

Assessment of Parental Knowledge of Pediatric Asthma Triggers

An analysis at CommuniCare Health Centers in San Antonio, TX

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Introduction: Asthma is an inflammatory disease of the lung. Once the airway get inflamed and swollen, it becomes narrower, and less air gets through to the lung tissue. This causes symptoms like wheezing, coughing, chest tightness, and difficulty breathing. Once considered a minor ailment, asthma is now the most common chronic disorder in childhood.

Asthma does run in families, which suggests that genetics play an important role in the development of the disease. If one or both parents have asthma, the child is much more likely to develop the condition. There are numerous factors that can be asthma triggers. Some the patient's guardian are unaware of. Once asthma is triggered, especially in pediatric patients, they are most likely to go to visit the clinic or emergency department. Overtime, this can be overwhelming financially and physically for the families. Therefore, it is vital to reduce the asthma attack morbidities and mortalities by education and prevention. Raising awareness about asthma triggers to guardians of pediatric asthmatic patients could play an integral role in achieving this goal.

Background: Asthma is a chronic lung disease that inflames and narrows the airways. Asthma causes recurring period of wheezing (whistling sound when you breathe), chest tightness, shortness of breath, and coughing. Asthma affects people of all ages, but it most often starts during childhood. Asthmatic patients tend to react strongly to certain inhaled substances. When the airways react, the muscle around them tighten, causing the airways to narrow

causing less air to flow into the lungs. Cells in the airways might make more mucus than usual and this can further narrow the airways. According to the Centers for Disease Control and Prevention (CDC), the prevalence of asthma has progressively increased in the past 15 years. In the U.S. alone, about 13.8 million children have been diagnosed with asthma.¹

Numerous factors including allergic, familial, infectious, occupational, socioeconomic, environmental, weather changes, exercise, and psychosocial have been implicated in the induction and exacerbation of asthma. Genetics have been identified as predisposing patients to having asthma. A study done by the National Institute of Environmental Health Sciences (NIEHS) in 615 Mexico City families show that variations in the genes, ORMDL3 and GSDML, were associated with the increases risk of childhood asthma.² Numerous asthma triggers have been identified and some are still unknown.

Triggers caused by substances in the environment are called allergens. Some examples of the most important environmental triggers for asthma include dust mites, cockroaches, pets, and molds. Researchers from the U.S. Department of Housing and Urban Development conducted a survey of lead hazards and allergens in household and found that 46 percent of homes had dust mites allergens that are high enough to produce allergic reactions. They also found that nearly 25 percent of homes have allergen levels high enough to trigger asthma symptoms in genetically susceptible individuals. The same survey also showed that nearly two-thirds of American homes have cockroach allergens.³

¹ CDC (Centers for Disease Control and Prevention). 2009 National Health Interview Survey Data: Lifetime Asthma Estimates. Available: <http://www.cdc.gov/asthma/nhis/09/table1-1.htm> [accessed 13 July 2013].

² Wu H, et al. 2009. Genetic variation in ORM1-like 3 (ORMDL3) and gasdermin-like (GSDML) and childhood asthma. *Allergy* 64(4):629-635.

³ Arbes SJ Jr, et al. 2003. House dust mite allergen in U.S. beds: Results from the First National Survey of Lead and Allergens in Housing. *J Allergy Clin Immunol* 111(2):408-414.

An environmental pollutant (indoor or outdoor) may affect asthma severity in the following ways:

- The pollutant might act as an inciter or trigger, leading to an asthma attack in an individual with hyper responsive airways.
- The pollutant can exacerbate preexisting airway inflammation, leading to increased airway hyper responsiveness, which may persist after cessation of exposure.
- The pollutant might augment or modify immune responses to inhaled antigens or intensify the impact of other pollutants in the respiratory tract.

According to the Natural Resources Defense Council, scientists have shown that air pollution from cars, factories and power plants, is a major cause of asthma attacks. A research study published in 2002 estimated that 30 percent of childhood asthma is due to environmental exposures, costing the nation \$2 billion per year. The Council also listed several air pollutants that can trigger asthma.

