CASE	PRESENCE OF MOLD		IMPROPER FOOD/PET FOOD STORAGE		IMPROPER GARBAGE STORAGE		EVIDENCE OF ROACHES/ PESTS		OCCUPANT/ VISITOR USE OF TOBACCO	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	0	0	1	1	1	0	1	1	1	1
2	1	0	1	0	1	1	1	0	0	0
3	0	0	0	0	1	1	0	0	0	0
4	0	1	0	0	0	0	1	1	0	0
5	0	0	1	0	1	1	1	0	0	0
6	1	0	1	1	1	1	1	0	0	0
7	1	1	0	0	0	0	1	0	0	0
8	1	1	2	1	1	0	1	1	0	0
9	1	0	0	0	1	1	1	1	1	0
10	0	0	1	0	1	0	1	1	1	1
11	0	0	0	0	1	1	0	0	0	0
12	0	0	1	1	1	1	1	0	0	0
13	1	0	0	0	1	0	0	0	2	2
14	0	0	1	0	0	0	1	0	0	0
15	0	0	0	0	1	1	1	1	0	0
16	0	0	2	2	1	1	1	1	0	0
17	0	0	0	0	1	1	1	0	0	0
SUM	6	3	11	6	14	10	14	7	5	4
+ / -	-3		-5		-4		-7		-1	

The Resident Questionnaire and the Health Questionnaire collected self-reported data on the types of environmental asthma triggers (or proxies for environmental asthma triggers) in the home versus overall frequencies. For example, participants were asked to report whether or not pests or their feces could be seen anywhere in the home, as opposed to on a room-by-room basis. As such, any affirmative response (or negative response if the question was phrased oppositely; i.e., “Is garbage contained in a sealable indoor trash can?”) was indicative of a frequency of one for that type of environmental asthma trigger.

The mean frequency of pre-intervention self-reported types of environmental asthma triggers was 2.94 ± 1.30 trigger types (Range: 1 – 5 per household). The most common pre-intervention self-reported environmental asthma trigger types were: garbage not being properly stored in a sealed trash can (a proxy for pest harborage), as well as evidence of pests themselves (n = 14 for both variables). When participants were asked to report on the presence of mold in their home, six households reported either seeing or smelling mold during the pre-intervention visit in at least one room of their home; the rooms most likely to be reported with mold were the kitchen (n = 3) and the bathroom (n = 6).

Post-intervention, improperly stored garbage remained the most frequent type of environmental asthma trigger reported (n = 10) and mold was still most likely to be reported in the bathrooms and the kitchen, although overall reports decreased. During post-intervention visits, participants also reported declines in: the overall frequency of all environmental asthma trigger types reported for all cases (50 pre-intervention instances and 30 post-intervention instances), as well as the frequency of environmental asthma trigger types per case (post-intervention mean = 1.76 ± .97 trigger types; Range: 0 – 4 per household).

The determination of the statistical significance of observed changes, pertaining to the self-reported presence of environmental asthma triggers, is discussed in the upcoming section: Statistical Analysis of Research Hypotheses.

Asthma Supplement. The Asthma Supplement (APPENDIX A) was completed on behalf of the 25 participating asthmatic children ≤17 years old, by their parent/legal

guardian. Self-report data were collected for a variety of measures to ascertain characteristics about the child's asthma.

The mean age of participating children when they were first diagnosed with asthma, as self-reported, was 5.76 ± 5.21 years. When asked during pre-intervention visits if the child used an Asthma Action Plan, the participants reported that the majority of the children (*n* = 16, 64.0%) had never received one; only five children (20.0%) were identified as having a current Asthma Action Plan that was being utilized. Of those five children, three were reported to have an asthma severity classification on the Asthma Action Plan of "mild intermittent", the other two children had severity classifications of "mild persistent" and "moderate persistent" (*n* = 1 for each classification, respectively). There was a slight increase in Asthma Action Plan utilization during post-intervention visits (*n* = 7, 28.0%); still the majority of children (*n* = 15, 60.0%) did not have a current Asthma Action Plan. The five children with reported pre-intervention severity classifications on their Asthma Action Plan did not change classifications; however, the two children with new Asthma Action Plans, as of post-intervention visits, reportedly had severity classifications of: "mild persistent" (*n* = 1) and "moderate persistent" (*n* = 1). Of school-aged participants (*n* = 23), the large majority had made their school nurse aware of their asthma diagnosis, as reported both pre- and post-intervention (*n* = 20, 80.0% and *n* = 22, 88.0%, respectively).

Participants were also asked to report whether or not physical activity and seasonality affected the child's asthma symptoms. Of the children old enough to partake in physical activity (*n* = 24), the majority of children (*n* = 14, 56.0%), during pre-intervention visits, reportedly had difficulty breathing when engaging in physical activity; during post-

intervention visits, this number slightly decreased to 13 children (52.0%). Different times of year were also reportedly more problematic for the asthmatic children, in terms of exacerbating symptoms. Both pre-and post-intervention it was reported that 16 children (64.0%) had more difficulty breathing at least one month out of the year. The mean number of months where the children had more difficulty breathing was 4.00 ± 1.51 months (Range: 2 – 7) pre-intervention and 3.87 ± 1.310 months (Range: 1 – 6) post-intervention. The most problematic season, identified both pre- and post-intervention, was reportedly the five months between October and February, with a reported number of children suffering in these months ranging from seven (February) to thirteen (December).

Participants were also asked to report whether or not the child slept on pillows and mattresses that were covered by allergen-reducing casings. During pre-intervention visits, responses were collected on behalf of 21 children. Of those 21 children, only one child reportedly slept on both a covered pillow and a covered mattress (4.8% of respondents), while two additional children reportedly slept only on a covered mattress (9.5% of respondents). During post-intervention visits, data was not collected for one asthmatic child. However, of the 24 children that provided post-intervention data: 22 children reportedly slept on both a covered pillow and a covered mattress (91.7% of respondents); one child slept on a covered pillow, but not a covered mattress (4.2% of respondents); and one child reportedly did not sleep on either a covered pillow or a covered mattress (4.2% of respondents). Allergen-reducing pillow and mattress covers were two of the supplies provided to participants during intervention visits; a summary of supplies provided to each participant can be seen in APPENDIX L.

Self-Reported Asthma Symptoms. Hypotheses 3 through 3-4 were concerned with the self-reported frequency of symptoms experienced by the asthmatic child in the month prior to the survey. Data collected were ordinal in nature, and although the intervals were not equivalent, increasing numbers along the scales was associated with an increased frequency of asthma symptoms; the ordinal options were consistent with options on validated Asthma Control Tests.

Participants in the home-based childhood asthma intervention study were asked to report the frequency of daytime asthma symptoms experienced by the child during the prior month on a scale from "1" ("zero" symptoms the prior month) to "5" ("multiple times throughout the day" in the prior month). The mean pre-intervention daytime asthma symptom value reported was 2.12 ± 1.20 (Range: 1 – 5), while the mean post-intervention daytime asthma symptom value reported was 1.64 ± .95 (Range 1 – 4). Only one participant reported that pre-intervention, the asthmatic child had been experiencing asthma symptoms "multiple times per day" in the prior month. Post-intervention, the highest frequency of daytime asthma symptoms experienced was "daily", which was reported for two asthmatic children. Additional daytime symptom data can be seen in Table 13 on the following page.

Table 13: Frequency of Self-Reported Asthma Symptoms in the Prior Month – by Case and Symptom Type

CASE	DAYTIME SYMPTOMS[1]		NIGHTTIME SYMPTOMS[2]		SHORT-ACTING MEDICATION[3]		ACTIVITY INTERFERENCE[4]		CASE + / -
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	
1	1	4	2	3	5	2	0	0	1
2	2	2	1	2	1	1	1	3	3
3	1	1	1	1	1	1	1	1	0
4	2	2	2	1	2	1	3	2	-3
5	1	1	1	1	1	1	1	1	0
6	1	1	1	1	1	1	1	1	0
7	2	1	2	1	2	1	4	3	-4
8	1	1	1	1	1	1	2	1	-1
9	2	4	2	3	2	3	1	3	6
10	1	1	1	1	1	1	3	3	0
11	4	1	1	1	1	1	3	3	-3
12	2	3	2	3	2	3	4	3	2
13	2	2	1	2	1	3	1	3	5
14	2	1	4	1	3	1	3	1	-8
15	5	1	2	2	5	1	3	1	-10
16	4	1	2	1	5	1	3	1	-10
17	1	1	1	1	2	1	1	1	-1
18	2	1	5	1	5	1	3	1	-11
19	4	1	5	1	5	1	3	1	-13
20	1	1	1	1	1	1	1	1	0
21	3	2	3	2	3	1	3	3	-4
22	2	1	1	1	3	1	0	0	-3
23	2	2	2	2	2	2	3	4	1
24	4	3	4	4	4	2	1	2	-2
25	1	2	1	2	4	1	1	1	-1
SUM	53	41	49	40	63	34	50	44	
+ / -	-12		-9		-29		-6		

[1] 1 = zero, 2 = 2 times per week or less, 3 = more than 2 times per week, but not daily, 4 = daily, 5 = multiple times throughout the day

[2] 1 = zero, 2 = 2 times per month or less, 3 = 3 – 4 times per month, 4 = more than 1 night per week, but not nightly, 5 = often, 7 times per week

[3] 1 = zero, 2 = 2 times per week or less, 3 = more than 2 times per week, but not daily, 4 = daily, 5 = several times per day

[4] 1 = none, 2 = minor limitation, 3 = some limitation, 4 = extremely limited

Participants in the home-based childhood asthma intervention study were also asked to report the frequency of nighttime asthma symptoms experienced by the child during

the prior month on a scale from "1" ("zero") to "5" ("often, 7 times per week"). The mean pre-intervention nighttime symptom value reported was 1.96 ± 1.27 (Range: 1 – 5), while the post-intervention mean reported was 1.60 ± .87 (Range: 1 – 4). Pre-intervention, two participating children reported the most frequent nighttime asthma symptom value ("5" = "often, 7 times per week); post-intervention the worst nighttime symptom frequency reported was "more than 1 night per week, but not nightly", which was reported by only one participant. Additional nighttime symptom data can be seen in Table 13 above.

The use of short-acting asthma medications is often used as a proxy for the frequency of asthma symptoms experienced; more reliance on short-acting medications mirrors an increase in asthma symptom frequency. As such, participants in the home-based childhood asthma intervention study were asked to report details of the child's medication use. During pre-intervention visits, a reported 23 children (92.0%) used asthma medication that was prescribed by a doctor, while 22 children (88.0%) were reported users of prescription asthma medications at post-intervention. During the pre-intervention visits, 17 children (68.0%) were reported taking controller medications, even when asthma symptoms were not present, while 10 children (40.0%) reportedly took additional short-acting medications only when symptoms were present. Post-intervention use of controller medication increased by one child (n = 18, 72.0%), while post-intervention use of short-acting medications decreased (n = 7, 28.0%). Only 12 participants pre-intervention and seven participants post-intervention reported the cost of asthma medications used in the prior month. The mean pre-intervention amount of money spent on asthma medications was $103.25 ± $142.26; post-intervention, the mean

amount of money spent on asthma medications in the prior month decreased to $75.71 ± $62.61.

Participants were also asked to report on the frequency of short-acting medication use by the child to control asthma symptoms during the prior month on a scale from "1" ("zero" use in the prior month) to "5" (use "several times per day" in the prior month). The mean pre-intervention short-acting medication use value reported was 2.52 ± 1.56 (Range: 1 – 5); the mean post-intervention value was 1.36 ± .70 (Range: 1 – 3). Pre-intervention data identified five children who were using their short-acting medication multiple times per day. The most frequent use of short-acting medication post-intervention was reported as "more than 2 times per week, but not daily" (reported by three children). Additional short-acting medication use data can be seen in Table 13 above.

Interference with normal activities is also used as a proxy for the frequency of asthma symptoms experienced; greater activity limitations mirror an increase in asthma symptom frequency. As such, participants in the home-based childhood asthma intervention study were also asked to report the severity of normal activity interference experienced by the child due to asthma symptoms during the prior month on a scale from "1" ("none") to "4" ("extremely limited"). Two participants were excluded from the activity interference analysis; one because the child was too young to determine effects (9 months old at pre-intervention) and the second because post-intervention activity interference was not reported. Given the remaining sample size of 23 asthmatic children, the mean pre-intervention activity interference value reported was 2.17 ± 1.11 (Range: 1 – 4). The mean post-intervention value reported was 1.91 ± 1.04 (Range: 1 – 4). Pre-intervention

data identified two children who were “extremely limited” in their activities due to asthma; post-intervention only one child was identified as being “extremely limited”. Additional activity limitation data can be seen in Table 13 above.

To evaluate overall changes in symptoms experienced by the asthmatic child, both pre- and post-intervention, the four types of symptoms (or symptom proxies) discussed above were also cumulated for each case. The pre-intervention mean value of all symptom data combined was 8.60 ± 4.00 (Range: 4 – 17), while the post-intervention mean value of all symptoms combined was 6.36 ± 2.93 (Range: 3 – 13). Combined values for all symptoms can be seen in Table 13 above.

Overall, 14 of the 25 participants reduced their overall symptom frequency from pre- to post-intervention; in contrast, six participants increased their overall symptom frequencies and five participants had unchanged cumulative symptoms frequencies from pre- to post-intervention. When looking at specific types of symptoms (or proxies for symptoms), overall participants decreased in each of the four designated areas, with the greatest overall change reported for the use of short-acting medication. While these changes in the raw asthma symptom data are in the expected direction, the determination of the statistical significance of such changes is discussed in the upcoming section: Statistical Analysis of Research Hypotheses.

Self-Reported Use of Health Care Services. Hypotheses 4 through 4-3 were concerned with the self-reported frequency of use of health care services by the child, as a result of their asthma, in the six months prior to the survey. These data were also recorded on the Asthma Supplement, which was completed by the parent/legal guardian on behalf of each of the participating asthmatic children.

Participants in the home-based childhood asthma intervention study were asked to report the frequency of the child's visits to a doctor's office during the prior six months, which were the direct result of asthma; the data were collected on a continuous scale. Participants were also asked to report the frequency, in the prior six months, of emergency room or urgent care facility use, as well as the frequency of overnight hospital admissions as a result of the child's asthma. The mean frequency of asthma-related doctor's visits pre-intervention was 1.96 ± 1.72 doctor's visits (Range: 0 – 6), which was slightly reduced to a mean of 1.48 ± 2.31 visits (Range: 0 – 8) post-intervention. Only three participants reported asthma-related use of an emergency department or urgent care facility pre-intervention (each with only one visit); only one participant reported post-intervention emergency department or urgent care facilities use (only one visit). Only one participant reported pre-intervention asthma-related overnight hospital admittance (with a one reported admittance); no participants reported overnight hospital admittance post-intervention. Raw self-reported health care services use data can be seen in Table 14 on the following page.

Table 14: Frequency of Self-Reported Health Care Services Use in the Prior Six Months – by Case and Service Type

CASE	DOCTOR'S OFFICE VISITS		EMERGENCY ROOM/URGENT CARE VISITS		OVERNIGHT HOSPITAL ADMISSIONS		CASE + / -
	Pre	Post	Pre	Post	Pre	Post	
1	6	2	0	0	0	0	-4
2	0	1	0	0	0	0	1
3	0	0	0	0	0	0	0
4	2	1	0	0	0	0	-1
5	1	0	0	0	0	0	-1
6	1	0	0	0	0	0	-1
7	1	0	0	0	0	0	-1
8	0	0	0	0	0	0	0
9	1	0	1	0	0	0	-2
10	3	0	0	0	0	0	-3
11	0	0	0	0	0	0	0
12	2	7	0	0	0	0	5
13	1	4	0	0	0	0	3
14	2	0	0	0	0	0	-2
15	5	1	0	0	0	0	-4
16	5	1	0	0	0	0	-4
17	1	1	0	0	0	0	0
18	2	0	0	0	0	0	-2
19	2	0	0	0	0	0	-2
20	2	0	0	0	0	0	-2
21	2	2	1	1	0	0	0
22	3	8	0	0	0	0	5
23	5	1	1	0	1	0	-6
24	2	6	0	0	0	0	4
25	0	2	0	0	0	0	2
SUM	49	37	3	1	1	0	
+ / -	-12		-2		-1		

Overall, fourteen participants reported post-intervention declines in the use of health care services for asthma, while six participants increased their use of health care services and five participants did not change their asthma-related health care services use from pre- to post-intervention. In terms of health care service type, the greatest overall

declines from pre- to post-intervention were seen in the use of doctor's office visits for asthma. The frequency of reported asthma-related emergency room or urgent care facilities visits, as well as the frequency of overnight hospitals admissions for asthma were remarkably small both pre- and post-intervention. Due to the extremely low sample size, the frequency of use of emergency rooms/urgent care facilities and the frequency of overnight hospital admissions could not be individually analyzed; however, the frequencies for these two measures were included in the overall cumulative analysis regarding asthma-related use of health care services. The determination of the statistical significance of any changes pertaining to the asthma-related use of health care services is discussed in the upcoming section: Statistical Analysis of Research Hypotheses.

Self-Reported Burden. The self-reported burden of asthma, in terms of missed school days and missed work days, was also identified on the Asthma Supplement. Participants in the home-based childhood asthma intervention study were asked to report the frequency of missed school days during the prior month, which were the direct result of asthma symptoms. Participants were also asked to report the frequency of missed work days during the prior month (spent by the caregiver caring for the child suffering from asthma symptoms); in both instances, the data were collected on a continuous scale.

The mean frequency of pre-intervention missed school days due to asthma was .50 ± .97 days (Range: 0 – 3), which decreased to a post-intervention mean frequency of zero missed school days. The mean frequency of missed work days by caregiver's was .15 ± .56 days pre-intervention (Range: 0 – 2) and .77 ± 1.92 days post intervention (Range: 0 – 6). Additional burden data can be seen in Table 15 on the following page.

Table 15: Burden of Asthma as Measured by Prior Month Missed School and Missed Work Days

CASE	MISSED SCHOOL DAYS		CASE	MISSED WORK DAYS	
	Pre	Post		Pre	Post
1*	NA	NA	1*	0	NA
2	0	0	2*	NA	NA
3	0	0	3	0	0
4	0	0	4*	NA	NA
5	0	0	5	0	0
6	0	0	6	0	0
7	0	0	7*	NA	0
8	0	0	8*	NA	NA
9*	NA	4	9	0	4
10	0	0	10	0	0
11	0	0	11	0	0
12*	4	NA	12*	NA	8
13*	3	NA	13*	NA	3
14*	30	NA	14*	NA	0
15	0	0	15	0	0
16	0	0	16	0	0
17	2	0	17	0	0
18	2	0	18*	NA	0
19	1	0	19*	NA	0
20	0	0	20*	NA	0
21	0	0	21	0	0
22	3	0	22	0	0
23	0	0	23*	0	NA
24	0	0	24	2	6
25	0	0	25	0	0

* Cases were excluded from analysis for failure to report both pre- and post-intervention data

Asthma Assessment. The Asthma Assessment test (APPENDIX A) was administered to the head of household during both the pre-intervention and the post-intervention visits. The Asthma Assessment test was not developed until later in the study period. As such, the first two participants in the home-based childhood asthma intervention study were not issued the test during the pre-intervention; one participant did

complete the Asthma Assessment post-intervention, but those data were excluded from analysis. Of the 15 Asthma Assessment tests that were completed, one was completed by the asthmatic child's legal guardian, one participant failed to indicate their relationship to the asthmatic child, one was completed by the asthmatic child's biologic father, and the remaining 12 were completed by the asthmatic children's biologic mothers.

Asthma Assessment tests were scored with one point being awarded for each correct answer on the true/false test; scores were summed for each case. A total of 20 points were possible, divided equally (five points each) amongst four topic areas: Asthma Symptoms, Asthma Triggers, Asthma Management, and Asthma Prevention. Results of the Asthma Assessment test are depicted in Table 16 on the following page.

Table 16: Caregiver Knowledge Scores on the Asthma Assessment Test

CASE	ASTHMA SYMPTOMS		ASTHMA TRIGGERS		ASTHMA MANAGEMENT		ASTHMA PREVENTION		CASE + / -
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	
1	NA	NA	NA	NA	NA	NA	NA	NA	NA
2	NA	5	NA	5	NA	4	NA	5	NA
3	5	5	5	4	5	5	5	5	-1
4	5	5	5	5	5	5	5	5	0
5	3	4	5	5	4	5	5	4	1
6	4	5	5	5	4	5	4	4	2
7	5	3	5	5	5	3	5	4	-5
8	5	5	5	5	2	5	5	5	3
9	4	3	1	1	2	2	3	3	-1
10	4	4	5	3	3	3	4	3	-3
11	4	4	4	5	4	4	5	5	1
12	4	4	4	5	4	5	5	5	2
13	4	4	4	4	5	5	5	5	0
14	5	5	5	5	4	4	4	4	0
15	5	5	4	5	4	4	4	4	1
16	5	5	5	5	5	5	5	5	0
17	4	5	5	5	5	5	5	5	1
SUM*	66	66	67	67	61	65	69	66	
+ / -	0		0		4		-3		

* Data from Cases 1 and 2 were not collected both pre- and post-intervention; Cases 1 and 2 were excluded from analysis

The mean score (out of 20) on the Asthma Assessment was 17.53 ± 2.50 pre-intervention (Range: 10 – 20) and 17.60 ± 3.07 post-intervention (Range: 9 – 20). Of the 15 caregivers that provided both pre- and post-intervention scores: seven improved their scores, four received lower scores post-intervention, and four caregiver total scores did not change.

Cumulative caregiver scores on the Asthma Assessment (for all cases combined) remained the same both pre- and post-intervention for the topic areas: Asthma Symptoms and Asthma Triggers. Three caregivers increased their Asthma Symptom scores (by

three total points); while two reduced their scores (by three total points) and ten caregivers maintained the same Asthma Symptom score. Three caregivers also increased their Asthma Trigger score (by three total points), while, again, two reduced their scores (by three total points) and ten scores remained unchanged.

Cumulative scores in the area of Asthma Management improved post-intervention, while cumulative scores in the area of Asthma Prevention decreased post-intervention. Four caregivers increased their Asthma Management scores (by six total points), while only one caregiver decreased their score (by two points); the remaining caregivers retained the same Asthma Management scores. In regards to Asthma Prevention, no caregivers improved their knowledge score; three caregivers decreased their scores (by three total points), while the remaining twelve caregivers' Asthma Prevention scores did not change pre- to post-intervention. The determination of the statistical significance of these changes in caregiver knowledge is discussed in the upcoming section: Statistical Analysis of Research Hypotheses.

Visual Assessment Checklist. During both the pre- and post-intervention home visits, study investigators that were trained as NEHA-certified Healthy Homes Specialists conducted room-by-room visual inspections of each home, as well as of the immediate home exterior (i.e., front and back yards). During the inspections, investigators indicated the observed cleanliness and clutter of each accessible area on a scale of 0 – 3 (i.e., 0 = not clean, 1 = some clean, and 2 = clean, and 0 = high clutter, 1 = medium clutter, and 2 = low clutter, respectively). The mean cleanliness rating for home exteriors (front yards and back yards combined) during the pre-intervention visit was 1.35 ± .745, which indicated that most homes had at least partially clean exteriors. For the post-intervention

assessment, the mean exterior cleanliness rating increased slightly to 1.47 ± .72, although two homes did not provide exterior cleanliness data. In terms of exterior clutter, pre-intervention inspections indicated that the mean exterior clutter rating was 1.59 ± .46; post-intervention the mean rating was nearly the same at 1.50 ± .60. Overall, home exteriors were generally assessed as having moderate to low levels of clutter.

To assess the cleanliness and clutter ratings of the interior of the homes overall, the individual ratings for each interior room (e.g., living room, kitchen, bathroom, and bedrooms) were summed and the summation was then divided by the number of rooms assessed, for each participating home. When looking at all of the participating homes together, the mean pre-intervention interior cleanliness rating was 1.65 ± .40, indicating that most homes were at least partially clean; post-intervention, the interior cleanliness value was nearly identical, with a mean rating of 1.66 ± .48. In terms of interior clutter, participating homes also had generally low-to-medium clutter levels. The mean pre-intervention interior clutter rating was 1.71 ± .32, which varied only slightly from the post-intervention mean of 1.65 ± .31, although this slight decline moved towards a higher level of clutter.

During both the pre- and post-intervention inspections, study investigators were also interested in identifying the presence of environmental asthma triggers. Whenever an environmental asthma trigger was observed (or a proxy for an environmental asthma trigger was observed), it was also indicated on the Visual Assessment Checklist (APPENDIX A). Nine environmental asthma trigger observation types were selected from the Visual Assessment Checklist for analysis. If the selected observation was made in any room of the home, a frequency of one was assigned. Subsequently, all instances

were summed for each case. Frequencies for eight of the nine observation types of interest can be seen in Table 17 below; the ninth observation of interest (evidence of rodents) was excluded, as none of the participants had evidence of rodents observed in their home in either the pre- or post-intervention visits.

Table 17: Frequency of Observed Environmental Asthma Triggers – by Case and Observation Type

CASE	UNVENTED GAS APPLIANCE		MOLD - OBVIOUS SOURCE		MOLD - NO OBVIOUS SOURCE		EVIDENCE OF TOBACCO SMOKING		IMPROPER STORED FOOD/PET FOOD		IMPROPER STORED GARBAGE		EVIDENCE OF ROACHES		EVIDENCE OF PEST CONTROL PRODUCTS	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	1	1	1	2	1	0	2	3	2	2	3	0	7	3	1	5
2	0	0	0	0	0	0	0	0	2	2	3	3	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
5	1	0	0	0	0	0	0	0	3	1	1	0	0	0	1	0
6	0	1	0	1	0	0	0	0	2	0	1	2	0	0	0	0
7	1	1	0	0	0	0	0	0	0	0	3	2	3	3	1	1
8	0	1	0	0	0	0	0	0	1	1	3	1	0	1	0	0
9	0	0	1	0	0	0	0	0	1	0	1	4	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	2	3	5	3	1	0
11	1	2	0	0	0	0	0	0	0	1	2	1	0	0	0	0
12	2	0	0	1	0	0	1	0	1	0	0	0	0	0	1	1
13	0	0	1	0	0	0	1	1	1	0	1	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	3	4	0	0	0	0
15	0	0	1	0	0	0	1	0	1	1	1	1	5	6	0	0
16	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	1
17	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
SUM	8	7	5	4	1	0	5	5	15	9	26	23	20	16	5	8
+ / -	-1		-1		-1		0		-6		-3		-4		3	

The mean number of overall environmental asthma trigger instances observed, per household, pre-intervention was 4.71 ± 3.87 triggers (Range: 0 – 17), while the mean number of asthma trigger instances observed, per household, post-intervention was 3.76 ±

2.97 triggers (Range: 0 – 11). Environmental asthma triggers were most likely to have been observed in the kitchen (pre-intervention = 29 observations for all cases; post-intervention = 22 observations for all cases) and the bathrooms (pre-intervention = 21 observations amongst all bathrooms; post-intervention = 17 observations amongst all bathrooms; [some homes had up to three bathrooms]).

The most commonly observed condition in participating homes, both pre- and post-intervention, was the presence of "improperly stored garbage" (e.g., interior trash receptacles without lids, trash not placed in proper receptacles; overflowing receptacles not removed from the premises). All but three of the participating homes had issues with improperly stored garbage identified in at least one room in the home. The least commonly observed condition (with the exception of the excluded "evidence of rodents") was the presence of "mold without an obvious source of moisture"; this observation was made in only one participating home during pre-intervention and in none of the homes post-intervention. However, if one considers this observation to be closely related to the observation of "mold with an obvious source of moisture", then the least commonly observed conditions (both with an overall frequency of five observations pre-intervention, and with five and eight observations post-intervention, respectively) were "evidence of tobacco smoke or other usage" and "evidence of the use of pest control products".

To look at the data collected on the Visual Assessment Checklist differently, the frequency of the types of observations made, versus the overall frequency of observations (which was cumulated for every room where the observation was made), was also examined. For this analysis, an observation frequency of greater than or equal to one was

given a value of "1" for each observation type; the lack of an observation in any area of the home for a particular observation type was assigned a value of "0". The frequency of types was then summed for each case. Excluding "evidence of the use of pest control products" (as discussed below), there were seven distinct environmental asthma trigger (or trigger proxy) observation types. The mean frequency of observation types for participating homes pre-intervention was 2.65 ± 1.62 types (Range: 0 – 7) and was 2.06 ± 1.48 post-intervention types (Range: 0 – 5); these frequencies are substantially lower than the overall observed frequencies, as many participating homes had more than one instance of an observation type (e.g., "evidence of cockroaches") due to the observation being made in multiple rooms of the same home (e.g., cockroaches observed in the kitchen, the bathroom, and the bedrooms).

When looking within each observation type individually, the overall frequency of observations from pre- to post-intervention: decreased for six types; did not change for one; and increased for the remaining one type ("evidence of use of pest control products"). Pest control products were most likely to be observed in the kitchen of participating homes (four observations both pre- and post-intervention, respectively). As the use of pest control products may be considered protective against pests that are recognized environmental asthma triggers, this observation was excluded from the statistical analysis of Hypothesis 1-2.

The determination of the statistical significance of observed changes, pertaining to the presence of environmental asthma triggers, is discussed in the upcoming section: Statistical Analysis of Research Hypotheses.

Statistical Analysis of Research Hypotheses

Statistical analysis was conducted on data collected from the 17 unique, participating homes, and the 25 asthmatic children that resided in those homes. Statistical analysis of study hypotheses was conducted using the IBM SPSS Statistics 20 statistical software package.

Hypotheses 1-1 and 1-2: Presence of Environmental Asthma Triggers. The presence of environmental asthma triggers (or proxies for environmental asthma triggers) both pre- and post-intervention was ascertained using self-reported data from the Resident Questionnaire and the Health Questionnaire, in addition to observations recorded on the Visual Assessment Checklist; manipulations to the data prior to statistical analysis were previously described. The alternate hypotheses predicted that the median frequency of environmental asthma triggers would decrease post-intervention (Hypothesis 1-1 utilized self-report data; Hypothesis 1-2 utilized observed data).

$H_{1\text{-}10}$: $Md_{\text{pre-int}} = Md_{\text{post-int}}$
$H_{1\text{-}1A}$: $Md_{\text{pre-int}} > Md_{\text{post-int}}$

$H_{1\text{-}20:}$ $Md_{\text{pre-int}} = Md_{\text{post-int}}$
$H_{1\text{-}2A:}$ $Md_{\text{pre-int}} > Md_{\text{post-int}}$

To analyze the difference in median environmental asthma trigger presence before and after the intervention, a Wilcoxon signed ranks test was conducted individually for both the self-report data and the observed data. Table 18, on the following page, defines the variables used for analysis of Hypotheses 1-1 and 1-2.

Table 18: Variable Definitions for Hypotheses 1-1 and 1-2

VARIABLE CODE	VARIABLE DESCRIPTION
PREtrigg_types_SR	Pre-intervention, self-reported data regarding the presence of types of environmental asthma triggers in the home
POSTtrigg_types_SR	Post-intervention, self-reported data regarding the presence of types of environmental asthma triggers in the home
PREtriggers	Pre-intervention, observed data regarding the overall frequency of environmental asthma triggers in the home
POSTtriggers	Post-intervention, observed data regarding the overall frequency of environmental asthma triggers in the home
PREtrig_types	Pre-intervention, observed data regarding the types of environmental asthma triggers in the home
POSTtrig_types	Post-intervention, observed data regarding the types of environmental asthma triggers in the home

Results of the statistical analyses of Hypothesis 1-1 and 1-2 can be seen in Tables 19 – 20 below and Tables 21 – 22 on the following page.

Table 19: Signed Ranks for Hypothesis 1-1

Ranks

		N	Mean Rank	Sum of Ranks
POSTtrigg_types_SR - PREtrigg_types_SR	Negative Ranks	12[a]	7.33	88.00
	Positive Ranks	1[b]	3.00	3.00
	Ties	4[c]		
	Total	17		

a. POSTtrigg_types_SR < PREtrigg_types_SR

b. POSTtrigg_types_SR > PREtrigg_types_SR

c. POSTtrigg_types_SR = PREtrigg_types_SR

Table 20: Test Statistics for Hypothesis 1-1

Test Statistics[a]

	POSTtrigg_types_SR - PREtrigg_types_SR
Z	-3.042[b]
Asymp. Sig. (2-tailed)	.002

a. Wilcoxon Signed Ranks Test

b. Based on positive ranks

The two-tailed significance value (p = .002) was transformed into a one-tailed significance value of p = .001; results indicated that there was a statistically significant difference between the self-reported frequency of types of environmental asthma triggers pre-intervention and the frequency of self-reported types of environmental asthma triggers post-intervention. The direction of change was as expected; therefore, the null Hypothesis 1-1 is rejected and the alternate Hypothesis 1-1 (median frequency of self-reported environmental asthma triggers would be reduced) is accepted. The test was repeated for Hypothesis 1-2 (observed environmental asthma triggers), with results indicated below.

Table 21: Signed Ranks for Hypothesis 1-2

Ranks

		N	Mean Rank	Sum of Ranks
POSTtriggers - PREtriggers	Negative Ranks	8[a]	8.56	68.50
	Positive Ranks	5[b]	4.50	22.50
	Ties	4[c]		
	Total	17		

a. POSTtriggers < PREtriggers

b. POSTtriggers > PREtriggers

c. POSTtriggers = PREtriggers

Table 22: Test Statistics for Hypothesis 1-2

Test Statistics[a]

	POSTtriggers - PREtriggers
Z	-1.651[b]
Asymp. Sig. (2-tailed)	.099

a. Wilcoxon Signed Ranks Test

b. Based on positive ranks.

The two-tailed significance value (p = .099) was transformed into a one-tailed significance value of p = .050; results indicated that there was a statistically significant difference between observed environmental asthma triggers from pre- to post-intervention. The direction of change was as expected; therefore, the null Hypothesis 1-2 is rejected and the alternate Hypothesis 1-2 (median frequency of observed environmental asthma triggers would be reduced) is accepted.

A second Wilcoxon signed rank test was also performed to determine differences in pre- and post-intervention frequency of environmental asthma trigger observations in terms of the type of observation made. Results from the analysis of observation types can be seen in Tables 23 and 24 below.

Table 23: Signed Ranks for Hypothesis 1-2 by Types

Ranks

		N	Mean Rank	Sum of Ranks
POSTtrig_types - PREtrig_types	Negative Ranks	7[a]	7.57	53.00
	Positive Ranks	4[b]	3.25	13.00
	Ties	6[c]		
	Total	17		

a. POSTtrig_types < PREtrig_types

b. POSTtrig_types > PREtrig_types

c. POSTtrig_types = PREtrig_types

Table 24: Test Statistics for Hypothesis 1-2 by Types

Test Statistics[a]

	POSTtrig_types - PREtrig_types
Z	-1.833[b]
Asymp. Sig. (2-tailed)	.067

a. Wilcoxon Signed Ranks Test

b. Based on positive ranks.

The two-tailed significance value (p = .067) was transformed into a one-tailed significance value of p = .034; results indicated that there was a statistically significant difference between the frequency of observed environmental asthma trigger types pre-intervention and the frequency of observed environmental asthma trigger types post-intervention. The direction of change was again as expected; further supporting the conclusion to reject the null Hypothesis 1-2 and to accept the alternate Hypothesis 1-2.

The study investigator was also interested in identifying any differences between self-reported and observed environmental asthma triggers types. There were five types of environmental asthma triggers (or environmental asthma trigger proxies) that were assessed by both self-report and observed measures: 1) presence of mold, 2) presence of environmental tobacco smoke; 3) improperly stored food or pet food; 4) improperly stored garbage; and 5) evidence of cockroaches or other pests. The mean pre-intervention number of these environmental asthma trigger types was: 2.76 ± 1.15 types as self-reported (Range: 1 – 4) and 2.18 ± 1.38 types as observed (Range: 0 – 5). The mean post-intervention number of these environmental asthma trigger types was 1.65 ± .86 types as self-reported (Range: 0 – 3) and 1.65 ± 1.06 types as observed (Range: 0 – 4). The difference in pre-intervention medians was statistically significant (p = .032); pre-intervention frequencies of environmental asthma triggers were significantly greater for self-report data than for observed data. There was no significant difference between self-reported and observed frequencies during post-intervention.

Hypothesis 2: Caregiver Knowledge about Asthma. The level of caregiver knowledge about asthma both pre- and post-intervention was ascertained using self-reported data from the Asthma Assessment; manipulations to the data prior to statistical

analysis were described above. The alternate hypothesis predicted that the median score on the Asthma Assessment test would increase post-intervention.

H_{20}: $Md_{\text{pre-int}} = Md_{\text{post-int}}$
H_{2A}: $Md_{\text{pre-int}} < Md_{\text{post-int}}$

To analyze the difference in caregivers' median knowledge score before and after the intervention (variable codes: PREedu and POSTedu, respectively), a Wilcoxon signed ranks test was conducted. Results of the analysis can be seen in Tables 25 and 26 below.

