Options to Increase Health Care Access
to Reduce Childhood Asthma in St. Louis, Missouri

Policy Memo
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I. Executive Summary

The Centers for Disease Control and Prevention (CDC) reports that asthma prevalence increased from 7.3% (20.3 million persons) in 2001 to 8.2% (24.6 million persons) in 2009, a 12.3% increase. By 2009, prevalence among children under 18 was 9.6%, and was highest among poor children (13.5%) and non-Hispanic black children (17.0%). Figure 1 illustrates the upward trend in pediatric asthma from 1980-2009. Many prominent medical publications have called pediatric asthma an epidemic, including the New England Journal of Medicine, Journal of the Royal Society of Medicine, Environmental Health Perspectives, Thorax, and the Journal of Asthma and Clinical Immunology.

Researchers have not pinpointed the specific cause of asthma, although they have identified many triggers for asthma attacks in individuals. Despite the ongoing research into cause and cure, methods for controlling the condition and preventing exacerbations for adults and children with asthma have been well established. The CDC, therefore, is focused on disease management. Their approach is a national public health program that includes interventions to reduce asthma deaths, hospitalizations, and emergency department (ED) visits, and to increase the proportion of persons who receive health care consistent with their Guidelines for the Diagnosis and Management of Asthma.

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While this approach has been fairly effective in higher-income areas of the country, minorities and lower-income communities are grappling with quickly increasing rates of childhood asthma coupled with poor management of the condition. With 48.3%3 of its population and over 80% of its public school children4 African-American, the City of St. Louis, Missouri is one such community. In 2009, the Asthma and Allergy Foundation of America named St. Louis the “Top Asthma Capital”. To reach this conclusion, US cities were ranked based on analysis of 12 factors in these three areas: Prevalence (morbidity and mortality statistics); Risk Factors (including air quality, pollen, “100% smoke-free” laws, poverty and more); and Medical Factors (medication usage and access to specialists)5. Historically a manufacturing community, St. Louis City has lost population and jobs over the decades. Many of those who remain are committed to the city’s revitalization, and look to better health for St. Louis’s children as one way to achieve that goal.

II. Problem Definition

PROBLEM STATEMENT

Many St. Louis city children, aged 5-14, who have asthma and whose families fall into the lowest earning quintile, struggle to manage the condition which limits the children’s capacity for educational, social and political development and leads to higher than average costs.

Current childhood asthma prevalence in St. Louis City (19.65%) is about double the national average, and almost double Missouri’s rate of 10.1% 6. Based on the 2010 US Census Bureau, there were 34,290 children residing in St. Louis between the ages of 5 and 14, which indicates that approximately 6,700 elementary and middle school age children in the city have asthma. This may not seem to be a noteworthy number, but for many of these children, their families and the programs that support them, asthma is very costly.

**The St Louis Challenge**

*Compared to other Missouri children with asthma, residents of St. Louis City have disproportionate numbers of emergency department (ED) visits and hospital stays attributed to the condition. The following statistics are from 2008 and are provided by the Missouri Department of Health and Senior Services 7.*

*In 2008, the population of the City of St. Louis represented about five percent of Missouri’s population 8, 9.*

**Emergency Department Use**

- In the city, the childhood asthma ED visit rate was 25.2 per 1,000 persons, more than 2.5 times the state rate of 8.8 per 1,000 (See Figure 2).
- City emergency departments had 2,038 visits by children presenting with asthma attacks age 17 and younger. This accounted for 16.1 percent of all childhood asthma ED visits in Missouri and 48.3 percent of the combined total adult/child asthma ED visits in St. Louis City.
- African-American children accounted for 91.9 percent of all childhood asthma ED visits in St. Louis City.

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7 Missouri Department of Health and Senior Services, Missouri Asthma Prevention and Control Program, Asthma in St. Louis City: Promoting Healthy and Active Children.
- The African American childhood asthma ED visit rate of 37.5 per 1,000 was nine times higher than the white rate of 4.2 per 1,000 in St. Louis City in 2008.