- Ground Level Ozone: this is a toxic component of smog. Ozone is produced at ground level when tailpipe pollution from cars and trucks reacts with oxygen and sunlight. This is a big problem in big cities with lots of traffic such as Los Angeles, Houston, and New York City.
- Sulfur Dioxide: this is a respiratory irritant that is produced when coal and crude oil are burned.
- Particulate Matter: this refers to a wide range of pollutant i.e. dust, soot, exhaust particles, and sulfate aerosols which are suspended as tiny particles in the air. Some

of these fine particles can become lodged in the lungs and could trigger asthma attacks.

- Nitrogen dioxide: this is a gas that is emitted from tailpipes and power plants. Nitrogen dioxide contributes to the formation of ground level ozone and smog. It can also react with other air pollutants to form small particles that can cause breathing difficulties, especially in patients with asthma. ⁴

Another study at the Keck School of Medicine of the University of Southern California found that children living within 150 meters of a freeway were more likely to be diagnosed with asthma than children who lived further away. This was based on a study of air pollution in 10 Southern California cities. Researchers at the same university also found that children who had higher levels of nitrogen dioxide exposure around their homes were more likely to develop asthma symptoms.⁵

To measure outdoor air pollution, the National Ambient Air Quality Standards (NAAQS) required by the Clean Air Act, have sets for six criteria pollutants (ozone, sulfur dioxide, nitrogen dioxide, carbon monoxide, lead, particulate matters less than 10 or 2.5 micrometers). The standards are designed to protect the health of all susceptible groups. For people with asthma, sulfur dioxide, sulfuric acid aerosols, and nitrogen dioxide can exacerbate respiratory symptoms in the short term. The Air Quality Index (AQI) provides standardized means of communicating health information associated with daily ambient levels of ground-level O₃(ozone), PM_{2.5}, PM₁₀, CO (carbon monoxide), SO₂ (sulfur dioxide) and NO₂ (nitrogen dioxide). The AQI was developed by the EPA and is reported in all U.S. metropolitan areas with

⁴ Asthma and Air Pollution. National Resources Defense Council, 8 June 2005. Web. 2 July 2013.

⁵ Gauderman WJ, et al. 2005. Childhood asthma and exposure to traffic and nitrogen dioxide. *Epidemiology* 16(6):737-743.

populations exceeding 350,000. For AQI of 0-50, there are no general health effects. For AQI of 51-100, there are possibilities of aggravation of heart or lung disease among patients with cardiopulmonary disease. For AQI of 101-150, there is mild aggravation of respiratory symptoms among susceptible people. For AQI of 151-200, there is significant aggravation of symptoms and decreased exercise tolerance in persons with heart and lung disease with possible respiratory effects in the general population. For AQI of 201-300, there is increasingly severe symptoms and impaired breathing likely in sensitive groups with increasing likelihood of respiratory effects in the general population. For AQI >300, there is severe respiratory effects and impaired breathing in sensitive groups with serious risk of premature mortality in persons with cardiopulmonary disease and the elderly.

With the mentioned background on asthma and some of its triggers, this project aims to assess parent's knowledge about asthma, specifically triggers. The assessment will help CommuniCare in its future efforts of asthma education and prevention efforts. If parents are well educated about asthma and its triggers, then they are more empowered to take efforts in reducing their child asthma flare-ups and symptoms. This in the long run will reduce asthma morbidities, mortalities, but also financial burden of medical costs to the clinics, emergency department, and families.

Methodology: Data will be collected from the target patient population of any pediatric patients younger than 18 years of age who have been diagnosed with asthma, have a history of asthma or wheezes, or come in for asthma. Once these patients have been identified, the guardian of the patient will be asked if they are interested in participating in a quick survey of their knowledge of asthma. They were then briefed that no personal patient information will be

requested or documented and that their participation in the survey is strictly voluntary. If they agree, then a survey consisted of one page, front and back, in both English and Spanish language with 11 questions, including demographic questions, was given. Every parent was given the same survey. These surveys were dispersed to 3 CommuniCare Health Centers: East, West, and Northwest campus. The providers and medical assistants at each of these campuses were instructed on what the criteria were and procedures on obtaining patient consent. On days that I am not at their campus, the providers or medical assistants can hand out the surveys only if the guardian consents to participating in the survey.