Table 25: Signed Ranks for Hypothesis 2

Ranks

		N	Mean Rank	Sum of Ranks
POSTedu - PREedu	Negative Ranks	4[a]	6.88	27.50
	Positive Ranks	7[b]	5.50	38.50
	Ties	4[c]		
	Total	15		

a. POSTedu < PREedu

b. POSTedu > PREedu

c. POSTedu = PREedu

Table 26: Test Statistics for Hypothesis 2

Test Statistics[a]

	POSTedu - PREedu
Z	-.498[b]
Asymp. Sig. (2-tailed)	.618

a. Wilcoxon Signed Ranks Test

b. Based on negative ranks.

The two-tailed significance value ($p = .618$) was transformed into a one-tailed significance value of $p = .309$; results indicated that there was not a statistically

significant difference between caregivers' asthma knowledge scores pre-intervention and their asthma knowledge scores post-intervention. Therefore, there is a failure to reject the null Hypothesis 2, which indicated that median caregivers' asthma knowledge scores did not significantly change from pre- to post-intervention.

Hypotheses 3 and 3-1 through 3-4: Asthma Symptoms. The frequency of symptoms experienced by the asthmatic child participants both pre- and post-intervention was ascertained using self-reported data from the Asthma Supplement; manipulations to the data prior to statistical analysis were described above. The alternate hypotheses predicted that the median frequency of asthma symptoms (and symptom proxies) experienced by the child in the prior month would decrease post-intervention. Changes in asthma symptoms (and symptom proxies) were analyzed individually for: daytime symptoms (Hypothesis 3-1); nighttime symptoms (Hypothesis 3-2); the use of short-acting medication (Hypothesis 3-3); and activity restrictions (Hypothesis 3-4). Cumulative changes in asthma symptom frequency were also analyzed to satisfy the testing of the overarching Hypothesis 3.

H_{30}: $Md_{\text{pre-int}} = Md_{\text{post-int}}$
H_{3A}: $Md_{\text{pre-int}} > Md_{\text{post-int}}$

$H_{3\text{-}10}$: $Md_{\text{pre-int}} = Md_{\text{post-int}}$
$H_{3\text{-}1A}$: $Md_{\text{pre-int}} > Md_{\text{post-int}}$

$H_{3\text{-}20}$: $Md_{\text{pre-int}} = Md_{\text{post-int}}$
$H_{3\text{-}2A}$: $Md_{\text{pre-int}} > Md_{\text{post-int}}$

$H_{3\text{-}30}$: $Md_{\text{pre-int}} = Md_{\text{post-int}}$
$H_{3\text{-}3A}$: $Md_{\text{pre-int}} > Md_{\text{post-int}}$

$H_{3\text{-}40}$: $Md_{\text{pre-int}} = Md_{\text{post-int}}$
$H_{3\text{-}4A}$: $Md_{\text{pre-int}} > Md_{\text{post-int}}$

To analyze the difference in median frequency of asthma symptoms (and symptom proxies) before and after the intervention, Wilcoxon signed ranks tests were conducted. Table 27 below defines the variables used for analysis of Hypotheses 3 through 3-4.

Table 27: Variable Definitions for Hypotheses 3 through 3-4

VARIABLE CODE	VARIABLE DESCRIPTION
PREsymp_day	Pre-intervention, self-reported data regarding the frequency of daytime asthma symptoms experienced by the child
POSTsymp_day	Post-intervention, self-reported data regarding the frequency of daytime asthma symptoms experienced by the child
PREsymp_night	Pre-intervention, self-reported data regarding the frequency of nighttime asthma symptoms experienced by the child
POSTsymp_night	Post-intervention, self-reported data regarding the frequency of nighttime asthma symptoms experienced by the child
PREmed_use	Pre-intervention, self-reported data regarding the frequency of use of short-acting medications by the child
POSTmed_use	Post-intervention, self-reported data regarding the frequency of use of short-acting medications by the child
PREact_int	Pre-intervention, self-reported data regarding the child's degree of normal activity interference due to asthma
POSTact_int	Post-intervention, self-reported data regarding the child's degree of normal activity interference due to asthma
PREsym_comb	Pre-intervention, summation of the four self-reported asthma symptom measures discussed above
POSTsym_comb	Post-intervention, summation of the four self-reported asthma symptom measures discussed above

Results of the statistical analyses of Hypotheses 3 through 3-4 can be seen in Table 28 and Table 29 on the following pages.

Table 28: Signed Ranks for Hypotheses 3 through 3-4

Ranks

		N	Mean Rank	Sum of Ranks
POSTsymp_day – PREsymp_day	Negative Ranks	10[a]	7.55	75.50
	Positive Ranks	4[b]	7.38	29.50
	Ties	11[c]		
	Total	25		
POSTsymp_night – PREsymp_night	Negative Ranks	7[d]	8.29	58.00
	Positive Ranks	6[e]	5.50	33.00
	Ties	12[f]		
	Total	25		
POSTmed_use – PREmed_use	Negative Ranks	13[g]	9.38	122.00
	Positive Ranks	3[h]	4.67	14.00
	Ties	9[i]		
	Total	25		
POSTact_int – PREact_int	Negative Ranks	9[j]	7.39	66.50
	Positive Ranks	5[k]	7.70	38.50
	Ties	9[l]		
	Total	23		
POSTsym_comb – PREsym_comb	Negative Ranks	14[m]	11.36	159.00
	Positive Ranks	6[n]	8.50	51.00
	Ties	5[o]		
	Total	25		

a. POSTsymp_day < PREsymp_day
b. POSTsymp_day > PREsymp_day
c. POSTsymp_day = PREsymp_day
d. POSTsymp_night < PREsymp_night
e. POSTsymp_night > PREsymp_night
f. POSTsymp_night = PREsymp_night
g. POSTmed_use < PREmed_use
h. POSTmed_use > PREmed_use
i. POSTmed_use = PREmed_use
j. POSTact_int < PREact_int
k. POSTact_int > PREact_int
l. POSTact_int = PREact_int
m. POSTsym_comb < PREsym_comb
n. POSTsym_comb > PREsym_comb
o. POSTsym_comb = PREsym_comb

Table 29: Test Statistics for Hypotheses 3 through 3-4

Test Statistics[a]

	POSTsymp_day – PREsymp_day	POSTsymp_night – PREsymp_night	POSTmed_use – PREmed_use	POSTact_int – PREact_int	POSTsym_comb – PREsym_comb
Z	-1.478[b]	-.922[b]	-2.816[b]	-.906[b]	-2.022[b]
Asymp. Sig. (2-tailed)	.139	.357	.005	.365	.043

a. Wilcoxon Signed Ranks Test

b. Based on positive ranks.

The two-tailed significance value (p = .043) was transformed into a one-tailed significance value of p = .022; results indicated that there was a statistically significant difference between the cumulative frequency of asthma symptoms (and symptom proxies) pre-intervention and the cumulative frequency of asthma symptoms (and symptom proxies) post-intervention. The direction of change was as expected; therefore, the null Hypothesis 3 is rejected and the alternate Hypothesis 3 (median self-reported asthma symptoms would decrease) is accepted.

When looking at the types of asthma symptoms (and symptom proxies) individually, differences emerge. The two-tailed significance value for daytime asthma symptoms (p = .139) was transformed into a one-tailed significance value of p = .070; although the direction of change was as expected and the change was approaching significance, results indicated that there was not a statistically significant difference between the frequency of daytime asthma symptoms from pre- to post-intervention. Therefore, there is a failure to reject the null Hypothesis 3-1, which indicated that the median frequency of daytime asthma symptoms alone did not significantly change after intervention.

Additionally, the results indicated that there was not a statistically significant difference between the frequency of nighttime asthma symptoms pre-intervention and the frequency of nighttime asthma symptoms post-intervention (two-tailed significance value, $p = .357$; one-tailed significance value, $p = .179$). Therefore, there is a failure to reject the null Hypothesis 3-2, which indicated that the frequency of nighttime asthma symptoms alone did not significantly change after intervention.

The frequency of use of short-acting asthma medication was also analyzed separately. The two-tailed significance value ($p = .005$) was transformed into a one-tailed significance value of $p = .003$; results indicated that there was a statistically significant difference between the frequency of short-acting medication use from pre- to post-intervention. Further, the direction of change was as expected; therefore, the null Hypothesis 3-3 is rejected and the alternate Hypothesis 3-3 (median frequency of use of short-acting asthma medication will decrease) is accepted.

Finally, the level of normal activity interference due to asthma was also analyzed separately. With a one-tailed significance value of $p = .183$, the results indicated that there was not a statistically significant difference between the level of activity interference due to asthma pre-intervention and the level of activity interference due to asthma post-intervention. Therefore, there is a failure to reject the null Hypothesis 3-4, which indicated that median activity limitations due to asthma alone did not significantly change after intervention.

Hypothesis 4 through 4-3: Use of Health Care Services. The pre- and post-intervention frequencies of use of health care services as a result of pediatric asthma were ascertained using self-reported data from the Asthma Supplement; manipulations to the

data prior to statistical analysis were described above. The alternate hypotheses predicted that the median frequency of use of health care services for asthma in the prior six months would decrease post-intervention.

H_{40}: $Md_{\text{pre-int}} = Md_{\text{post-int}}$
H_{4A}: $Md_{\text{pre-int}} > Md_{\text{post-int}}$

$H_{4\text{-}10}$: $Md_{\text{pre-int}} = Md_{\text{post-int}}$
$H_{4\text{-}1A}$: $Md_{\text{pre-int}} > Md_{\text{post-int}}$

$H_{4\text{-}20}$: $Md_{\text{pre-int}} = Md_{\text{post-int}}$
$H_{4\text{-}2A}$: $Md_{\text{pre-int}} > Md_{\text{post-int}}$

$H_{4\text{-}30}$: $Md_{\text{pre-int}} = Md_{\text{post-int}}$
$H_{4\text{-}3A}$: $Md_{\text{pre-int}} > Md_{\text{post-int}}$

Changes in doctor's office use (Hypothesis 4-1) were analyzed individually. Due to inadequate sample size, changes in the use of emergency room/urgent care facilities (Hypothesis 4-2), as well as changes in overnight hospital admissions (Hypothesis 4-3) could not be analyzed. However, data reported for these categories were used to analyze cumulative changes in asthma-related use of health care services (Hypothesis 4).

To analyze the difference in median frequency of health care services use before and after the intervention, Wilcoxon signed ranks tests were conducted. Table 30 on the following page defines the variables used for analysis of Hypotheses 4 and 4-1.

Table 30: Variable Definitions for Hypotheses 4 and 4-1

VARIABLE CODE	VARIABLE DESCRIPTION
PREdr_off	Pre-intervention, self-reported data regarding the frequency of doctor's office visits in the past six months as a result of the child's asthma
POSTdr_off	Post-intervention, self-reported data regarding the frequency of doctor's office visits in the past six months as a result of the child's asthma
PREhc_comb	Pre-intervention, summation of the three self-reported healthcare use measures (doctor's office visits, emergency room/urgent care visits, and hospital admission)
POSThc_comb	Post-intervention, summation of the three self-reported healthcare use measures (doctor's office visits, emergency room/urgent care visits, and hospital admission)

Results of the statistical analyses of Hypotheses 4 and 4-1 can be seen in Table 31 below and Table 32 on the following page.

Table 31: Signed Ranks for Hypotheses 4 and 4-1

Ranks

		N	Mean Rank	Sum of Ranks
POSTdr_off - PREdr_off	Negative Ranks	14[a]	9.29	130.00
	Positive Ranks	6[b]	13.33	80.00
	Ties	5[c]		
	Total	25		
POSThc_comb - PREhc_comb	Negative Ranks	14[d]	9.54	133.50
	Positive Ranks	6[e]	12.75	76.50
	Ties	5[f]		
	Total	25		

a. POSTdr_off < PREdr_off

b. POSTdr_off > PREdr_off

c. POSTdr_off = PREdr_off

d. POSThc_comb < PREhc_comb

e. POSThc_comb > PREhc_comb

f. POSThc_comb = PREhc_comb

Table 32: Test Statistics for Hypotheses 4 and 4-1

Test Statistics[a]

	POSTdr_off - PREdr_off	POSThc_comb - PREhc_comb
Z	-.940[b]	-1.070[b]
Asymp. Sig. (2-tailed)	.347	.285

a. Wilcoxon Signed Ranks Test

b. Based on positive ranks.

In terms of the overall cumulative frequency of health care visits due to asthma (doctor's offices, emergency rooms/urgent care facilities, and hospital admissions) in the prior six months, the results indicated a two tailed significance value (p = .285), which was transformed into a one-tailed significance value of p = .143. Results indicated that there was not a statistically significant difference between pre- and post-intervention health care utilization; therefore, there is a failure to reject the null Hypothesis 4, which indicated that there was not a significant change in the median frequency of use of health care services (combined) after intervention.

The frequency of visits to doctor's office due to asthma in the prior six months was also analyzed separately. The two-tailed significance value (p = .347) was transformed into a one-tailed significance value of p = .174; results indicated that there was not a statistically significant difference between pre- and post-intervention frequency of doctor's office visits. Therefore, there is a failure to reject the null Hypothesis 4-1, which indicated that the median frequency of doctor's office visits due to asthma in the prior six months did not significantly change after intervention. As mentioned above, the sample size was inadequate to analyze proposed Hypotheses 4-2 and 4-3.

Hypotheses 5 and 6: Burden of Asthma. The burden of asthma is often described in terms of missed school days by the child, due to asthma, and missed work days by caregivers tending to the asthmatic child. The pre- and post-intervention frequencies of missed school days and missed work days as a result of pediatric asthma were ascertained using self-reported data from the Asthma Supplement; manipulations to the data prior to statistical analysis were described above. The alternate hypotheses predicted that the median frequency of missed school days (variable code: PREmiss_sch) and the median frequency of missed work days (variable code: PREmiss_wrk) would decrease post-intervention (variable codes: POSTmiss_sch and POSTmiss_wrk, respectively).

H_{50}: $Md_{\text{pre-int}} = Md_{\text{post-int}}$
H_{5A}: $Md_{\text{pre-int}} > Md_{\text{post-int}}$

H_{60}: $Md_{\text{pre-int}} = Md_{\text{post-int}}$
H_{6A}: $Md_{\text{pre-int}} > Md_{\text{post-int}}$

Results of the statistical analyses of Hypotheses 5 and 6 can be seen in Table 33 below and Tables 34 through 36 on the following page.

Table 33: Signed Ranks for Hypothesis 5

Ranks

		N	Mean Rank	Sum of Ranks
POStmiss_sch - PREmiss_sch	Negative Ranks	4[a]	2.50	10.00
	Positive Ranks	0[b]	.00	.00
	Ties	12[c]		
	Total	16		

a. POStmiss_sch < PREmiss_sch
b. POStmiss_sch > PREmiss_sch
c. POStmiss_sch = PREmiss_sch

Table 34: Test Statistics for Hypothesis 5

Test Statistics[a]

	POStmiss_sch - PREmiss_sch
Z	-1.841[b]
Asymp. Sig. (2-tailed)	.066

a. Wilcoxon Signed Ranks Test

b. Based on positive ranks.

Table 35: Signed Ranks for Hypothesis 6

Ranks

		N	Mean Rank	Sum of Ranks
POSTmiss_wrk - PREmiss_wrk	Negative Ranks	0[a]	.00	.00
	Positive Ranks	2[b]	1.50	3.00
	Ties	11[c]		
	Total	13		

a. POSTmiss_wrk < PREmiss_wrk

b. POSTmiss_wrk > PREmiss_wrk

c. POSTmiss_wrk = PREmiss_wrk

Table 36: Test Statistics for Hypothesis 6

Test Statistics[a]

	POSTmiss_wrk - PREmiss_wrk
Z	-1.414[b]
Asymp. Sig. (2-tailed)	.157

a. Wilcoxon Signed Ranks Test

b. Based on negative ranks.

The Wilcoxon signed ranks test for the analysis of missed school days resulted in a two tailed significance value (p = .066), which was transformed into a one-tailed significance value of p = .033; results indicated that there was a statistically significant difference between pre- and post-intervention missed school days due to asthma. The direction of change was as expected; therefore, the null Hypothesis 5 is rejected and the

alternate Hypothesis 5 (median missed school days in the prior month would decrease) is accepted.

Alternatively, the results indicated that there was not a statistically significant difference between pre- and post-intervention caregiver missed work days (one-tailed significance value $p = .079$), due to a child's asthma. Therefore, there is a failure to reject the null Hypothesis 6, which indicated that the number of missed work days by caregivers of asthmatic children did not significantly change after intervention.

Summary of Hypotheses Testing

As described above, a number of hypotheses and sub-hypotheses were analyzed for the home-based childhood asthma intervention study. Results of statistical hypotheses testing indicated that some changes were of significant magnitude and were in the expected direction, while other results proved to be either non-significant or non-attainable. A summary of the results of hypotheses testing can be seen in Table 37 on the following page.

Table 37: Summary of Hypotheses Testing Results

HYPOTHESIS NUMBER	BRIEF DESCRIPTION OF THE ALTERNATE HYPOTHESIS	STATISTICAL RESULT[1]	CONCLUSION	INTERPRETATION
1-1	Median self-reported environmental asthma trigger types will be reduced post-intervention	***p* = .001**	***Reject the null hypothesis***	The frequency of self-reported environmental asthma trigger types decreased after intervention
1-2	Median observed environmental asthma trigger frequency will be reduced post-intervention	***p* = .050**	***Reject the null hypothesis***	The frequency of observed environmental asthma triggers decreased after intervention
2	Median scores on the caregiver Asthma Assessment test will increase post-intervention	*p* = .309	Fail to reject the null hypothesis	There was no change in caregivers 'scores on the Asthma Assessment after intervention
3	Median overall frequency of self-reported asthma symptoms will decrease post-intervention	***p* = .022**	***Reject the null hypothesis***	The combined frequency of asthma symptoms (and proxies) decreased after intervention
3-1	Median frequency of self-reported past month daytime asthma symptoms will decrease post-intervention	*p* = .070	Fail to reject the null hypothesis	There was no change in the frequency of daytime asthma symptoms after intervention
3-2	Median frequency of self-reported past month nighttime asthma symptoms will decrease post-intervention	*p* = .179	Fail to reject the null hypothesis	There was no change in the frequency of nighttime asthma symptoms after intervention
3-3	Median frequency of self-reported past month use of short-acting medication will decrease post-intervention	***p* = .003**	***Reject the null hypothesis***	The frequency of short-acting medication use decreased after intervention
3-4	Median frequency of self-reported past month activity limitations will decrease post-intervention	*p* = .183	Fail to reject the null hypothesis	The frequency of activity limitations did not change after intervention.
4	Median frequency of past six month health care services use will decrease post-intervention	*p* = .143	Fail to reject the null hypothesis	The frequency of overall health care services use did not change after intervention.
4-1	Median frequency of past six month doctor's office visits will decrease post-intervention	*p* = .174	Fail to reject the null hypothesis	The frequency of doctor's office visits did not change after intervention.
4-2	Median frequency of past six month emergency room/urgent care visits will decrease post-intervention	Insufficient sample size	No conclusion	No interpretation can be made
4-3	Median frequency of past six month overnight hospital admissions will decrease post-intervention	Insufficient sample size	No conclusion	No interpretation can be made
5	Median frequency of missed school days per month will decrease post-intervention	***p* = .033**	***Reject the null hypothesis***	The frequency of missed school days decreased after intervention.
6	Median frequency of missed work days per month will decrease post-intervention	*p* = .079	Fail to reject the null hypothesis	The frequency of caregivers' missed work days did not change after intervention

[1] All hypotheses were tested using the non-parametric Wilcoxon signed ranks test

A discussion of these results can be found in the following CHAPTER 5 DISCUSSIONS, CONCLUSIONS, & RECOMMENDATIONS.

CHAPTER 5

DISCUSSION, CONCLUSIONS, & RECOMMENDATIONS

Discussion of Results

Participant Demographics

Throughout the recruitment period from January 2012 through April 2013, a total of 22 households were enrolled in the home-based childhood asthma intervention study. Five of the participating households were ultimately excluded from data analysis, as they failed to provide both pre- and post-intervention data. The 17 included households were home to 25 self-reported asthmatic children ≤17 years old. Self-reported and observational data were collected for all participating households, as well as all asthmatic children, and were recorded on the data collection tools: the Resident Questionnaire, the Health Questionnaire, the Asthma Supplement, the Asthma Assessment, and the Visual Assessment Checklist (APPENDIX A).

The majority of the participating households were located in the city of Las Vegas; however, the greatest number of participating households located within one zip code (89030) was in North Las Vegas (n = 5); notably, zip code 89030 is primarily Hispanic (73.1%) and is an area with a substantially lower median income ($31,382 ± $1,813) than greater Clark County (USCB, 2013a). Most participating homes were either owner-occupied single family residences (n = 5, 29.4%) or rental apartments or condominiums (n = 5, 29.4%); the home ownership rate for the study population was well below that of the overall Clark County rate of 55.7% for 2008 – 2012 (USCB, 2013b). All but two of the participating homes (88.2%) were constructed prior to 1999 and the slight majority of participants (n = 9, 52.9%) had lived in their home for one year or less; study participants

also differed from greater Clark County in these regards. For example, as of 2010, 66.6% of Clark County housing stock had been built prior to the year 2000 (USCB, 2012b); therefore, the study population was more likely to live in older housing versus the greater county population at the time. Additionally, from 2008 – 2012, 76.7% of Clark County residents were reported to have lived in their homes for one year or more, which implies that study participants may be more transient than the general county population (USCB, 2013b). In addition to housing characteristics, the study population also differed from overall Clark County demographics on a number of other measures.

Namely, the majority of participating households had four or more occupants (n = 16, 94.1%), while Clark County's average household size from 2008 – 2012 was 2.74 occupants (USCB, 2013b). Additionally, due to the convenient sampling design, the study population over-represented Hispanic children. In 2012, 29.8% of the Clark County population identified as Hispanic (USCB, 2013b); however, the large majority of participating asthmatic children were identified as being of Hispanic descent (n = 18, 72.0%). The study population was also more likely (41.2% versus 32.9%, respectively) to speak a language other than English at home versus greater Clark County (USCB, 2013b); seven participating households indicated that Spanish was their primary language.

Further, in addition to being largely comprised of minority participants, the study population also heavily consisted of households with lower socioeconomic status. Most of the participants would be considered Medicaid-eligible and most insured children were in fact covered by Medicaid (n = 11, 44.0%). The 2012 HUD income limits, which were the reference values used for the study, identified the median family income in Clark

County, Nevada to be $64,300. The HUD limits define low income as incomes that are only 80% of the area median income (AMI); very low incomes are those that are only 50% of the AMI; and extremely low incomes are those that are only 30% of the AMI, all based on household size (HUD 2012). Based on the household size of the study participants and the associated HUD income limits, 82.4% of study participants (n = 14) could be classified as extremely low income (one participant did not report household income, another participant could be classified as low income, and one additional participant exceeded the area median income for their household size); in other terms, these 14 participating households could be identified as living below the poverty line. The study population was much more likely to be living below the poverty line than the larger Clark County population (82.4% versus 14.2% from 2008 – 2012, respectively) (USCB, 2013b).

Finally, the study population also largely consisted of children with somewhat severe asthma, as defined by self-reported severity from Asthma Action Plans or based on their self-reported impairment profiles (excluding lung function markers, which were not collected in this study). Of the participants who reported current use of an Asthma Action Plan by the asthmatic child (n = 5), three reported the asthma severity classification on the Asthma Action Plan as intermittent; one reported a mild persistent severity, and the one additional child was reported to have an asthma severity classification of moderate persistent. Using the classification guidelines for asthma severity from the *NHLBI 2007 Guidelines for the Diagnosis and Management of Asthma*, Table 38 on the following page identifies the severity classification for each participant

without a current Asthma Action Plan, based on each self-reported impairment parameter.

Table 38: Pre-Intervention Participant Asthma Severity Classification Based on Self-Reported Impairment

Case	Daytime Symptoms	Nighttime Awakenings	Short-Acting Medication	Interference with Activities
1	Intermittent	Intermittent	Severe Persistent	Intermittent
2	Intermittent	Intermittent	Intermittent	Intermittent
3	Intermittent	Intermittent	Intermittent	Intermittent
4	Intermittent	Intermittent	Intermittent	Severe Persistent
5	Intermittent	Intermittent	Intermittent	Mild Persistent
6	Intermittent	Intermittent	Intermittent	Moderate Persistent
7	Moderate Persistent	Intermittent	Intermittent	Moderate Persistent
8	Intermittent	Intermittent	Intermittent	Severe Persistent
9	Intermittent	Intermittent	Intermittent	Intermittent
10	Intermittent	Moderate Persistent	Mild Persistent	Moderate Persistent
11	Severe Persistent	Intermittent	Severe Persistent	Moderate Persistent
12	Moderate Persistent	Intermittent	Severe Persistent	Moderate Persistent
13	Intermittent	Intermittent	Intermittent	Intermittent
14	Intermittent	Severe Persistent	Severe Persistent	Moderate Persistent
15	Moderate Persistent	Severe Persistent	Severe Persistent	Moderate Persistent
16	Intermittent	Intermittent	Intermittent	Intermittent
17	Mild Persistent	Mild Persistent	Mild Persistent	Moderate Persistent
18	Intermittent	Intermittent	Mild Persistent	Intermittent
19	Moderate Persistent	Moderate Persistent	Moderate Persistent	Moderate Persistent
20	Intermittent	Intermittent	Moderate Persistent	Intermittent

As Table 38 demonstrates, 12 of the 20 participants (60.0%), without a current Asthma Action Plan, self-reported at least three out of four impairment levels that would be consistent with an intermittent asthma severity classification. However, according to the *Guidelines*, the asthma severity classification is assigned based on the highest category indicated by any of the impairment parameters (Adams, Fuhlbrigge, Guilbert, Lozano, & Martinez, 2002; NHLBI, 2007). Therefore, for the study population including those with a current Asthma Action Plan, 32.0% of children (n = 8) could be classified with an asthma severity of intermittent; 12.0% (n = 3) could be classified as having mild persistent asthma; 28.0% (n = 7) could be classified with moderate persistent asthma; and an additional 28.0% of participating children (n = 7) could be said to have severe persistent asthma.

This distribution of asthma severity for the study population, based on self-reported short-term impairment, is noticeably skewed towards more severe asthma. These results differ from a national survey of asthma severity, conducted in 1998; the national distribution of asthma severity, during the time of the study, was: 49.3% intermittent; 19.2% mild persistent; 13.1% moderate persistent; and 18.4% severe persistent (Adams et al., 2002; Rabe et al., 2004). Given the inverse relationship between asthma severity and allergen-driven response mechanisms, it is possible that the home-based childhood asthma intervention, which focused on environmental allergen reduction, may have had an even greater impact on the study population had the classifications been less severe (Holgate, 2011). The impact of the intervention study on the impairment parameters (symptoms) identified above is further discussed in the upcoming section: Discussion of Research Questions.

Housing Characteristics

When considering asthma-related characteristics of participants' home environments, it is useful to compare study data to statewide data collected via the Asthma Call-Back Survey (ACBS). The ACBS is an in-depth survey of asthma-related issues and is a component of the larger Behavioral Risk Factor Surveillance Survey (BRFSS); BRFSS participants that reported a diagnosis of asthma were asked to participate in the follow-up ACBS. Unpublished, pooled data from the 2007 through 2010 ACBSs provided insight into the characteristics of the homes of 986 adult asthmatics in Nevada (Nevada State Health Division [NSHD], 2012). While the ACBS data represent adult asthmatics (and differences in race/ethnicity profiles and income levels exist between the ACBS and the childhood asthma intervention study), the ACBS survey data provide useful insight into asthmatics' home environments, which is otherwise unavailable; a number of interesting comparisons are made in Table 39 below.

Table 39: Comparison between 2007-2010 Nevada Asthma Call-Back Survey Responses and Childhood Asthma Intervention Study Responses for Selected Parameters
(Source: NSHD, 2012)

Parameter		Percentage of Participants Responding Affirmatively	
		Nevada Asthma Call-Back Survey (2007 – 2010)	Home-Based Childhood Asthma Intervention Study (Pre-Intervention)
Presence of Mold/Musty Odor		7.3%	35.3%
Presence of Indoor Pets		73.1%	52.9%
Pets Allowed in the Bedrooms		57.7%	29.4%
Visual Pests	Cockroaches	19.8%	82.4%
	Rodents	3.2%	
Smoking Tobacco in the Home		14.9%	23.5%
Presence of Unvented Gas Appliances		6.2%	41.2%
Use of Allergen-Reducing Pillow Covers		26.0%	4.8%
Use of Allergen-Reducing Mattress Covers		27.3%	14.3%
		N = 986	*N* = 17

Data from the table above demonstrate additional differences between the housing characteristics of the study population and the housing characteristics of the larger population of asthmatics in Nevada. For nearly all parameters, the pre-intervention study population had substantially more participants with a given exposure than the larger ACBS population; the exception being the percentage of participants reporting domestic pets and their associated behaviors. Post-intervention, while most of the exposure parameters were reduced, the most marked change in frequency occurred through the increased use of allergen-reducing pillow and mattress covers, which is seen as protective against exposure to house dust mite allergens (Rao & Phipatanakul, 2011). Nearly all study participants (91.7%) reported post-intervention use of allergen-reducing pillow and mattress covers for the asthmatic children. Twenty allergen-reducing pillow covers were provided across 14 participating households (82.4%) and 17 allergen-reducing mattress covers were provided across 13 participating households (76.5%) during the intervention portion of the study; case specific distribution can be found in APPENDIX L.

Participant Behaviors

Descriptive changes in participants' behaviors were also apparent from pre- to post-intervention; many of which could be deemed protective against exposure to environmental asthma triggers. Post-intervention, fewer participants with domestic pests allowed them in the bedrooms; aside from removing domestic pets from the home entirely, this strategy is seen as appropriate for reducing exposure to pet allergens (EPA, 2013). Post-intervention, all participants self-reported the use of damp mopping cleaning techniques and all participants with vacuums reported their use; both cleaning techniques are preferred for the reduction of allergens in the home (Krieger et al., 2010; NCHH,

2008). Interestingly, post-intervention visual assessments by study investigators classified the average cleanliness of two participating homes as "not clean" and another four participating homes as only partially clean, making regular damp mopping or vacuuming unlikely to have occurred in these homes; this finding highlights the differences between self-reported and observed data. However, some self-reported data were, in fact, supported by investigator observations. For example, participants reported an increased frequency of properly storing garbage, which was confirmed visually by investigators; this behavior is an example of an Integrated Pest Management (IPM) technique, which (when multiple IPM techniques are employed) has been shown to be effective at reducing pest exposure (Krieger et al., 2010).

While the participant behaviors discussed above changed for the positive after intervention, additional participant behaviors changed from pre- to post-intervention in an undesirable direction. For example, the self-reported changing of HVAC air filters in an appropriate time frame (every one to three months) decreased post-intervention. Also, the use of harsh chemical irritants and air freshening products did not decrease substantially after intervention. Improper ventilation and increased use of volatile chemicals could negatively impact indoor air quality and could continue to prompt asthma symptoms (EPA, 2013).

In addition to the data discussed above, the study also collected additional self-reported data pertaining to general health (i.e., physical activity and diet) behaviors of the participating asthmatic children; behaviors that may contribute to childhood obesity, which has been linked to asthma exacerbation (Kusunoki et al., 2012). Post-intervention frequency of weekly physical activity and the time spent per physical activity session

both increased for eight participating children (weekly frequency decreased for five children, while time spent reduced for three children). In terms of a healthy diet, daily fruit and vegetable intake reportedly increased for six participating children, while decreasing for five children. Weekly fast food consumption decreased for three participating children and increased for three additional participating children. Overall, self-reported ratings of the healthiness of the asthmatic children's diet slightly increased to a mean of 7.20 ± 1.44 (on a scale where 5 was considered "average" and 10 was considered "healthy"). While perceived improvements in these areas could be considered positive outcomes, the home-based childhood asthma intervention study did not intervene on these measures specifically; therefore, credit for positive outcomes (or, conversely, negative outcomes) in physical activity and diet behaviors cannot be attributed to participation in the study. Further, no additional home-based asthma intervention studies in the literature could be found that also reported on these health measures; therefore, no direct conclusions can be made.

Discussion of Research Questions

This study attempted to answer three broad research questions. First, the study attempted to determine the impact of a home-based childhood asthma intervention program on the presence of recognized environmental contributors to asthma. The results for this study suggest that a home-based childhood asthma intervention program can successfully reduce the presence of both self-reported and observed environmental asthma triggers in the home environment of Clark County asthmatic children; a result which is mirrored by similar successes in the literature (Krieger et al., 2005; Krieger et al., 2010; Morgan et al., 2004; Takaro et al., 2004). In fact, for this study population, the

overall frequency of instances, as well as general types of environmental asthma triggers were reduced based on both self-reported and observational data.

Post-intervention, raw self-reported data from participants identified: fewer instances of mold in any room of their home; improved food storage and garbage storage behaviors (e.g., keeping food in airtight containers and disposing of trash in receptacles with lids); less evidence of a cockroach infestation or other pest infestation anywhere in the home; and reduced occupant or visitor use of tobacco products in the home. Additionally, when cumulated, the post-intervention reduction in the median frequency of self-reported environmental asthma triggers (and proxy environmental asthma triggers) was also statistically significant. Recognizing that self-report data may be biased, objective observational data were also collected to answer the first research question.

As with the self-reported data, post-intervention raw data from study investigator observations also identified overall reductions in environmental asthma triggers. Post-intervention, the investigators observed: fewer unvented gas appliances; fewer instances of suspected mold; fewer instances of improperly stored food or trash; as well as, reduced evidence of pest infestations. When looking at observed types of environmental asthma triggers present (versus the sum of all instances), the frequency also decreased post-intervention. When overall frequency and types of asthma triggers were analyzed statistically, the noted post-intervention decreases in the raw data were found to be statistically significant. These results are consistent with the literature that suggests that home-based interventions can be effective at reducing exposure to environmental asthma triggers (Morgan et al., 2004).

Second, the study attempted to determine the impact of a home-based childhood asthma intervention program on caregivers' general knowledge of asthma. The Asthma Assessment test was proctored to the adult head of household during the pre-intervention and post-intervention visits (excluding the first two enrolled cases); pre-intervention deficiencies were used to guide the targeted educational portion of the intervention. The Asthma Assessment test was designed as a 20 point true/false test focused on asthma: symptoms, triggers, management, and prevention. Overall, the change in Asthma Assessment scores was not statistically significant; however, seven participants did increase their score after intervention. Another four participants' scores did not change, but both their pre- and post-intervention scores were relatively high (18/20 for $n = 2$ and 20/20 for $n = 2$). As the mean score on the pre-intervention Asthma Assessment tests was 17.53/20, it is not surprising that there was not room for significant improvement. It is unclear whether the study population was particularly knowledgeable about the asthma topics of concern or if the Asthma Assessment test was oversimplified. As such, the impact of the targeted education portion of this home-based childhood asthma intervention program cannot adequately be assessed for this population.

Finally, the study attempted to determine the impact of a home-based childhood asthma intervention program on self-reported asthma symptoms and self-reported burden of the disease (as measured by use of health care services, as well as missed school days by the asthmatic child and missed work days for the asthmatic child's adult caregiver). In terms of self-reported asthma symptoms, raw data indicated mean post-intervention decreases in frequency for all symptoms (and symptom proxies): daytime symptoms, nighttime symptoms, use of short-acting medication, and normal activity interference;

when combined, the decrease was statistically significant. This result was expected, as reducing exposure to environmental asthma triggers has been connected to reductions in symptomatic days (Morgan et al., 2004).

Individually, daytime symptoms decreased from pre- to post-intervention for ten participating children (40.0%); while in the desired direction, this decline was not statistically significant (although it was approaching significance, $p = .070$). Nighttime symptoms also decreased from pre- to post-intervention for seven participants (28.0%); this reduction also failed to meet statistical significance. Nine participants (36.0%) also demonstrated improvements in the degree of normal activity interference caused by asthma during post-intervention; again, this reduction, alone, was also not statistically significant. However, statistical significance was reached for the post-intervention reduction in the frequency of use of short-acting medications; this finding is important, as caregivers of asthmatics outside of the intervention program may be more likely to increase, rather than decrease, the use of short-acting medications in response to a perceived increase in symptom severity (Graves, Adams, Bender, Simon, & Portnoy, 2007).

In terms of asthma burden, additional measures were collected: the number of visits to doctor's offices, urgent care/emergency rooms, and hospital admissions in the prior six months; the number of missed school days by the asthmatic child in the prior month; and the number of missed work days by the child's caregiver in the prior month. Assessing the burden of asthma in terms of health care use was a challenge in this study, as there was not adequate power to detect changes in this infrequent outcome. No participants in the study reported overnight hospital admissions and only three participants reported use

of an urgent care facility or emergency room at pre-intervention; had the participants had more poorly controlled asthma, it is possible that the frequency of these outcomes would have been greater and more likely to be measurable (Morgan et al., 2004). The number of doctor's office visits due to asthma did decrease post-intervention, which is seen as beneficial, but it did not decrease significantly.