**Hospitalizations**
- In St. Louis City there were 472 asthma hospitalizations for children age 17 and younger in 2008, accounting for 16.7 percent of all childhood asthma hospitalizations in Missouri and 40.4 percent of the combined child/adult asthma hospitalizations in the city.
- In 2008, the childhood asthma hospitalization rate in St. Louis City was 58.3 per 10,000 persons, which was nearly three times Missouri’s rate of 19.7 per 10,000 (See Figure 3).
- 870 days of hospital care were due to childhood asthma in the City of St. Louis, with an average of 1.8 days per hospitalization.
- Charges for childhood asthma hospitalizations in the city totaled $3.2 million, accounting for 16.9 percent of all childhood asthma charges in the state.

**III. Methods**

There were a number of resources used to complete analysis for this policy memo. The majority of data came from federal government publications and academic, peer-reviewed journals. Some came from local and state government and asthma coalitions and organizations that work locally and nationally. The Department of Health and Human Services (DHHS) and National Institutes of Health (NIH) were key sources of information and original research, specifically two operational divisions: The CDC and to a lesser extent, The National Heart, Lung and Blood Institute (NHLBI). The Environmental Protection Agency’s (EPA’s) National Asthma Forum and the Census Bureau were important sources as well. The accuracy these federal reports provided – often because of the Law of Large Numbers – was unsurpassable. One problem with this type of research, however, is lag time. Major studies using panel data often look back into
previous decades of data, while more current years and trends are left for future studies. Another challenge facing the memo was that agencies provide aggregated information that often had to be disaggregated. For example, finding specific data for pediatric asthma in St. Louis was often data within embedded within reports about Missouri; pediatric data was often lumped with all asthma cases.

The American Lung Association as well as multiple medical and health peer-reviewed journals were essential for understanding health care approaches, medical advances, trends and efficacy. Health economic journals offered cost benefit analyses of asthma programs, which were of particular interest. Identifying the most important costs (ED/hospitalization) and being able to compare them in a cost-benefit analysis (CBA) was a challenge, however, as many existing CBAs were focused on reducing different costs such as lost school days, days with symptoms or lifetime costs of asthma. The same held true for benefits.

To grasp the how school programs might be implemented and made more effective, in person visits to Colorado’s Cherry Creek District and Denver Public Schools were conducted as well as visits to the Web sites. National Jewish Hospital and Denver Health Web site were consulted because of their joint “Step Up” public school asthma program that uses educational video games in schools. National Jewish has been recognized as the top respiratory hospital in the U.S., and it followed that researchers there would assemble an effective school program. Peggy Gaddy, Asthma Program Coordinator at Missouri’s Department of Health and Senior Services provided insight about how well St. Louis school-based initiatives are faring in the recession/slow recovery. She gave updates on current CDC-funded and private programming. Jini Puma, PhD, Rocky Mountain Prevention Research Center, is currently heading up Culture of Wellness program in 26 Denver Head Start centers and provided information for this policy
memo. She shared knowledge about how she started up a new health program for preschool kids and about the private-public model she used.

Statutes in the Affordable Care Act were reviewed, with help from such sources as the Henry J. Kaiser Family Foundation, so that the status quo solution could be fully understood as the Act takes effect. In this instance, the status quo is not static, as different parts of the law go into effect at different times.

Because using video games for health education is a relatively new phenomenon, there have been relatively few studies on its efficacy, especially in the long term. The studies that were located were promising, but most recommended that more evidence be gathered. Compared to other areas of the policy memo in which decades of data builds on itself and panel data is available for review, this is the area in which research is most lacking.

**IV. Issue Analysis**

**A. Asthma Treatment**

Public health goals for asthma, outlined in the 2012 CDC Healthy People objectives, focus on mitigating the impact of asthma rather than on reducing asthma incidence or prevalence because there is no cure and cause(s) are unknown. (Details about the definition of asthma can be found in Appendix C). Two types of medications are used, one a “rescue medication” during an asthma attack or exacerbation that relaxes the small muscles in the airways and decreases inflammation. The cornerstone of treatment, however, is long-term, inhaled preventive medication (usually a corticosteroid taken once or twice daily) to control inflammation and airway hyperreactivity.

“Asthma management strategies include adequate patient education, consistent use of preventive medication, and control of environmental factors that affect asthma (home-based, multi-trigger multi-component interventions). These strategies have been shown to be effective in improving
the health of individuals affected by asthma and are integral to reducing the impact of asthma in
the United States. In 2007, the National Asthma Education and Prevention Program (NAEPP) published Clinical Activities for Quality Asthma Care: Recommendations of the National Asthma Education and Prevention Program, which identifies four components of care and recommends ten specific activities for asthma management. These are widely used clinically and in program planning and are outlined in Appendix D.