A copy of the survey can be found in the Appendix section of this paper. Demographics question such as patient gender, age, duration of asthma, and zip code were requested in the survey. Questions 1-4 assesses the when, where, and what causes most asthma exacerbations. Questions 5-11 assesses what asthmatic patients are exposed to in the environment, both indoor and outdoor. Some of the choices to the questions are triggers found to cause/exacerbate asthma symptoms. Not every trigger is listed, but just the common household and everyday factors that pediatric asthmatics are exposed to. At the end of the survey, these two questions were asked:

* Was this survey easy to complete? (¿Estuvo fácil completar el cuestionario?)

A. Yes (Sí) _____ B. No _____

* Would you complete another survey for us in the future?

(¿Completaría otro cuestionario en el futuro?)

A. Yes (Sí) _____ B. No _____

These two questions were asked to examine how parent's felt about the survey and if they would be willing to do something similar in the future. These two questions will be used by CommuniCare to gauge patient's interest/participation in its future project efforts.

The target size of the project is to obtain at least 50 surveys within the period of June 17, 2013 – July 19, 2013. After the end date of July 19, the surveys will then be coded into an excel spreadsheet to gather statistical information on parents' knowledge about asthma and its triggers. The data will be analyzed for any correlations and then be used as part of an asthma education and prevention program grant proposal by CommuniCare. Information from the survey will help CommuniCare to educate and address about asthma triggers that parents are not aware of.

Results: The target goal of 50 surveys was not achieved during the data collection period of June 17, 2013- July 19, 2013. However, forty-one patients (n=41) with asthma met the inclusion criteria for the study. Of those 41, 20 were male and 21 were female. The average patient age was 7. The zip codes provided came from all over San Antonio, but 78229 had a higher frequency than the others. It accounted for about 10% of the total surveys. Question about the duration of asthma or wheezing had conflicting responses. Some responses were in years, weeks, and hours. There was no consistency in the unit of time for this specific demographic question. The question pertaining to the location of where their child usually develop asthma symptoms, the majority of respondents said at "home". Result from this question can be found in Chart 1 in the Appendix. The time of year that their child's asthma symptoms are the worst is in winter followed by fall. Winter for the purpose of this study was defined as December, January, and February. Fall was defined as September, October, and November. Result from this question can be found in Chart 2 in the Appendix. For the question asking what kind of triggers asthmatic patients have symptoms with, majority of respondents indicated weather changes as the main trigger. Cold/flu was the second highest followed by dust. Result from this

question can be found in Chart 3 in the Appendix. There were only two respondents who selected air fresheners as a trigger for their child. No asthma patients have symptoms after ingesting foods or medications. Only 8 respondents (19.5% of total) indicated that their child is exposed to a smoker in the household. About 58% of the respondents (n=24) indicated that their home is 10 years or older. Result from this question can be found in Chart 4 in the Appendix.

Almost all of the respondents, about 33 out of 41 (80% of total), indicated that their household uses some sort of air freshener. This was the choice most selected by respondents followed by fabric softener sheets and perfume. Result from this question can be found in Chart 5 in the Appendix. When asked what is in their child's bedroom, the top three were window blinds, curtains, and stuffed animals. Result from this question can be found in Chart 6 in the Appendix. Only one respondent answered "yes" to having their child spend time in the basement of their home. When asked if their child is exposed to strong odors, perfume, occupational chemicals, or dust/smog; the majority indicated perfumes. Result from this question can be found in Chart 7 in the Appendix. For the questions asking if they use methods for dust mite control, about 32% of respondents (n=13) said "yes". The final two questions about the ease of the survey and if respondents were willing to do another similar survey for CommuniCare in the future, 95% and 100% said yes respectively.

Discussion: Data collection during the indicated time period progressed at a steady pace. There was not a flux of patient that I encountered who fit the criteria. As a result, only 41 surveys were obtained and the target goal of 50 was not achieved. Whenever a patient with the inclusion criteria showed up, I asked the parent/guardian if they were interested in doing the

questionnaire and with their consent, were given a survey. The respondents understood the questions and answered to the best of their knowledge. However, there was a demographic question that had inconsistency in the responses. The question about the duration of asthma or wheeze had responses with different units of time i.e.: years, weeks, days. This led me to believe that respondents were unsure about whether the question was asking about the length of their child's asthma attack or the length of time that their child was diagnosed with asthma. To better improve this question, I should have used better wording to ask about the length of time that their child had been living with asthma. This way, I can better correlate the parent/guardian's level of knowledge of asthma and its triggers. The longer their child has been diagnosed with asthma, the more informed the parents' are of their children's asthma triggers.