In contrast, the number of missed school days due to asthma did significantly decrease for study participants; however, whether or not school was in session during the month prior to either the pre- or post-intervention visit was not addressed. Missed work days by caregivers were also assessed both pre- and post-intervention and no significant change was identified; however, hereto, the out-of-home work status of the respondent for the prior month was not addressed. Further, it was not verified that the primary occupant who responded to the questionnaire regarding missed work was, in fact, the child's primary caregiver who would, in turn, be forced to miss work to care for the asthmatic child. These shortcomings of the data collection tools highlight some of the proposed recommendations that could improve upon the current home-based childhood asthma intervention program.

In summary, the home-based childhood asthma intervention program provided the following answers to three over-arching research questions: 1) as implemented, the program can effectively reduce both self-reported and observed frequencies of known environmental asthma triggers and trigger proxies in participants' homes; 2) as designed, the program did not improve caregivers' general knowledge about asthma; however, it is unclear whether this was due to above average knowledge at baseline or due to ineffective educational interventions/assessments; and 3) as implemented, the program

can decrease the frequency of asthma symptoms in participants and can decrease the related burden of missed school days, but may not significantly decrease missed work days of adult caregivers or use of health care services.

Interpretation of Results

The results from this home-based childhood asthma intervention study are perhaps most usefully compared to two noteworthy multi-faceted asthma intervention studies in the literature. In the Seattle-King County Healthy Homes Project study by Krieger et al. (2005), 274 children with provider-diagnosed persistent asthma were enrolled in a case-control asthma intervention study to compare a high-intensity intervention (seven home visits and a full set of resources) to a low-intensity intervention (a single home visit and limited resources). Similarly, in the Inner City Asthma Study by Morgan et al. (2004), 937 asthmatic children with positive skin tests to indoor allergens were enrolled in a year-long case-control study; cases received education in the form of six modules and targeted intervention activities over a minimum of five visits, while controls received only bi-annual evaluations.

To briefly summarize the results of Krieger et al.'s study, the high-intensity intervention group demonstrated significantly: higher quality of life for caregivers; reduced use of urgent health services; reduced days with asthma symptoms in the prior two weeks; reduced days with activity limitation; reduced use of short-acting medications; and reduced missed school days in the prior two weeks; no statistically significant change was demonstrated in missed work days. In the Inner City Asthma Study, intervention participants demonstrated significant: reductions in days with asthma

symptoms; reductions in unscheduled health care visits; and reductions in measured environmental allergen levels (Morgan et al., 2004).

Some of the statistically significant results achieved by the aforementioned studies were also achieved by this home-based childhood asthma intervention program (i.e., reduced environmental asthma triggers; reduced overall asthma symptom frequency; reduced use of short-acting medications; reduced missed school days). This study was also similar to the studies above, in that there was not a statistically significant reduction in the number of missed work days. However, despite these similar results, sizable differences also exist.

There may be several explanations for the failure of this home-based childhood asthma intervention program to mimic all positive results of the aforementioned studies: 1) the sample size was substantially smaller than those in the larger studies; 2) the number of intervention visits in the current program was drastically less than the number of intervention visits in the comparison longitudinal studies (less frequent than even the control group visits); 3) variables were collected differently (e.g., baseline days with symptoms in the current study were collected as ordinal variables, rather than continuous variables; in the comparison studies, daytime and nighttime symptoms were combined; additional clinical markers were collected); 4) participants of the larger studies were required to have more severe asthma classifications and to have more consistent use of health care services at baseline than was required of participants in the current program; and 5) a behavioral theory was not employed by the current study when providing education. However, given these prominent differences in study design and methodology, it is notable that the current home-based childhood asthma intervention

program was still able to demonstrate significant improvements in a number of participant and home environment characteristics.

Study Limitations

This home-based childhood asthma intervention program study had a number of limitations, which suggest that the data and results may not be generalizable. First, the recruiting method was one of convenience. Participants were recruited from the NVHHP Healthy Homes Program, which relied on community partners to refer eligible participants for a variety of reasons. Therefore, the bias selection of asthmatic children enrolled in the intervention program was convenient (not random) and may not be representative of the asthmatic children of the highest need (e.g., those with more severe symptoms, those with poor asthma control, and those who frequently use emergency health care services to treat their asthma). Further, because the sample was one of convenience (and because federal funding for the project ceased two years prematurely), the final sample size was small (N = 17 households with N = 25 asthmatic children). Therefore, differences could not be further ascertained based on: age, race/ethnicity, asthma severity classification, or any other categorical variable. Although statistical testing with non-parametric techniques allowed for analyses of adequate statistical power, such a small sample cannot be considered representative of the larger population of asthmatic children in Clark County, Nevada or representative of the impact of a home-based childhood asthma intervention program outside of this study population.

Additionally, the pre-experimental design of the study was itself limited. With the pre-experimental design, there was no random assignment to an intervention group and to a control group; in fact, there was no control group at all. There was also limited

information available from non-participants or from those who failed to complete all aspects of the study. As a result, changes within the group could be examined from pre- to post-intervention; however, differences seen in the intervention group from pre- to post-intervention may be theoretically due to factors outside of the intervention itself (e.g., changes to the school environment where children spend a large portion of their time; temporal changes in weather across the months from pre- to post-intervention). Therefore, threats to internal validity existed and true causality (that the intervention was the only factor responsible for reducing: environmental asthma triggers, short-acting medication use, and the number of missed school days) cannot be claimed, but only inferred.

Further, the data collection tools used in the study were also limited. At the time of the study, no comprehensive validated tools for the collection of home-based data, that also included asthma-specific measures, were identified through a literature search. As such, data collection tools were developed in their entirety specifically for this study; with the exception of the Asthma Supplement, which contained components of the validated Asthma Control Test (Nathan et al., 2004; Schatz et al., 2006). Data collection tools were derived using an expansive search of the literature, in an effort to increase content validity. Data collection tools were also piloted and modified during the early phases of the NVHHP Healthy Homes Program to increase their reliability when used for the home-based childhood asthma intervention study. Additionally, study staff were similarly trained and certified to ensure data collection techniques were also consistent throughout the course of the study to limit issues with inter-observer reliability.

Finally, a number of data collection tools used for the study relied on participants self-reporting data. Self-reported data was beneficial, as it allowed for the collection of data not immediately observable during pre- or post-intervention visits; however, self-reported data may be subject to response bias (e.g., due to social desirability); recall bias (e.g., an inability to recall the age of the child's asthma diagnosis); or other forms of cognitive bias. In an effort to counter these potential biases, where possible, observational data were also collected.

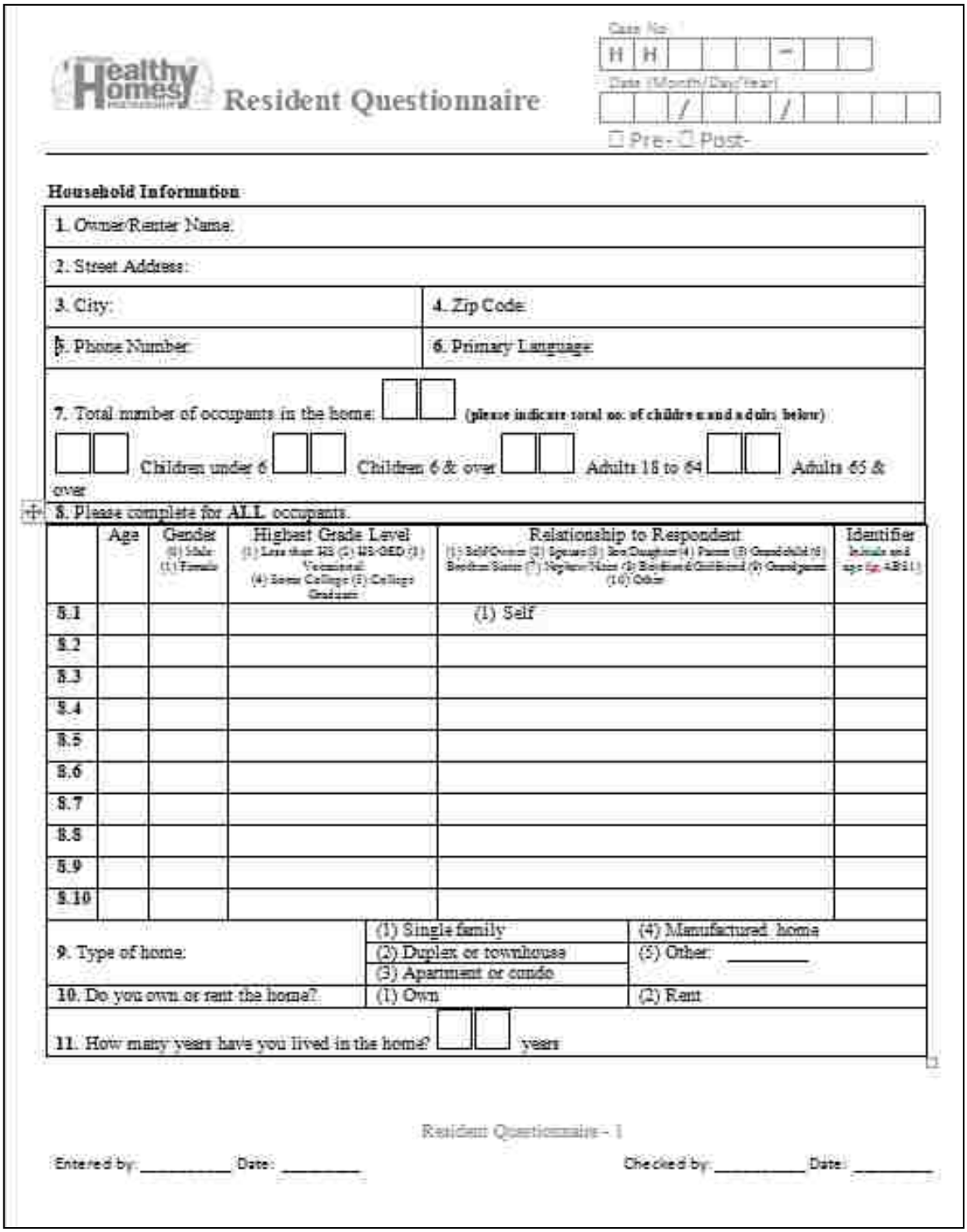
Conclusions and Recommendations for Further Study

Overall, the home-based childhood asthma intervention study was successful at improving (in both general and statistical terms) a number of asthma outcomes for a small group of asthmatic children ≤17 years old, who reside in Clark County, Nevada. The study also included a population (minority participants of low socioeconomic status) known to be at increased risk for adverse asthma outcomes. In addition to the measurable benefits (as already discussed), overall, participants also reported improvements in the health of their asthmatic children after participation in the intervention program. In fact, none of the participating children had post-intervention self-reported overall health values that would be considered below "average" health. Further, the majority of participants (*n* = 17, 68.0%) reported that the child's health was either "somewhat better" or "much better" after participation in the program.

Despite the apparent successes of the program, a number of recommendations from the literature and lessons learned from the study could reduce limitations and improve a future study of its kind. Recommendations for an ideal, future multi-faceted home-based childhood asthma intervention study in Clark County are as follows:

1. Conduct a case-control study that is longitudinal by design, which includes multiple opportunities to collect data and promote positive behavior change
2. Increase the sample size and ensure that individuals of highest risk (e.g., non-Hispanic black children) are well-represented in the study population
3. Update current data collection tools by: validating the tools; revising questions to capture relevant background data (e.g., are you the child's primary caregiver?) or to collect new variable types (i.e., continuous versus ordinal); and adding additional questions to mirror the representative Asthma Call-Back Survey
4. Collect data on additional measures of burden (e.g., caregiver quality of life)
5. Conduct additional objective data collection activities (e.g., allergen testing in the home and of the participant, spirometry, collection of clinical medical data)
6. Consider a greater focus on behavior change using a recognized behavior change theory (e.g., Social Cognitive Theory, Social Learning Theory, the Transtheoretical Model)
7. Provide additional intervention supplies to participants (e.g., HEPA vacuums, air filters, door mats, food storage containers)
8. Conduct a cost-benefit analysis to highlight the cost-savings associated with primary prevention activities of a home-based childhood asthma intervention program
9. Focus on asthma control, regardless of severity classification, to improve overall quality of life for asthmatic children

These recommendations are supported by the wealth of current literature that is available on asthma; however, future research will need to continue to be novel and innovative to further advance the understanding of such a complex environmental disease. To continue to improve outcomes for children suffering from this chronic, incurable, and costly disease and to reduce the global burden of the disease, it remains essential that the next generation of public health professionals continues to contribute to the body of knowledge on multi-faceted home-based childhood asthma interventions and that they further encourage public health practice, funding, and policy to align with the research findings.



Healthy Homes

Resident Questionnaire

Case No.
H H -
Date (Month/Day/Year)
/ /
☐ Pre- ☐ Post-

Household Information

1. Owner/Renter Name:	
2. Street Address:	
3. City:	4. Zip Code:
5. Phone Number:	6. Primary Language:

7. Total number of occupants in the home: ☐☐ **(please indicate total no. of children and adults below)**

☐☐ Children under 6 ☐☐ Children 6 & over ☐☐ Adults 18 to 64 ☐☐ Adults 65 & over

8. Please complete for **ALL** occupants.

	Age	Gender (0) Male (1) Female	Highest Grade Level (1) Less than HS (2) HS/GED (3) Vocational (4) Some College (5) College Graduate	Relationship to Respondent (1) Self/Owner (2) Spouse (3) Son/Daughter (4) Parent (5) Grandchild (6) Brother/Sister (7) Nephew/Niece (8) Boyfriend/Girlfriend (9) Grandparent (10) Other	Identifier Initials and age (ex. AB51)
8.1				(1) Self	
8.2					
8.3					
8.4					
8.5					
8.6					
8.7					
8.8					
8.9					
8.10					

9. Type of home:	(1) Single family	(4) Manufactured home
	(2) Duplex or townhouse	(5) Other: _____
	(3) Apartment or condo	
10. Do you own or rent the home?	(1) Own	(2) Rent

11. How many years have you lived in the home? ☐☐ years

Entered by: _____ Date: _____ Checked by: _____ Date: _____

12. What was the household's total income **last year**? (Select one)	(1) Didn't work at all last year	(5) $15,000 - $24,999	(9) $75,000 - $99,999
	(2) Less than $5,000	(6) $25,000 - $34,999	(10) Over $100,000
	(3) $5,000 - $9,999	(7) $35,000 - $49,999	(11) I don't know
	(4) $10,000 - $14,999	(8) $50,000 - $74,999	(99) RTA/NA

13. In the **last 2 years**, have you or anyone in your household received benefits or used the services of any of the following social programs?

	No	Yes	RTA/NA
1. Temporary Assistance for Needy Families (TANF)	(0)	(1)	(99)
2. Disability Insurance	(0)	(1)	(99)
3. Veteran's Pay	(0)	(1)	(99)
4. Low income housing	(0)	(1)	(99)
5. Disaster Relief	(0)	(1)	(99)
6. Pell grants	(0)	(1)	(99)
7. Unemployment insurance	(0)	(1)	(99)
8. General Assistance Welfare	(0)	(1)	(99)
9. Public health clinic	(0)	(1)	(99)
10. Legal services	(0)	(1)	(99)
11. Medicare	(0)	(1)	(99)
12. Food stamps	(0)	(1)	(99)
13. Social Security	(0)	(1)	(99)
14. Medicaid	(0)	(1)	(99)
15. WIC	(0)	(1)	(99)
16. I don't know	(0)	(1)	(99)
17. Other	(0)	(1)	(99)

Indoor Air Quality

1. Does the home have a working central heating/air conditioning unit? (Select one) (If No, skip to Question 2)	(0) No, there is no unit (1) Yes, but the unit is not working (2) Yes, there is a working unit
1.1. Are the air filters replaced at least every 3 months?	(0) No (1) Yes (99) RTA/NA
1.2. Does the unit have a thermostat? (If No, skip to Question 2)	(0) No (1) Yes (99) RTA/NA
1.2.1. Do you know how to work your thermostat?	(0) No (1) Yes (99) RTA/NA
1.2.2. Can you program your thermostat for different temperatures throughout the day?	(0) No (1) Yes (99) RTA/NA

1.2.3. What is the average temperature setting of your thermostat in the summer (July/Aug.)?	(1) Below 65°F (2) 65°F - 74°F (3) 75°F - 85°F (4) Above 85°F (5) I don't know (99) RTA/NA
1.2.4. What is the average temperature setting of your thermostat in the winter (Dec./Jan.)?	(1) Below 65°F (2) 65°F - 74°F (3) 75°F - 85°F (4) Above 85°F (5) I don't know (99) RTA/NA

		No	Yes	RTA/NA
2. Besides a central heating/air conditioning unit, do you use any of the following?	1. Space heater	(0)	(1)	(99)
	2. Electric fans	(0)	(1)	(99)
	3. Humidifiers	(0)	(1)	(99)
	4. Stove/Oven to heat your home	(0)	(1)	(99)
	5. Fireplace	(0)	(1)	(99)
	6. Swamp cooler	(0)	(1)	(99)
	7. Other:_____	(0)	(1)	(99)

3. What is the average cost of your cooling (gas or electric) bill in the summer (July/Aug.)?	$[ ][ ][ ] per month (2) IDK/RTA
4. What is the average cost of your heating (gas or electric) bill in the winter (Dec./Jan.)?	$[ ][ ][ ] per month (2) IDK/RTA
5. Are there places in your home that feel drafty? (If No, skip to Question 6)	(0) No (1) Yes
5.1. If yes, where?_____(99) RTA/NA	
6. Can mold or mildew be seen or smelled in the home? (If No, skip to Question 7)	(0) No (1) Yes

		No	Yes	RTA/NA
6.1. If yes, where in the home can mold or mildew be seen or smelled?	1. Front yard	(0)	(1)	(99)
	2. Backyard	(0)	(1)	(99)
	3. Entryway	(0)	(1)	(99)
	4. Living room	(0)	(1)	(99)
	5. Dining room	(0)	(1)	(99)
	6. Kitchen	(0)	(1)	(99)
	7. Adult's bedroom	(0)	(1)	(99)
	8. Child's bedroom	(0)	(1)	(99)
	9. Bathroom	(0)	(1)	(99)
	10. Laundry room	(0)	(1)	(99)
	11. Hallway	(0)	(1)	(99)
	12. Staircase	(0)	(1)	(99)
	13. Garage	(0)	(1)	(99)
	14. Other:_____	(0)	(1)	(99)

7. Are there pets inside the home?	Cats(s): # ☐☐	(99) RTA/NA
	Dog(s): # ☐☐	(99) RTA/NA
	Other: _____ # ☐☐	(99) RTA/NA
7.1. If yes, are the pets allowed in the bedrooms?	(0) No (1) Yes (99) RTA/NA	

Poisoning Prevention

1. Does the home have a working telephone?	(0) No	(1) Yes	(2) I don't know	(99) RTA/NA
2. Is emergency contact information present in the home? (If No, skip to Question 3)	(0) No	(1) Yes	(2) I don't know	(99) RTA/NA
2.1. If yes, does the information include a number to a poison control center?	(0) No	(1) Yes	(2) I don't know	(99) RTA/NA
3. Is anyone in the home trained in Cardiopulmonary Resuscitation (CPR) or First Aid?	(0) No	(1) Yes	(2) I don't know	(99) RTA/NA
4. Is there a first aid kit present in the home?	(0) No	(1) Yes	(2) I don't know	(99) RTA/NA
5. Has a radon test ever been performed in the home? (If No, skip to Question 6)	(0) No	(1) Yes	(2) I don't know	(99) RTA/NA
5.1. What were the results of the radon test?	(1) 0-3 (2) 4-7 (3) 7 and above (4) I don't know (99) RTA/NA			
6. Has a lead assessment ever been performed in the home? (If No, skip to Question 7)	(0) No	(1) Yes	(2) I don't know	(99) RTA/NA
6.1. Did any components of your home contain lead?	(0) No	(1) Yes	(2) I don't know	(99) RTA/NA
6.1.1. If yes, what components? _____				(99) RTA/NA
7. Are any of the following products used in the home?				
7.1. Bleach, ammonia, cleaners, or detergents	(0) No	(1) Yes	(2) I don't know	(99) RTA/NA
7.2. Paints, stains, paint thinners, adhesives, or glues	(0) No	(1) Yes	(2) I don't know	(99) RTA/NA
7.3. Air fresheners, air purifiers, or candles	(0) No	(1) Yes	(2) I don't know	(99) RTA/NA
8. Does the home have a vacuum?	(0) No	(1) Yes	(2) I don't know	(99) RTA/NA

9. How do you usually clean your home?		No	Yes	RTA/NA
	1. Sweeping or dry mopping	(0)	(1)	(99)
	2. Damp mopping	(0)	(1)	(99)
	3. Dusting	(0)	(1)	(99)
	4. Vacuuming	(0)	(1)	(99)

Injury Prevention

1. On a scale of 1 (worst) to 10 (best), how would you rate the overall safety of your home? (circle number) 1(unsafe)——2——3——4——5(average)——6——7——8——9——10(safe) (99) RTA/NA				
2. Do you have at least one working smoke detector? **(If No, skip to Question 3)**	(0) No	(1) Yes	(2) I don't know	(99) RTA/NA
2.1. If yes, do you test the batteries monthly?	(0) No	(1) Yes		(99) RTA/NA
3. Is there a fire extinguisher present in the home? **(If No, skip to Question 4)**	(0) No	(1) Yes	(2) I don't know	(99) RTA/NA

		No	Yes	RTA/NA
3.1. If yes, where is the fire extinguisher located?	1. Kitchen	(0)	(1)	(99)
	2. Bathroom	(0)	(1)	(99)
	3. Laundry room	(0)	(1)	(99)
	4. Hallway	(0)	(1)	(99)
	5. Garage	(0)	(1)	(99)
	6. Other	(0)	(1)	(99)

4. Do you have a working carbon monoxide detector? **(If No, skip to Question 5)**	(0) No	(1) Yes	(2) I don't know	(99) RTA/NA
4.1. If yes, do you test the batteries monthly?	(0) No	(1) Yes		(99) RTA/NA
5. What is the temperature of your water heater setting?	(1) No hot water (2) Below 120°F (3) At or above 120°F (4) I don't know (99) RTA/NA			

Structural Elements of the Home

1. On a scale of 1 (worst) to 10 (best), how would you rate your overall satisfaction with your home? (circle number) 1(unsatisfied)——2——3——4——5(average)——6——7——8——9——10(satisfied) (99) RTA/NA				
2. On a scale of 1 (worst) to 10 (best), please rank your opinion of your home as it compares to other homes? (circle number) 1(worse than others)——2——3——4——5(average)——6——7——8——9——10(better than others) (99) RTA/NA				
3. Are there **currently** any problems with the plumbing in the home? **(If No, skip to Question 4)**	(0) No	(1) Yes	(2) I don't know	(99) RTA/NA
3.1. If yes, what exactly are the problems? _____ _____ _____(99) RTA/NA				

		No	Yes	RTA/NA
3.2. What rooms have the plumbing problems?	1. Living room	(0)	(1)	(99)
	2. Dining room	(0)	(1)	(99)
	3. Kitchen	(0)	(1)	(99)
	4. Adult's bedroom	(0)	(1)	(99)
	5. Child's bedroom	(0)	(1)	(99)

6. Bathroom	(0)	(1)	(99)
7. Laundry room	(0)	(1)	(99)
8. Hallway	(0)	(1)	(99)
9. Staircase	(0)	(1)	(99)
10. Garage	(0)	(1)	(99)
11. Other:	(0)	(1)	(99)

4. Are all the windows in the home able to be opened? (If Yes, skip to Question 5)	(0) No	(1) Yes	(2) I don't know	(99) RTA/NA

4.1. If no, what are the locations of the inoperable windows?	No	Yes	RTA/NA
1. Living room	(0)	(1)	(99)
2. Dining room	(0)	(1)	(99)
3. Kitchen	(0)	(1)	(99)
4. Adult's bedroom	(0)	(1)	(99)
5. Child's bedroom	(0)	(1)	(99)
6. Bathroom	(0)	(1)	(99)
7. Laundry room	(0)	(1)	(99)
8. Hallway	(0)	(1)	(99)
9. Staircase	(0)	(1)	(99)
10. Garage	(0)	(1)	(99)
11. Other:	(0)	(1)	(99)

5. Is there any water damage present in the home? (If Yes, skip to Question 6)	(0) No	(1) Yes	(2) I don't know	(99) RTA/NA

5.1. If yes, what rooms have water damage?	No	Yes	RTA/NA
1. Living room	(0)	(1)	(99)
2. Dining room	(0)	(1)	(99)
3. Kitchen	(0)	(1)	(99)
4. Adult's bedroom	(0)	(1)	(99)
5. Child's bedroom	(0)	(1)	(99)
6. Bathroom	(0)	(1)	(99)
7. Laundry room	(0)	(1)	(99)
8. Hallway	(0)	(1)	(99)
9. Staircase	(0)	(1)	(99)
10. Garage	(0)	(1)	(99)
11. Other:	(0)	(1)	(99)

6. Is there any damage to the roof, such as leaks, sagging, or missing roofing materials? (If No or I don't know, skip to Pests)	(0) No	(1) Yes	(2) I don't know	(99) RTA/NA

6.1. If yes, describe the type of roof damage? _____
_____
_____(99) RTA/NA

Pests

1. Is all food stored in airtight containers?	(0) No	(1) Yes	(99) RTA/NA
2. Is pet food stored in airtight containers and/or off the floor?	(0) No	(1) Yes	(99) RTA/NA

3. Is food ever eaten outside of the kitchen or dining area?	(0) No	(1) Yes	(99) RTA/NA
4. Is garbage contained in a sealable indoor trash can?	(0) No	(1) Yes	(99) RTA/NA
5. Have cockroaches, other insects, rodents, or their feces been seen in the home?	(0) No	(1) Yes	(99) RTA/NA
6. Have bed bugs been seen in the home or has anyone in the home experienced bed bug bites?	(0) No	(1) Yes	(99) RTA/NA
7. Has anyone used pesticides (sprays, foggers, etc.) to control pests in or around your home?	(0) No	(1) Yes	(99) RTA/NA
8. Have any **professional** pest control workers done work in or around your home?	(0) No	(1) Yes	(99) RTA/NA
8.1. If yes, what was the reason for their visit and what did they do? _____			(99) RTA/NA
9. On average, how often do you wash bed sheets? (Select one)	(1) Once a week (2) Every 2 weeks (3) Monthly (4) Less often than monthly (99) RTA/NA		
9.1. When you wash the sheets, do you use hot water?	(0) No	(1) Yes	(99) RTA/NA
10. When you wash a normal load of clothes, do you usually use hot water?	(0) No	(1) Yes	(99) RTA/NA

Energy Efficiency

1. Which electronics do you keep plugged in to an outlet even when the power is off?		No	Yes	RTA/NA
	1. Computers	(0)	(1)	(99)
	2. Televisions	(0)	(1)	(99)
	3. VCR/DVD Players	(0)	(1)	(99)
	4. Cell phone chargers	(0)	(1)	(99)
	5. Toaster	(0)	(1)	(99)
	6. Blender	(0)	(1)	(99)
	7. Other electronics	(0)	(1)	(99)

2. Approximately how old is your toilet?

Bathroom 1: ☐☐ years (2) I don't know (99) RTA/NA

Bathroom 2: ☐☐ years (2) I don't know (99) RTA/NA

Bathroom 3: ☐☐ years (2) I don't know (99) RTA/NA

3. Approximately how old is your refrigerator?

Refrigerator 1: ☐☐ years (2) I don't know (99) RTA/NA

Refrigerator 2: ☐☐ years (2) I don't know (99) RTA/NA

4. What are the top three rooms that you spend the most time in? (Top 3 rooms)		No	Yes	RTA/NA
	1. Living room	(0)	(1)	(99)
	2. Dining room	(0)	(1)	(99)
	3. Kitchen	(0)	(1)	(99)
	4. Adult's bedroom	(0)	(1)	(99)
	5. Child's bedroom	(0)	(1)	(99)
	6. Bathroom	(0)	(1)	(99)
	7. Laundry room	(0)	(1)	(99)
	8. Hallway	(0)	(1)	(99)
	9. Staircase	(0)	(1)	(99)
	10. Garage	(0)	(1)	(99)
	11. Other	(0)	(1)	(99)

4.1. Of those three rooms, how many light bulbs do you usually use in each one?		
	Room 1 _____	(1) 0-3 (2) 4-6 (3) 7 and above (99) RTA/NA
	Room 2 _____	(1) 0-3 (2) 4-6 (3) 7 and above (99) RTA/NA
	Room 3 _____	(1) 0-3 (2) 4-6 (3) 7 and above (99) RTA/NA

4.2. Are the light bulbs compact fluorescent (CFLs) or regular light bulbs?	(1) CFLS (2) Regular light bulbs (3) A mix of both (99) RTA/NA

Note to Staff
-RTA/NA= "Refused to answer/ Not Applicable"
-IDK/RTA= "I don't know/ Refused to answer"

Healthy Hawaii Pre-Health Questionnaire

Case No.
H H -

Date (Month/Day/Year)
/ /

Demographic Data

1. Your [or the child's] name: _____ 2. Age: _____

3. If you are responding for a child, what is your relationship to the child? (Select one)
(1) Biological parent (2) Step-parent (3) Foster parent (4) Legal guardian (5) Other_____ (99) RTA/NA

4. What is your [or the child's] race?

	No	Yes	RTA/NA		No	Yes	RTA/NA
1. White	(0)	(1)	(99)	8. Guamanian/Chamorro	(0)	(1)	(99)
2. Black/African American	(0)	(1)	(99)	9. Filipino	(0)	(1)	(99)
3. American Indian/Alaskan Native	(0)	(1)	(99)	10. Vietnamese	(0)	(1)	(99)
4. Asian Indian	(0)	(1)	(99)	11. Chinese	(0)	(1)	(99)
5. Japanese	(0)	(1)	(99)	12. Korean	(0)	(1)	(99)
6. Native Hawaiian	(0)	(1)	(99)	13. Samoan	(0)	(1)	(99)
7. Hispanic/Latino/Spanish	(0)	(1)	(99)	14. Other:_____	(0)	(1)	(99)

5. If you [or the child] are of Hispanic, Latino, or Spanish origin, what is your ethnicity?

(1) Mexican/Mexican American/Chicano	(3) Puerto Rican	(99) Not Hispanic, Latino, or Spanish origin
(2) Cuban	(4) Other:_____	

Health Care

1. Do you [or the child] currently have health (medical) insurance? (If No, skip to Question 2)		(0) No	(1) Yes	(99) RTA/NA
1.1. What type of health insurance do you [or the child] have? (Select one)	(1) Medicaid	(2) Medicare	(3) Private/Other	(99) RTA/NA
2. In the **past year**, have you [or the child] used any type of health care services from doctors, nurses, clinics, or hospitals? (If No, skip to Question 3)		(0) No	(1) Yes	(99) RTA/NA

2.1. In the **last time** you [or the child] used a health care service, where did you [or the child] go? (Select one)	(1) Hospital	(5) Chiropractor
	(2) Emergency Room	(6) Healer/'Curandero'
	(3) Private Doctor's Office	(7) Other:_____
	(4) Quick Care	(99) RTA/NA

3. Do you [or the child] have any trouble getting healthcare? (If No, skip to Question 4)	(0) No	(1) Yes	(99) RTA/NA

3.1. If yes, what are the reasons you have trouble getting health care for yourself [or the child]?		No	Yes	RTA/NA
	1. I have never needed health care.	(0)	(1)	(99)
	2. I have no transportation/ too far away.	(0)	(1)	(99)
	3. Services are not open when needed.	(0)	(1)	(99)
	4. They don't speak my language.	(0)	(1)	(99)
	5. I don't feel welcomed.	(0)	(1)	(99)
	6. I'll lose my job.	(0)	(1)	(99)

Entered by: _____ Date: _____ Checked by: _____ Date: _____

	7. I don't know.	(0)	(1)	(99)
	8. I don't know where services are available.	(0)	(1)	(99)
	9. They don't provide services I need.	(0)	(1)	(99)
	10. They don't treat me with respect.	(0)	(1)	(99)
	11. They don't understand my problems.	(0)	(1)	(99)
	12. It is too expensive/ I don't have insurance.	(0)	(1)	(99)
	13. Other:_____	(0)	(1)	(99)

General Health

1. On a scale of 1 (worst) to 10 (best), how would you rate your [or the child's] overall health? (circle number) 1(poor)——2——3——4——5(average)——6——7——8——9——10(excellent) (99) RTA/NA					
Question 2 & 3 **Does your [or the child's] health currently limit your [or their] ability to perform:** (Select one)					
2. Vigorous physical activities such as: running, lifting heavy objects, and strenuous sports?	(1) No, not at all	(2) Yes, a little	(3) Yes, a lot	(99) RTA/NA	
3. Moderate physical activities such as: pushing a vacuum or climbing 1 flight of stairs?	(1) No, not at all	(2) Yes, a little	(3) Yes, a lot	(99) RTA/NA	
4. On a scale of 1 (worst) to 10 (best), how would you rate the healthiness of your [or the child's] diet? (circle number) 1(unhealthy)——2——3——4——5(average)——6——7——8——9——10(healthy) (99) RTA/NA					
5. How many fruits and vegetables do you [or the child] usually eat **per day**?	(1) 0	(2) 1-2	(3) 3-4	(4) 5 or more	(99) RTA/NA
6. How many times **per week** do you [or the child] usually eat fast food?	(1) 0	(2) 1-2	(3) 3-4	(4) 5 or more	(99) RTA/NA
7. How many times **per week** do you [or the child] usually exercise? (**If zero, skip to Question 8**)	(1) 0	(2) 1-2	(3) 3-4	(4) 5 or more	(99) RTA/NA
7.1. When you [or the child] do exercise, how many minutes are spent?				(1) 0-29 mins (2) 30-59 mins (3) 60 mins & above (99) RTA/NA	
8. How many hours **per day** do you [or the child] usually spend television, playing video games, on a cell phone, or on a computer?				(1) 0-3 hrs (2) 4-6 hrs (3) 7-9 hrs (4) 10 hrs & above (99) RTA/NA	
9. Does anyone who lives in the home smoke cigarettes, cigars, or other tobacco products?			(0) No	(1) Yes	(99) RTA/NA
10. Do visitors ever smoke cigarettes, cigars, or other tobacco products in your home?			(0) No	(1) Yes	(99) RTA/NA

Preventative Care

1. Do you [or the child] see a dentist at least **one time per year**?	(0) No	(1) Yes		(99) R.TA/NA
2. Have you [or the child] ever been tested for exposure to lead, by a blood test? **(If No, skip to Injury Prevention)**	(0) No	(1) Yes	(2) I don't know	(99) R.TA/NA
2.1. Where did you [or the child] receive the blood lead test?	(1) Health District (2) Doctor's Office (3) Laboratory (4) Other: _____ (99) R.TA/NA			
2.2. Was the blood sample collected by blood draw or the stick of a finger? (Select one)	(1) Blood draw (in a vein)	(2) Stick of finger (capillary)		(99) R.TA/NA
2.3. What was the resulting blood lead level?	(1) 0 µg/dL (2) 1-5 µg/dL (3) 6-9 µg/dL (4) 10 µg/dL & above (5) I don't know (99) R.TA/NA			

Injury Prevention

1. In the **past 6 months**, have you [or the child] been scalded by water in this home? **(If No, skip to Question 2)**	(0) No	(1) Yes	(99) R.TA/NA
1.1. If yes, did this injury require medical attention?	(0) No	(1) Yes	(99) R.TA/NA
2. In the **past 6 months**, have you [or the child] suffered any other type of injury **in the home** that resulted in a visit for medical care? **(If No, skip to Quality of Life)**	(0) No	(1) Yes	(99) R.TA/NA

		No	Yes	R.TA/NA
2.1. If yes, how were you hurt?	1. Burned	(0)	(1)	(99)
	2. Bruised/ Fractured	(0)	(1)	(99)
	3. Tripped/ Fell	(0)	(1)	(99)
	4. Choked	(0)	(1)	(99)
	5. Poisoned	(0)	(1)	(99)
	6. Drowned	(0)	(1)	(99)
	7. Cut/ Stabbed/ Scraped	(0)	(1)	(99)
	8. Suffocated	(0)	(1)	(99)
	9. Other:	(0)	(1)	(99)
		No	**Yes**	**R.TA/NA**
2.2. If yes, where did the injury occur?	1. Front yard	(0)	(1)	(99)
	2. Backyard	(0)	(1)	(99)
	3. Entryway	(0)	(1)	(99)
	4. Living room	(0)	(1)	(99)
	5. Dining room	(0)	(1)	(99)
	6. Kitchen	(0)	(1)	(99)

	7. Adult's bedroom	(0)	(1)	(99)
	8. Child's bedroom	(0)	(1)	(99)
	9. Bathroom	(0)	(1)	(99)
	10. Laundry room	(0)	(1)	(99)
	11. Hallway	(0)	(1)	(99)
	12. Staircase	(0)	(1)	(99)
	13. Garage	(0)	(1)	(99)
	14. Other:	(0)	(1)	(99)

Quality of Life (Select one)

1. You seem to get sick a little easier than other people.	(1)	(2)	(3)	(4)	(5)	(99)
2. You are healthy as anybody you know.	(1)	(2)	(3)	(4)	(5)	(99)
3. You think your home environment negatively affects your health.	(1)	(2)	(3)	(4)	(5)	(99)

(1= Strongly Agree, 2= Agree, 3= Neither, 4= Disagree, 5= Strongly Disagree, 99= RTA/NA)

Asthma Diagnosis (Skip if not the Primary Resident)

1. Has anyone **under age 6**, who lives in this home, ever been diagnosed by a doctor, nurse, or other health professional with asthma? (**If No, skip to Question 2**)	(0) No (1) Yes (2) No children under 6 (99) RTA/NA
1.1. How many children **under age 6** have been diagnosed with asthma? ☐☐ (99) RTA/NA	
For each child, please indicate:	Symptoms within **past 12 months**
1.1.1 Name_____ Age_____	(0) No (1) Yes (99) RTA/NA
1.1.2 Name_____ Age_____	(0) No (1) Yes (99) RTA/NA
2. Has anyone **aged 6 or older**, who lives in this home, ever been diagnosed by a doctor, nurse, or other health professional with asthma? (**If No, skip to Question 3**)	(0) No (1) Yes (99) RTA/NA
2.2 How many people **age 6 or older** have been diagnosed with asthma? ☐☐ (99) RTA/NA	
For each person, please indicate:	Symptoms within **past 12 months**
2.1.1 Name_____ Age_____	(0) No (1) Yes (99) RTA/NA
2.1.2 Name_____ Age_____	(0) No (1) Yes (99) RTA/NA
2.1.3 Name_____ Age_____	(0) No (1) Yes (99) RTA/NA
2.1.4 Name_____ Age_____	(0) No (1) Yes (99) RTA/NA
If YES to Question 1 or 2 above, STOP! **Complete the Asthma Supplement for all consented participants.**	

3. Do you [or anyone in the home] have difficulty breathing or think you may have undiagnosed asthma? (**If No, STOP the Health Assessment!**)	(0) No	(1) Yes	(2) I don't know	(99) RTA/NA

3.1. If yes, is the difficulty breathing due to a diagnosis (by a doctor, nurse, or other health professional) of another respiratory illness or disease?	(0) No	(1) Yes	(99) RTA/NA
3.1.1. If yes, what was the diagnosis? _____			(99) RTA/NA
If NO to 3.1., please complete the Suspected Asthma Supplement for all consented participants.			