B. Asthma Expense

Pediatric asthma is costly. In 2006, the U.S. spent $8 billion on its treatment. It represents the second highest condition-specific childhood health care cost, below only mental health disorders. In a 2005 analysis of Medical Expenditure Panel Survey (MEPS) data, researchers estimated the annual direct and indirect costs of asthma in the 2.52 million school children who had the condition in 1996. They calculated all costs in 2003 dollars. The study found that the total economic impact of childhood asthma was $1.7 billion, or $791 per child per year. It found that for a child without asthma, all-cause medical weighted per capita costs were $618 compared to $1,042 for a child with asthma. Additionally, indirect costs included a total of 14.5 million days of school absence, an estimated $719 million in lost work productivity of parents and 211 child deaths accounting for $264.7 million in lost lifetime earnings.

As health care costs have increased over the last ten years and the asthma caseload significantly grown since 1996, so too has the cost burden increased on families, health agencies

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10 Centers for Disease Control and Prevention, National Surveillance of Asthma: United States 2001-2010, 1.
and society. According to the Medical Expenditure Panel Survey (MEPS) in 2009, median per visit charges for Emergency Room care were $465 to $469\textsuperscript{13} for children under age 18. Analysis of federally-sponsored Healthcare Cost and Utilization Project (HCUP) data reveals hospitalization costs. It found that in 2006 the average charge for a child's hospitalization for asthma was $9,100\textsuperscript{14}.

C. Childhood Asthma and Race

The American Lung Association states that rates of pediatric asthma range widely from 5.5% in Tennessee to 18% in the District of Columbia\textsuperscript{15}. Rates also show great variance within states, metro regions and even within cities. Race is one of the risk factors for asthma and can explain some of this variance.

The fastest rate of asthma increase is being seen among African American children. There was a nearly 50% increase in asthma between 2001 and 2009 among black children, with rates rising from 11.4% to 17.0% (or one out of every six African American children had the diagnosis)\textsuperscript{16}. This is of great concern to communities, public health officials and those interested in rising health care costs. In 2003-2004, black children in the U.S. had a 260% higher

emergency department visit rate than whites, 250% higher hospitalization rate, and 500% higher
death rate from asthma\textsuperscript{17}.

Researchers note that the genetics of race itself is not a causal factor. Of all the African
nations, only South Africa bears an asthma burden that approaches that of the United Kingdom.
Also, while some African countries are showing recent increases in asthma and allergy in
recently urbanized and polluted areas, allergy and asthma are virtually unknown in most rural
African communities where vocabulary for such conditions is nonexistent\textsuperscript{18}. Epidemiologist
Matt Steiner with the City of St. Louis Department of Health, agrees there are no racial
predispositions genetically-linked to asthma, but explains, “What we do see is a larger segment
of our African-American population living in poorer socioeconomic conditions, which can affect
their health in a lot of ways\textsuperscript{19}.” A preponderance of studies concurs with Steiner’s assessment. In
the US, several research teams have isolated the numerous demographic variables that being
poor and black in America can aggregate. Urban poverty seems to have created ripe conditions
for the epidemic that include these risk factors: \textit{in utero} smoke exposure\textsuperscript{20}, childhood
overweight/obesity, early life exposure to concentrated air pollutants\textsuperscript{21}, old housing stock with
allergens like dust mites, mold and cockroaches, little or no health insurance, low birth weight
and lung intubation of newborns, lower access to health (and/or prenatal) care, lower quality
health care, and secondhand smoke.

\textsuperscript{17} Lari Akinbami, “The State of Childhood Asthma, United States, 1980-2005,” \textit{Centers for Disease Control and
Prevention Vital and Health Statistics} no. 381, Advance Data (December 29, 2006): 10–12,
\textsuperscript{18} Matthias Wjst and Daniel Boakye, “Asthma in Africa,” \textit{PLoS Med} 4, no. 2 (February 27, 2007): e72,
doi:10.1371/journal.pmed.0040072.
\textsuperscript{19} STL-TV, \textit{Asthma in St. Louis - Are We Doing Enough?}, You Tube Video, Public Service Video (STL-TV, government
access channel, 2011), http://www.youtube.com/watch?v=30dU1v-lAWc.
\textsuperscript{20} C. Andrew Aligne et al., “Risk Factors for Pediatric Asthma,” \textit{American Journal of Respiratory and Critical Care
\textsuperscript{21} Nina Annika Clark et al., “Effect of Early Life Exposure to Air Pollution on Development of Childhood Asthma,”
Lara J. Akimbani, M.D. is one of the leading national researchers in pediatric asthma. In a comprehensive 2009 study published in *Pediatrics*, she admits that many questions remain about childhood asthma. Inconsistencies are present across studies regarding causation of asthma and allergy, and increased asthma awareness and proper diagnosis may play a role in the upsurge in diagnosis. But she also points to a study that documents inappropriately low prescription rates for preventive medications for minority children as evidence that high quality care as well as access to care for minority families is lacking, which can reduce health outcomes in many ways over the long term.