Furthermore with the data collected, Chart 1 indicates that a lot of the patients develop asthma symptoms in the home environment. This says a lot about where most asthma symptoms occur and that there might be some triggers that parents might not be aware of that are within their household. According to Chart 2, most respondents indicated that winter and fall season is when their child's asthma symptoms are the worst. The reason for this is because winter season tends to bring more cold and flu problems. In asthma, the lungs are already irritable, and any virus that impacts the lungs has the propensity to create more problems. In one study published in the *Journal of Allergy and Clinical Immunology* in 2005, researchers identified what they came to call the "September epidemic," an upswing in the number of children admitted to emergency rooms for the treatment of acute asthma symptoms in the fall months. The study concluded that one reason behind the increase was the start of the school

season, and a greater exposure to cold and flu viruses.⁶ Data in Chart 2 correlates with this study findings which shows that fall and winter months are when most asthmatic children develop symptoms. The National Heart, Lung and Blood Institute recommends that parents speak to their child's doctor about a winter asthma action plan to have a better day-to-day asthma symptom control. In the summer months, asthmatic patients tend to feel better without their medication. This lead those to see of a lesser need to take their medications come the fall and winter seasons which lead to more flare-ups of asthma symptoms. If patients are more compliant and vigilant about taking their regular asthma medications daily, then there would be fewer asthma flare-ups or exacerbations.

According to Chart 3, the top three factors that parents listed that their child have symptoms with are weather changes, cold/flu, and dust. This leads me to believe that these are what parents perceived to be the common trigger for their child's asthma symptoms. However, those triggers might not always be the cause. Other causes have been linked to lesser known triggers such as air freshener products and fabric softener sheets. Only two respondents indicated air fresheners as a trigger for their child which shows the lack of parental knowledge about them. The top three most used household items were: air freshener products, fabric softener sheets, and perfume as indicated in Chart 5. What parents do not know is that a study have shown that air fresheners are asthma trigger. New research compiled by scientists from Emory University in Atlanta, Georgia and the Atlanta Allergy & Asthma Clinic suggests that various chemical additives in air fresheners can trigger allergies, asthma and other health problems. Many scented air freshener products contain harmful volatile organic compounds

⁶ Bouche, Colette. Breathe Easily: Winter Asthma Advice. WebMD, 13 November 2007. Web. 23 July 2013.

(VOCs) like formaldehyde, petroleum distillates, benzene and limonene, which are known to trigger asthma and other respiratory symptoms.⁷ If parents are concerned about discerning smell in their home, they should use other methods. According to the National Resources Defense Council, air fresheners are not a solution for poor air quality and cannot substitute for good ventilation. The best solution is to open windows to bring in fresh air or to use fans to maintain air circulation. If parents are more aware and educated about the harmful effects of air fresheners on their child's asthma, then they can use preventative methods to avoid them.

The second item most respondents indicated that are used in their household are fabric softener sheets. Even though these sheets smell great, they can cause a plethora of problems. A study published in the *Journal of Toxicology and Environmental Health* indicates that fabric softener sheets can cause sensory irritation, pulmonary irritation, and reduce midexpiratory airflow velocity. The study reports that five common products used in dryer sheets emit the chemicals styrene, phenol, toluene, thymol, xylene and trimethylbenzene. The study was performed on mice, and results indicated that their entire upper respiratory systems were compromised, limiting airflow and normal respiration.⁸ In addition, most standard fabric softeners and dryer sheets contain noxious scents and chemicals such as quaternary ammonium compounds, which release toxic chemicals like formaldehyde into the environment. Formaldehyde causes a variety of serious allergic reactions including rashes, respiratory conditions and neurological disorders. Parents can use other alternative methods to prevent

⁷ Benson, Jonathan. Study: Exposure to common air fresheners can cause allergies, asthma. NaturalNews, 17 November 2011. Web. 23 July 2013.

⁸ Anderson RC, Anderson JH. *Journal of Toxicology and Environmental Health*. 26 May 2000;60(2):121-36.

this asthma trigger in their child. Methods like clothe line drying, chemical free dryer balls, or baking soda have been recommended as good and safe alternatives to fabric softener sheets.