Note to Staff
-RTA/NA= "Refused to answer/ Not Applicable"

Case No.

H H -

Healthy Homes Asthma Supplement

For: Participants with DIAGNOSED asthma

Date (Month/Day/Year)

/ /

☐ Pre- ☐ Post-

Asthma Diagnosis

1. Your [or the child's] name:_____	2. Age:_____
3. Approximately when was your [or the child's] asthma diagnosis?	☐☐☐☐ (year) (99) RTA/NA
4. Do you [or the child's] use an Asthma Action/Control Plan, provided from a medical professional? **If Yes, answer Questions 4.1 and 4.2**	(1) No, never given a Control Plan (2) No, have one but don't use it (3) Yes (4) I don't know (99) RTA/NA
4.1. When was the last time a doctor reviewed the Asthma Action/Control Plan? Within the last...	(1) Month (2) 3 Months (3) 6 Months (4) Year (5) 3 Years (6) It has never been reviewed (7) I don't know (99) RTA/NA
4.2. What was the classification of asthma severity on the Asthma Action/Control Plan?	(1) Mild Intermittent (2) Mild Persistent (3) Moderate Persistent (4) Severe Persistent (5) I don't know (99) RTA/NA
5. If a childhood asthma diagnosis, is the child's school nurse aware of the diagnosis?	(0) No (1) Yes (2) Not a childhood diagnosis (3) I don't know (99) RTA/NA

Asthma Symptoms

1. In the **past month**, how often have you [or the child] had daytime coughing, wheezing, or shortness of breath?	(1) Zero (2) 2 times per week or less (3) More than 2 times per week, but not daily (4) Daily (5) Throughout the day (99) RTA/NA

Entered by:_____ Date: _____ Checked by:_____ Date: _____

2.1. **Complete if child is 4 years of age and under** In the **past month**, how often has the child woken up at night due to coughing, wheezing, or shortness of breath?	(1) Zero (2) 1-2 times per month (3) 3-4 times per month (4) More than 1 time per week (99) R:TA/NA
2.2. **Complete for adults or children 5 years of age and over** In the **past month**, how often have you [or the child] woken up at night due to coughing, wheezing, or shortness of breath?	(1) Zero (2) 2 times per month or less (3) 3-4 times per month (4) More than 1 night per week, but not nightly (5) Often, 7 times per week (99) R:TA/NA
3. In the **past month**, how many times have you [or the child] needed to use short-acting medication to control symptoms of coughing, wheezing, or shortness of breath?	(1) Zero (2) 2 times per week or less (3) More than 2 times per week, but not daily (4) Daily (5) Several times per day (99) R:TA/NA
4. How much do symptoms of coughing, wheezing, or shortness of breath interfere with your [or the child] normal activities (work, school, etc.)?	(1) None (2) Minor limitation (3) Some limitation (4) Extremely limited (99) R:TA/NA
5. Does physical activity cause your [or the child's] asthma symptoms to worsen?	(0) No (1) Yes (99) R:TA/NA
6. Do you [or the child] have more trouble with asthma during certain times of year?	(0) No (1) Yes (99) R:TA/NA

6.1. During which month(s) do you [or the child] have more trouble with asthma?

	No	Yes	R:TA/NA		No	Yes	R:TA/NA		No	Yes	R:TA/NA
1. January	(0)	(1)	(99)	5. May	(0)	(1)	(99)	9. September	(0)	(1)	(99)
2. February	(0)	(1)	(99)	6. June	(0)	(1)	(99)	10. October	(0)	(1)	(99)
3. March	(0)	(1)	(99)	7. July	(0)	(1)	(99)	11. November	(0)	(1)	(99)
4. April	(0)	(1)	(99)	8. August	(0)	(1)	(99)	12. December	(0)	(1)	(99)

Burden of Asthma

1. In the **past month**, how many days of work have you missed (or days of school has the child missed) due to asthma? **(If zero, skip to Question 2)**

☐☐ days (99) R:TA/NA

1.1. If the child has missed school (in the past month), how many days of work have you or another adult caregiver missed because of the child's asthma? ☐☐ days (99) RTA/NA	
Questions 2-4 During the **past 6 months**, how many times have you the child been _____ because of asthma?	
2. Seen in a doctor's office	☐☐ times (99) RTA/NA
3. Seen in the emergency room or urgent care center	☐☐ times (99) RTA/NA
4. Admitted to the hospital overnight	☐☐ times (99) RTA/NA
Questions 5-6 In the **past month**, approximately how much money has been spent on _____ related to asthma?	
5. Your [or the child's] medications	$☐☐☐ (2) IDK/RTA
6. Other medical expenses	$☐☐☐ (2) IDK/RTA

Asthma Medication

1. Do you take any asthma medication that was prescribed by a doctor? (If No, skip to Question 2)	(0) No (1) Yes (99) RTA/NA

1.1. For each prescribed medication currently being taken, please indicate:

	Prescribed Dose			
Medication Name	**# of puffs, mg, ml each time** (Circle puff, mg, or ml)	**# of times/ day**	**# of times/ week**	**Expired** (0) No (1) Yes
1.	puff - mg - ml			
2.	puff - mg - ml			
3.	puff - mg - ml			
4.	puff - mg - ml			
5.	puff - mg - ml			

(99) RTA/NA

1.1.1. Are all medications currently being taken as prescribed?	(0) No (1) Yes (99) RTA/NA

1.1.1.1. If no, please describe how the medications are being taken: _____ _____ (99) R.TA/NA	
2. Do you take any over the counter asthma medication that was not prescribed by a doctor? **(If No, skip to question 3)**	(0) No (1) Yes (99) R.TA/NA

2.1. For each over the counter medication currently being taken, please indicate:

Medication Name	Prescribed Dose: # of puffs, mg, ml each time (Circle puff, mg, or ml)	# of times/ day	# of times/ week	Expired (0) No (1) Yes
1.	puff - mg - ml			
2.	puff - mg - ml			
3.	puff - mg - ml			
4.	puff - mg - ml			
5.	puff - mg - ml			

(99) R.TA/NA

If NO to Questions 1 and 2, skip to Asthma Control	
3. In the past month, have you [or the child] been taking any of those asthma medications?	(0) No (1) Yes (99) R.TA/NA
4. If a childhood asthma case, does the child's school nurse have the asthma medication?	(0) No (1) Yes (2) Not a childhood case (3) I don't know (99) R.TA/NA
5. Do you [or the child] take medications for asthma even without symptoms?	(0) No (1) Yes (99) R.TA/NA
6. Do you [or the child] take medications for asthma only when symptoms occur?	(0) No (1) Yes (99) R.TA/NA
7. Do you [or the child] use a spacer for taking inhaled medications? **(If No, skip to Asthma Control)**	(0) No (1) Yes (99) R.TA/NA
7.1. If yes, in the past 2 weeks, when inhalers were used, how often did you [or the child] use the spacer?	(1) Never (2) Less than half the time (3) About half the time (4) More than half the time (5) Most/all the time (6) I don't know (99) R.TA/NA

Asthma Control

1. Do yours [or the child's] sleeping pillows have special allergen-reducing, dust-proof covers?	(0) No (1) Yes (99) RTA/NA
2. Do yours [or the child's] sleeping mattresses have special allergen-reducing, dust-proof covers? **(If No, skip to question 4 or 5)**	(0) No (1) Yes (99) RTA/NA
2.1 What size mattress do you [or the child] regularly sleep on?	(1) Twin (2) Full (3) Queen (4) King (5) California King (99) RTA/NA
Questions 4-8 ****For self-report if available** Adults and children over 12 years old (If under 12 years old, skip to Question 9)**	
4. In the **past month**, how much of the time did your asthma keep you from getting as much done at work, school or at home?	(1) None of the time (2) A little of the time (3) Some of the time (4) Most of the time (5) All of the time (99) RTA/NA
5. During the **past month**, how often have you had shortness of breath?	(1) Not at all (2) Once or twice per month (3) 3 to 6 times a week (4) Once a day (5) More than once a day (99) RTA/NA
6. During the **past month**, how often did your asthma symptoms (wheezing, coughing, shortness of breath, chest tightness, or pain) wake you up at night or earlier than usual in the morning?	(1) Not at all (2) Once or twice per month (3) Once a week (4) 2 or 3 nights a week (5) 4 or more nights a week (99) RTA/NA
7. During the **past month**, how often have you used your rescue inhaler or nebulizer medications (such as Albuterol)?	(1) Not at all (2) Once a week or less (3) 2 to 3 times per week (4) 1 or 2 times per day (5) 3 or more times per day (99) RTA/NA
8. How would you rate your asthma control during the **past month**?	(1) Not controlled at all (2) Poorly controlled (3) Somewhat controlled (4) Well controlled (5) Completely controlled (99) RTA/NA

Questions 9-12 ****For self-report if available** Children 4 to 11 years old**	
9. How is your asthma today?	(1) Very bad (2) Bad (3) Good (4) Very good (99) RTA/NA
10. How much of a problem is your asthma when you run, exercise or play sports?	(1) It's a big problem, I can't do what I want. (2) It's a problem and I don't like it. (3) It's a little problem but it's okay. (4) It's not a problem. (99) RTA/NA
11. Do you cough because of your asthma?	(1) No, none of the time (2) Yes, some of the time (3) Yes, most of the time (4) Yes, all the time. (99) RTA/NA
12. Do you wake up during the night because of your asthma?	(1) No, none of the time (2) Yes, some of the time (3) Yes, most of the time (4) Yes, all the time. (99) RTA/NA

Note to Staff
-RTA/NA= "Refused to answer/ Not Applicable"

Healthy Homes **Asthma Assessment**

Case No.
H H _ _ _ - _ _

Date (Month/Day/Year)
_ _ / _ _ / _ _ _ _

☐ Pre- ☐ Post-

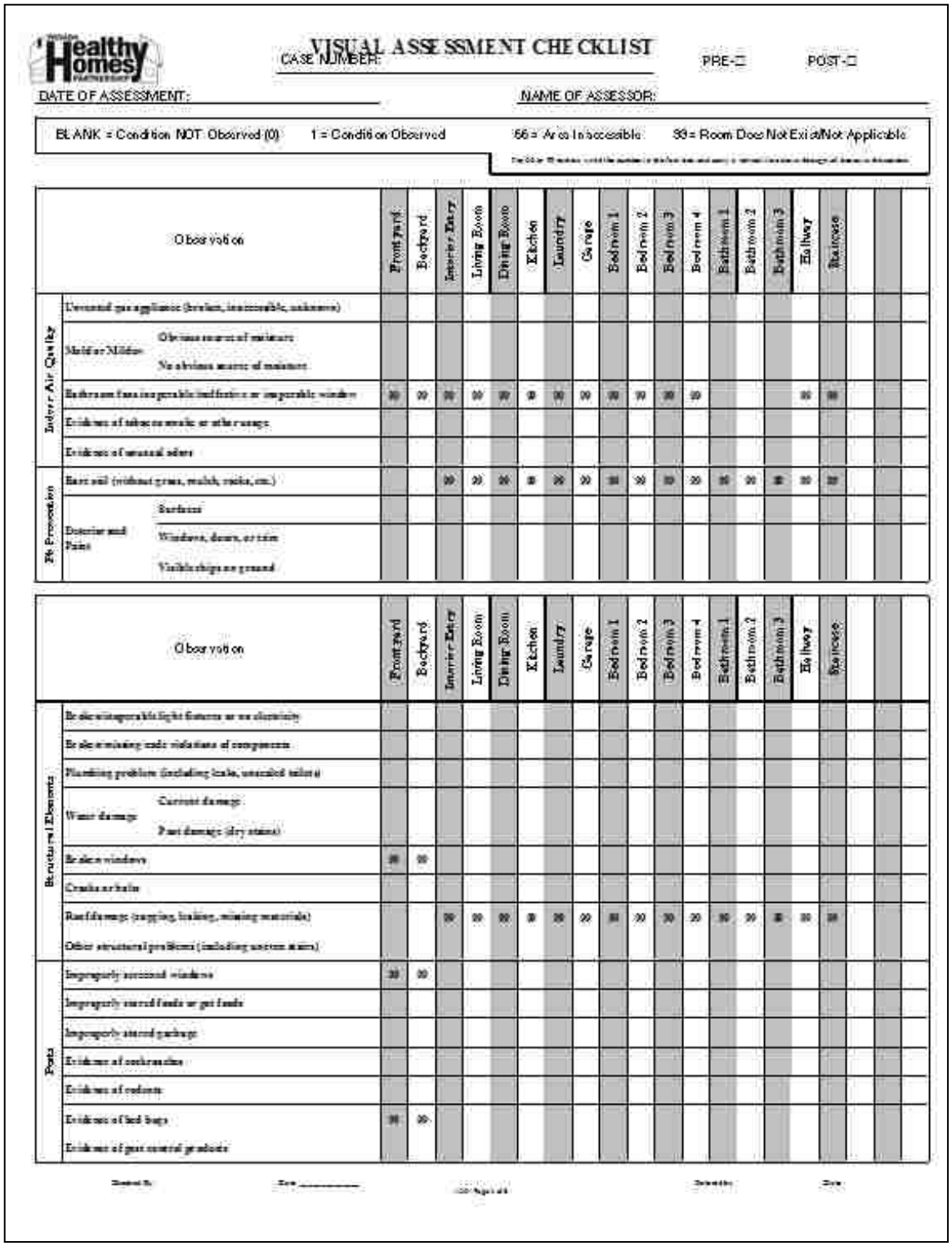
Name_____

Please read all of the following statements carefully and decide whether you believe they are true or false. Please circle your answer.

Symptoms	1	Wheezing, coughing, chest tightness and shortness of breath are symptoms of asthma.	(0) False	(1) True
	2	It is best to wait and see if asthma symptoms go away on their own before taking "as needed" medications.	(0) False	(1) True
	3	During an asthma attack, it is hard to breathe.	(0) False	(1) True
	4	Nighttime coughing and early morning coughing are symptoms of asthma.	(0) False	(1) True
	5	Not all asthma episodes need to be taken seriously.	(0) False	(1) True
Triggers	6	Tobacco smoke can relieve asthma symptoms and does not cause attacks.	(0) False	(1) True
	7	Pets can trigger asthma symptoms or attacks.	(0) False	(1) True
	8	Mold in your home DOES NOT trigger asthma symptoms or attacks.	(0) False	(1) True
	9	Dust mites can trigger asthma symptoms or attacks.	(0) False	(1) True
	10	Cockroaches DO NOT trigger asthma symptoms or attacks.	(0) False	(1) True
Management	11	Asthma cannot be cured, but it can be controlled.	(0) False	(1) True
	12	Someone with asthma only needs to see a doctor about asthma when he or she is having an asthma attack.	(0) False	(1) True
	13	The best way to manage asthma is to deal with it yourself, without consulting a doctor.	(0) False	(1) True
	14	Contact with environmental allergens and contaminants early in life may contribute to the development of asthma.	(0) False	(1) True
	15	An inhaler will deliver a useful dose of medication, no matter how it is used.	(0) False	(1) True
Prevention	16	Washing bed sheets in hot water, covering mattresses and pillows with dust-proof covers, and not allowing pets in the bedroom, can reduce allergens in a home.	(0) False	(1) True
	17	There is nothing a person with asthma can do to keep from getting an asthma attack.	(0) False	(1) True
	18	People with asthma should not exercise.	(0) False	(1) True
	19	People with asthma can still live normal and healthy lives.	(0) False	(1) True
	20	Asthma may result from both genetic and environmental factors.	(0) False	(1) True

Educational Assessment Score (for Healthy Homes Staff Only)		
Principles	**Score (__/20)**	**Place an (X) for each principle with 2 or more missed questions. Discuss principles at 2nd visit.**
Symptoms		
Triggers		
Management		
Prevention		
Total Score (Sum)	=	

Entered by: _____ Date: _____ Checked by: _____ Date: _____



VISUAL ASSESSMENT CHECKLIST

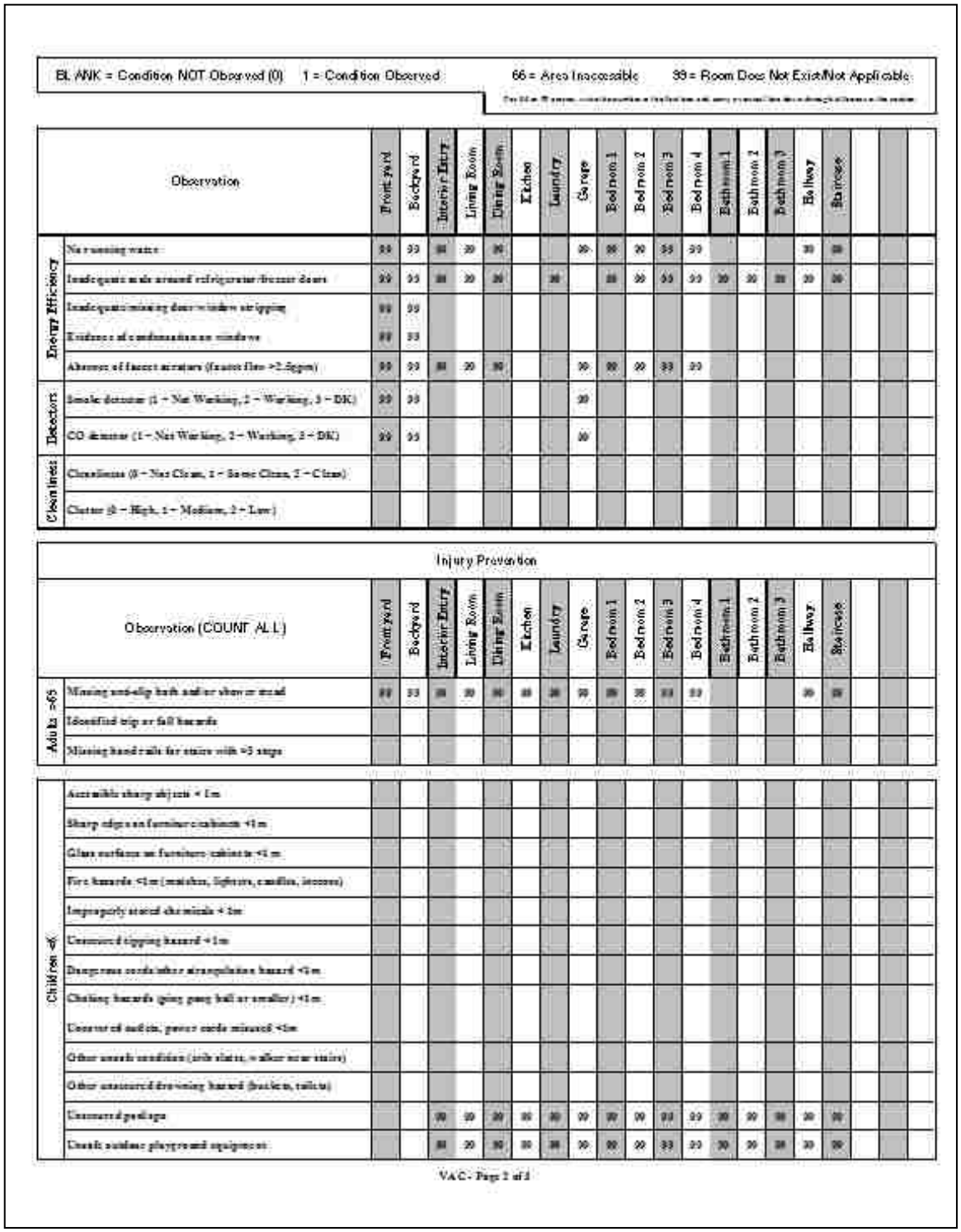
CASE NUMBER: PRE-☐ POST-☐

DATE OF ASSESSMENT: NAME OF ASSESSOR:

BLANK = Condition NOT Observed (0) 1 = Condition Observed 66 = Area Inaccessible 99 = Room Does Not Exist/Not Applicable

	Observation	Frontyard	Backyard	Interior Entry	Living Room	Dining Room	Kitchen	Laundry	Garage	Bedroom 1	Bedroom 2	Bedroom 3	Bedroom 4	Bathroom 1	Bathroom 2	Bathroom 3	Hallway	Staircase			
Indoor Air Quality	Unvented gas appliance (heater, inaccessible, unknown)																				
	Mold or Mildew: Obvious source of moisture																				
	Mold or Mildew: No obvious source of moisture																				
	Bathroom fans inoperable/ineffective or inoperable windows	99	99	99	99	99	99	99	99	99	99	99	99				99	99			
	Evidence of tobacco smoke or other usage																				
	Evidence of unusual odors																				
Fire Prevention	Bare soil (without grass, mulch, rocks, etc.)			99	99	99	99	99	99	99	99	99	99	99	99	99	99	99			
	Exterior and Paint: Surfaces																				
	Exterior and Paint: Windows, doors, or trim																				
	Exterior and Paint: Visible chips on ground																				

	Observation	Frontyard	Backyard	Interior Entry	Living Room	Dining Room	Kitchen	Laundry	Garage	Bedroom 1	Bedroom 2	Bedroom 3	Bedroom 4	Bathroom 1	Bathroom 2	Bathroom 3	Hallway	Staircase			
Structural Elements	Broken/unsupported light fixtures or no electricity																				
	Broken/missing code violations of concern																				
	Plumbing problem (including leaks, unvented toilets)																				
	Water damage: Current damage																				
	Water damage: Past damage (dry stains)																				
	Broken windows	99	99																		
	Cracks or holes																				
	Roof damage (sagging, leaking, missing materials)			99	99	99	99	99	99	99	99	99	99	99	99	99	99	99			
	Other structural problems (including uneven stairs)																				
Pests	Improperly screened windows	99	99																		
	Improperly stored foods or pet foods																				
	Improperly stored garbage																				
	Evidence of cockroaches																				
	Evidence of rodents																				
	Evidence of bed bugs	99	99																		
	Evidence of past external predators																				



BLANK = Condition NOT Observed (0) 1 = Condition Observed 66 = Area Inaccessible 99 = Room Does Not Exist/Not Applicable

	Observation	Front yard	Backyard	Interior Entry	Living Room	Dining Room	Kitchen	Laundry	Garage	Bedroom 1	Bedroom 2	Bedroom 3	Bedroom 4	Bathroom 1	Bathroom 2	Bathroom 3	Hallway	Staircase			
Energy Efficiency	No running water	99	99	99	99	99			99	99	99	99	99				99	99			
	Inadequate seals around refrigerator/freezer doors	99	99	99	99	99		99		99	99	99	99	99	99	99	99	99			
	Inadequate/missing door/window stripping	99	99																		
	Evidence of condensation on windows	99	99																		
	Absence of faucet aerators (faucet flow >2.2gpm)	99	99	99	99	99			99	99	99	99	99								
Detectors	Smoke detector (1 = Not Working, 2 = Working, 3 = DK)	99	99						99												
	CO detector (1 = Not Working, 2 = Working, 3 = DK)	99	99						99												
Cleanliness	Cleanliness (0 = Not Clean, 1 = Some Clean, 2 = Clean)																				
	Clutter (0 = High, 1 = Medium, 2 = Low)																				

Injury Prevention

	Observation (COUNT ALL)	Front yard	Backyard	Interior Entry	Living Room	Dining Room	Kitchen	Laundry	Garage	Bedroom 1	Bedroom 2	Bedroom 3	Bedroom 4	Bathroom 1	Bathroom 2	Bathroom 3	Hallway	Staircase			
Adults >65	Missing anti-slip bath mat or shower stand	99	99	99	99	99	99	99	99	99	99	99	99				99	99			
	Identified trip or fall hazards																				
	Missing hand rails for stairs with >3 steps																				
Children <6	Accessible sharp objects <1m																				
	Sharp edges on furniture/cabinets <1m																				
	Glass surfaces on furniture/cabinets <1 m																				
	Fire hazards <1m (matches, lighters, candles, incenses)																				
	Improperly stored chemicals <1m																				
	Unsecured rigging hazard <1m																				
	Dangerous cords/other strangulation hazard <1m																				
	Choking hazards (ping pong ball or smaller) <1m																				
	Unsecured outlets, power cords misused <1m																				
	Other unsafe conditions (crib slats, pillow near stairs)																				
	Other unsecured drowning hazard (buckets, toilets)																				
	Unsecured garbage			99	99	99	99	99	99	99	99	99	99	99	99	99	99	99			
	Unsafe outdoor playground equipment			99	99	99	99	99	99	99	99	99	99	99	99	99	99	99			

VAC - Page 2 of 3

NT = Reading NOT Taken	I = Room/Area Inaccessible	NA = Room Does Not Exist/Not Applicable

Readings	Outside	Floor 1 (Living Room)	Floor 2 (Hallway)	Hot Water (Kitchen)	Refrigerator	Freezer
Temperature						
Relative humidity				NA	NA	NA
Carbon monoxide	NA			NA	Ignore Footage	

Additional Notes

APPENDIX B – EXAMPLE ASTHMA ACTION PLAN

Asthma Action Plan

For: ______________________ Doctor: ______________________ Date: ______________

Doctor's Phone Number ______________________ Hospital/Emergency Department Phone Number ______________________

GREEN ZONE

Doing Well

- No cough, wheeze, chest tightness, or shortness of breath during the day or night
- Can do usual activities

And, if a peak flow meter is used,

Peak flow: more than ____________
(80 percent or more of my best peak flow)

My best peak flow is: ____________

Take these long-term control medicines each day (include an anti-inflammatory).

Medicine	How much to take	When to take it

Before exercise	☐ ____________	☐ 2 or ☐ 4 puffs ____________	5 minutes before exercise

YELLOW ZONE

Asthma Is Getting Worse

- Cough, wheeze, chest tightness, or shortness of breath, or
- Waking at night due to asthma, or
- Can do some, but not all, usual activities

-Or-

Peak flow: ________ to ________
(50 to 79 percent of my best peak flow)

First Add: quick-relief medicine—and keep taking your GREEN ZONE medicine.

____________________ ☐ 2 or ☐ 4 puffs, every 20 minutes for up to 1 hour
(short-acting beta$_2$-agonist) ☐ Nebulizer, once

Second If your symptoms (and peak flow, if used) return to GREEN ZONE after 1 hour of above treatment:
☐ Continue monitoring to be sure you stay in the green zone.

-Or-

If your symptoms (and peak flow, if used) do not return to GREEN ZONE after 1 hour of above treatment:

☐ Take: ____________________ ☐ 2 or ☐ 4 puffs or ☐ Nebulizer
(short-acting beta$_2$-agonist)

☐ Add: ____________________ mg per day For ________ (3–10) days
(oral steroid)

☐ Call the doctor ☐ before/ ☐ within ________ hours after taking the oral steroid.

RED ZONE

Medical Alert!

- Very short of breath, or
- Quick-relief medicines have not helped, or
- Cannot do usual activities, or
- Symptoms are same or get worse after 24 hours in Yellow Zone

-Or-

Peak flow: less than ____________
(50 percent of my best peak flow)

Take this medicine:

☐ ____________________ ☐ 4 or ☐ 6 puffs or ☐ Nebulizer
(short-acting beta$_2$-agonist)

☐ ____________________ mg
(oral steroid)

Then call your doctor NOW. Go to the hospital or call an ambulance if:

- You are still in the red zone after 15 minutes AND
- You have not reached your doctor.

DANGER SIGNS

- **Trouble walking and talking due to shortness of breath**
- **Lips or fingernails are blue**

- **Take ☐ 4 or ☐ 6 puffs of your quick-relief medicine AND**
- **Go to the hospital or call for an ambulance** ____________ (phone) **NOW!**

See the reverse side for things you can do to avoid your asthma triggers.

How To Control Things That Make Your Asthma Worse

This guide suggests things you can do to avoid your asthma triggers. Put a check next to the triggers that you know make your asthma worse and ask your doctor to help you find out if you have other triggers as well. Then decide with your doctor what steps you will take.

Allergens

☐ Animal Dander

Some people are allergic to the flakes of skin or dried saliva from animals with fur or feathers.

The best thing to do:

- Keep furred or feathered pets out of your home.

If you can't keep the pet outdoors, then:

- Keep the pet out of your bedroom and other sleeping areas at all times, and keep the door closed.
- Remove carpets and furniture covered with cloth from your home. If that is not possible, keep the pet away from fabric-covered furniture and carpets.

☐ Dust Mites

Many people with asthma are allergic to dust mites. Dust mites are tiny bugs that are found in every home—in mattresses, pillows, carpets, upholstered furniture, bedcovers, clothes, stuffed toys, and fabric or other fabric-covered items.

Things that can help:

- Encase your mattress in a special dust-proof cover.
- Encase your pillow in a special dust-proof cover or wash the pillow each week in hot water. Water must be hotter than 130° F to kill the mites. Cold or warm water used with detergent and bleach can also be effective.
- Wash the sheets and blankets on your bed each week in hot water.
- Reduce indoor humidity to below 60 percent (ideally between 30—50 percent). Dehumidifiers or central air conditioners can do this.
- Try not to sleep or lie on cloth-covered cushions.
- Remove carpets from your bedroom and those laid on concrete, if you can.
- Keep stuffed toys out of the bed or wash the toys weekly in hot water or cooler water with detergent and bleach.

☐ Cockroaches

Many people with asthma are allergic to the dried droppings and remains of cockroaches.

The best thing to do:

- Keep food and garbage in closed containers. Never leave food out.
- Use poison baits, powders, gels, or paste (for example, boric acid). You can also use traps.
- If a spray is used to kill roaches, stay out of the room until the odor goes away.

☐ Indoor Mold

- Fix leaky faucets, pipes, or other sources of water that have mold around them.
- Clean moldy surfaces with a cleaner that has bleach in it.

☐ Pollen and Outdoor Mold

What to do during your allergy season (when pollen or mold spore counts are high).

- Try to keep your windows closed.
- Stay indoors with windows closed from late morning to afternoon, if you can. Pollen and some mold spore counts are highest at that time.
- Ask your doctor whether you need to take or increase anti-inflammatory medicine before your allergy season starts.

Irritants

☐ Tobacco Smoke

- If you smoke, ask your doctor for ways to help you quit. Ask family members to quit smoking, too.
- Do not allow smoking in your home or car.

☐ Smoke, Strong Odors, and Sprays

- If possible, do not use a wood-burning stove, kerosene heater, or fireplace.
- Try to stay away from strong odors and sprays, such as perfume, talcum powder, hair spray, and paints.

Other things that bring on asthma symptoms in some people include:

☐ Vacuum Cleaning

- Try to get someone else to vacuum for you once or twice a week, if you can. Stay out of rooms while they are being vacuumed and for a short while afterward.
- If you vacuum, use a dust mask (from a hardware store), a double-layered or microfilter vacuum cleaner bag, or a vacuum cleaner with a HEPA filter.

☐ Other Things That Can Make Asthma Worse

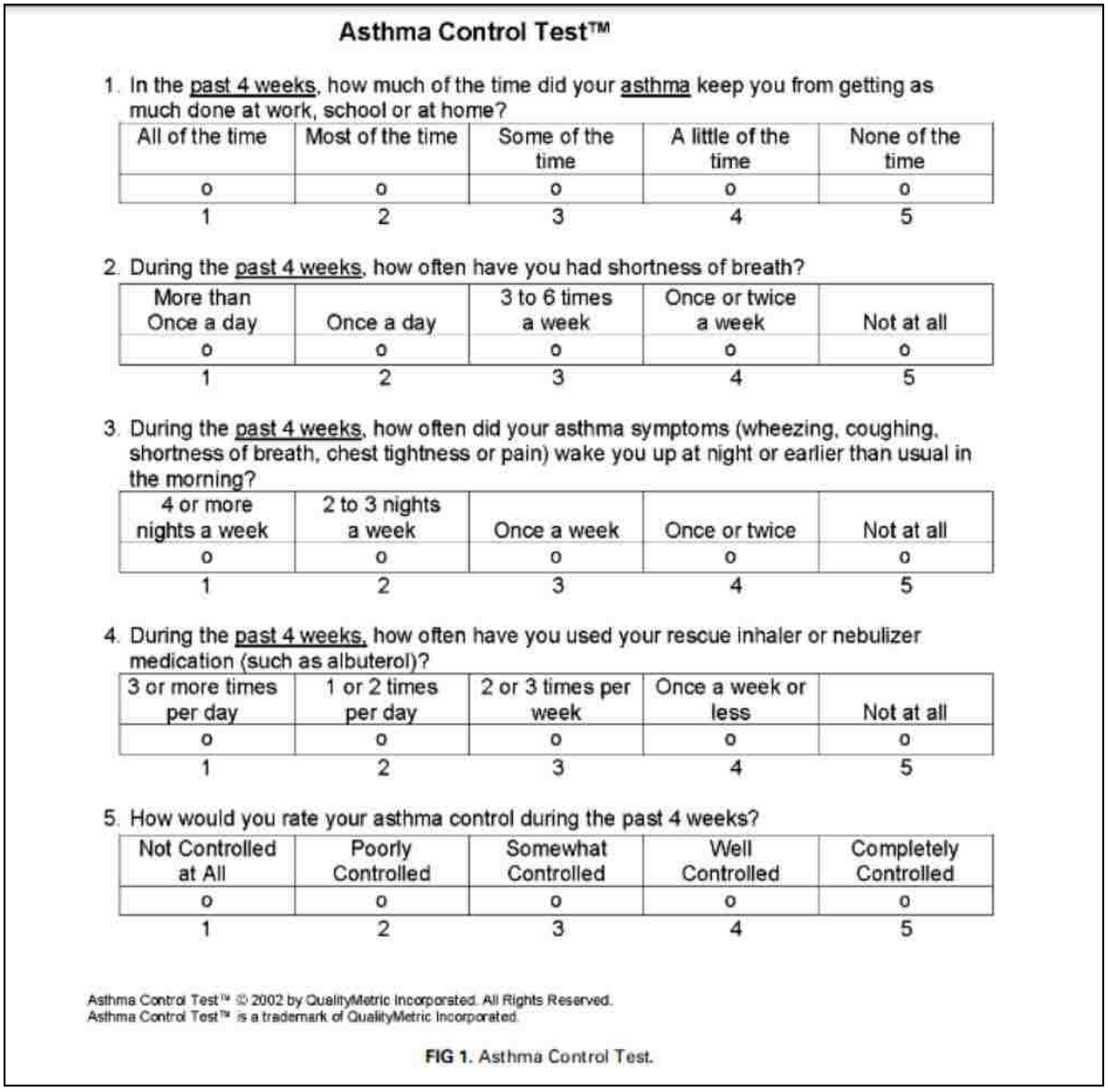
- Sulfites in foods and beverages: Do not drink beer or wine or eat dried fruit, processed potatoes, or shrimp if they cause asthma symptoms.
- Cold air: Cover your nose and mouth with a scarf on cold or windy days.
- Other medicines: Tell your doctor about all the medicines you take. Include cold medicines, aspirin, vitamins and other supplements, and nonselective beta-blockers (including those in eye drops).