According to the CDC, blacks have a slightly lower rate of smoking than whites. But the American Lung Association (ALA) reports that among African Americans, as with other U.S. populations, smoking prevalence declines as education level increases. The ALA also describes the disproportionate amount of cigarette advertising in African American communities as unfair and destructive: “Since the signing of the Master Settlement Agreement (MSA) in 1998 through 2005, the average youth in the United States is annually exposed to 559 tobacco ads, every adult female 617 advertisements, and every African American adult 892 ads. Money spent on magazine advertising of mentholated cigarettes, popular with African Americans, increased from 13 percent of total ad expenditures in 1998 to 49 percent in 2005.
The former Brown and Williamson Tobacco Company (now part of R.J. Reynolds Tobacco Company) ran a campaign for Kool cigarettes aimed at black youths in 2006 that featured hip-hop DJ competitions, themed cigarette packs, and was billed as a ‘celebration’ of hip-hop music and culture.

D. Childhood Asthma and Poverty

According to the St Louis Regional Chamber and Growth Association, the City of St. Louis is home to about 320,000 people in about 62 square miles, making it the most densely populated and industrial city in the metro area. Four interstate highways pass through the city, and a busy port operates on its eastern flank. According to the Bureau of Labor Statistics, African Americans (49.2% of the city’s population) and those without higher education degrees have been hit harder by the Great Recession than other groups, with unemployment rates upwards of 15%. Nearly four years after the start of the Recession (September, 2011) there were still 61,000 displaced workers in the metro area who were yet to find jobs.

“The social determinants of health, defined by the World Health Organization are the social conditions in which people are born, live, and work. Underlying these health disparities include poverty, racism, substandard housing and school conditions, inadequate insurance

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United States Census Bureau, Missouri QuickFacts.
coverage, and competing demands and stressors (e.g., food insecurity, unemployment, violence). These factors place barriers between families and good asthma control for their children."

A study in the journal *Pediatrics* indicated that a majority of interviewed low-income parents had positive attitudes and beliefs about follow-up care for their children following a trip to the ED. However, the connections between childhood asthma and poverty include living and going to school in environments with substantial asthma triggers (smoke, pollution, mold, stress) and practical considerations including lack of money, time or transportation required to get to medical appointments. The same study indicated that less frequently, negative attitudinal issues arise among low-income parents of children with asthma. These include a lack of trust in the medical system or a belief that when health is not in crisis, medication and care are not needed. These issues may be bridged with better communication between providers and patients.

These challenges can take a high toll on kids with asthma. A recent study of pediatric Medicaid patients showed that 17.7% of asthma prescriptions prescribed at two primary care sites went unfilled, even though they would have been free. Boys had greater odds of getting their prescriptions filled than girls, black and Hispanic patients were more likely than white patients to have their prescriptions filled and prescriptions submitted electronically were more likely to be filled than paper prescriptions. Conflicting data comes from another recent study of patients seen in a pediatric emergency department. It showed that 32% of prescriptions written for children went unfilled and no patient characteristics (language, health literacy, perception of

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25 Sharon R Smith et al., “Parental Impressions of the Benefits (pros) and Barriers (cons) of Follow-up Care After an Acute Emergency Department Visit for Children with Asthma,” *Pediatrics* 110, no. 2 Pt 1 (August 2002): 323.
26 Ibid., 327.
medication affordability or agreement with treatment plan) were associated with predicting which patients were at highest risk for medication nonadherence. 

This second study may indicate that once the medical crisis is over, discharge orders from the ED are hard to follow or health issues move down the list of priorities and stressors for caretakers. However, most importantly, the two studies together point to the relative effectiveness of the primary care setting for medication adherence and caretaker understanding of an asthma management plan.