According to Chart 4, about 58% of respondents (n=24) said that their home is either 10 years or older. Older homes tend to have more indoor particulates, allergens, and problems with mold which can trigger asthma symptoms. Some parents have identified methods to reduce the allergens and dust in their homes with the use of HEPA air filters, hypo-allergenic bedding, and frequent cleaning. Chart 6 shows the top three items in their child's bedroom: window blinds, curtains, and stuffed animals. These items tend to accumulate and attract more dust and allergens in homes. Therefore, parents need to clean/vacuum these frequently to avoid unnecessary asthma symptoms.

Overall, based on the assessment made from data from the surveys, I can say that parents are more aware of the common triggers like weather changes, cold/flu, and dust. These triggers are often blamed as the cause of their child's asthma symptoms. However, what they do not realize is that common household items like air freshener products and fabric softener sheets are also asthma triggers. These items are found in almost every household today and it can be a serious problem for asthmatic patients. Asthmatics might develop asthma symptoms which can lead parents to believe that it is just the weather changing, cold/flu problems, dust or allergens in the air. If awareness was raised about the lesser known triggers mentioned like air freshener products and fabric softener sheets, then parents can help alleviate and prevent their child's asthma symptoms. This in the long run can help reduce asthma morbidities, medical visits, and increase the well-being of their child. Education and prevention efforts can be used as interventions to address this issue. Based on the respondents surveyed, 100 percent of them

would be willing to complete a similar survey in the future. This can help CommuniCare in its future education and prevention efforts about asthma.

An example of a successful asthma intervention method can be seen at Boston Children's Hospital. The hospital has a program call the Community Asthma Initiative. This program targets asthmatic children ages 2-18 who have visited the hospital's Emergency Department or have been hospitalized for asthma. The program works with each family to understand their child's asthma, the medications used to treat it, and to identify and reduce asthma triggers in the home. Home visits paired with community outreach and education about asthma triggers yielded remarkable results. As of October 2012, there are over 986 children enrolled in the program. The results are as follow:

- 80% reduction in the percentage of patients with asthma-related hospitalization.
- 56% reduction in the percentage of patients with Emergency Department visits.
- 41% reduction in the percentage of patients with missed school days for children.
- 46% reduction in the percentage of patients with lost work days for parents.⁹

These positive reductions proves the power of prevention, education, and intervention methods to reduce the asthma morbidities and mortalities. If CommuniCare is able to do something similar in its outreach and education efforts, it too will become an integral part in maintaining the community's well-being and help alleviate the asthma disease that plagues children today.

One problem that this study faces is the small sample size. There is not enough information from the small sample to make any major correlation analysis with confidence.

⁹ Tsopelas, Lindsay. Community Asthma Initiative. Boston Children's Hospital. Available: <http://www.childrenshospital.org/clinicalservices/Site1951/mainpageS1951P0.html>. [Accessed 23 July 2013].

There can only be interpretations and assumptions made from the data extrapolated. If the project went on for at least a semester instead of just 6 weeks, then there could be significant information to make about any correlation from the data collection due to having a larger sample size. Statistical analysis like chi square, linear regressions, and p-values were not made in this project due to the small sample size. Another area to improve is the wording on the question about the duration of asthma or wheeze in the survey. There needs to be consistency in the unit of time in the response to make any correlation analysis. Other problems might arise, but the biggest rate limiting step of the project is the length of time for the project. A longer period could reveal more statistically significant information and correlations.

Appendix:

Chart 1

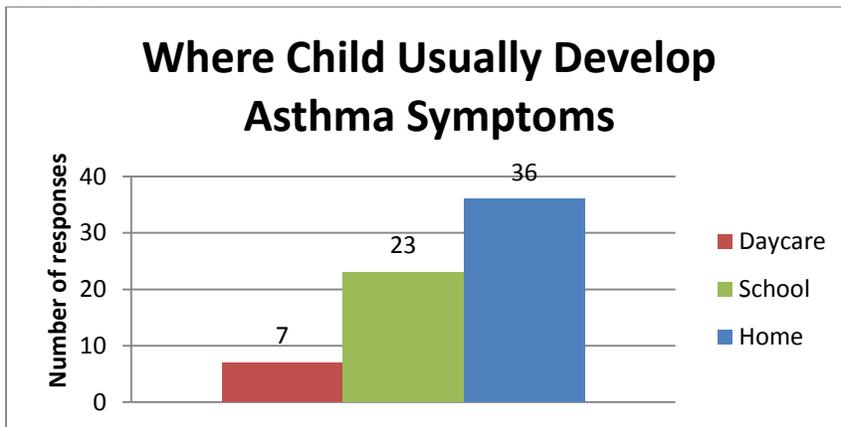


Chart 2

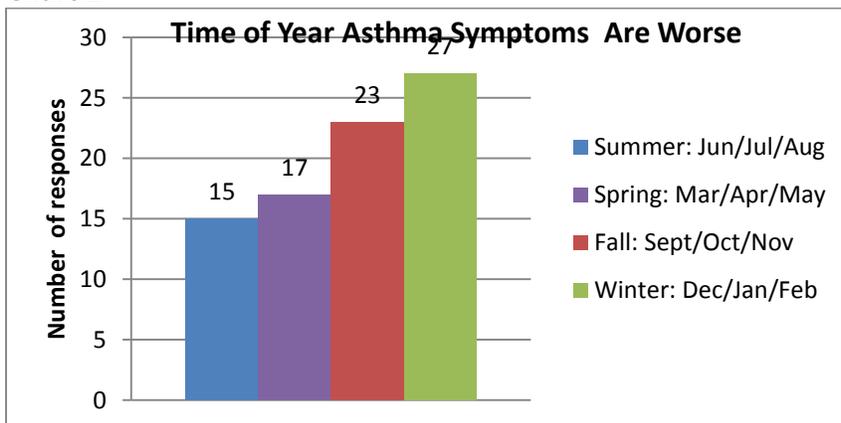


Chart 3

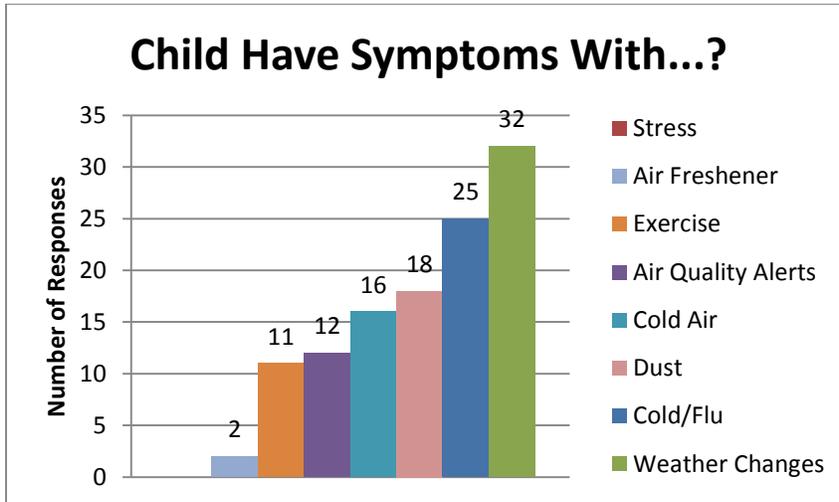


Chart 4