U.S. Department of Health and Human Services
National Institutes of Health

National Heart Lung and Blood Institute

For More Information, go to: www.nhlbi.nih.gov

NIH Publication No. 07-5251
April 2007



Asthma Control Test™

1. In the past 4 weeks, how much of the time did your asthma keep you from getting as much done at work, school or at home?

All of the time	Most of the time	Some of the time	A little of the time	None of the time
o	o	o	o	o
1	2	3	4	5

2. During the past 4 weeks, how often have you had shortness of breath?

More than Once a day	Once a day	3 to 6 times a week	Once or twice a week	Not at all
o	o	o	o	o
1	2	3	4	5

3. During the past 4 weeks, how often did your asthma symptoms (wheezing, coughing, shortness of breath, chest tightness or pain) wake you up at night or earlier than usual in the morning?

4 or more nights a week	2 to 3 nights a week	Once a week	Once or twice	Not at all
o	o	o	o	o
1	2	3	4	5

4. During the past 4 weeks, how often have you used your rescue inhaler or nebulizer medication (such as albuterol)?

3 or more times per day	1 or 2 times per day	2 or 3 times per week	Once a week or less	Not at all
o	o	o	o	o
1	2	3	4	5

5. How would you rate your asthma control during the past 4 weeks?

Not Controlled at All	Poorly Controlled	Somewhat Controlled	Well Controlled	Completely Controlled
o	o	o	o	o
1	2	3	4	5

FIG 1. Asthma Control Test.

(Figure source: Shatz et al., 2006)

APPENDIX D – IRB APPROVAL

UNLV
UNIVERSITY OF NEVADA LAS VEGAS

Biomedical IRB – Expedited Review
Approval Notice

NOTICE TO ALL RESEARCHERS:

Please be aware that a protocol violation (e.g., failure to submit a modification for any change) of an IRB approved protocol may result in mandatory remedial education, additional audits, re-consenting subjects, researcher probation, suspension of any research protocol at issue, suspension of additional existing research protocols, invalidation of all research conducted under the research protocol at issue, and further appropriate consequences as determined by the IRB and the Institutional Officer.

DATE: January 5, 2011

TO: **Dr. Shawn Gerstenberger**, Environmental and Occupational Health

FROM: Office of Research Integrity - Human Subjects

RE: Notification of IRB Action by John Mercer/Dr. John Mercer, Chair and Charles Rasmussen/Dr. Charles Rasmussen, Co-Chair
Protocol Title: **Healthy Homes Building Strategic Alliance**
Protocol #: 1008-3565
Expiration Date: January 4, 2012

This memorandum is notification that the project referenced above has been reviewed and approved by the UNLV Biomedical Institutional Review Board (IRB) as indicated in Federal regulatory statutes 45 CFR 46 and UNLV Human Research Policies and Procedures.

The protocol is approved for a period of one year and expires January 4, 2012. If the above-referenced project has not been completed by this date you must request renewal by submitting a Continuing Review Request form 30 days before the expiration date.

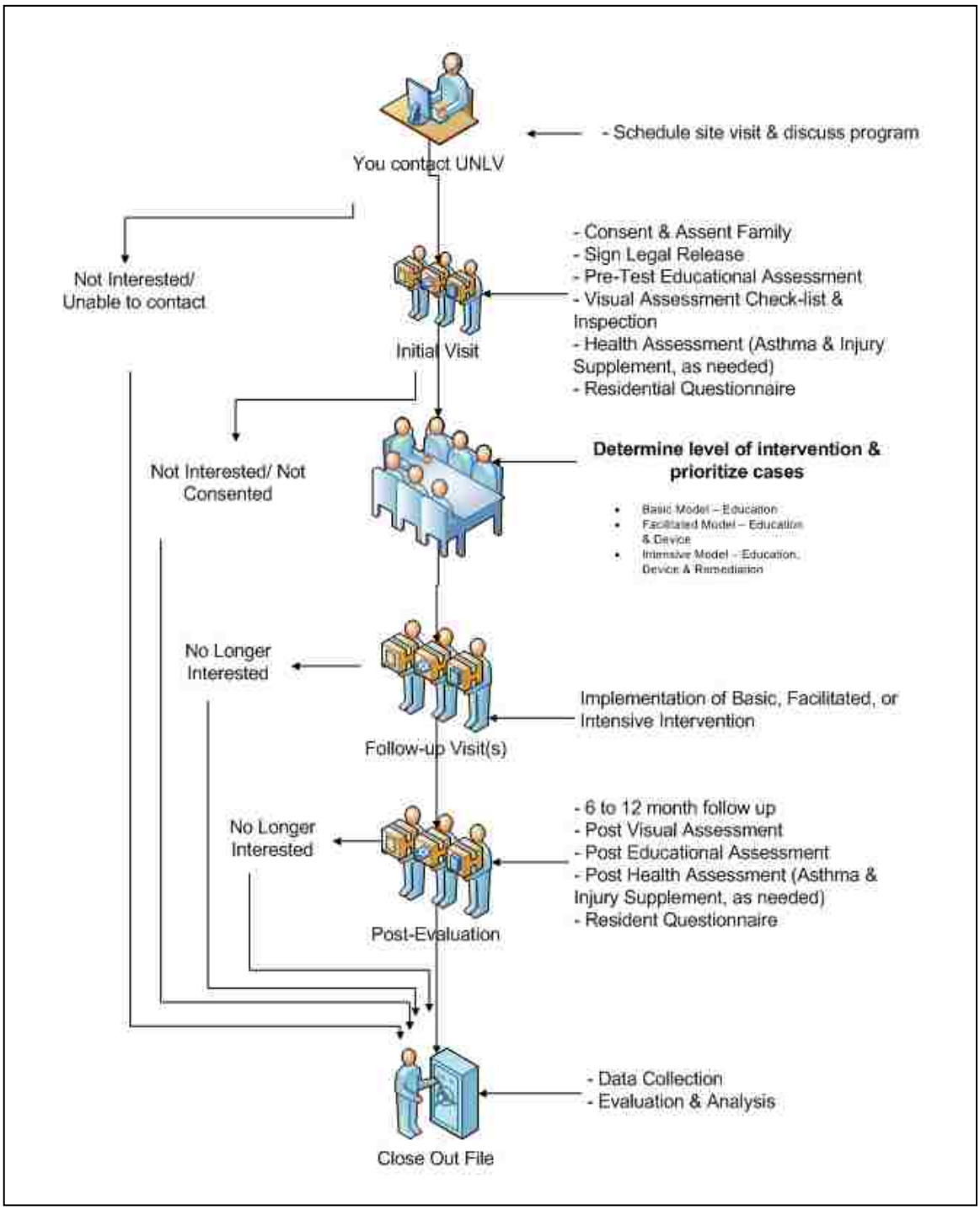
PLEASE NOTE:
Upon approval, the research team is responsible for conducting the research as stated in the protocol most recently reviewed and approved by the IRB, which shall include using the most recently submitted Informed Consent/Assent forms and recruitment materials. The official versions of these forms are indicated by footer which contains approval and expiration dates.

Should there be *any* change to the protocol, it will be necessary to submit a **Modification Form** through ORI - Human Subjects. No changes may be made to the existing protocol until modifications have been approved by the IRB. Modified versions of protocol materials must be used upon review and approval. Unanticipated problems, deviations to protocols, and adverse events must be reported to the ORI – HS within 10 days of occurrence.

If you have questions or require any assistance, please contact the Office of Research Integrity - Human Subjects at IRB@unlv.edu or call 895-2794.

Office of Research Integrity – Human Subjects
4505 Maryland Parkway • Box 451047 • Las Vegas, Nevada 89154-1047
(702) 895-2794 • FAX: (702) 895-0805

APPENDIX E – NVHHP PRODUCTION PROCESS



APPENDIX F – CONSENT AND RELEASE OF LIABILITY FORMS

Healthy Homes Consent Form

TITLE OF STUDY: Healthy Homes Building Strategic Alliance

INVESTIGATOR(S): Shawn L. Gerstenberger, PhD (702-895-5420), Sheniz Moonie, PhD (702-671-2231), Michelle Chino PhD (702-895-2649), Erika Marquez MPH, Jennifer Berger MPH, Mackenzie Burns MPH, Sabrina Bartholomew (La Monica) BS, Michelle Ching BS, Tara Dickinson BS (702-895-5449).

SPONSOR: Centers for Disease Control and Prevention

Name of Participant: _____

Case Number: _____

Purpose
The Department of Environmental and Occupational Health (DEOH) at University of Nevada Las Vegas (UNLV) is doing a research study to identify and reduce health hazards in the home. UNLV team members will assess the overall condition and safety of the home by identifying hazards in the home related to asthma, injury, poisoning, and structural problems. Identifying these areas through a home assessment will allow us to provide you with information on improving the safety of your home and health.

Procedures
You are being asked to participate in the study because you were refferred by one of our community partners. If you or your family choose to participate, this study should take about 12 hours of your time, over a period of 6-12 months. UNLV team members, each specially trained and certified, will visit your home on three or more separate occasions. An overview of the process is provided to you.

A UNLV Healthy Homes assessment may include the following services at *no cost*:

Initial visit: During the first visit, you will complete forms necesssary for enrollment. The forms include this consent form, a legal release waiver, and questionnaires about your health and home. These forms need to be completed by each participating family member. After all the forms are complete your home will be checked for saftey and health hazards through a Healthy Homes and Lead Risk Assessment. A list of some of the activities at your first visit include:

- Checking for carbon monoxide
- Checking for lead-based paint
- Checking for moisture or other structural problems
- Checking for pests, and
- Checking for any other safety hazards

Follow-up visit(s): At the next visit, scheduled at a time best for you, UNLV team members will provide you with an educational tool kit designed to address hazards in your home. Depending on available resources some homes will be provided with devices such as a smoke alarm or fire estinguisher, and/or remediation of one or all of the hazards found in your home. A list of some of the activities at your next visit include:

Educational/Device Intervention:

Approved by the UNLV IRB. Protocol 1008-3565
Received: 01-17-12 Approved: 01-17-12 Expiration: 01-05-13

- Educational tool will be provided to each household. Tailored specifically to address hazards found in the home.
- If applicable, provide household with a mop, broom, bucket, trash can, smoke alarm, CO-detector, fire extinguisher, and a trash can with a lid.
- A UNLV team member will discuss recommendations for reducing or eliminating hazards in the home.

Remediation Intervention:

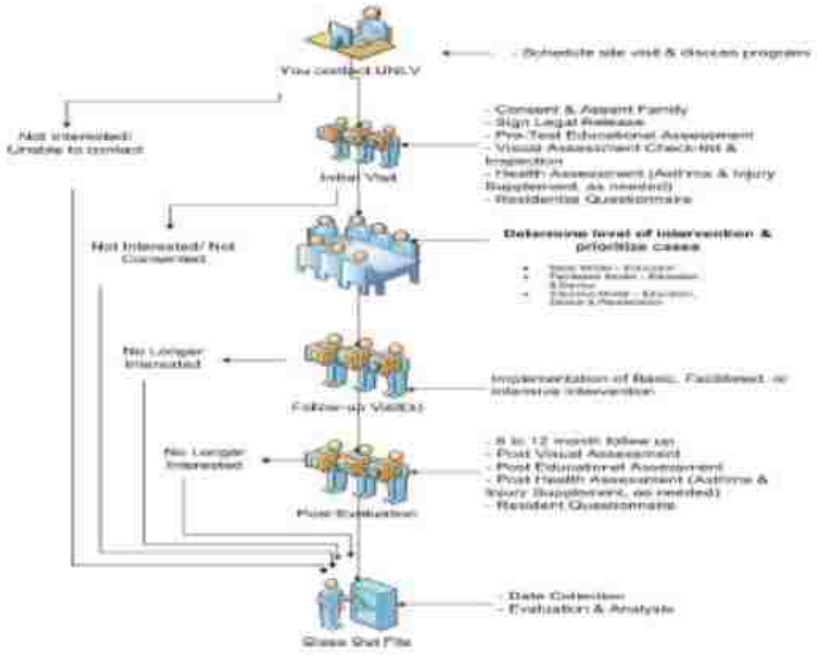
- If household meets financial qualification criteria, set by community partners, hazards in the home requiring remediation may be fixed.

Last visit: During the last visit, about 6-12 months after your first visit, UNLV team members will re-evaluate your home for saftey and health hazards. At this time, you will also complete the last set of questionnaires about your health and home

What the UNLV Healthy Homes program will not include:

- The healthy homes program will not assess the property for asbestos containing material.
- The healthy homes program will not assess the property for radon.

Once the intervention is provided and all questionnaires and follow up visits take place, the study is complete. At this time, each participating household will receive a $50 gift card to Walmart, from the Southern Nevada Health District (SNHD). This gift card can be used to purchase home maintenance and cleaning supplies.



Approved by the UNLV IRB. Protocol 1008-3565
Received: 01-17-12 Approved: 01-17-12 Expiration: 01-05-13

Benefits & Risks

The benefits for participating in this study include personalized educational materials that can help you make your home a safer and healthier place. In addition, you may qualify to receive free devices and/or supplies related to creating and maintaining a healthy home.

Risks of participating in this study are minimal. There may be some level of discomfort that may come with home visits and answering questions about your home and health. If you are uncomfortable answering any of the questions in this study, you are free to skip those questions or discontinue participation. Participation is voluntary and you can withdraw at anytime. There is no penalty or loss of benefits from this study for those who choose not to participate.

Other important things to know:
All information gathered in this study will be kept completely confidential. Data will be evaluated using case numbers instead of personal names, therefore no reference will be made in written or oral materials that could link you to this study. All records will be stored in a locked facility at UNLV for five years after completion of the study or until publication. After the storage time the information gathered will be destroyed. Only researchers from UNLV will have access to the study data. You can ask questions about this study at anytime.

Questions
If you do have questions about the research, your rights as a participant, or would like more information please contact principle investigater Dr. Shawn Gerstenberger at (702) 895-5420 or shawn.gerstenberger@unlv.edu. For questions regarding the rights of research subjects, any complaints or comments regarding the manner in which the study is being conducted you may contact **the UNLV Office of Research Integrity – Human Subjects at 702-895-2794 or toll free at 877-895-2794 or via email at IRB@unlv.edu.**

Please inital one box below. Signing your name below indicates that you agree to be in this study.

_____ The initial indicates that I have read the above consent.

or

_____ The initial indicates that the above consent was read to me by the research team member

Signature of participant or parent/legal guardian of a minor child	**Date**
Printed name of participant or parent/legal guardian of a minor child	**Date**
Signature of person obtaining consent	**Date**
Printed name of person obtaining consent	**Date**

Approved by the UNLV IRB. Protocol 1008-3565
Received: 01-17-12 Approved: 01-17-12 Expiration: 01-05-13

CONSENT TO PARTICIPATE IN "HEALTHY HOMES" PROGRAM AND GENERAL RELEASE OF LIABILITY

This *Consent to Participate in "Healthy Homes" Program and General Release of Liability* ("Release") is made by _____ ("Participant") in favor of the Board of Regents of the Nevada System of Higher Education, on behalf of the University of Nevada, Las Vegas ("UNLV"), and is based on the following:

Description of Program

1. UNLV's School of Community Health Sciences has obtained a grant (the "Grant") from the Centers for Disease Control and Prevention, an agency of the United States Department of Health and Human Services (the "CDC") to identify, and in some instances correct, health hazards in private homes.

2. In accordance with the Grant, and in cooperation with the Southern Nevada Health District ("SNHD"), an agency of the State of Nevada, UNLV has established a "Healthy Homes" program in which UNLV students and faculty members ("UNLV Team Members") perform in-home inspections to identify hazards related to asthma, injury, poisoning, and structural problems. The Healthy Homes program is offered without cost to the Participant.

3. The Healthy Homes program involves three or more visits to a Participant's home over a period of 6 to 12 months. Each visit will last between 2 and 4 hours.

4. During their initial visit, UNLV team members will ask the Participant to complete an enrollment form and answer a questionnaire regarding the Participant's personal health and the condition of his or her home. Afterwards, UNLV Team Members will perform a series of inspections and tests that include the following:

    - Detection of volatile organic compounds, such as, carbon monoxide.
    - Detection of Lead-based paint using an X-ray Fluorescence handheld device.
    - Identification of moisture problems in the home using a moisture detector.
    - Identification of safety hazards that can lead to injury.
    - Identification of pests through a visual assessment.

5. In one or more subsequent visits, UNLV Team Members will provide the Participant with an educational "tool kit" to assist the Participant in identifying safety hazards in the home. UNLV Team Members will meet with the Participant to discuss the results of their inspection and to advise the Participant on ways to reduce risks in the home.

6. Depending on available resources and funding, UNLV may assist the Participant in the correction of certain hazards found in the home, including the following:

    - Providing cleaning materials such as a mop, broom, bucket, and/or trash can with a lid.
    - Providing safety equipment such as a smoke alarm, carbon monoxide-detector, and/or fire extinguisher.

7. If the Participant meets certain financial qualification criteria, UNLV may arrange for the remediation of certain structural safety hazards in the home.

8. UNLV Team Members will conduct a final home visit in which the Participant will be asked to complete a final set of questionnaires about his or her personal health and home. UNLV Team Members will also re-evaluate the Participant's home for safety and health hazards and perform one or more of the following inspections:

   - Detection of volatile organic compounds, such as, carbon monoxide.
   - Detection of Lead-based paint using an X-ray Fluorescence handheld device.
   - Identification of moisture problems in the home using a moisture detector.
   - Identification of safety hazards that can lead to injury.
   - Identification of pests through a visual assessment.

9. The Healthy Homes program will *not* include tests to determine the presence of asbestos or radon gas.

10. Upon completion of the final visit, the household will receive a $50 gift card to Wal-mart to purchase cleaning supplies.

Agreement and Release

Based on the foregoing, the Participant agrees as follows:

A. **Consent to Participate in the Healthy Homes Program**. Participant agrees to participate in the Healthy Homes program and consents to the use of all information and data, including photographs, video, film and other images, obtained by UNLV Team Members for analysis and publication. Participants agree to allow UNLV, CDC and/or SNHD to use survey responses and other data for research on housing and health. UNLV will remove all identifying information such as names, addresses and telephone numbers prior to using data for research or publication. Each Participant will be assigned a unique identifying number, which shall be kept confidential. All information will be entered into a password protected computer and any physical data files will be secured. No personal information will be used in any reports or publications that may result from this program. UNLV will retain information acquired during this program for as long as required by State and/or Federal law and regulation.

B. **Acknowledgment of Risks of Program Participation**. The Participant acknowledges that there may be some level of discomfort that may come with home visits and answering questions about his or her home and health. If the Participant is uncomfortable answering any of the questions in this study, he or she is free to skip those questions or discontinue participation in the program. Participation is voluntary and the Participant can withdraw at any time, although only those persons who complete the program will be eligible to receive a $50 Wal-mart gift card. The Participant also acknowledges that there may be risks associated with any corrective action taken in his or her home, including the removal and replacement of building materials, the use of tools and other construction equipment. The Participant will comply with all reasonable requests made by any contractor performing work on his or her property to ensure the safety of the Participant, UNLV Team Members and others.

C. **Release of UNLV, CDC and SNHD**. Participant acknowledges that the inspection of his or home is not comprehensive and that additional risks may exist beyond those (if any) identified by UNLV. Participant agrees that UNLV's inspection is for research purposes only and may not be relied upon by the Participant for any reason. Participant acknowledges that risks may be identified by UNLV that do not in fact exist (a "false

positive") and that UNLV may fail to observe risks that do in fact exist (a "false negative"). UNLV does not warrant the accuracy of any tests and advises the Participant to obtain independent verification of the condition of his or home by appropriately licensed professionals. If any corrective actions are proposed, work will be performed by a third party contractor. The Participant agrees that any claims arising from such work will be solely the responsibility of the third party contractor and not UNLV, the CDC and/or SNHD. Participant releases UNLV, CDC and SNHD, together with their employees, agents and other representatives, from all claims, arising out of his or her participation in the Healthy Homes program.

I have read, understand and agree to all terms and provisions of this Release.

Signature of participant: _____ Date: _____

Printed name: _____ Date: _____

Signature of person obtaining consent: _____ Date: _____

Printed name of person obtaining consent: _____ Date: _____

APPENDIX G – PROTOCOL FOR CONDUCTING THE HEALTHY HOME INVESTIGATION (HHI)

NEVADA HEALTHY HOMES PARTNERSHIP (NVHHP)

Protocol for Conducting a Residential Healthy Homes Investigation (HHI)

Purpose:

1. To identify the potential healthy homes issue(s) present in homes of NVHHP program participants
   a. Potential healthy homes issues are those identified as violations of the "Seven Principles of Healthy Homes" as defined by the National Environmental Health Association (NEHA) and the National Center for Healthy Housing (NCHH)
   b. The NVHHP program is a cooperative non-profit group comprised of members from the University of Nevada, Las Vegas (UNLV), the Southern Nevada Health District (SNHD), the Nevada State Health Division (NSHD), and supporting health and housing community partners

Full participation in the NVHHP program includes three total visits, spread across an approximately 6 month period.

1. The first healthy homes investigation (HHI_1) includes:
   a. A series of questionnaires aimed at collecting data about the home itself, the health of residents, and the primary resident's existing knowledge about healthy homes issues
   b. A visual inspection, by a NEHA-certified Healthy Homes Specialist (HHS), of all accessible rooms of the home and the surrounding yard
2. The second HHI visit (HHI_2), conducted approximately two to four weeks after HHI_1, includes:
   a. The delivery of an assessment report providing general recommendations for a healthy home, detailing the specific healthy homes issue(s) identified by the investigation, and summarizing the specific recommendations of the NVHHP, as well as, a summary of the assistance and or referrals that will be provided by NVHHP
   b. Targeted education, based on deficiencies in knowledge of healthy home(s) issues either recorded or observed at HHI_1
   c. The delivery of "intervention tools" (defined later in this document) to improve the health and safety of the home
3. The third HHI visit (HHI_3), conducted approximately six months after HHI_1, includes:
   a. A repeat of all HHI_1 activities, for the assessment of changes in the health and safety of the home resulting from participation in the NVHHP program
   b. Confirmation of services (if applicable) provided by NVHHP community partners
   c. Compensation for complete participation in the program with a Walmart gift card

Components of the Healthy Homes Investigation (HHI):

Identification of Eligible Homes

Eligible homes are homes that meet the following income and family size criteria:

2012 Dept. of Housing and Urban Development (HUD) Income Guidelines: Clark County, NV								
# of Household Members	1	2	3	4	5	6	7	8
Income Limit	$37,000	$42,250	$47,550	$52,800	$57,050	$61,250	$65,500	$69,700

AND, which are:

1. Referred by partner agencies - OR -
2. Recruited from outreach events - OR –
3. Personal requests received via word-of-mouth or through the NVHHP website, located at: http://NVHHP.org

AND, which meet at least one of the following criteria:

1. Have a child aged ≤17, with diagnosed or suspected asthma, permanently residing in the home
2. Have a child aged ≤6, permanently residing in the home
    a. The home must be in one of the following target zip codes:
        i. 89030, 89101, 89104, 89106, 89107, 89109, 89110, 89119, or 89121
3. Have an adult aged ≥65, permanently residing in the home
    a. The home must be in one of the following target zip codes:
        i. 89030, 89101, 89104, 89106, 89107, 89109, 89110, 89119, or 89121

Case priority is determined in the order in which the criteria are listed above.

Before HHI_1:

NVHHP staff will contact the primary resident to arrange a time and date for HHI_1 to be conducted; the date of first contact, on which a verbal agreement to participate is acquired, will be considered the "Open Date" of the case. Activities to be completed prior to HHI_1 include:

1. The case will be assigned to a primary HHS, hereby referred to as the Case Manager (CM)
2. The scheduled case will be entered into Lotus Notes by NVHHP staff and a weekly schedule will be e-mailed to all NVHHP staff the week prior to the scheduled inspection(s). The weekly schedule will include:
    a. The date the case was opened
    b. The client's primary contact information
    c. The street address for the home to be assessed
    d. Directions for conducting a HHI only, or both an HHI and a lead (Pb) inspection
    e. Additional case notes, including the referral source of the new client
    f. The assigned CM and the NVHHP staff member assigned to later data check the new case

g. The case qualifying data (i.e., asthmatics, children <6 years old, children >6 and ≤17 years old, adults >65 years old, homes built prior to 1978, and/or homes in target zip codes)

A phone call confirming the appointment will be made the day prior to the scheduled HHI_1. (NVHHP staff should be notified of all appointment cancellations). Prior to HHI_1, the CM will prepare a case folder for the new client and a "1st Visit" folder; this includes (one of each, at minimum):

1. Case Management Plan
2. Consent Form
3. Legal Liability Form
4. Resident Questionnaire
5. Pre-Health Assessment
6. Educational Assessment
7. Child Safety Supplement
8. Suspected Asthma Supplement
9. Asthma Supplement
10. Asthma Educational Assessment
11. Visual Assessment Checklist
12. Blank piece of paper for the drawing of the home layout ("map")
13. Real Property Parcel Record
    a. Obtained from the Clark County Assessor webpage located at: http://www.clarkcountynv.gov/depts/assessor/Pages/RecordSearch.aspx

AND, if applicable (homes with children with documented elevated blood lead levels (EBLLs) or any homes constructed before 1978):

14. Lead Investigation Questionnaire
15. Paint Sheets for XRF (X-Ray Fluorescence) results recording
16. Additional sampling sheets (i.e. Soil, Dust for homes with EBLL children)
17. A copy of the Environmental Protection Agency's (EPA) The Lead-Safe Certified Guide to Renovate Right brochure in either English or Spanish, as appropriate

The CM will fill in as much information as possible on the forms, prior to going to HHI_1, including:

1. The case number (retrieved from the "Lead and HH Inspection List" database on the UNLV Healthy Homes server)
2. Client contact information
3. Property record information obtained from the Clark County Assessor Real Property Parcel Record

If a lead (Pb) inspection is to be conducted, the following activities must also take place prior to HHI_1:

1. The XRF analyzer and Geiger Counter must also be retrieved from the University of Nevada, Las Vegas (UNLV) Environmental and Occupational Health (EOH) laboratory by NVHHP staff trained in Radiological Safety and Transportation
    a. Prior to taking this equipment off campus, appropriate travel documents ("Risk Management and Safety: Shipping & Receiving Radioactive Material Instructions for

Drivers" and "Radioactive Material Transportation Checklist") must be completed and faxed to the UNLV Radiological Safety Office (RSO) at 702-895-4690

The CM will also ensure that a camera (with a charged battery), temperature/humidity detector, carbon monoxide detector, refrigerator/freezer thermometers, and moisture meter are brought to HHI_1.

Additional lead sampling equipment should also be taken to homes with EBLL cases, including: disposable gloves, ghost wipes, plastic sample tubes, etc. For homes with EBLLs, please see Appendix A for specific protocols regarding the preparation for and completion of required lead (Pb) sampling activities.

During HHI_1:

The CM, accompanied by at least one other NVHHP staff member, will conduct the HHI_1. If the second staff member is not a NEHA-certified HHS, than they must administer the forms and questionnaires and act as HHS_1 (duties below), while the certified CM acts as HHS_2 (duties below) and conducts the visual assessment. If both members are certified HHSs, then either member may complete either set of duties, as HHS_1 or HHS_2, but it is recommended that the CM perform the duties of HHS_2.

HHS 1 Duties

1. Complete the Consent Form with the primary resident (R1 = home owner)
2. Complete the Legal Liability Waiver with the R1
3. Complete Page 1 and the Lead Based Hazards section on Page 2 of the Lead Investigation Questionnaire with the R1 (if applicable)
4. Complete the Resident Questionnaire with the R1
5. Complete the Pre-Health Assessment with the R1
6. Complete the Educational Assessment with the R1
7. Complete the Child Safety Supplement (only for homes with children aged ≤6)
8. Complete the Suspected Asthma Supplement (only for R1 who reported respiratory difficulties without a respiratory disease diagnosis on the Pre-Health Assessment)
9. Complete the Asthma Supplement (only for R1 who reported an asthma diagnosis on the Pre-Health Assessment)
10. Complete the Asthma Educational Assessment with the R1 (only for R1 who reported ANY member of the household as having an asthma diagnosis on the Pre-Health Assessment)
11. Complete the HELP of Southern Nevada Weatherization Contact Form (only for R1 who report energy efficiency issues in the home, which are supported by the visual observations of the HHS 2)
12. Inquire with the R1 regarding additional child household members (aged ≥6 through <18), with diagnosed or suspected asthma, for whom the R1 is willing (and legally authorized; i.e. biological child, step-child, etc.; if the R1 is not legally authorized, an additional consent form must be obtained from the child's parent or legal guardian) to provide additional health information
    a. If the child (C1) is permitted to participate:
        i. Complete a Pre-Health Assessment with the R1 on behalf of C1

ii. Complete the Suspected Asthma Supplement with the R1 on behalf of C1 (only for C1 with reported respiratory difficulties without a respiratory disease diagnosis on the Pre-Health Assessment) - OR -

iii. Complete the Asthma Supplement (only for C1 with a reported asthma diagnosis on the Pre-Health Assessment)

b. Complete items i. through iii. (above) for any additional child residents aged ≥6 through <18 (with diagnosed or suspected asthma) for which the R1 is willing to allow participation in the NVHHP program

13. Inquire with the R1 regarding additional child household members (aged ≤6), for whom the R1 is willing (and legally authorized; i.e. biological child, step-child, etc.; if the R1 is not legally authorized, an additional consent form must be obtained from the child's parent or legal guardian) to provide additional health information
    a. If the child (C2) is permitted to participate:
        i. Complete a Pre-Health Assessment with the R1 on behalf of C2
        ii. Complete the Suspected Asthma Supplement with the R1 on behalf of C2 (only for C2 with reported respiratory difficulties without a respiratory disease diagnosis on the Pre-Health Assessment) - OR -
        iii. Complete the Asthma Supplement (only for C2 with a reported asthma diagnosis on the Pre-Health Assessment)
    b. Complete items i. through iii. (above) for any additional child residents aged ≤6 for which the R1 is willing to allow participation in the NVHHP program
14. Inquire with the R1 regarding additional adult household members, aged ≥65, who are present during HHI_1 and who may be willing to provide their health information
    a. If a second adult (R2 = second resident) is willing to participate:
        i. Complete an additional Consent Form with the R2
        ii. Complete a Pre-Health Assessment with the R2
        iii. Complete the Suspected Asthma Supplement (only for the R2 who reported respiratory difficulties without a respiratory disease diagnosis on the Pre-Health Assessment) - OR -
        iv. Complete the Asthma Supplement (only for the R2 who reported an asthma diagnosis on the Pre-Health Assessment)
    b. Complete items i. through iv. (above) for any additional adult residents (aged ≥65) willing to participate in the NVHHP program
15. Inquire with the R1 regarding additional adult household members related to an asthmatic child, aged ≥18 with diagnosed or suspected asthma, who are present during HHI_1 and who may be willing to provide their health information
    a. If a third adult (R3 = tertiary resident) is willing to participate:
        i. Complete an additional Consent Form with the R3
        ii. Complete a Pre-Health Assessment with the R3
        iii. Complete the Suspected Asthma Supplement (only for the R3 who reported respiratory difficulties without a respiratory disease diagnosis on the Pre-Health Assessment) - OR -
        iv. Complete the Asthma Supplement (only for the R3 who reported an asthma diagnosis on the Pre-Health Assessment)
    b. Complete items i. through iv. (above) for any additional adult residents (aged ≥18 with diagnosed or suspected asthma) willing to participate in the NVHHP program

16. Complete applicable components of the Case Management Plan form, to ensure that no documents are overlooked, as follows:
    a. Check "Yes" or "No" regarding the completion of a lead inspection
        i. If "Yes", complete the date and inspector name
        ii. If "Yes", check appropriate boxes to indicate the proper completion of listed documents
        iii. If "No", cross out the lead inspection section
    b. Check "Yes" regarding the completion of the initial healthy homes visit
        i. Complete the date and additional inspector names
        ii. Complete the documents chart to ensure all required forms were completed
        iii. Check appropriate boxes to indicate the proper completion of activities ("Consent signed?", "Legal signed?", and "Copies to HO?")
17. Place all case documents in a "1st Visit Docs" folder

HHS 2 Duties

1. Inform the R1 that you will be conducting a full room-by-room visual assessment of the home and inquire if there are areas of the home with which you should not enter/are not allowed by the R1's request
2. Use the blank piece of paper to draw a home layout ("map")
    a. On the map, indicate:
        i. The case number
        ii. The date of HHI_1
        iii. Label each room/unique area as follows:
            1. Front yard
            2. Backyard
            3. Interior Entryway
            4. Living Room
            5. Dining Room
            6. Kitchen
            7. Laundry
            8. Garage
            9. Bedroom 1
            10. Bedroom 2
            11. Bedroom 3
            12. Bedroom 4
            13. Bathroom 1
            14. Bathroom 2
            15. Bathroom 3
            16. Hallway
            17. Staircase
        iv. If any additional rooms are present, they should be identically labeled on both the map and Visual Assessment Checklist (VAC) form in the columns provided
        v. Label, on the map, any additional rooms which exist, but which are inaccessible for subsequent observation (i.e., at the R1's request, due to the presence of a hazard, etc.)