E. Pollution in St. Louis City

For years the St. Louis area has struggled to meet clean-air standards. The EPA has designated the St. Louis metro area -- as well as other counties in the region -- a “non-attainment” area for ground-level ozone and fine particulate matter, meaning that it exceeds federal standards. Heavy industry and diesel from the port and four highways cutting through the city create conditions of high carbon monoxide, nitrogen oxides (some of which contributes to ozone in hot months), PM-2.5 (fine particulates), PM-10 (coarse dust particles) and volatile organic compounds. In 2012, the American Lung Association ranked the St. Louis area one of the most polluted cities in the nation because of year-round particle pollution.

In 2011, Governor Jay Nixon vetoed state funding for all local air pollution control programs in Missouri. The cuts had several consequences for St. Louis. First, it lost federal funding that was passed through the state. Second, it was forced to eliminate approximately 20 of the 24 jobs in the city’s air pollution control program while the State Department of Natural Resources assumed responsibility for all local pollution control statewide by adding 4 FTEs.

Allergies, which often trigger asthma, are also burdensome in St. Louis. The humidity and older housing stock in the city creates ripe conditions for dust mites, mold and cockroaches. St. Louis has been named one of the “worst” cities for ragweed\(^{32}\) as well. Unfortunately, ragweed thrives on high levels of carbon dioxide so high traffic areas and climate disruption indicate that St. Louis will experience higher ragweed pollen counts going forward.

**F. Emergency Department (ED) Visits/Hospitalizations**

Pharmaceuticals account for most asthma costs in the US. However, emergency room visits and hospital stays are expensive, stressful and disruptive — and often avoidable — and therefore represent key metrics in asthma program failure or success. In 2009, according to Healthcare Cost and Utilization Project (HCUP) data, pneumonia and asthma were the top two non-newborn reasons for pediatric hospitalization. Pneumonia was responsible for 167,600 discharges and asthma was responsible for 137,200 discharges\(^{33}\). While secondary diagnoses were not specified in the 2009 report, there may be significant overlap between the two diagnoses. In 2006, HCUP data showed that 27% of all children with asthma hospitalizations had a secondary diagnosis of pneumonia.

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Also significant in 2006: the hospitalization rate for asthma among children living in the poorest communities was 76 percent greater than it was among children living in wealthier communities throughout the US\textsuperscript{34}.

As in hospitalizations, asthma is a significant reason for emergency department visits. In 2004, children’s asthma exacerbations were cited as the reason for 750,000 visits in the US. While this figure decreased somewhat to 640,000 in 2007\textsuperscript{35}, by 2009 it was back up to 774,000 emergency department (ED) asthma visits for children under 15.

According to pediatric pulmonologist Roger Heinle, this is “a significant concern because recurrent visits to the emergency department for asthma flares are a risk factor for dying from asthma. In fact, the prevention of emergency department visits

\begin{center}
\textbf{Asthma ED Visit Rate Racial and Socioeconomic Discrepancies around the US}
\end{center}

\begin{tabular}{|l|}
\hline
\textbf{St. Louis City} & \\
\hline
25.2 per 1,000 & \\
\textbf{2.86 times as high as} Missouri’s rate of 8.8 per 1,000 & \\
\hline
\textbf{New York City} & \\
\hline
The Bronx: rate is similar to St. Louis City’s & \\
\textbf{Twice as high as} Manhattan’s rate & \\
\hline
\textbf{Washington, DC} & \\
\hline
Highest inner city area: 45.2 per 1,000 & \\
\textbf{11.6 times as high as} Lowest city area, Northwest: 3.9 per 1,000 & \\
\hline
\end{tabular}

\textit{Sources: Statewide Planning and Research Cooperative System (SPARCS), 2008 and PediatricAsthma.org, 2013.}


is an important clinical and quality outcome goal, indicating that emergency care for asthma episodes should be a routine topic of conversation during regular asthma follow-up care.  