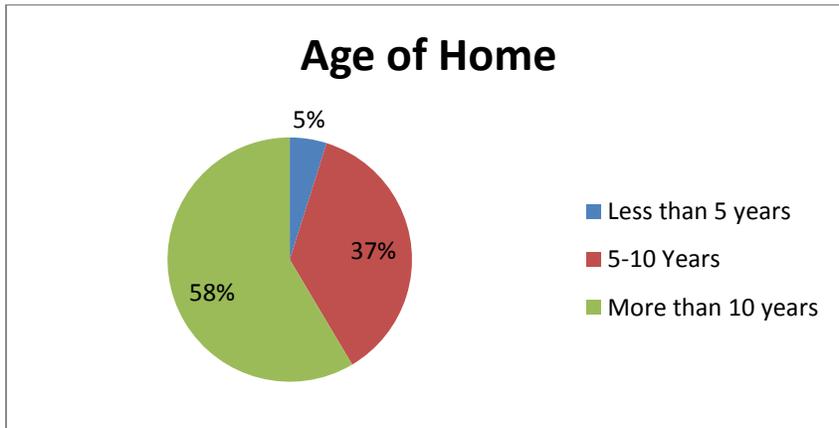


Chart 5

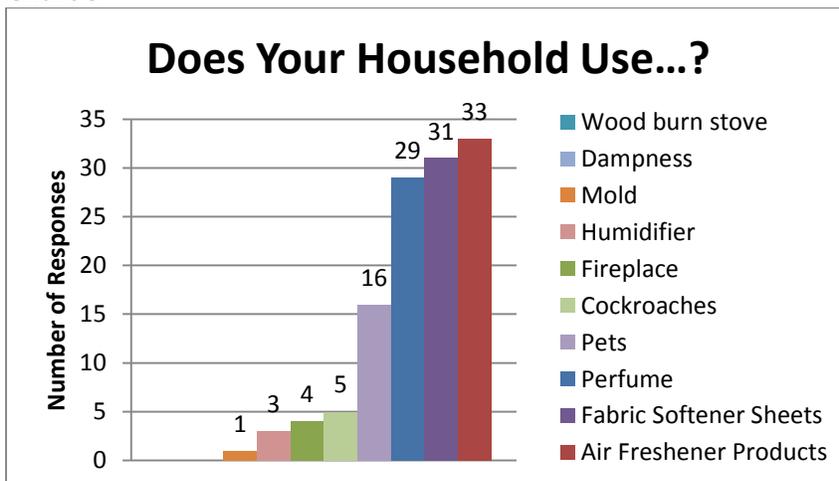


Chart 6

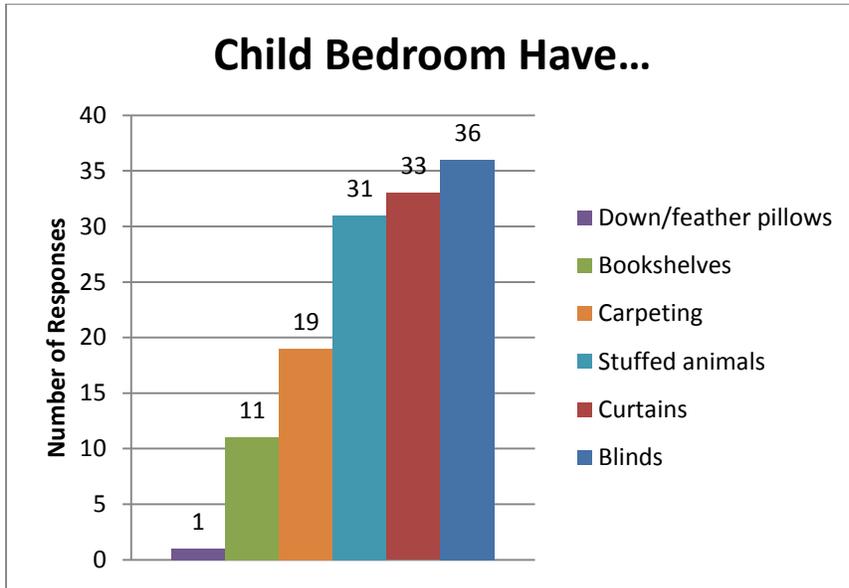
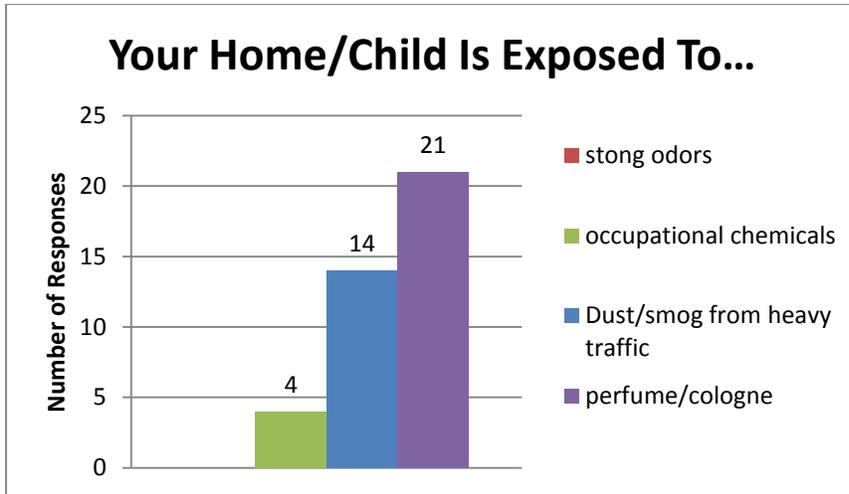