3. Place the refrigerator and freezer thermometers into the most used refrigerator in the home, regardless of location
4. Conduct a visual assessment of all accessible areas of the home using the Visual Assessment Checklist (VAC) form
    a. On the VAC, if not already filled in, indicate:
        i. The case number
        ii. Check the Pre- checkbox to indicate that the visit is HHI_1
        iii. The date of the assessment
        iv. The name of the HHS conducting the visual assessment
        v. Write in any additional rooms (i.e. Bedroom 5, Bathroom 4, etc.) into blank columns of all section headings, as dictated by the map
    b. Using the map as your guide, indicate "99" (indicating that a room does not exist) in the first row, under each appropriate column heading for non-existent areas
        i. Draw a vertical line from the "99" in the first box down through the entire column to indicate "99"s should be data entered for all subsequent boxes
        ii. Follow this same procedure at each section break, for clarity
    c. Using the map as your guide, indicate "66" (indicating an area that is inaccessible for any reason) in the first row, under each appropriate column heading for inaccessible areas
        i. Draw a vertical line from the "66" in the first box down through the entire column to indicate "66"s should be data entered for all subsequent boxes
        ii. Follow this same procedure at each section break, for clarity
        iii. For data entry purposes, a pre-filled "99" takes precedence over a "66"
    d. Check each accessible area for EVERY observation listed in the leftmost column of the VAC under the following sections:
        i. Indoor Air Quality
        ii. Pb Prevention
        iii. Structural Elements
        iv. Pests
        v. Energy Efficiency
        vi. Detectors
        vii. Cleanliness
    e. Record all visual assessment results as follows:
        i. If the observation/condition is NOT observed, simply leave the corresponding box BLANK
        ii. If the observation/condition is observed, write a "1" in the corresponding box

1. **EXCEPTIONS** for recording observations on Page 2 of the VAC:
    a. For smoke detector and carbon monoxide (CO) detector observations:
        i. Leave the corresponding box BLANK if no detector exists in the area
        ii. Write a "1" in the corresponding box if a detector is present, but NOT working
        iii. Write a "2" in the corresponding box if a detector is present AND is working

iv. Write a "3" in the corresponding box if a detector is present, but it is UNKNOWN if the detector is working

b. For cleanliness and clutter observations:
   i. EVERY accessible area, should have a "0", "1", or "2" written in the corresponding box to indicate as follows:
      1. The area in question was not clean = "0"; some clean = "1"; clean = "2"
      2. The area in question had a high level of clutter = "0"; a medium level of clutter = "1"; a low level of clutter = "2"

f. For homes with permanent residents aged ≥65, check each accessible area for every observation listed in the leftmost column of the VAC under the Adults ≥65 section
   i. Record visual assessment results in this section as follows:
      1. If the observation/condition is NOT observed, simply leave the corresponding box BLANK
      2. If the observation/condition is observed, write a NUMBER in the corresponding box, which is indicative of the number of instances of said observation counted
         a. Refer to Appendix B: Injury Prevention Counts for examples regarding appropriate counting and recording of instances

g. For homes with permanent child residents aged ≤6, check each accessible area for every observation listed in the leftmost column of the VAC under the Children ≤6 section
   i. Use a meter stick, or approximate the height of 1 meter, to be used as a guide throughout all areas; this is the height, from the floor, under which an observation should be recorded
   ii. Record visual assessment results in this section as follows:
      1. If the observation/condition is NOT observed at all or is NOT observed at a distance of ≤1 meter from the floor, simply leave the corresponding box BLANK
      2. If the observation/condition is observed, within a distance of ≤1 meter from the floor, write a NUMBER in the corresponding box, which is indicative of the number of instances of said observation counted
         a. Refer to Appendix B: Injury Prevention Counts for examples regarding appropriate counting and recording of instances

h. On Page 3 of the VAC, obtain and record the following:
   i. Use the carbon monoxide (CO) detector to determine the presence of CO:
      1. On the first floor of the home, in the Living Room
      2. On the second floor of the home, in the Hallway (if applicable)
   ii. Use the temperature/relative humidity detector to obtain the temperature (in degrees Fahrenheit) and relative humidity (as a percentage):
      1. Outside

2. On the first floor of the home, in the Living Room
3. On the second floor of the home, in the Hallway (if applicable)

iii. Use the infrared beam of the temperature detector to obtain the temperature of the hot water at the kitchen faucet
iv. Retrieve the thermometers from the primary refrigerator and freezer to record the corresponding temperatures
v. All boxes in the Readings section should be completed with either a measured value or one of the following data entry codes:
   1. If not applicable, record "NA" in the corresponding box
   2. If the reading could not be taken, record "NT" in the corresponding box
   3. If the area required for the reading is inaccessible, record "I" in the corresponding box
vi. If not filled in prior to HHI_1, the livable square footage of the home can be obtained from the Real Property Parcel Record or must be obtained/estimated by the RI (necessary for mobile homes)

i. Complete the Additional Notes section of the VAC, as needed
   i. Notes may include expansions or details of observations, discrepancies between self-reported information and subsequent observations, additional case notes not captured on another form, etc.
j. Take pictures of egregious healthy homes issues, particularly of issues for which you would refer the client to a community partner for additional assistance (if applicable)

HHS 1 and HHS 2 Shared Duties (for homes that also need lead inspections – homes built prior to 1978 or homes with EBLL children)

1. Complete the Building Condition section on Page 3 of the Lead Investigation Questionnaire
   a. The results of the Building Condition assessment should identify:
      i. Deteriorating painted surfaces
      ii. Areas of visible dust or paint chip accumulation
      iii. The presence of any significant structural or moisture-related problems in the home (if applicable)
2. Take a picture of the home exterior, including the street address number if possible
3. Put on a dosimeter(s)
4. The following actions must be completed by an Environmental Protection Agency (EPA) – certified Lead Risk Assessor
   a. Turn on and calibrate the XRF
      i. Take at least 3 calibration check readings of at least 20 seconds each and record results on the Calibration Form found in the XRF case
         1. For any inspection lasting longer than four hours, the calibration check must be repeated, and for every 4 hours thereafter
   b. Using the map drawn during the healthy homes visual assessment, systematically take readings in each room
      i. Check paint on walls, doors, shelves, floors, and furniture, as well as all friction, impact, and chewable surfaces, etc.
      ii. Take at least one XRF reading on each testing combination in each room

iii. Check additional substrates in the home that are potentially lead-containing
    1. Tile
    2. Porcelain
    3. Vinyl
    4. Etc.
iv. Record results (this can be done be any NVHHP staff member; no special certification required) on Paint Sheets, including:
    1. Substrate tested
    2. Component tested
    3. Color of paint/substrate tested
    4. Condition of the paint/substrate tested
        a. Indicated as: "Intact", "Fair", or "Poor"
    5. Location/area of the component tested
        a. As identified by the map
    6. Numerical result from the XRF
    7. Circle associated positive/negative indicator
        a. Values over 1.0 mg/cm^2 are considered positive, as such "+" should be circled
        b. Values under 1.0 mg/cm^2 are considered negative, as such "-" should be circled
v. After completing all original readings in the home, return to ten randomly selected points, which were previously tested, to perform repeat XRF tests for quality control/quality assurance
    1. Record the results on the Paint Sheets in an identical fashion, but indicate that the readings is a "Repeat" in the Notes section
vi. Take photographs of all lead-positive components
    1. The location of pictures taken in the home should be recorded on the Case Management Plan form

c. Calibrate and turn off the XRF
    i. Take at least 3 calibration check readings of at least 20 seconds each and record results on the Calibration Form found in the XRF case
d. For homes with EBLL children, complete additional sampling activities as outlined by Appendix A

After HHI_1:

After completion of HHI_1, the following activities should be conducted to accurately debrief a case:

1. Download XRF data to the server under the appropriate case folder (if applicable)
2. Download pictures to the server under the appropriate case folder (if applicable)
    a. Label pictures (Picture 1, Picture 2, etc.) according to the order listed on the Case Management Plan
3. Enter the case into the "Lead and HH Inspection List" database, as a place holder
    a. At minimum, data enter:
        i. The case number
        ii. The R1 name
        iii. The date the first inspection was completed

iv. The name of the inspectors

4. Update the "Case Tracking" database with:
    a. Case number(s)
    b. The date the case was open
    c. Case status
    d. Case manager
    e. Staff member assigned to data check
    f. Indicate "NA" for not applicable fields
5. Send a case note e-mail to NVHHP staff, which includes:
    a. Results of lead testing (if applicable)
    b. Brief summary of identified Healthy Homes issues

Within 2 weeks from the completion of HHI_1, the following activities should be completed:

1. Completely enter data from HHI_1 (indicate completion by initialing individual documents, as well as, updating the "Lead and Healthy Homes Data Entry" section on the Case Management Plan) into the following databases:
    a. "Lead and HH Inspection List" (data through HHI_1)
    b. "Lead Inspection" (if applicable)
    c. "Resident Questionnaire"
    d. "Health Questionnaire"
    e. "Education"
    f. "Visual Assessment"
    g. "Suspected Asthma Supplement" (if applicable)
    h. "Asthma Supplement" (if applicable)
    i. "Asthma Educational Assessment" (if applicable)
    j. "Child Safety Supplement" (if applicable)
2. Update the Case Management Plan regarding any missing case documents (if applicable)
3. Complete the XRF excel file with information collected on the Paint Form (if applicable)
4. Write the Residential Environmental Lead Hazard Investigation Report and post the completed report to the appropriate folder on the server (if applicable)
    a. E-mail NVHHP staff regarding the completion of the report for the addition of signatures, forwarding to appropriate community partners, and mailing to the home owner
5. Write the Healthy Homes Assessment Report and post the completed report to the appropriate folder on the server
    a. E-mail NVHHP staff regarding the completion of the report
    b. Place a copy of the signed report in the "2nd Visit" case folder
6. E-mail community partners with referrals (if applicable)
    a. Include the name and address of the NVHHP client, the reason for the referral, and inquire about the eligibility of the client (copy NVHHP staff on the e-mail)
        i. If a HELP of Southern Nevada Contact Form was completed at HHI_1 on behalf of the R1, indicate this in the contact e-mail to the agency
7. Update the Case Management Plan section entitled "Educational Healthy Homes Visit"
    a. For any section on the Educational Assessment or Asthma Educational Assessment where two or more questions were missed, indicate that the R1 needs targeted education (or indicate that none is needed)

b. Indicate which "Intervention Tools" will be provided to the R1, based on responses from the HHI_1 questionnaires and Visual Assessment (or indicate that none are needed), including:
    i. Carbon monoxide detector
    ii. Emergency contact magnet
    iii. Smoke detector
    iv. Fire extinguisher
    v. First aid kit
    vi. Non-slip rug backing
    vii. Batteries
    viii. Energy efficiency kit
    ix. Garbage can and lid
    x. Integrated Pest Management (IPM) supplies
        1. Gel bait
        2. Boric acid
        3. Caulk
    xi. Cleaning supplies
        1. Simple Green cleaner
        2. Rags
        3. Bucket
        4. Mop
        5. Broom
    xii. Asthma management supplies
        1. Allergen-reducing pillow covers
        2. Allergen-reducing mattress covers
    xiii. Other
c. Indicate which "Referrals" were given to the R1, based on responses from the HHI_1 questionnaires and Visual Assessment (or indicate that none were given)
    i. **EXCEPTION**: The NVHHP does not currently provide referrals for rental properties; only owner-occupied homes can receive referrals

8. After completion of data entry and report writing, place the case into the box of the NVHHP staff member assigned to check the accuracy of the data entry

Before HHI_2:

The HHI_2 will be scheduled by NVHHP staff anywhere from two to four weeks after the completion of HHI_1. A phone call confirming the appointment will be made the day prior to the scheduled HHI_2. (NVHHP staff should be notified of all appointment cancellations). Activities to be completed prior to the HHI_2 include:

1. The CM will prepare a "2nd Visit" case folder for the client; this includes:
    a. The Case Management Plan (transferred over from the "1st Visit" case folder)
        i. Refer to the Case Management Plan to determine if any missing documents need resolution at HHI_2
    b. A NVHHP Educational Booklet
        i. Any educational deficiencies identified, by either the Educational Assessment, the Asthma Educational Assessment, or other communication, should be highlighted/underlined in the Educational Booklet for targeted education at HHI_2
    c. One printed copy of the completed Healthy Homes Assessment Report for the R1

i. One signed electronic copy of the Healthy Homes Assessment Report will remain on the NVHHP server in the appropriate case file

2. Collection of intervention tools to be provided to the R1, as indicated by the Case Management Plan and the Healthy Homes Assessment Report

During HHI_2:

The purpose of the HHI_2 is to provide specific, targeted education to the R1, based on the Seven Principles of Healthy Homes, as well as additional NVHHP project aims (energy efficiency/sustainability and asthma). At HHI_2, the HHSs should:

1. Discuss the Healthy Homes Assessment Report
    a. Review the "General Recommendations for a Healthy Home" section
    b. Discuss the "Identified Healthy Homes Issues" section
        i. Highlight the specific recommendations provided to address each issue
        ii. If no healthy homes issues were identified, reinforce positive behaviors and encourage continued action
    c. Discuss the "Identified Asthma Triggers" section (if applicable)
        i. Highlight the specific recommendations provided to address each issue
    d. Discuss the "Assistance Provided by the Nevada Healthy Homes Partnership Program" section (if applicable)
        i. Highlight the specific intervention tools provided by the NVHHP
            1. Where possible, demonstrate the proper use of supplied tools
    e. Discuss the "Referrals Provided by the Nevada Healthy Homes Partnership" section (if applicable)
        i. Highlight the specific issues and corresponding community partners that may be able to assist with the remediation of said issues
        ii. **REMINDER:** The NVHHP does not currently provide referrals for rental properties; only owner-occupied homes can receive referrals
    f. Discuss the NVHHP Educational Booklet
        i. Describe the organization and usefulness of the Educational Booklet
        ii. Section-by-section, discuss highlighted/underlined statements that correspond to missed questions on the Educational Assessment or Asthma Educational Assessment
            1. If the Case Management Plan indicates that "No targeted education is needed", briefly discuss the Educational Booklet as a whole
        iii. Highlight the "Resources" section to encourage the R1 to seek out additional services that may positively contribute to the health and safety of the home and its occupants

After HHI_2:

After completion of HHI_2, the following activities should be conducted to accurately debrief a case:

1. Update the "Lead and HH Inspection List" database (data through HHI_2)
2. After completion of data entry, place the case into the box of the NVHHP staff member assigned to check the accuracy of the data entry
3. Send a case note e-mail to NVHHP staff

If the case includes an asthmatic participant, the following additional activities should be completed by the CM after the HHI_2:

1. Contact R1, by phone, 3-4 months after HHI_2 to inquire about the health status of the asthmatics in the home, any new health issues, and/or need for referrals
    a. Update the Case Management Plan accordingly, indicating:
        i. An update on the child's health
        ii. If intervention tools given at HHI_2 are being utilized
        iii. Whether the child currently has an asthma action control plan
        iv. If the R1 has any additional questions or requests
2. Should contact with the R1 not be achieved after three separate attempts, an asthma newsletter from the NVHHP will be sent
    a. The newsletter will contain suggestions for reducing asthma triggers in the home, advice about getting an asthma action control plan, highlighted local resource(s), and other pertinent asthma-specific education

Before HHI_3:

The HHI_3 will be scheduled by NVHHP staff anywhere from four to six months after the completion of HHI_1. A phone call confirming the appointment will be made the day prior to the scheduled HHI_3. (NVHHP staff should be notified of all appointment cancellations). Activities to be completed prior to the HHI_3 include:

1. The CM will prepare a "3rd Visit" case folder for the client; this includes:
    a. The Case Management Plan (transferred over from the "2nd Visit" case folder)
    b. Resident Questionnaire (indicate "Post")
    c. Post-Health Assessment
    d. Educational Assessment (indicate "Post")
    e. Child Safety Supplement (indicate "Post", if applicable)
    f. Suspected Asthma Supplement (indicate "Post", if applicable)
    g. Asthma Supplement (indicate "Post", if applicable)
    h. Asthma Educational Assessment (indicate "Post", if applicable)
    i. Visual Assessment Checklist (indicate "Post")
    j. A copy of the home layout ("map")
    k. Program Evaluation
    l. Gift Card Agreement
        a. The Gift Card Agreement should be pre-filled with the name of the R1 and the assigned gift card number and pin number
            i. A photocopy of the gift card should be labeled with the appropriate case number and maintained in the case file
            ii. The Accounts Receivable Gift Card Tracking excel sheet should also be updated with appropriate information, prior to gift card disbursal at HHI_3

During HHI_3:

The CM, accompanied by at least one other NVHHP staff member, will conduct the HHI_3. If the second staff member is not a NEHA-certified HHS, than they must administer the forms and questionnaires and act as HHS_1 (duties below), while the certified CM acts as HHS_2 (duties below) and conducts the visual assessment. If both members are certified HHSs, then either member may complete either set of duties, as HHS_1 or HHS_2, but it is recommended that the CM perform the duties of HHS_2.

HHS 1 Duties

1. Complete the Resident Questionnaire with the R1
2. Complete the Post-Health Assessment with the R1
3. Complete the Educational Assessment with the R1
4. Complete the Child Safety Supplement (only for homes with children aged ≤6)
5. Complete post assessments for ALL applicable documents completed at HHI_1 for the R1 and any additional household residents (refer to the Case Management Plan for necessary documents)
    a. If any documents from HHI_1 cannot be completed at HHI_3, indicate the reason on the Case Management Plan
6. Complete the Program Evaluation with the R1
7. Complete the Gift Card Agreement with the R1 and supply them with their assigned gift card

HHS 2 Duties

1. Inform the R1 that you will again be conducting a full room-by-room visual assessment of the home and inquire if there are areas of the home with which you should not enter/are not allowed by the R1's request
2. Refer to the map from HHI_1 for location descriptions
    a. If any additional rooms are present, other than those predetermined on the Visual Assessment Checklist (VAC), label them appropriately on the post-VAC form in the columns provided
    b. Indicate, on the VAC, any rooms which exist, but which are inaccessible for subsequent observation (i.e., at the R1's request, due to the presence of a hazard, etc.)
3. Place the refrigerator and freezer thermometers into the most used refrigerator in the home, regardless of location
4. Conduct a visual assessment of all accessible areas of the home using the Visual Assessment Checklist (VAC) form
    a. On the VAC, if not already filled in, indicate:
        i. The case number
        ii. Check the Post- checkbox to indicate that the visit is HHI_3
        iii. The date of the assessment
        iv. The name of the HHS conducting the visual assessment
        v. Write in any additional rooms (i.e. Bedroom 5, Bathroom 4, etc.) into blank columns of all section headings, as dictated by the map
    b. Using the map as your guide, indicate "99" (indicating that a room does not exist) in the first row, under each appropriate column heading for non-existent areas
        vi. Draw a vertical line from the "99" in the first box down through the entire column to indicate "99"s should be data entered for all subsequent boxes
        vii. Follow this same procedure at each section break, for clarity
    c. Using the map as your guide, indicate "66" (indicating an area that is inaccessible for any reason) in the first row, under each appropriate column heading for inaccessible areas
        viii. Draw a vertical line from the "66" in the first box down through the entire column to indicate "66"s should be data entered for all subsequent boxes
        ix. Follow this same procedure at each section break, for clarity

d. Check each accessible area for EVERY observation listed in the leftmost column of the VAC under the following sections:
    x. Indoor Air Quality
    xi. Pb Prevention
    xii. Structural Elements
    xiii. Pests
    xiv. Energy Efficiency
    xv. Detectors
    xvi. Cleanliness
e. Record all visual assessment results as indicated in HHI_1
f. For homes with permanent residents aged ≥65, check each accessible area for every observation listed in the leftmost column of the VAC under the Adults ≥65 section
    xvii. Record visual assessment results in this section as indicated in HHI_1
g. For homes with permanent child residents aged ≤6, check each accessible area for every observation listed in the leftmost column of the VAC under the Children ≤6 section
    xviii. Use a meter stick, or approximate the height of 1 meter, to be used as a guide throughout all areas; this is the height, from the floor, under which an observation should be recorded
    xix. Record visual assessment results in this section as indicated in HHI_1
h. On Page 3 of the VAC, obtain and record the readings as indicated in HHI_1
i. Complete the Additional Notes section of the VAC, as needed
    xx. Notes may include expansions or details of observations, discrepancies between self-reported information and subsequent observations, additional case notes not captured on another form, etc.
j. Using the Case Management Plan for reference, take follow-up pictures of areas with egregious healthy homes issues identified in HHI_1 (if applicable)
    xxi. The location of pictures taken in the home should be recorded in the Additional Notes section of the VAC and recorded on the Case Management Plan form
    xxii. Pictures should be taken in the same location as those taken in HHI_1, even if the healthy homes issue(s) has been mediated before HHI_3

After HHI_3:

After completion of HHI_3, the following activities should be conducted to accurately debrief a case:

1. Download pictures to the server under the appropriate case folder (if applicable)
    a. Label pictures (Post-Picture 1, Post-Picture 2, etc.) according to the order listed on the Case Management Plan
2. Send a case note e-mail to NVHHP staff

Within 2 weeks from the completion of HHI_3, the following activities should be completed:

1. Completely enter data from HHI_3 (indicate completion by initialing individual documents, as well as, updating the "Lead and Healthy Homes Data Entry" section on the Case Management Plan) into the following databases:
    a. "Lead and HH Inspection List" (data through HHI_3)
    b. "Lead Inspection" (if applicable)

c. "Resident Questionnaire"
d. "Health Questionnaire"
e. "Education"
f. "Visual Assessment"
g. "Suspected Asthma Supplement" (if applicable)
h. "Asthma Supplement" (if applicable)
i. "Asthma Educational Assessment" (if applicable)
j. "Child Safety Supplement" (if applicable)

2. After completion of data entry, place the case into the box of the NVHHP staff member assigned to check the accuracy of the data entry
3. NVHHP staff will update the "Case Tracking" database and Case Management Plan once data entry is complete and case closure criteria has been met
   a. Case closure criteria includes:
      i. A case involving an asthmatic child is closed when one of the following criteria is met:
         1. A child that previously did not have a primary care physician, now has a physician
         2. There has been a reduction in emergency department/physician office visits due to asthma symptoms
         3. A child that did not have an asthma action plan, now has a current asthma action plan
         4. The Asthma Educational Assessment score has improved from the initial testing
         5. If it is not possible to improve on any of the above measures from HHI_1 to HHI_3, than the asthma case will be closed upon delivery of the Healthy Homes Assessment Report, upon delivery of intervention tools (if applicable), upon completion of any referred renovation (if applicable), and upon completion of HHI_3 activities and data management
      ii. All remaining cases are closed when:
         1. The final home visit, data management, and home remediation (if applicable) is complete - AND -
         2. A relationship has been established with recommended local resources (if applicable)
   b. If the R1 withdraws from the program at any point, the case is closed:
      i. After the Healthy Homes Assessment Report has been mailed to the homeowner and all data management is complete
   c. A case will be administratively closed if:
      i. The R1 fails to respond by phone (or main method of contact) to NVHHP staff after 3 attempts - AND -
      ii. The R1 fails to reply within 2 weeks to a letter sent to residence requesting contact

Appendix A
Sample Collection for Homes with EBLL Children

Dust Sample Collection

1. Equipment
   a. Disposable wipes
   b. Sample tubes
   c. Disposable gloves
   d. Masking tape
   e. Templates
   f. Indelible marker
   g. Trash bag
   h. Sample carry bag
2. Forms
   a. Forensic Analytical Chain of Custody form
   b. Dust Sample form

Procedure:

1. Identify area where sample(s) is/are to be collected, possible location of dust wipe samples include:
   a. Any surface that tested positive for lead with the XRF
   b. The principal play room
   c. Kitchen
   d. Child's bedroom
   e. Entry way
   f. Areas undergoing renovation or remodeling
   g. Etc.
2. Label sample tube using an indelible marker with the following information:
   a. Dust sample # ____
   b. Case # ____
   c. Date
   d. Location (floor, windowsill, etc.)
   e. Type of surface, if relevant (carpet, tile, etc.)
   f. Dimensions or area (in ft^2) of the sample collection area
3. Using a clean dust wipe, wipe off the template before the first use, in between collecting each sample, and after collecting the last sample
4. Lay the template down in the desired area and adhere to surface with masking tape
5. Put disposable gloves on and use new gloves for each sample collected
   a. Do not touch any surface other than the wipe after putting on the glove
6. Place wipe at one corner of surface with wipe fully opened and flat on the surface
7. First wipe pass is side-to-side
   a. Grasp the wipe between the thumb and palm
   b. Press down firmly
   c. Wipe side-to-side with as many "S" motions as are necessary to completely cover the entire wipe area
8. Second wipe pass is top-to-bottom
   a. Fold wipe in half with the contaminated side facing inward

b. Once folded, place the wipe at the top corner of the wipe area and press down firmly with the palm and fingers
c. Repeat wiping area with "S" motion, but move in a top-to-bottom direction

9. For the final pass
   a. Fold the wipe in half again (contaminated side inward)
   b. Wipe around the perimeter of the wipe area
10. After wiping, fold the wipe (contaminated side facing inward) and insert the wipe into the sample tube
11. Seal the tube
12. Remove all trash (masking tape, gloves, etc.) and place in trash bag
13. Record the sample on the Forensic Analytical Chain of Custody form
14. Repeat steps 2 – 13 for all samples to be collected
15. Before finishing the dust sample procedure, one blank sample should be collected by:
    a. Removing a wipe from the packet with a new glove and shaking the wipe open
    b. Refold the wipe as it occurs during the actual sampling procedure, and then insert into a sample tube without touching any surface or object
    c. Label the tube and record on the Chain of Custody form

Soil Sample Collection

1. Equipment
   a. Soil sampling device
   b. Disposable gloves
   c. Dust wipes
   d. Sample tubes
   e. Indelible marker
   f. Tape measure
   g. Trash bag
   h. Sample carry bag
2. Forms
   a. Forensic Analytical Chain of Custody form
   b. Soil/Water Sample form

Procedure:

Soil samples may be collected as a composite consisting of 3-10 subsamples. It is recommended that, if bare soil is present, the team collect at least one soil sample, preferably from an area frequented by the child, in the following manner:

1. Identify area where sample(s) is are to be collected; possible location of soil samples should include:
   a. The child's principal play area
   b. Along the drip line
   c. Near the building foundation
   d. Etc.
2. Diagram where the samples are to be collected
   a. Samples taken along the foundation drip line should be on a straight line, at least 2-6 feet apart

b. Samples taken in play areas or patches should be from equidistant points along each axis of an X-shaped grid

3. Label sample tube(s) using an indelible marker with the following information:
   a. Soil # ____
   b. Case # ____
   c. Date
   d. Location (play area, drip line, sandbox, etc.)
4. Ideally, soil samples should be as uniform as possible and should not contain rocks, stones, sticks, vegetation, or other debris
5. Using a clean dust wipe, wipe off the soil sampling device before the first use and, if samples are not composited, in between collecting each sample
6. Use soil sampling device to collect the top ½ inch to inch section of soil and transfer to the sample tube
   a. All subsamples are collected in this manner, and placed in the same tube
7. After collecting the last sample, clean off the soil sampling device with a wipe until all traces of visible dirt have been removed
8. Dispose of any trash into the trash bag
9. Record sample on Forensic Analytical Chain of Custody form
   a. The same form that was used to record dust samples can be used again

Water Sample Collection

1. Equipment
   a. Nalgene bottle (1 liter capacity)
   b. Indelible marker
2. Forms
   a. Forensic Analytical Chain of Custody form
   b. Directions for Water Sample Collection form
   c. Soil/Water Sample form

Procedure:

The sample should be collected after water has been sitting in the pipes for at least six hours (i.e. no water use during this period prior to sample collection). Due to this requirement, early morning is the best time for collecting a sample, therefore the team will leave a 1 liter Nalgene bottle with the child's family for them to collect the sample. An instruction sheet and a blank Forensic Analytical Chain of Custody form will also be provided to the family. The collection procedure is as follows:

1. Using an indelible marker, label a 1 liter Nalgene sample bottle with the Case # and draw a "Fill" line around the top rim of the bottle
2. Explain to the family the importance of following the instruction sheet which details that:
   a. A minimum 6-hour period during which there is no water use throughout the house must be achieved prior to sampling. It is recommended that the sample be collected during the early morning (before flushing the toilet, washing hands, etc.) to ensure that the necessary stagnant water condition exists.
   b. A kitchen or bathroom cold-water faucet is to be used for sampling
   c. Place the opened sample bottle below the faucet and gently open the cold water tap; fill the sample bottle to the top and turn off the water

d. Tightly cap the sample bottle
e. Show the family what information should be filled out on the forms provided

3. Advise the family that NVHHP staff will return to pick up the sample and paperwork the following morning
   a. Assign the task or water sample pick up to a member of the NVHHP staff

Samples Preparation and Shipment to the Lab

1. Equipment
   a. Collected sample bottles
   b. Shipping box
   c. Packing material
2. Forms
   a. Appropriate Chain(s) of Custody
   b. FedEx Shipping Label

Procedure:

1. Double check that the sample bottles are properly labeled and recorded on the chain of custody form(s)
2. Ensure that all the lids are securely closed
   a. For sample bottles containing liquid samples, wrap the lids with parafilm to prevent leaking and maintain sample integrity
3. Complete the chain of custody form with "relinquished by" information
4. Copy the chain of custody form for the file
5. Place sample bottles in box and ensure they are securely packed (use newspaper, bubble wrap, packing peanuts, etc.)
6. Complete a FedEx shipping label and take package(s) to FedEx for shipping

Appendix B
Injury Prevention Counts

Observation	Identification	Example
Missing anti-slip bath and/or shower tread	Instance in a room or area	If a room has 2 rugs that are missing non-slip tread, that would be counted as 2.
Identified trip or fall hazards	Instance in a room or area	A room is found to have 2 cords from the same plug going across a walkway (they are together.) This would count as 1.
Missing hand rails for stairs with >3 steps	Instance in a room or area	A stairway has 5 steps and is missing 2 handrails. This would be counted as 1.
Accessible sharp objects <1m	Instance in a room or area	There are three tables and one countertop that all have small objects below 1m. This would be counted as 4.
Sharp edges on furniture/cabinets <1m	Instance in a room or area	1 table is found in the room. The table has 4 sharp corners. This would be counted as 1.
Glass surfaces on furniture/cabinets <1m	Instance in a room or area	There is a table top with a free piece of glass. This would be counted as 1.
Fire hazards <1m	Instance in a room or area	1 table has 5 candles and 1 set of matches on the table top. This would be counted as 1.
Improperly stored chemicals	Instance in a room or area	There are chemicals underneath the kitchen sink (10 bottles). More chemicals are found across the room in a bucket (3 bottles) across the room. This would be counted as 2.
Unsecured tipping hazard	Instance in a room or area	A hoarder home is found to have many tipping hazards. One room has a large tv on an unstable stand, and 3 of the wall have piles of stuff resting against them to the ceiling. This would be counted as 4.
Dangerous cords other strangulation hazard <1m	Instance in a room or area	There are 4 miniblind cords that hang below 1 meter and 1 mess of loss cords on the ground. This would be counted as 5.
Choking hazards <1m	Instance in a room or area	There are three tables and one countertop that all have small objects below 1m. This would be counted as 4.
Uncovered outlets, power cords misused	Instance in a room or area	A room has 5 uncovered outlets, but only 3 would actually be accessible to a small child. This would be counted as 3.
Other unsafe conditions	Instance in a room or area	There is a set of hardwood stairs without a safety gate. The HO indicates that the child spends most of this time upstairs. This would be counted as 1.

Other unsecured drowning hazard	Instance in a room or area	The backyard of a home is full of trash, including buckets, old trashcans, and old cooking pans. There are 3 clusters of these items identified. This would be counted as 3.
Unsecured pool/spa	Instance in a room or area	There is a pool and spa in the backyard. However, the pool and spa are connected (spa water feeds into pool). This would be counted as 1.
Unsafe outdoor playground equipment	Instance in a room or area	There is a playground set in the front yard with a separate slide nearby (<5 ft away). Both are deemed unsafe. This would be counted as 2.

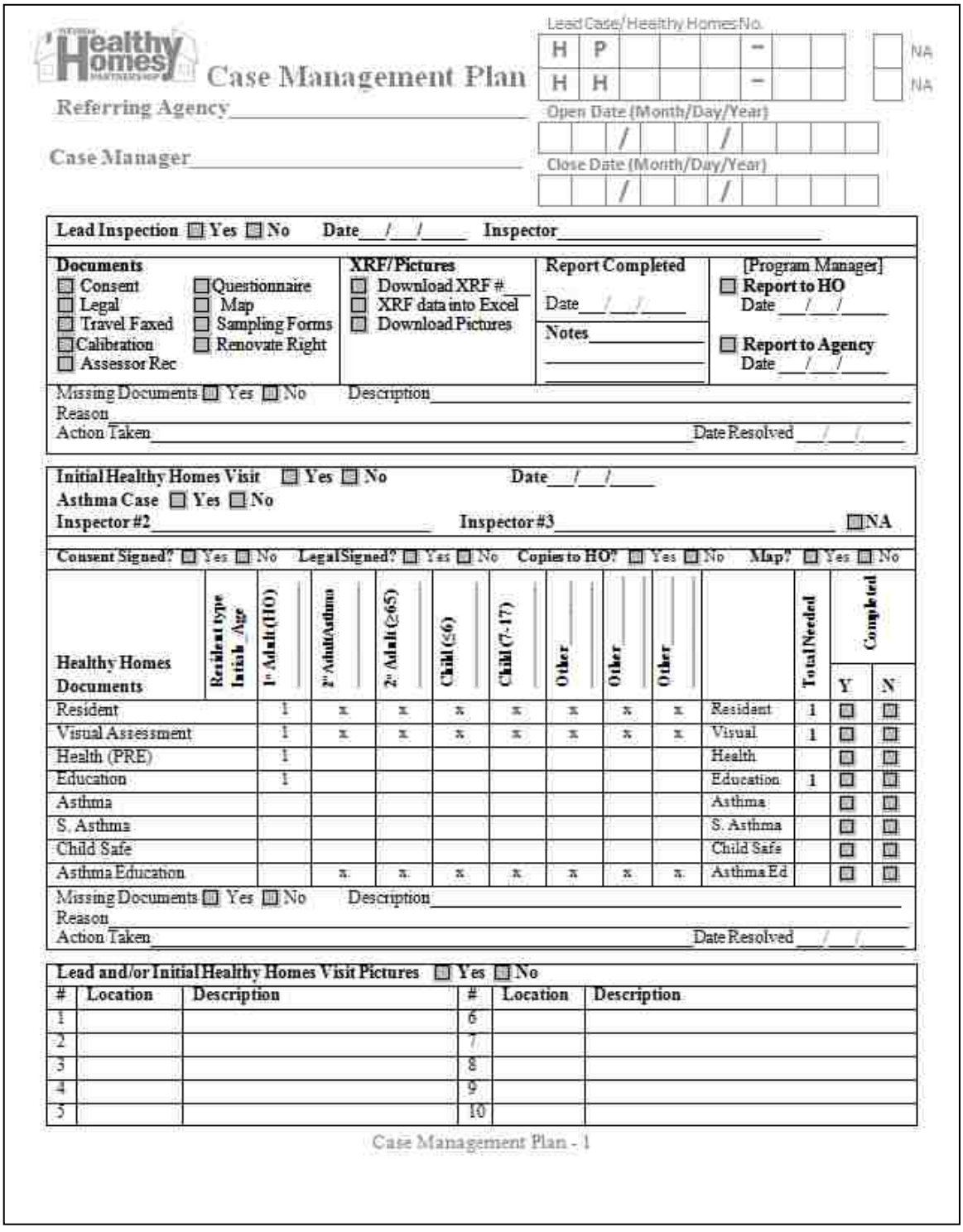
Appendix C
Definitions of Acronyms and Terms Used in the Protocol

1st Visit Docs	Healthy Homes Investigation, Visit 1 Documents
66	Indicates, on the Visual Assessment Checklist, any inaccessible areas
99	Indicates, on the Visual Assessment Checklist, any non-existent areas; indicates on the questionnaires any not applicable response or refusal to answer a question
C1	Primary Child Resident; the first child for which you have gained consent and have collected questionnaire data
C2	Secondary Child Resident; the second child for which you have gained consent and have collected questionnaire data
Case Management Plan	The document designed by the Nevada Healthy Homes Partnership to track case related progress and documentation from case opening to case closure
CM	Case Manager; the Healthy Homes Specialist assigned to be the primary manager of the case and to follow the case to completion
CO	Carbon Monoxide; an odorless, colorless poisonous gas
EBLL	A child with an Elevated Blood Lead Level; defined as greater than 10µg/dL
Educational Booklet	The packet designed by the Nevada Healthy Homes Partnership to introduce participants to the "Seven Principles of Healthy Homes", as well as additional principles deemed important by the Nevada Healthy Homes Partnership; the packet is used to provide targeted education and resources at the second Healthy Homes visit
EOH	University of Nevada, Las Vegas Department of Environmental and Occupational Health
EPA	United States Environmental Protection Agency
Healthy Homes Issues	Problems within a residence that are identified as violations of the National Environmental Health Association and the National Center for Healthy Housing "Seven Principles of Healthy Homes" ("Keep it Dry", "Keep it Clean", "Keep it Pest-Free", "Keep it Safe", "Keep it Contaminant-Free", "Keep it Ventilated" , and "Keep it Maintained") or the Nevada Healthy Homes Partnership additional principles of concern ("Keep it Green" and "Keep Asthma Controlled")
HHI	Healthy Homes Investigation; a two-pronged investigation into the health and safety of a residence, determined via occupant self-report questionnaires and visual observations by Healthy Homes Specialists
HHI_1	Healthy Homes Investigation, Visit 1; the first of three visits to a participating residence (questionnaires and visual observations are completed)

HHI_2	Healthy Homes Investigation, Visit 2; the second of three visits to a participating residence (targeted education is completed; intervention tools and referrals are provided)
HHI_3	Healthy Homes Investigation, Visit 3; the third of three visits to a participating residence (questionnaires and visual observations are completed)
HHS	Healthy Homes Specialist; certified by the National Environmental Health Association to conduct Healthy Homes Investigations
HO	Home Owner; equivalent to R1
I	Indicates, on the Visual Assessment Checklist, that the area required for a reading was inaccessible
IPM	Integrated Pest Management; a broad environmental approach to safely and effectively reduce or eliminate pests
Intervention Tools	Small devices or tools provided to participating homes, in an effort to address reported or observed Healthy Homes Issues; in addition to targeted education, example intervention tools that may be provided include: smoke detectors, carbon monoxide detectors, fire extinguishers, cleaning supplies, Integrated Pest Management supplies, allergen-reducing pillow and mattress covers, etc.
NA	Indicates, on the Visual Assessment Checklist, any not applicable reading
NCHH	National Center for Healthy Housing; a national non-profit organization dedicated to making homes safe and healthy
NEHA	National Environmental Health Association; a national, professional organization aimed at advancing environmental health to provide safe environments for all
NT	Indicates, on the Visual Assessment Checklist, any reading that was applicable but not taken
NVHHP	Nevada Healthy Homes Partnership; a cooperative non-profit group comprised of members from the University of Nevada, Las Vegas (UNLV), the Southern Nevada Health District (SNHD), the Nevada State Health Division (NSHD), and supporting health and housing community partners
R1	Primary Resident Home Owner; the owner of the residence and the primary contact for the case
R2	Secondary Resident; any second resident of the home over age 18 years, who has given consent and provided questionnaire data
R3	Tertiary Resident; any third resident of the home over age 18 years, who has given consent and provided questionnaire data

Referrals	The names and numbers of Nevada Healthy Homes Partnership community partners, who may be able to provide (upon qualification) additional services and assistance to participating residences
RSO	University of Nevada, Las Vegas Radiological Safety Office
UNLV	University of Nevada, Las Vegas
VAC	Visual Assessment Checklist; the tool developed by the Nevada Healthy Homes Partnership for the recording of visual observations made within the residence
XRF	X-Ray Fluorescence analyzer; handheld, portable devices for the identification of elemental materials (including lead [Pb]) in various substrates

APPENDIX H – CASE MANAGEMENT PLAN



Healthy Homes

Case Management Plan

Lead Case/Healthy Homes No.