Chart 7



CommuniCare Health Center – Pediatrics
PARENT ASTHMA TRIGGER QUESTIONNAIRE
CUESTIONARIO PARA PADRES: PROVOCACIONES DEL ASMA

Patient gender (Género del paciente) _____
Patient age (La edad del paciente) _____
Duration of asthma or wheezing (Duración de asma o sibilancias) _____
Zip Code (código postal) _____

***CHECK ANSWERS THAT APPLY. Some questions can have more than one check. ***
*** Seleccione las respuestas que correspondan. Algunas preguntas pueden tener más de una respuesta***

1. Does your child develop asthma symptoms at (¿Desarrolla su hijo los síntomas del asma en la/el):
 Home (Casa)
 Daycare (Guarderia)
 School (Escuela)
 Work (Trabajo)

2. What time of year are asthma symptoms worse (¿Qué época del año empeoran los síntomas del asma?):
 Summer: Jun/Jul/Aug (Verano: junio / julio / agosto)
 Fall: Sep/Oct/Nov (Otoño: septiembre / octubre / noviembre)
 Winter: Dec/Jan/Feb (Invierno: diciembre / enero / febrero)
 Spring: Mar/Apr/May (Primavera: marzo / abril / mayo)

3. Does your child have symptoms with (¿Tiene su hijo síntomas con):
 Colds/Flu (Resfriados / Gripe)
 Stress (Estrés)
 Weather Changes (Los cambios del tiempo)
 Air Quality Alerts (Alertas de calidad de aire)
 Cold Air (Aire frío)
 Exercise (Ejercicio)
 Air Freshener Products (Productos aromatizantes)
 Dust (Polvo)
 Other (Otros): _____

4. Does your child have symptoms after ingesting certain foods or medications (¿Tiene su hijo síntomas después de ingerir ciertos alimentos o medicamentos):
 Yes (Sí)– List (listar): _____
 No

5. Does anyone in your household/daycare smoke (¿Alguien en su hogar / guardería fuma?):
 Yes (Sí)
 No

****PLEASE COMPLETE THE OTHER SIDE****
****POR FAVOR COMPLETE EL OTRO LADO****

6. How old is your home (¿Cuántos años tiene su hogar):

- Less than 5 Years (Menos de 5 años)
- 5 – 10 Years (5 - 10 Años)
- More than 10 Years (Más de 10 años)

7. Does your house have or household members use (¿Tiene en el hogar o utilizan miembros del hogar):

- Perfume (Perfume o fragancia)
- Air Freshener Products (Productos aromatizantes)
- Fabric Softener Sheets (Hojas de suavizante de telas)
- Fireplace
- Wood Burn Stove (Estufa de combustión)
- Mold (Moho)
- Dampness/Moisture (humedad)
- Humidifier (Humidificador)
- Cockroaches (Cucarachas)
- Pets (Mascotas): _____

8. Does your child's bedroom have (¿Tiene la recámara de su hijo):

- Blinds (Persianas)
- Curtains (Cortinas)
- Bookshelves (Estantería)
- Down/Feather Pillows (Almohadas de plumas)
- Stuffed Animals (Peluches)
- Carpeting (Alfombras)

9. Does your child spend time in the basement of your home (¿Pasa su hijo tiempo en el sótano del hogar?):

- Yes (Sí)
- No

10. Is your home or child exposed to (¿Esta su casa o niño expuesto a):

- Dust/smog from heavy traffic (Polvo / niebla o humo de tráfico pesado)
- Strong Odors (Los olores fuertes): *Please Specify (Por favor Especifique)*: _____
- Occupational Chemicals (i.e. paint, hairstyling products, etc.) (Productos químicos ocupacionales (por ejemplo, pinturas, productos de peluquería, etc))
- Perfume/Cologne (Perfume o fragancia)

11. Have you used methods for dust or mite control (¿Ha utilizado los métodos para el control de polvo y ácaros): Yes (Sí) _____ No _____

If yes, please specify (En caso afirmativo, por favor especifique)

Was this survey easy to complete? (¿Estuvo fácil completar el cuestionario?)

A. Yes (Sí) _____ B. No _____

Would you complete another survey for us in the future?

(¿Completaría otro cuestionario en el futuro?)

A. Yes (Sí) _____ B. No _____