H P – NA

H H – NA

Referring Agency_____

Open Date (Month/Day/Year) __/__/__

Case Manager_____

Close Date (Month/Day/Year) __/__/__

Lead Inspection ☐ Yes ☐ No **Date**__/__/____ **Inspector**_____

Documents	**XRF/Pictures**	**Report Completed**	[Program Manager]
☐ Consent ☐ Questionnaire ☐ Legal ☐ Map ☐ Travel Faxed ☐ Sampling Forms ☐ Calibration ☐ Renovate Right ☐ Assessor Rec	☐ Download XRF #___ ☐ XRF data into Excel ☐ Download Pictures	Date__/__/____ Notes_____	☐ **Report to HO** Date __/__/____ ☐ **Report to Agency** Date __/__/____

Missing Documents ☐ Yes ☐ No Description_____

Reason_____

Action Taken_____ Date Resolved __/__/____

Initial Healthy Homes Visit ☐ Yes ☐ No **Date**__/__/____

Asthma Case ☐ Yes ☐ No

Inspector #2_____ **Inspector #3**_____ ☐NA

Consent Signed? ☐ Yes ☐ No **Legal Signed?** ☐ Yes ☐ No **Copies to HO?** ☐ Yes ☐ No **Map?** ☐ Yes ☐ No

Healthy Homes Documents	**Resident type Initials_Age**	**1° Adult (HO)**	**2° Adult/Asthma**	**2° Adult (≥65)**	**Child (≤6)**	**Child (7-17)**	**Other**	**Other**	**Other**		**Total Needed**	**Completed Y**	**Completed N**
Resident		1	x	x	x	x	x	x	x	Resident	1	☐	☐
Visual Assessment		1	x	x	x	x	x	x	x	Visual	1	☐	☐
Health (PRE)		1								Health		☐	☐
Education		1								Education	1	☐	☐
Asthma										Asthma		☐	☐
S. Asthma										S. Asthma		☐	☐
Child Safe										Child Safe		☐	☐
Asthma Education			x	x	x	x	x	x	x	Asthma Ed		☐	☐

Missing Documents ☐ Yes ☐ No Description_____

Reason_____

Action Taken_____ Date Resolved __/__/____

Lead and/or Initial Healthy Homes Visit Pictures ☐ Yes ☐ No

#	Location	Description	#	Location	Description
1			6		
2			7		
3			8		
4			9		
5			10		

Case Management Plan - 1

Educational Healthy Homes Visit ☐ Yes ☐ No **Date**__/__/____
Inspector #2_____ **Inspector #3**_____ ☐ **NA**

Educational Assessment Targeted Education
☐ Dry
☐ Clean
☐ Ventilated
☐ Pest-Free
☐ Safe
☐ Contaminant-Free
☐ Maintained
☐ Green
☐ Asthma
Quiz Total___/35
☐ No Targeted Education

Resources given to HO
☐ Report
☐ Educational Booklet
☐ Intervention Tools
☐ Targeted Education
☐ Other_____

Intervention Tools
☐ CO Detector
☐ Emergency #
☐ Smoke Detector
☐ Fire Extinguisher
☐ First Aid Kit
☐ Non-slip Backing
☐ Batteries
☐ Energy Kit
☐ Gel Bait
☐ Boric Acid
☐ Garbage Can
☐ Lid
☐ Caulk
☐ Simple Green
☐ Rags
☐ Bucket
☐ Mop
☐ Broom
☐ Other
☐ No Tools

Asthma Tools
☐ Pillow Enc#___
☐ Matt. Enc #___
Sizes:

Referral(s)/Contact Date
_____
Date__/__/____

Reason_____
Eligibility ☐ Yes ☐ No

Services_____

Asthma Educational Assessment Targeted Education
Quiz Total___/20
Needed? ☐ Yes ☐ No

Referral(s)/Contact Date
_____
Date__/__/____

Reason_____
Eligibility ☐ Yes ☐ No

Services_____

Notes_____

Asthma Case Contact (Newsletter/Phone Contact) **Not an Asthma Case** ☐

Healthy Homes Asthma Newsletter ☐ Yes ☐ No Date__/__/____ Inspector_____

Event(s) ☐ Yes ☐ No
Date__/__/____
Event Description_____

☐ Asthma Trigger Reduction Section
☐ Highlighted Local Resource Service
☐ Cleaning Tips
☐ Internet Link: _____
☐ Healthy Homes Announcement
☐ Other:_____
☐ Other:_____

Phone Contact Attempt ☐ Yes ☐ No Date__/__/____ Inspector_____

Date__/__/____
Name:_____
Relationship to Child:
☐ Unable to make phone contact

Child Health Status?_____
Questions?_____
Need Requests?_____
Referral? ☐ Yes ☐ No

Notes_____

Referral(s)/Contact ☐ Yes ☐ No
Date__/__/____

Reason_____
Eligibility ☐ Yes ☐ No

Services_____

Case Management Plan - 2

Final Healthy Homes Visit ☐ Yes ☐ No Date ___/___/_____

Inspector #2 _____ **Inspector #3** _____ ☐ N/A

ALL forms collected? ☐ Yes ☐ No **ALL entries complete?** ☐ Yes ☐ No **Copy of Map** ☐ Yes ☐ No

Healthy Homes Documents	**Resident type Initials_Age**	**1° Adult (H0)**	**2° Adult/Asthma**	**2° Adult (≥65)**	**Child (≤6)**	**Child (7-17)**	**Other**	**Other**	**Other**		**Total Needed**	**Completed**	
												Y	**N**
Resident		1	x	x	x	x	x	x	x	Resident	1	☐	☐
Visual Assessment		1	x	x	x	x	x	x	x	Visual	1	☐	☐
Health (POST)										Health		☐	☐
Education		1								Education	1	☐	☐
Asthma (As indicated)										Asthma		☐	☐
S. Asthma (As indicated)										S. Asthma		☐	☐
Child Safe (As indicated)										Child Safe		☐	☐
Map [from 1° visit]		1	x	x	x	x	x	x	x	Map	1	☐	☐
Asthma Education			x	x	x	x	x	x	x	Asthma Ed		☐	☐
Program Evaluation		1	x	x	x	x	x	x	x	P. Eval	1	☐	☐
Gift Card Agreement		1	x	x	x	x	x	x	x	Agreement	1	☐	☐
Gift Card		1	x	x	x	x	x	x	x	Gift Card	1	☐	☐

Missing Documents ☐ Yes ☐ No Description _____

Reason _____

Action Taken _____

Date Resolved ___/___/_____

Final Healthy Homes Visit Pictures ☐ Yes ☐ No

#	Location	Description	#	Location	Description
1			6		
2			7		
3			8		
4			9		
5			10		

Lead and Healthy Homes Data Entry

☐ Pb&HH Date ___/___/_____ ☐ Initial Visit ☐ Second Visit ☐ Final Visit		☐ Data Checked	Notes:
☐ Lead	Date ___/___/_____ ☐ N/A	☐ Data Checked	Notes:
☐ Initial Visit	Date ___/___/_____ ☐ N/A	☐ Data Checked	Notes:
☐ Final Visit	Date ___/___/_____ ☐ N/A	☐ Data Checked	Notes:

Case Closure [Program Manager]			
Administrative ☐ Yes ☐ No Contact Attempts: ☐ phone (# calls)_____ ☐ Letter __/__/_____ ☐ Other _____ __/__/_____			
Remediation ☐ Yes ☐ No			
Organization	**Date Completed**	**Data Entered/Initials**	**Case Closed** ☐ Yes ☐ No _____ __/__/____ **Signature** **Date**

Case Notes (Notes, Date, Initials)

APPENDIX I – EXAMPLE HEALTH HOMES ASSESSMENT REPORT

NEVADA Healthy Homes PARTNERSHIP

[INSERT DATE OF LETTER/REPORT]

Dear [INSERT HOME OWNER/ TENANTS NAME],

You agreed to have your home inspected by a team of National Environmental Health Association-Certified Healthy Homes Specialists, trained to identify health hazards in your home. The team conducted a room-by-room inspection of your home to identify common issues that could negatively affect the health of those living there.

A report of the findings from the assessment is attached for your records and a Healthy Homes Specialist will go over the details of this report with you. The report includes a summary of what Healthy Homes issues were identified (through either your questionnaire responses or the visual inspection) and also includes suggestions about what you can do to resolve any issues and improve the overall health and safety of your home.

It is possible that many issues were identified during your home assessment and it is also possible that not all of the issues in your home were detected by the Healthy Homes Specialists; therefore, in addition to this report, you will also be provided with an educational packet that provides further tips for addressing many common Healthy Homes problems. This packet can serve as a useful resource for maintaining the health of any home.

In addition, the Nevada Healthy Homes Partnership may be able to provide you with equipment to address your Healthy Homes issues, if present, or may be able to provide you with referrals to community partners that may be able to help. If you have questions or concerns regarding the information provided in the report, please call the Nevada Healthy Homes Partnership at 1-888-524-0227.

Thank you very much for your time,

[INSERT YOUR NAME]
Certified Healthy Homes Specialist
University of Nevada, Las Vegas

Case Number: HH XXXXX [INSERT STREET ADDRESS]
[INSERT DATE OF REPORT] [INSERT CITY, STATE, ZIP CODE]

Healthy Homes Assessment Report

On [INSERT DATE OF INSPECTION], a Healthy Homes inspection was conducted on your home. This report summarizes the major Healthy Homes issues (if any), identified from the questionnaire given to you and the visual assessment of accessible areas of the home conducted by Healthy Homes Specialists. It also provides you with some general tips for creating and maintaining a Healthy Home.

I. General Recommendations for a Healthy Home:

The Healthy Homes Specialists recommend the following actions based on the "Principles of a Healthy Home":

Keep it Dry

- Check and fix leaks in the plumbing system
- Never allow standing water to be present in or around your home
- Direct water from sprinklers and irrigation systems away from the home
- Open windows in rooms where water is frequently used, like the bathroom or kitchen

Keep it Clean

- Where possible, install smooth, cleanable surfaces, like tile or hardwood
- Wet-clean, mop, and vacuum regularly to remove a greater amount of dirt
- Eliminate clutter in your home
- Keep pets away from sleeping areas

Keep the Air Fresh

- Open the windows in your home frequently and use fans to circulate the air
- Ensure bathroom fans and clothes dryers are ventilated to areas outside the home
- Keep vents clean and replace air filters frequently
- Avoid smoking in or near the home

Keep it Pest-Free

- Clean properly to remove access to food, water, and shelter for pests
- Seal cracks and openings in the home and screen all windows to avoid pest entry
- Store food in air-tight pest-resistant containers and keep pet food off the floor
- Avoid using pesticides in your home; instead use safer alternatives such as sticky traps or sealed bait traps

Keep it Safe

- Install handrails and anti-slip mats in the bathtubs or showers to prevent falls
- Replace smoke detector and carbon monoxide detector batteries yearly
- Install smoke detectors (at least one in each sleeping area and at least one per floor) and install carbon monoxide (CO) detectors outside every sleeping area

- Keep a fire extinguisher in the home and keep it charged

Keep it Contaminant-Free

- Get your home tested for a poisonous gas called radon
- If a lead inspection was conducted, please see the separate Residential Environmental Lead Hazard Investigation Report
- Consider having your home checked for asbestos by a professional
- Limit the presence, use, and mixing of contaminants such as bleach, ammonia, and pesticides in your home

Keep it Maintained

- Replace and repair broken items in a timely fashion
- Repair cracks and holes in the walls, ceilings, and home foundation
- Only allow professionals to service your heating/air conditioning system and garage door

Keep it Green

- Seal drafty doors and windows with weather-stripping or caulk
- Install compact fluorescent light bulbs (CFLs) in the light fixtures you use the most
- In the winter, change your thermostat to 68° when you're home and 55° when away
- In the summer, change your thermostat to 80° when you're home and a few degrees warmer when you're away
- Install low-flow showerheads and low-flow faucet aerators to save water and heat

For additional recommendations on how you can keep your home (or any home) safe and healthy, please refer to the educational packet provided to you.

II. Identified Healthy Homes Issues

Results from the questionnaire you completed, as well as from the visual assessment of the home, identified [INSERT THE APPROPRIATE RESPONSE FROM: the following Healthy Homes issues or no major Healthy Homes issues of immediate concern]. Use the information from the Residential Questionnaire, Visual Assessment Checklist, and the Health Questionnaire (if applicable) to compile this section. [IF ISSUES ARE IDENTIFIED, INSERT: Following each identified Healthy Homes issue, please pay special attention to the specific recommendation(s) for how you can decrease or eliminate the health and safety hazards associated with these concerns. IF ISSUES ARE NOT IDENTIFIED, INSERT: As such, the Healthy Homes Specialists have no specific recommendations. In the future, if you have questions about how to keep your home healthy and safe, please refer to the educational packet provided to you or contact the Nevada Healthy Homes Partnership.]

1. [INSERT PRIMARY CONCERN HERE, *i.e.* Pest infestation]
   ⇒ [INSERT RECOMMENDATIONS HERE]

⇒ Remove clutter
   ⇒ Store food in air-tight containers
   ⇒ Screen all operable windows
   ⇒ Utilize Integrated Pest Management techniques

[IF NEEDED, PROVIDE A BRIEF DESCRIPTION OF THE ISSUE HERE, *i.e.* The Healthy Homes Specialists observed live cockroaches in several rooms of the home. The fact that these pests were visible and active during the day is suggestive of a major infestation. In addition to being a nuisance, the dander of cockroaches and their feces can trigger asthma attacks in susceptible individuals. The recommendations above can significantly reduce the severity of the infestation.]

2. [INSERT SECONDARY CONCERN HERE, *i.e.* Lack of appropriate safety devices (fire extinguishers, smoke detectors, and carbon monoxide detectors]
   ⇒ [INSERT RECOMMENDATIONS HERE]
   ⇒ Install a carbon monoxide detector outside of sleeping areas
   ⇒ Replace the batteries in the Hallway smoke detectors

[IF NEEDED, PROVIDE A BRIEF DESCRIPTION OF THE ISSUE HERE]

3. [INSERT TERTIARY CONCERN HERE, *i.e.* Structural problems]
   ⇒ [INSERT RECOMMENDATIONS HERE]
   ⇒ Contact Rebuilding Together for possible assistance in repairing the roof

[IF NEEDED, PROVIDE A BRIEF DESCRIPTION OF THE ISSUE HERE]

4. [INSERT FOURTH CONCERN HERE, IF APPLICABLE]
   ⇒ [INSERT RECOMMENDATIONS HERE]

[IF NEEDED, PROVIDE A BRIEF DESCRIPTION OF THE ISSUE HERE]

5. [INSERT FIFTH CONCERN HERE, IF APPLICABLE]
   ⇒ [INSERT RECOMMENDATIONS HERE]

[IF NEEDED, PROVIDE A BRIEF DESCRIPTION OF THE ISSUE HERE]

III. Identified Asthma Triggers

[OMIT THIS SECTION ENTIRELY, IF NO ISSUES WERE IDENTIFIED]

Results, from the questionnaire you completed, indicated that you and/or someone who permanently resides in your home suffer(s) from asthma. Asthma is a chronic lung

disease that may make it difficult to breathe on a regular basis and that can sometimes result in dangerous asthma attacks. Unfortunately, there may be "triggers" in your home that make asthma symptoms and attacks more likely. Based on your questionnaire responses, as well as the visual assessment of your home, the Healthy Homes Specialists have identified the following asthma triggers in your home. Following each identified asthma trigger, please pay special attention to the specific recommendation(s) for how you can decrease or eliminate the health and safety hazards associated with these concerns.

1. [INSERT PRIMARY TRIGGER HERE, *i.e.* Pests]
   - ⇒ [INSERT RECOMMENDATIONS HERE]
   - ⇒ Remove clutter
   - ⇒ Store food in air-tight containers
   - ⇒ Screen all operable windows
   - ⇒ Utilize Integrated Pest Management techniques

   [IF NEEDED, PROVIDE A BRIEF DESCRIPTION OF THE TRIGGER HERE, *i.e.* The Healthy Homes Specialists observed live cockroaches in several rooms of the home. In addition to being a nuisance, the dander of cockroaches and their feces can trigger asthma attacks in susceptible individuals. The recommendations above can significantly reduce the severity of the infestation.]

2. [INSERT SECONDARY TRIGGER HERE, *i.e.* Use of respiratory irritants in the home]
   - ⇒ [INSERT RECOMMENDATIONS HERE]
   - ⇒ Avoid smoking tobacco products inside the home or near the susceptible individual
   - ⇒ Avoid using bleach and other chemicals with strong odors in the home
   - ⇒ Regularly change air filters to ensure proper ventilation throughout the home

   [IF NEEDED, PROVIDE A BRIEF DESCRIPTION OF THE ISSUE HERE]

IV. Assistance Provided by the Nevada Healthy Homes Partnership: [OMIT THIS SECTION ENTIRELY, IF NO ISSUES WERE IDENTIFIED]

In an effort to assist you in addressing your specific Healthy Homes issues and to improve your home's health and safety, the Nevada Healthy Homes Partnership will provide you with:

- ☑ [INSERT DEVICES HERE]
- ☑ _____
- ☑ _____
- ☑ _____
- ☑ _____
- ☑ _____

☑ _____

V. Referrals Provided by the Nevada Healthy Homes Partnership: [OMIT THIS SECTION ENTIRELY, IF NO ISSUES WERE IDENTIFIED AND/OR THE HOME DOES NOT QUALIFY FOR ASSISTANCE]

Based on the results of your Healthy Homes Assessment, the Nevada Healthy Homes Partnership believes that you could potentially benefit from additional assistance, beyond the scope of this program. As such, the Nevada Healthy Homes Partnership recommends that you contact the following community partner(s) to see if you qualify for additional assistance that may help you further improve the health and safety of your home:

- Rebuilding Together of Southern Nevada (702) 259-4900
  - ⇒ [INSERT BRIEF DESCRIPTION OF THE ISSUE FOR WHICH THEY ARE PRIMARILY BEING REFERRED HERE]
    - ⇒ **[CM to email with homeowner information to: Therese Elliot at telliott@rtsnv.org]**

- HELP of Southern Nevada (702) 369-4357
  - ⇒ [INSERT BRIEF DESCRIPTION OF THE ISSUE FOR WHICH THEY ARE PRIMARILY BEING REFERRED HERE]
    - ⇒ **[CM to email with homeowner information to: Arlene Rick at arick@helpsonv.org]**

- Las Vegas Urban League (702) 636-3949
  - ⇒ [INSERT BRIEF DESCRIPTION OF THE ISSUE FOR WHICH THEY ARE PRIMARILY BEING REFERRED HERE]
    - ⇒ **[CM to email with homeowner information to: Stacy Thornton at sthornton@lvul.org]**

- City of Henderson, Neighborhood Services/Weatherization (702) 267-2000
  - ⇒ [INSERT BRIEF DESCRIPTION OF THE ISSUE FOR WHICH THEY ARE PRIMARILY BEING REFERRED HERE]
    - ⇒ **[CM to email with homeowner information to: Barbara.austin@cityofhenderson.com or Lili.equihua@cityofhenderson.com]**

- Other community partner with phone number
  - ⇒ [INSERT BRIEF DESCRIPTION OF THE ISSUE FOR WHICH THEY ARE PRIMARILY BEING REFERRED HERE]
    - ⇒ **[CM to find contact person at organization and send them email or call on behalf of the homeowner as a potential client pending eligibility]**

VI. Certification and Disclaimer

We hereby certify that on [INSERT DATE OF INSPECTION] the dwelling located at [INSERT THE ADDRESS OF THE INSPECTED HOME] contained [INSERT THE APPROPRIATE RESPONSE FROM: the aforementioned identified Healthy Homes issues, or, no identified Healthy Homes issues.]

Please be reminded that this report is limited in scope to the information gathered during the investigation. This report is intended for use by the family who occupies the dwelling and there is no warranty or guarantee of the health or safety conditions in the building based on this assessment. The report may not be considered a compliance inspection or certification for past or present codes or regulations of any kind. If you have any questions regarding any part of this report, please contact the Nevada Healthy Homes Partnership at 1-888-524-0227 and we will be happy to assist you.

_____ _____
[NAME OF FIRST HHS] Date
NEHA-certified HHS: [HHS NUMBER]

_____ _____
[NAME OF SECOND HHS] Date
NEHA-certified HHS: [HHS NUMBER]

_____ _____
Shawn L. Gerstenberger Date
NEHA-Certified HHS: 9006387

Erika R. Torres, MPH
NEHA-Certified HHS: 9006404

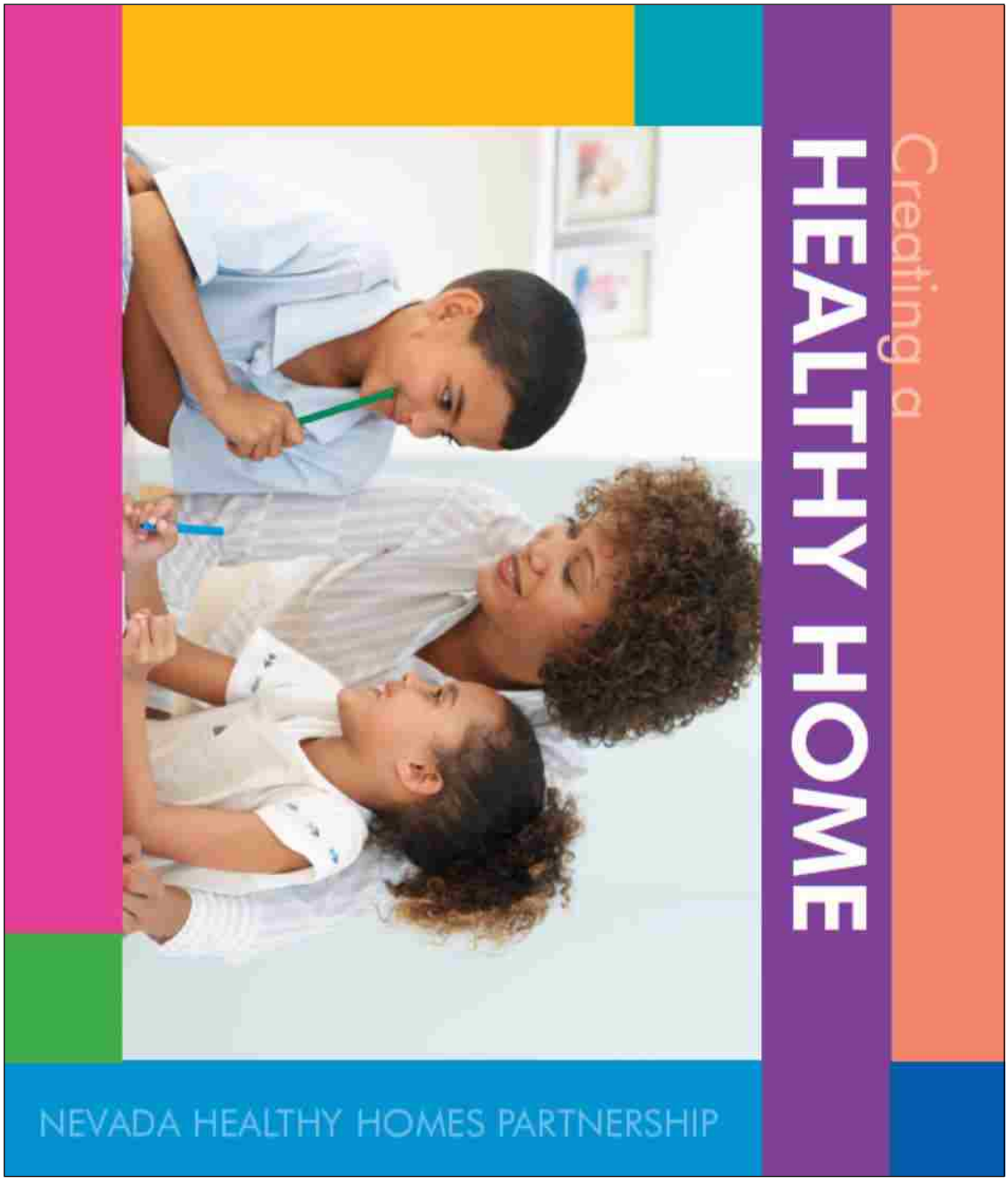
Mackenzie S. Burns, MPH
NEHA-Certified HHS: 9006381

Jennifer Berger, MPH
NEHA-Certified HHS: 9006436

Michelle Ching, MPH
NEHA-Certified HHS: 9008601

Tara Dickinson, BS
NEHA-Certified HHS: 9008600

APPENDIX J – *CREATING A HEALTHY HOME* EDUCATIONAL BOOKLET



Healthy Homes are homes that are safe, clean, and healthy for the people who live there. Many studies link health issues such as asthma, lead poisoning, and injury to hazards in the home. A hazard is a source of danger and can be anything that increases the risk of harm. Many hazards may be present in your home and should be addressed. Because many people in the United States spend over half of each day inside their homes, and children often spend up to 90 percent of their time indoors, the home plays an important role in health.

Everyone deserves to be safe and healthy, but some of the most serious health problems for families can start in the home! A healthy home affects everyone, especially:

- **Children** are more likely to be affected by hazards in the home because their bodies are still growing. Children play and crawl on the floor and often put things in their mouths. When compared to adults, relative to their body weight, children eat more food, drink more water, and breathe more air. For this reason, children often have greater contact with sources that may be harmful to their health. Children also depend on adults to make their homes safe.
- **Expecting mothers** should live in a healthy home. Contaminants such as lead, pesticides, and tobacco smoke can be harmful to the health of the developing baby.
- **Seniors** may be subject to trips and falls in the home. Common objects such as rugs, uneven flooring, poor lighting, and a lack of handrails can all be hazards for injury.

By following the Seven Healthy Homes Principles shown in this booklet, you can help make your home a healthier place to live. These principles are simple ways to help create a healthier home for you and your family.

"The connection between health and the dwelling of the population is one of the most important that exists."

Florence Nightingale

Principles of a Healthy Home

Keep Your Home **DRY**	Moisture in your home can lead to mold and mildew, and can support pests. Too much moisture can also damage the home itself. Keeping your home dry helps you avoid these problems, and helps you create and maintain a healthy home.
Keep Your Home **CLEAN**	Many health hazards are related to clutter or filth, so it important to keep your home clean. Clutter can collect dirt, provide a hiding spot for pests, and can cause trips or falls.
Keep the Air **FRESH**	A home should have clean, fresh air. Indoor air can become polluted if it is not properly circulated and filtered. Bringing fresh air in and filtering out pollutants helps keep your family healthy.
Keep Your Home **PEST-FREE**	Cockroaches, rodents, and other pests come into the home looking for food, water and shelter. Unfortunately, these pests bring diseases and hazards with them. Pests can be eliminated using safe techniques that will not harm your family or pets.
Keep Your Home **SAFE**	A home should be safe for residents of all ages. Injuries can occur from a variety of objects and sources, and contribute to drowning, suffocation and poisoning. Most of these injuries can be easily prevented with just a few simple steps.
Keep Your Home **CONTAMINANT-FREE**	Contaminants such as tobacco smoke, asthma triggers and chemicals present in common household products can be harmful to your health. Products such as household cleaners and pesticides must be properly stored to prevent poisoning and other injury. Keeping your home contaminant-free is important to creating a healthy environment for you and your family.
Keep Your Home **MAINTAINED**	All homes, no matter how old or new, need to be maintained. Cracks, leaks and breaks can lead to various problems in your home. Taking care of minor repairs right away helps prevent large repairs later, saves time, effort and money, and can help prevent health problems.
Keep Your Home **GREEN**	A home should keep undesirable weather out and air conditioning/heating in. A home should also be equipped to conserve energy and water, which saves money and reduces human impact on the environment. Thankfully, these problems are easily fixed.

Keep Your Home

DRY

What's the problem?

Too much moisture in or near your home can cause damage to your property and can also be harmful to your health. Large amounts of moisture can cause wood to rot, insects to breed, and mold to grow. When too much moisture is present, it can cause floors and walls to rot, and can leave holes and cracks where pests can live. Mold in your home can also be a serious problem, because it is a trigger for asthma and other respiratory illnesses.

How does it happen?

There are many ways that moisture can enter your home. Poorly managed water around the foundation of the home and leaks in the plumbing can lead to severe damage. Moisture can also come from condensation that collects on mechanical equipment (like your air conditioner) or on other cold surfaces.

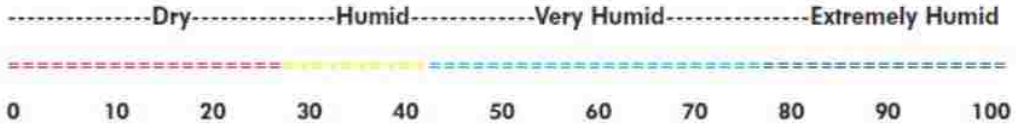
Things you can do:

- Check and fix any leaks in your plumbing as soon as possible.
- Do not let any standing water be present in or around your home.
- Do not let water collect on the roof of your home.
- Make sure rain gutters and drain pipes are clean and carry water away from the foundation of your home.
- Point water from sprinklers and irrigation systems away from the outside walls of your home.
- Open windows in rooms where water is frequently used, like bathrooms and the kitchen.

"Mold can grow almost anywhere: on walls, ceilings, carpets or furniture. Humidity or wetness can cause mold to grow in your home."

U.S. Department of Housing and Urban Development

MONITORING MOISTURE LEVELS



The Healthy Homes Assessor uses a tool called a Moisture Meter to detect wet spots in your home. Wet spots can be the result of a leaky pipe, high humidity (especially in bathing areas), a leaky roof, etc.

Your Assessor can work with you to develop a plan of action. This might mean fixing a leaky pipe, using a fan, or opening a window while showering.

The Healthy Homes Assessor will use this form to determine if you have too much moisture in your home. With simple changes, most moisture problems in the home can be solved.

Keep Your Home

CLEAN

What's the problem?

Too much clutter and dirt in your home can cause germs, pests, and contaminants to collect, which can make your family sick. A dirty home can put your family at risk for poisonings and injuries, and can cause health problems like asthma.

How does it happen?

As you go in and out of your home, your family may bring in dirt and dust that can build up over time. Also, busy schedules often prevent us from picking up and cleaning on a regular basis.

Extra clutter in your home may create tripping hazards, provide a home for pests, and can make cleaning tasks even more difficult.

Things you can do:

- Make sure your home has smooth surfaces, that you can wet-clean or mop.
- Get rid of extra clutter to make it easier to clean.
- Take off your shoes before entering your home to reduce dirt and dust.
- Keep pets away from sleeping areas and especially off the beds.
- Keep a cleaning schedule that includes vacuuming.

"Keeping a home clean includes controlling the source, creating smooth and cleanable surfaces, reducing clutter, and using effective cleaning methods."

National Center for Healthy Housing

GENERAL CLEANING SCHEDULE

Daily

- Clean counters, sinks and stove top with warm, soapy water.
- Wipe any spills on the floor or counters.
- Clean cutting boards with hot soapy water.
- Store all food in sealed containers.
- Keep garbage in a sealed or covered container.
- Take garbage out daily and keep container clean.

Weekly

- Sweep and mop hard-surface floors.
- Wash and dust all hard surfaces.
- Scrub sinks, showers and toilets.
- Vacuum all carpeted areas.
- Wash bed sheets in hot water.

Monthly

- Clean the tops of cabinets and baseboards.
- Clean the top of the refrigerator and ledges in the bathroom.
- Check for leaks under the sink and repair if found.
- Clean window sills and window tracks.
- Clean washing machine by running an empty load with hot water and 2 cups of vinegar.
- Wipe down the inside of the oven or use the self-cleaning cycle.

You do not need dangerous chemicals to clean your home. Instead try these healthier options:

All-purpose cleaner: Mix 1 tsp. dish detergent, 1 tsp. borax and a squeeze of lemon in 1 qt. warm water.

Toilet bowl cleaner: Mix 1/4 cup baking soda and 1 cup vinegar, pour into basin and let it set for a few minutes. Scrub with brush and rinse.

Window cleaner: Mix 2 tsp. of white vinegar with 1 liter warm water. Use crumpled newspaper or cotton cloth to clean.

Tub and tile cleaner: For simple cleaning, rub in baking soda with a damp sponge and rinse with fresh water. For tougher jobs, first wipe surfaces with vinegar and follow with baking soda to scour. (Use sparingly since vinegar can break down tile grout.)

Air freshener: Place baking soda or vinegar with lemon juice in small dishes to absorb household odors.

Dishwasher cleaner: Run an empty cycle using 1 tbsp. bleach or by placing a coffee cup with one cup of vinegar on the dish rack during a cycle. This removes rust, mold and discoloration.

Keep Your Air

FRESH

What's the problem?

Healthy air inside your home is air that is clean, fresh, and moving. People living in homes that do not have clean, fresh air have higher rates of respiratory irritation and are more likely to develop illnesses, like a cold or the flu. Poor ventilation may also worsen asthma symptoms, while fresh and moving air can reduce moisture, mold, and allergens in your home.

How does it happen?

Gas-burning appliances (like water heaters, furnaces, stoves, and clothes dryers), fireplaces, and air conditioning systems have special ventilation requirements that keep these appliances from polluting the air inside your home. But when these appliances are not installed correctly or they break down, harmful fumes can be produced that pollute the air and can damage your health. Smoking tobacco also produces similar harmful and poisonous fumes.

Things you can do:

- Open the windows frequently or use fans to keep the air inside your home moving.
- Reminder: If you or a family member has severe allergies, avoid opening the windows during peak allergy seasons and use fans instead.
- Make sure bathroom fans and clothes dryers are vented to areas outside of the home.
- Make sure chimneys are clean and fireplace vents are open during use.
- Keep vents clean and replace air conditioning/ heating filters once every 1-3 months.
- Never smoke tobacco inside or near the home.

"The average person breathes approximately 35 pounds of air each day. Air is the #1 element that sustains our lives."

American Lung Association

HEALTHY INDOOR AIR

Here are some tips that you can use to keep the air in your home healthy:

- Use air filters to remove pollutants and allergens from the air. Change air filters at least every 1-3 months.
- Carpets can trap allergens and dust, which if disturbed, are released into the air. Vacuum often to remove these hazards.
- Bathrooms, kitchens, and basements can have too much humidity. An easy way to reduce humidity in any given room would be to open a window or turn on the exhaust fan.
- A carbon monoxide (CO) detector helps detect poisonous CO gas. CO detectors should be installed on each floor, near the sleeping area.
- Radon is an invisible and odorless gas that has been found to cause cancer. A radon text kit is the only way to detect radon. Every home should be tested.
- Cars, motorcycles, and gas lawnmowers pollute the air and release carbon monoxide, which can cause serious harm. You should never run cars, motorcycles, or gas lawnmowers in the garage when the garage door is closed.
- Barbeque grills, ovens, and gas-operated space heaters can all create dangerous fumes and gases. These pieces of equipment should never be used for heating your home.

Keep Your Home

PEST-FREE

What's the problem?

Pests (like cockroaches, rodents, dust mites, and any other unwanted guests) can decrease the health of your home, by spreading disease and making your family sick. Unfortunately, when people try to get rid of these pests, they often use pesticides - which are contaminants that can be harmful to your family's health. Pesticides are extremely dangerous to pregnant woman, children, and family pets.

How does it happen?

Pests often enter the home through unsealed cracks and openings. Pests need food, water, and shelter to survive, which is why they try to live in your home. When clutter collects it becomes an ideal hiding place for pests. Improperly stored food and garbage also invite pests into your home.

Things you can do:

- Remove pests' access to food, water and shelter by cleaning regularly.
- Seal cracks and openings in your home and make sure all windows have screens.
- Store food in pest-resistant containers and keep pet food stored and off the floor.
- Use safe alternatives to pesticides, such as sticky traps or sealed bait traps.
- Do not use pesticides in your home. Pesticides are best used by trained professionals.

"Rats and mice spread over 35 diseases. These diseases can be spread to humans directly, through handling of rodents, through contact with rodent feces, urine or saliva, or through rodent bites."

Centers for Disease Control and Prevention

CHECKLIST FOR A PEST-FREE HOME

P esticides should be stored out of the reach of children.

E liminate clutter.

S tore all food and trash in sealed containers.

T ake out the trash every day.

F requently vacuum.

R epair or seal any holes in walls or floors.

E liminate sources of water.

E xplore other options before resorting to pesticides.

What steps will you take to keep your home pest-free?

Keep Your Home SAFE

What's the problem?

Injuries often occur in the home. Most injuries are not just "accidents" and actually can be prevented if safety measures are taken. Falls, poisonings, burns, choking, suffocation, and drowning are common injuries that occur in the home and can be prevented.

How does it happen?

Injuries in the home can occur in many different ways. People can be injured by tripping over rugs without nonslip pads, or on uneven/cracked floors. Improper storage of vitamins, medication, and household products can result in severe poisoning. Burns and fires may result from misuse of lighters and matches, or from damaged and overused electrical cords and outlets. For children, accessible mini-blind cords can pose a suffocation hazard, and even small buckets with as little as 2 inches of water can be a common drowning hazard.

Things you can do:

- Install handrails and anti-slip mats to protect your family from trips and falls.
- Install at least 1 smoke detector on every level of your home and keep a fire extinguisher in the home.
- Have first aid supplies available.
- Set water heaters at or below 120° F to prevent burns.
- Do not allow young children to sleep in the same bed with siblings or adults.
- Completely fence pools and spas with fences that have self-closing, self-latching gates.
- Store buckets empty and turned upside-down.
- Store all firearms unloaded, in a locked cabinet, and separate from ammunition.
- In general, children should be supervised by an adult at all times to keep them safe!

"Home accidents kill one person every 16 minutes and injure one person every 4 seconds in the U.S. Make sure emergency telephone numbers are next to all phones."

U.S. Department of Housing and Urban Development

FIRE ESCAPE PLAN

Draw a basic floor plan of your home, and mark your family's fire escape route. The route should have two ways to exit the home, as well as a safe, common place to meet outside the home. Talk with your children about the dangers of smoke, the importance of not hiding during a fire and remaining outside your home. Keep in mind that infants and disabled or elderly family members may need help exiting the home. Practice your plan with a drill.

Childproof Shopping List

- Anti-scald devices for faucets
- Carbon monoxide detectors
- Cordless phone
- Corner and edge bumpers
- Doorknob covers and door locks
- Door stops and door holders
- Outlet covers and outlet plates
- Safety gates
- Safety latches and locks for cabinets and drawers
- Safety netting for balconies and railings
- Safety tassels and inner cord stops
- Smoke detectors
- Window guards

Keep Your Home

CONTAMINANT-FREE

What's the problem?

Contaminants are substances that make something (such as the air you breathe, water you drink, or food you eat) impure or unclean. Contaminants get in our bodies and can make us sick, while some can even cause death. There are many common contaminants which may be found in your home, such as: tobacco smoke, carbon monoxide (CO), radon, pesticides, and lead. Even air fresheners, cleaning products, sprays, coatings, glues, and other household products can produce fumes that may also be harmful your health.

How does it happen?

Contaminants can enter the body through direct contact with skin or by eating, drinking, or breathing them into your body. Sometimes, even a small amount of contact with a contaminant is enough to make you feel sick. Other times, having contact with a contaminant may not make you feel sick, even though it is doing great harm inside your body.

Things you can do:

- Never allow smoking tobacco inside or near your home.
- Install at least 1 carbon monoxide detector near each sleeping area.
- Limit the use and mixing of contaminants like bleach, ammonia, pesticides, and other chemicals in your home.
- Consider having your home tested for asbestos and for a poisonous gas called radon (both have been linked to cancer).
- If your home was built before 1978, have your home tested for lead.
- If you suspect that your home may have asbestos or lead, never attempt to remove them yourself. These materials are dangerous and should be removed by professionals!

"You can't see or smell carbon monoxide, but at high levels it can kill a person in minutes."

Environmental Protection Agency

WAYS TO PREVENT CONTAMINANTS IN YOUR HOME

In and Around the House:

- Lead, asbestos, and radon are very dangerous. Make sure your home is tested by a professional.
- Some homes built before 1978 have lead paint. Make sure to keep paint in good condition. Do not let it chip, peel, or create dust!
- Because carbon monoxide is poisonous, install at least one carbon monoxide detector on each floor.
- Many cleaners contain contaminants, and their fumes can make you sick. Make sure the room is ventilated when you use cleaners, and never mix cleaning products. Many times, soap and water are enough!
- Pesticides can damage the health of your family. Avoid using pesticides if possible.
- Dirt can be a source of contaminants. Take off your shoes when entering the home from outside.

In the Garage:

- Kids love to get into containers. Keep paints, varnishes, pesticides, cleaners and chemicals out of the reach of children or in locked cabinets. Store chemicals in their original containers with proper labels.
- Many pesticides and plant food come in pellet form, which can look like candy to children. Keep these out of the reach of children.
- Gasoline-operated machines and vehicles are very dangerous in the garage. Never run them with the garage door closed.

In the Kitchen:

- Stoves can create fumes. If your stove has a hood, make sure to turn on the fan when you cook.
- Keep your cleaning supplies out of the reach of children and read all labels carefully before use.

TOXIN-FREE

Keep Your Home

MAINTAINED

What's the problem?

Regular maintenance is necessary regardless of the age of your home. When a home is not maintained, small problems can become larger problems and can also be dangerous to your family. For example: unrepaired cracks in the floors and walls of your home can allow a poisonous gas called radon to enter. Chipping paint or tile may contain a toxic metal called lead. In general, all fixtures, appliances, and structural components of your home can be harmful if not kept in good repair.

How does it happen?

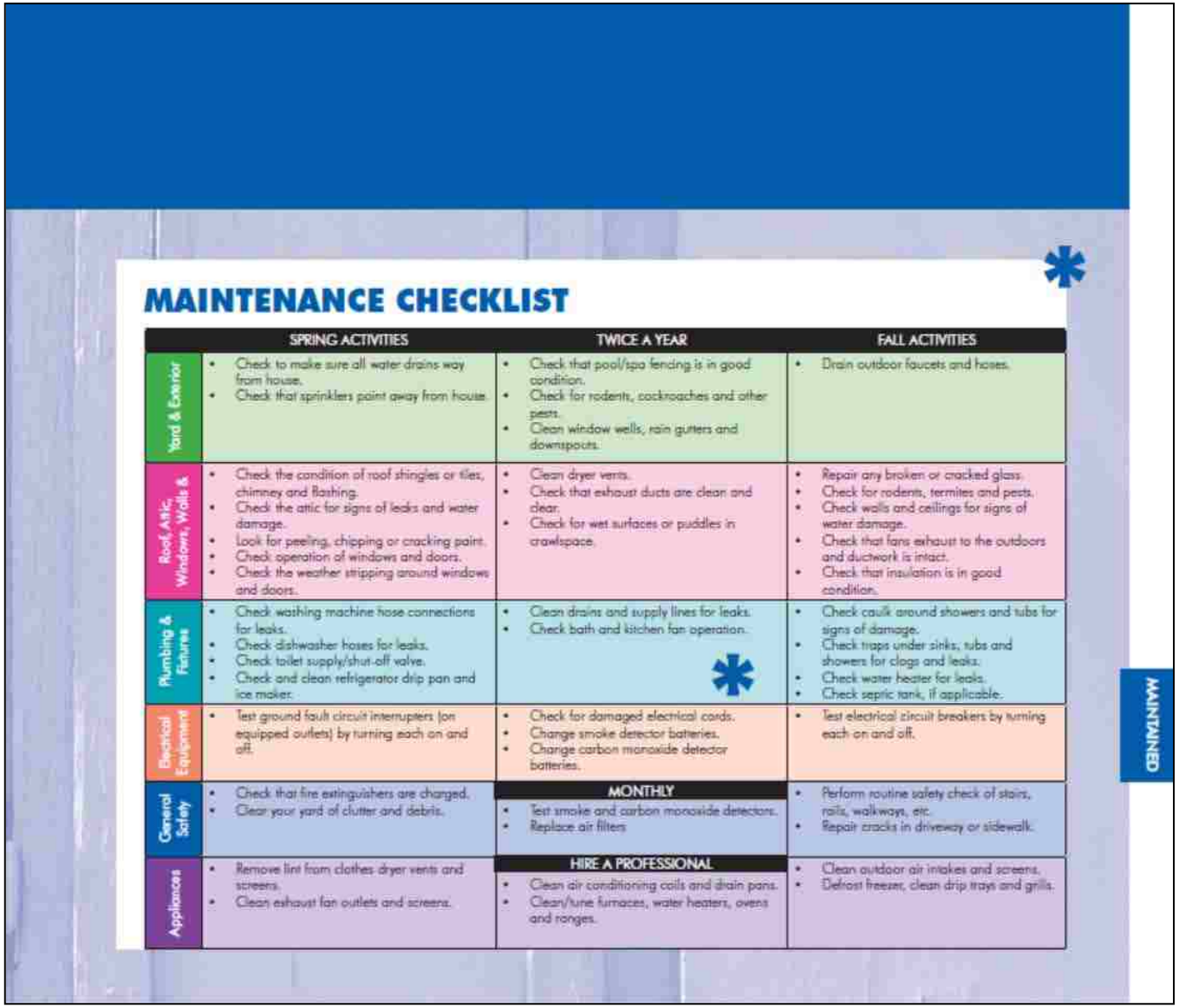
The outside of your home can break down and require maintenance due to weather conditions, pollution, and as a consequence of normal wear and tear. The inside of your home can deteriorate when small problems are left unrepaired and can become larger issues in the future.

Things you can do:

- Frequently inspect, clean and organize your home.
- Replace and repair items that are broken, as soon as possible.
- Regularly replace air filters and batteries in smoke/carbon monoxide detectors.
- Keep a maintenance checklist in your home.
- Reminder: Never attempt to repair your furnace, HVAC (heating ventilation air conditioning) systems, or your garage door springs on your own – these maintenance tasks require help from professionals to avoid injury.

"We all have the most critical tools needed to make the largest impact on our home's safety... our own two hands."

Home Safety Council



MAINTENANCE CHECKLIST

	SPRING ACTIVITIES	TWICE A YEAR	FALL ACTIVITIES
Yard & Exterior	• Check to make sure all water drains way from house. • Check that sprinklers paint away from house.	• Check that pool/spa fencing is in good condition. • Check for rodents, cockroaches and other pests. • Clean window wells, rain gutters and downspouts.	• Drain outdoor faucets and hoses.
Roof, Attic, Windows, Walls &	• Check the condition of roof shingles or tiles, chimney and flashing. • Check the attic for signs of leaks and water damage. • Look for peeling, chipping or cracking paint. • Check operation of windows and doors. • Check the weather stripping around windows and doors.	• Clean dryer vents. • Check that exhaust ducts are clean and clear. • Check for wet surfaces or puddles in crawlspace.	• Repair any broken or cracked glass. • Check for rodents, termites and pests. • Check walls and ceilings for signs of water damage. • Check that fans exhaust to the outdoors and ductwork is intact. • Check that insulation is in good condition.
Plumbing & Fixtures	• Check washing machine hose connections for leaks. • Check dishwasher hoses for leaks. • Check toilet supply/shut-off valve. • Check and clean refrigerator drip pan and ice maker.	• Clean drains and supply lines for leaks. • Check bath and kitchen fan operation.	• Check caulk around showers and tubs for signs of damage. • Check traps under sinks, tubs and showers for clogs and leaks. • Check water heater for leaks. • Check septic tank, if applicable.
Electrical Equipment	• Test ground fault circuit interrupters (on equipped outlets) by turning each on and off.	• Check for damaged electrical cords. • Change smoke detector batteries. • Change carbon monoxide detector batteries.	• Test electrical circuit breakers by turning each on and off.
General Safety	• Check that fire extinguishers are charged. • Clear your yard of clutter and debris.	**MONTHLY** • Test smoke and carbon monoxide detectors. • Replace air filters	• Perform routine safety check of stairs, rails, walkways, etc. • Repair cracks in driveway or sidewalk.
Appliances	• Remove lint from clothes dryer vents and screens. • Clean exhaust fan outlets and screens.	**HIRE A PROFESSIONAL** • Clean air conditioning coils and drain pans. • Clean/tune furnaces, water heaters, ovens and ranges.	• Clean outdoor air intakes and screens. • Defrost freezer, clean drip trays and grills.

MAINTAINED

Keep Your Home GREEN

What's the problem?

Keeping your home "green" usually means two things: (1) that your home is protected from outside weather (especially hot and cold air) and (2) that small changes are made in your home that help conserve water and energy. A home that is not "green" often has higher water and heating/cooling bills, leaving less money for your family's health.

How does it happen?

If your home is not "green," outside heat or cold can get inside your home through cracks around windows and doors, or through poor attic insulation. A home that is not "green" also uses more water and electricity than it should, resulting in high utility bills!

Things you can do:

- Check for gaps and cracks around windows and doors. If light or air flows through, the gaps need to be sealed with caulk. Gaps around doors can be sealed with weatherstripping.
- Check, or have a professional check, the amount of insulation you have in your attic. More insulation means lower heating and cooling bills!
- Electronics (like computers, televisions and cell phone chargers) use energy when they are plugged in, even if the power switch is off. This can add up to 8 percent of your energy bill. Unplug electronics when not in use.
- Install CFL bulbs, especially in the light fixtures that you use the most often. CFLs are just as bright as regular light bulbs, but they use less power (20-33 percent) and last 8 to 15 times longer.
- In the winter, set your thermostat to 68° when you're home and 55° when you're away. In the summer, set your thermostat to 80° when you're home and 83° when you're away.
- Install low-flow showerheads and low-flow faucet aerators to save water and heat.
- During colder times of the year, set your ceiling fans to spin in reverse. This pushes warm air down and lowers your heating bill.

"Families that earn less than $10,000 a year pay as much as 16 percent of their incomes on home energy bills."

U.S. Department of Housing and Urban Development

Educational Material

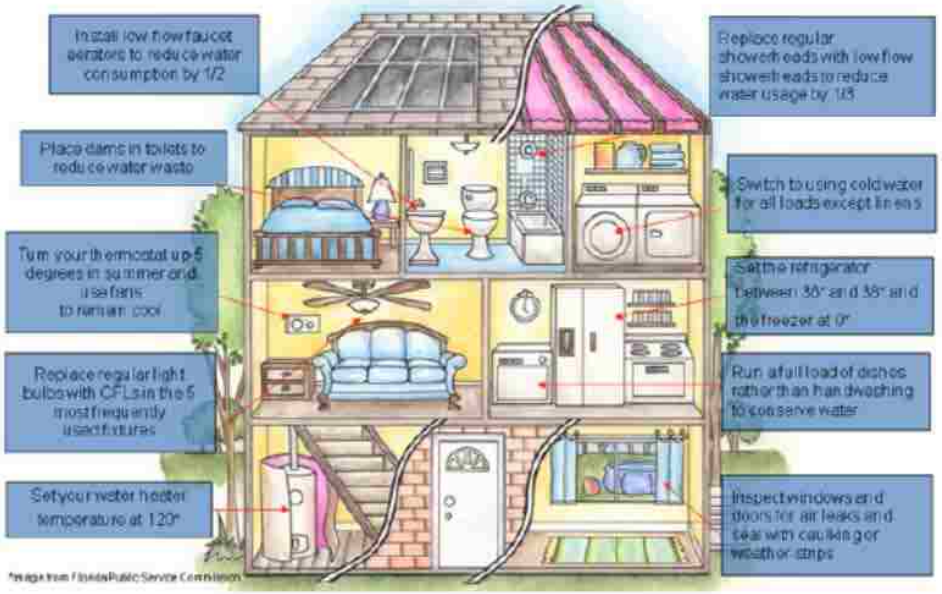


*Image from Florida Public Service Commission

GREEN

ASTHMA

What's the problem?

Asthma is a lung disease that makes breathing difficult for millions of Americans, including a large number of children. Asthma is the result of swollen, inflamed, and constricted airways. Asthma may cause repeated episodes of wheezing, breathlessness, chest tightness, and nighttime or early morning coughing. These symptoms can happen often or just some of the time. For some people, asthma symptoms get worse when they exercise. For many people, asthma symptoms sometimes limit their regular activities and, at times, force them to miss school or work.

In addition to making breathing very difficult, asthma can make people extra sensitive to things they come into contact with every day in the environment – these things become known as asthma "triggers." Asthma triggers can be found both outside and inside your home, and can include: the weather, pollen, dust, chemicals, other respiratory illnesses, tobacco smoke, pet dander, and many others.

When someone with asthma comes into contact with a trigger, the airways in their lungs get even more swollen and produce mucus – making an even smaller space for air to get through. The muscles of their airways also tighten, and the person experiences what is known as an asthma "attack." Asthma attacks, no matter how small, can be dangerous and need to be taken seriously. Asthma is a serious health problem that if not properly managed can be life-threatening.

While asthma is a serious chronic disease that cannot be cured, it can be successfully controlled. People with asthma can live normal, healthy lives. The best way to manage asthma is to understand and avoid asthma triggers, and to work with a health care professional to regularly monitor and control the disease.

How does it happen?

Asthma can happen to anyone, at any age. Sometimes asthma starts in childhood, and other times, asthma begins later in life. The exact cause of asthma is unknown, but scientists believe that asthma may result from a combination of genetic and environmental factors.

Asthma tends to be genetic, meaning it runs in families. For example, if your mom or dad has asthma, you are more likely to have asthma too. Also, if certain allergies run in your family, you may be more likely to develop asthma as well. It is also suspected that certain respiratory infections, if infected in early childhood, may damage developing lungs and contribute to asthma.

Contact with environmental allergens and contaminants early in life may also contribute to the development of asthma. We also know that many things in our environment are asthma triggers, which make asthma symptoms worse. Here we identify five major asthma triggers that may be found in your home. By reducing or avoiding these triggers, any family members with asthma will be better able to manage and control their symptoms.

Asthma Trigger	What can you do?
Tobacco smoke	If you have to smoke, do not smoke in or near your home or car.
Dust mites	To reduce dust mites, wash your sheets every week in hot water, and consider special "allergen impermeable" mattresses and pillow covers. Also, vacuum frequently with a vacuum cleaner fitted with a microfiltration bag or use a HEPA vacuum cleaner, and remove shoes upon entering the home.
Cockroaches and their feces and saliva	To get rid of cockroaches and other pests, remove sources of food and water, keep your house clean, and seal up cracks or openings in the walls and ceilings of your home. (See the section on "Keep Your Home Pest-free" for more tips.)
Mold	To prevent mold, reduce moisture in your home. If mold is on a hard surface, it can be washed off with a mixture of 10 parts water to 1 part bleach. If mold is on a soft material, such as ceiling tile or carpet, the material may need to be replaced. (See the section "Keep Your Home Dry" for more tips.)
Pets and their fur, saliva and urine	Pets should be kept outside if possible. Pets should not sleep in the bedroom. Vacuum often with a microfiltration bag, and brush pets outside to remove loose dander and hair.

"Asthma is one of the main reasons that students miss school due to illness, more than 14 million lost school days every year."

American Lung Association

ASTHMA

ASTHMA

ASTHMA CONTROL TEST FOR CHILDREN 4-11 YEARS

This test provides a score that helps the doctor determine if your child's asthma treatment plan is working or if it needs adjusting.

How to take the **Asthma Control Test:**

1. Let your child respond to the **first four questions (1-4)**. If he/she needs help reading or understanding the question, you may help, but let he/she select the response. Complete the **remaining three questions (5-7)** on your own without letting your child's response influence your answers. There are no right or wrong answers.
2. Write the number of each answer in the score box provided.
3. Add up each score for the total.
4. Take the test to the doctor to talk about your child's asthma.

If your child's score is 19 or less, it may be a sign that your child's asthma is not controlled as well as it could be. Bring this test to the doctor to talk about the results.

19 or less

1. How is your asthma today?

Very bad	Bad	Good	Very good	SCORE
0	1	2	3	

2. How much of a problem is your asthma when you run, exercise or play sports?

Very bad	Bad	Good	Very good	
0	1	2	3	

3. Do you cough because of your asthma?

Very bad	Bad	Good	Very good	
0	1	2	3	

4. Do you wake up during the night because of your asthma?

Very bad	Bad	Good	Very good	
0	1	2	3	

5. During the last 4 weeks, how many days did your child have daytime asthma symptoms?

Not at all	1-3 days	4-10 days	11-18 days	19-24 days	Everyday	
5	4	3	2	1	0	

6. During the last 4 weeks, how many days did your child wheeze during the day because of asthma?

Not at all	1-3 days	4-10 days	11-18 days	19-24 days	Everyday	
5	4	3	2	1	0	

7. During the last 4 weeks, how many days did your child wake up during the night because of asthma?

Not at all	1-3 days	4-10 days	11-18 days	19-24 days	Everyday		TOTAL
5	4	3	2	1	0		

ASTHMA CONTROL TEST FOR PEOPLE 12 YEARS AND OLDER

Know your score. Share the results with your doctor.

1. Write the number of each answer in the score box provided.
2. Add up each score for the total.
3. Take the test to the doctor to talk about your score.

If your score is 19 or less, your asthma may not be controlled as well as it could be. Talk to your doctor.

					SCORE
1. In the past 4 weeks, how much of the time did your asthma keep you from getting as much done at work, school or home?					
All of the time 1	Most of the time 2	Some of the time 3	A little of the time 4	None of the time 5	
2. During the past 4 weeks, how often have you had shortness of breath?					
More than once a day 1	Once a day 2	3 to 6 times a week 3	Once or twice a week 4	Not at all 5	
3. During the past 4 weeks, how often did your asthma symptoms (wheezing, coughing, shortness of breath, chest tightness or pain) wake you up at night or earlier than usual in the morning?					
4 or more nights a week 1	2 or 3 nights a week 2	Once a week 3	Once or twice 4	Not at all 5	
4. During the past 4 weeks, how often have you used your rescue inhaler or nebulizer medication (such as albuterol)?					
3 or more times a day 1	1 or 2 times a day 2	2 or 3 times a week 3	Once a week or less 4	Not at all 5	
5. How would you rate your asthma control during the past 4 weeks?					
Not controlled at all 1	Poorly controlled 2	Somewhat controlled 3	Well controlled 4	Completely controlled 5	
					TOTAL

RESOURCES

NATIONAL RESOURCES

National Center for Healthy Housing
http://www.nchh.org

Centers for Disease Control and Prevention
http://www.cdc.gov

Interactive website provides tips for each area of your home and yard.

U.S. Department of Housing and Urban Development (HUD)
300 S. Las Vegas Blvd., Suite 2900
Las Vegas, NV 89101-5833
(702) 366-2100
http://www.HUD.gov

Provides affordable housing, supports energy conservation and supports community development.

LOCAL RESOURCES

Keep your Air Healthy

Energy Assistance Program (EAP)
Las Vegas (702) 486-1404
Reno/Carson City (775) 684-0730
http://dwss.nv.gov

Federally-funded program that helps low-income households pay their home heating and cooling bills.

Keep your Home Pest-Free

Southern Nevada Health District, Zoonotic Disease Program
625 Shadow Lane
P.O. Box 3902
Las Vegas, NV 89127
(702) 759-0588
http://www.southernnevadahealthdistrict.org

Compiles statistics, performs surveillance and generates reports of zoonotic diseases in Southern Nevada.

U.S. Environmental Protection Agency
http://www.epa.gov

Provides information about controlling pests at home and outdoors.

Keep your Home Safe

Southern Nevada Health District, Drowning Prevention Program
400 Shadow Lane, Suite 101
P.O. Box 3902
Las Vegas, NV 89127
(702) 759-1270
http://www.gethealthyclarkcountry.org

Provides drowning facts and information about common mistakes, how to prevent drowning and pool safety.

Clark County Fire Department
575 E. Flamingo Road
Las Vegas, NV 89119
(702) 455-7311
http://fire.co.clark.nv.us

Provides information about fire safety and drowning prevention.

Las Vegas Neighborhood Services
City Hall, Second Floor
400 Stewart Ave.
Las Vegas, NV 89101
(702) 229-2330
Fax (702) 382-3045
http://www.lasvegasnevada.gov

Promotes, develops and supports safe, healthy neighborhoods.

North Las Vegas Neighborhood Services
2225 Civic Center Dr., Suite 220
North Las Vegas, NV 89030
(702) 633-1532
Fax (702) 642-1511
http://www.CityofNorthLasVegas.com

Offers programs that provide affordable housing and promote public services throughout North Las Vegas.

City of Henderson Neighborhood Services
240 Water St.
P.O. Box 95050
Henderson, NV 89009-5050
(702) 267-2000
http://www.cityofhenderson.com

Promotes, develops and supports safe, healthy neighborhoods.

Keep your Home Contaminant-Free

POISON CONTROL HOTLINE
Toll Free (800) 222-1222

Southern Nevada Health District, Childhood Lead Poisoning Prevention Program (CLPPP)
625 Shadow Ln.
P.O. Box 3902
Las Vegas, NV 89127
(702) 759-1283
http://www.southernnevadahealthdistrict.org

Educates the public about the dangers of lead poisoning and how to prevent it. Tests children for blood lead levels.

University of Nevada Cooperative Extension, Radon Education Program
8050 Paradise Rd., Suite 100
Las Vegas, NV 89123-1904
(702) 222-3130
http://www.unce.unr.edu

Offers free residential radon testing and educational materials about radon.

Keep your Home Maintained

Rebuilding Together of Southern Nevada (Las Vegas)
611 S. Ninth St.
Las Vegas, NV 89101
(702) 259-4900
http://www.rtsnv.com

Nonprofit organization that works to preserve affordable homeownership and revitalize communities.

Keep your Home Green

Low Income Weatherization Assistance

Assists low-income families in making their homes more energy efficient and/or weatherized. (Qualification criteria applies.)

HELP of Southern Nevada
1640 E. Flamingo Rd., #100
Las Vegas, NV 89119
(702) 369-4357
http://www.helpsonv.org

City of Henderson Neighborhood Services
240 Water St.
P.O. Box 95050
Henderson, NV 89009-5050
(702) 267-2000
http://www.cityofhenderson.com

Las Vegas Urban League
930 W. Owens
Las Vegas, NV 89106
(702) 636-3949
http://www.lvcul.org/

Asthma

Southern Nevada Health District, Chronic Disease Prevention Program
400 Shadow Lane, Suite 101
P.O. Box 3902
Las Vegas, NV 89127
(702) 759-1270
http://www.gethealthyclarkcounty.org

Provides information about asthma, symptoms, triggers and management.

American Lung Association of Nevada
3552 W. Cheyenne Ave., Suite 130
North Las Vegas, NV 89032
(702) 431-6333
http://www.lungnevada.org

Fights to prevent lung disease in all its forms with a focus on asthma, tobacco control, and environmental health.

Quality of Life & Mental Health

Project Shero
(702) 242-1517
http://www.project-shero.org

Provides women and children with enrichment programs.

Nevada Early Intervention Services (NEIS)
1161 S. Valley View Blvd.
Las Vegas, NV 89102
(702) 486-7670
Referral Hotline (702) 486-9200
http://www.health.nv.gov

Offers free services to families of children birth to age 3 with developmental delays.

Bilingual Behavioral Services
4660 S. Eastern Ave., Suite 200
Las Vegas, NV 89119
(702) 435-0609

Offers services for children focused on academic support, art and performing arts therapy, social skills and self-esteem, communication skills and anger management. Also offers individual and family counseling, substance abuse education and prevention, and parenting classes.

Oral Health

University of Nevada, Las Vegas School of Dental Medicine
1001 Shadow Lane, MS-7410
Las Vegas, NV 89106-4124
(702) 774-2400
http://dentalschool.unlv.edu

Offers quality oral health care services to the community.

Substance Abuse and Violence

S.A.F.E House (Stop Abuse in the Family Environment)
921 American Pacific Dr., Suite 300
Henderson, NV 89014
(702) 451-4203
Hotline (702) 564-3227
http://www.safehousenv.org

Provides safe shelter, support, advocacy, counseling and education for victims of domestic abuse.

Las Vegas Rescue Mission and Shelter of Hope
480 W. Bonanza Road
Las Vegas, NV 89106
(702) 382-1766
http://www.vegasrescue.org

Serves those who are homeless or struggling with addictions.

The Shade Tree
1 W. Owens
North Las Vegas, NV 89101
(702) 385-0072
http://www.theshadetree.org

Provides safe shelter to women and children who are homeless, abused or in crisis. Life-changing services promote stability, dignity and self-reliance.

Family and Child Treatment of Southern Nevada (FACT)
1050 S. Rainbow Blvd.
Las Vegas, NV 89145
(702) 258-9767
http://www.factsnv.org

Provides counseling and services to children, adults and families to heal from the traumas of abuse, neglect and violence.

Tobacco Cessation

Southern Nevada Health District, Tobacco Control Program
400 Shadow Lane, Suite 101
P.O. Box 3902
Las Vegas, NV 89127
(702) 759-1270
http://www.gethealthyclarkcounty.org

Provides community outreach to raise awareness about tobacco use and smoking.

Nevada Tobacco Users' Helpline
6375 W. Charleston Blvd., Suite A100
Las Vegas, NV 89146
(702) 877-0684
1-800-QUIT-NOW
http://www.livingtobaccofree.com

Telephone-based bilingual counseling with educational classes, support groups and medication assistance program.

Health

Southern Nevada Health District
625 Shadow Lane
P.O. Box 3902
Las Vegas, NV 89127
(702) 759-1000
http://www.southernnevadahealthdistrict.org

Provides services such as immunizations, family planning, HIV screening, sexually transmitted disease screening and treatment, tuberculosis clinic.

Nevada Cancer Institute
1 Breakthrough Way
Las Vegas, NV 89135
(702) 822-5433
http://nevadacancerinstitute.org

Provides hope to communities in Nevada through research education, early detection and prevention.

Nutrition

Food for Kids
4525 W. Reno Ave.
Las Vegas, NV 89118
(702) 877-5437

Strives to help children in Nevada who are hungry by providing food and assistance to children and their families.

Three Square
4190 N. Pecos Rd.
Las Vegas, NV 89115
(702) 644-3663
http://www.threesquare.org

Provides wholesome food to hungry people through non-profit and faith-based organizations.

Nevada Supplemental Nutrition Program for Women, Infants, and Children (WIC)
Toll Free (800) 863-8942

Federally funded supplemental food program that provides nutritious foods to eligible families with moderately low incomes.

Vaccinations

Southern Nevada Health District
625 Shadow Ln.
P.O. Box 3902
Las Vegas, NV 89127
(702) 759-0850
www.southernnevadahealthdistrict.org

Offers childhood and travel immunizations.

Infants and Children

Safe Kids Clark County
3186 Maryland Pkwy., Suite 101
Las Vegas, NV 89109
(702) 731-8666
http://safekidsclarkcounty.org

A non-profit organization dedicated to the prevention of injuries to children.

Helping Kids Clinic
968 E. Sahara Ave.
Las Vegas, NV 89104
(702) 732-7001
http://www.helpingkidsclinic.org

Provides free health care to children who have barriers to health access.

Sunrise Children's Foundation
2755 E. Desert Inn Rd., Suite 200
Las Vegas, NV 89121
(702) 731-8373
http://www.sunrisechildren.org

Emphasizes pediatric health and education and the betterment of all children.

St. Jude's Ranch for Children
Boulder City Campus
100 St. Jude's St.
Boulder City, NV 89006
(702) 294-7100
http://www.stjudesranch.org

Rescues abused, abandoned and neglected children of all races and faiths to give them a safe home-like environment.

StandUp for Kids
Toll Free (800) 365-4543
http://www.standupforkids.org

Committed to helping and rescuing homeless/street kids.

Family to Family Connection
6114 W. Charleston Blvd.
Las Vegas, NV 89146-1127
(702) 870-9583
http://www.newbabycenter.com

Offers free services to families of newborn babies up to age 4.

St. Rose Dominican Hospitals
Family to Family Connection
31 Church St.
Henderson, NV 89015
(702) 568-9601
http://www.strosehospitals.org

Provides free services to parents of children up to 4 years, including hospital visits, classes, workshops and educational materials.

Education

Big Brothers, Big Sisters of Southern Nevada
4065 E. Post Rd.
Las Vegas, NV 89120
(702) 731-2227
Fax (702) 737-9209
http://www.bbbsn.org

Matches mentors with children and encourages one-on-one relationships to help children increase their self esteem.

Emergency and Disaster Relief

In an emergency, dial 911

American Red Cross
Southern Nevada Chapter
1771 E. Flamingo Rd., Suite 206-B
Las Vegas, NV 89119
(702) 791-3311
http://www.redcrosslasvegas.org

Provides services to victims of disasters and helps people to prepare for and respond to emergencies.

Nevada 2-1-1
211 or (702) 836-2110
http://www.nevada211.org

Offers access to basic human needs resources, programs for children, youth and families, and support for disaster recovery.

Emergency Aid of Boulder City
600 Nevada Hwy.
P.O. Box 60673
Boulder City, NV 89006
(702) 293-0332

Provides emergency assistance for rent, utilities, goods, gasoline, auto repairs and medical needs to residents and stranded travelers.

Resources for the Disabled

New Vista Ranch
P.O. Box 80025
Las Vegas, NV 89180
(702) 457-4677
http://www.newvistaranch.org

Provides quality housing and support services to developmentally disabled adults.

Senior Citizens

Helping Hands of Vegas Valley
2100 S. Maryland Pkwy., Suite 3
Las Vegas, NV 89104
(702) 633-7264
http://www.hhovv.org

Provides assisted transportation to medical appointments, loan of durable medical equipment to patients 60 years or older who maintain independence in their own home.

Salud En Acción
625 Shadow Ln.
P.O. Box 3902
Las Vegas, NV 89127
(702) 759-0874
http://www.southernnevadahealthdistrict.org

Provides bilingual Medicare advocacy to the Hispanic community.


NEVADA
Healthy Homes
PARTNERSHIP
Nevada Healthy Homes Partnership
888.524.0227
www.nvhhp.org
SNHD
Southern Nevada Health District
UNLV

APPENDIX K – CITI CERTIFICATION

CITI Collaborative Institutional Training Initiative

Human Research Curriculum Completion Report
Printed on 8/19/2010

Learner: Mackenzie Burns (username: kenziesb)
Institution: University of Nevada, Las Vegas
Contact Information Department: Environmental and Occupational Health
Phone: 702 895 1565
Email: kenziesb@aol.com

Group 2. Social / Behavioral Research Investigators and Key personnel.: If you have any questions regarding your requirements you may contact the UNLV OPRS by phone at 702.895.2794 or by email at OPRSHumanSubjects@unvl.edu

Stage 1. Basic Course Passed on 07/26/10 (Ref # 4698291)

Required Modules	Date Completed	
Introduction	08/12/08	no quiz
History and Ethical Principles - SBR	07/26/10	4/4 (100%)
Defining Research with Human Subjects - SBR	07/26/10	4/5 (80%)
The Regulations and The Social and Behavioral Sciences - SBR	07/26/10	4/5 (80%)
Assessing Risk in Social and Behavioral Sciences - SBR	07/26/10	4/5 (80%)
Informed Consent - SBR	07/26/10	5/5 (100%)
Privacy and Confidentiality - SBR	07/26/10	3/3 (100%)
Research with Prisoners - SBR	07/26/10	3/4 (75%)
Research with Children - SBR	07/26/10	3/4 (75%)
Research in Public Elementary and Secondary Schools - SBR	07/26/10	4/4 (100%)
International Research - SBR	07/26/10	3/3 (100%)
Internet Research - SBR	07/26/10	4/4 (100%)
Group Harms: Research With Culturally or Medically Vulnerable Groups	08/25/08	3/3 (100%)
Workers as Research Subjects-A Vulnerable Population	08/25/08	4/4 (100%)
Conflicts of Interest in Research Involving Human Subjects	08/25/08	1/2 (50%)
UNLV	08/25/08	no quiz

For this Completion Report to be valid, the learner listed above must be affiliated with a CITI participating institution. Falsified information and unauthorized use of the CITI course site is unethical, and may be considered scientific misconduct by your institution.

Paul Braunschweiger Ph.D.
Professor, University of Miami
Director Office of Research Education
CITI Course Coordinator

Return

APPENDIX L – SUMMARY OF PROVIDED INTERVENTION SUPPLIES

Case	Carbon Monoxide Detector	Smoke Detector	First Aid Kit	Fire Extinguisher	Mop	Broom	Mop Bucket	Green Cleaner	Cleaning Rags	Energy Efficiency Kit	Cockroach Bait Stations	Pest Sticky Trap	Caulk	Boric Acid	Batteries (9v for Detectors)	Emergency Phone # Magnet	Allergen-Reducing Pillow Cover	Allergen Reducing Mattress Cover
1	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes					Yes 1	Yes 1
2	Yes	Yes		Yes	Yes	Yes	Yes									Yes		
3																Yes		
4																		
5								Yes	Yes								Yes 1	
6			Yes	Yes				Yes	Yes		Yes					Yes	Yes 1	Yes 1
7			Yes	Yes				Yes			Yes			Yes		Yes	Yes 1	Yes 1
8	Yes		Yes	Yes			Yes				Yes		Yes				Yes 2	Yes 2
9	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes		Yes			Yes	Yes 2	Yes 1
10	Yes	Yes	Yes	Yes				Yes		Yes	Yes			Yes		Yes	Yes 1	Yes 1
11	Yes		Yes								Yes					Yes	Yes 2	Yes 2
12	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes		Yes	Yes	Yes	Yes	Yes 1	Yes 1
13		Yes		Yes													Yes 3	Yes 2
14	Yes			Yes			Yes	Yes	Yes						Yes	Yes	Yes 1	Yes 1
15	Yes		Yes								Yes		Yes	Yes		Yes	Yes 1	Yes 1
16				Yes				Yes			Yes				Yes	Yes	Yes 1	Yes 1
17	Yes			Yes				Yes		Yes	Yes					Yes	Yes 2	Yes 2
Sum	10	4	9	12	4	4	6	10	6	2	11	1	4	4	3	12	20	17

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Dissertation Title: Evaluating the Impact of a Home-Based Childhood Asthma Intervention Program in Clark County, Nevada

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