Many children who visit an ED are repeat visitors or have been previously hospitalized for asthma. Dr. Dee Hodge practices pediatric emergency medicine at St. Louis Children’s Hospital and was recently interviewed about asthma in the city. “Unfortunately we see a lot of kids with asthma. It’s probably our single most frequent diagnosis for kids coming into the emergency room,” he says. “We see kids who are in sometimes 6, 7, 8 times a year with their acute asthma attacks. That’s a child where somewhere in the system we’re failing this child.” Figures 5, 6 and 7 illustrate the discrepancy in ED visits between children and adults, and between whites and African Americans. The first chart shows that the ED rate has remained fairly steady over 9 years of data, while the total number of expensive ED visits increased between 2004-2009 because the number of individuals with the condition increased. The second graph shows that children and blacks make a disproportionate number of trips to the ED. The third graph shows the stark difference in ED utilization between whites and blacks with asthma.

G. Health Care Access

According to the American Lung Association’s 2010 Report, State of the Lung in Diverse Communities, adequate access to healthcare is integral to reducing the burden of asthma.

“Without proper treatment, asthma can become life threatening. The issue of access to

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36 Ibid.
38 STL-TV, Asthma in St. Louis - Are We Doing Enough?
health care for minority populations has become an area of concern in recent years\textsuperscript{39}.” The CDC report, *Access to Health Care, Part 1: Children* states, “The health of children depends partially on their access to health care services. Despite the improved health outlook for U.S. children in this century because of the reduction in infectious and contagious diseases, recent economic and social changes have called attention to new challenges to children’s health and their need for health services. Changes in family structure, geographic mobility, and economic well-being have placed many children in need of health services resulting from conditions relating to hunger, poor housing conditions, violence, and neglect. Health services and interventions are needed to deal with crises...In addition, although the rates of many health conditions among children have remained stable, rates of respiratory conditions, especially asthma, have increased dramatically...\textsuperscript{40+}

In recent years, access has focused on third party coverage because high cost is often cited as the reason health care is avoided\textsuperscript{41}. However, there are a number of other reasons given for not accessing care, especially among families with children with special health needs. These include transportation, scheduling, trust in medical staff, and a child refusing to go. A 2007 study in the *American Journal of Public Health* linked poverty, caregiver education and access to care. Their study concluded that children with special health care needs have less access to health care services when their parents have lower incomes or have lower education levels because their


parents do not recognize the need for services. The study concluded that an appropriate policy response would be providing more information at the family level\textsuperscript{42}.

Another health care access study focusing on children with chronic conditions found that they were at greater risk for unmet health care needs than were children without chronic conditions. This was true across all income levels after controlling for socioeconomic and insurance status difference. However, the magnitude of the disparity increased with family income level\textsuperscript{43}. Dr. Robert Strunk, a renowned pediatric pulmonologist at Washington University School of Medicine and St. Louis Children’s Hospital recently said: “My biggest challenge is to help solve that problem of access to care and getting the care approved and the underserved, the inner city, the urban areas\textsuperscript{44}.”

A 2010 George Washington University’s report estimates that of the 1.17 million children with asthma who are uninsured, 600,000 are eligible but not enrolled in Medicaid or the Children's Health Insurance Program (CHIP). The study noted that those most at risk – low income, medically underserved, and African-American and Hispanic children – have the least access to preventive care and the most visits to EDs. This represents a positive externality, in which some are consuming below the marginal benefit curve to society. In other words, those who are underutilizing health care consume less than the socially efficient outcome and this creates a dead weight loss to society. The underconsumer pays - and society pays – in many different ways: emergency room bills, lost productivity, etc. There needs to be an intervention so that resources are allocated to their best and we approach Pareto optimum conditions.


\textsuperscript{43} Silver and Stein, “Access to Care, Unmet Health Needs, and Poverty Status Among Children with and Without Chronic Conditions.”

\textsuperscript{44} STL-TV, \textit{Asthma in St. Louis - Are We Doing Enough?}. 
While medical researchers and practitioners continue their work on this difficult and increasingly damaging puzzle, local, state and national policy makers must focus their energy on it as well. Childhood asthma is a costly disease to society and policy strategies must be examined that will help more patients get access to care to control symptoms and increase disease maintenance. Barriers to health care include time, finances, transportation and cultural obstacles including distrust and educational differences. Multiple studies highlight barriers to health care and help explain why poorer minority communities have higher incidences of disease.

H. Arguments Against Intervention

1. Uncontrolled Growth of Government Spending is Harming the US Economy

The nation’s runaway deficit and huge burden of entitlement programs is crippling our economy and future fiscal options. On May 14, 2010, the IMF ranked the U.S. in second place among countries that must reduce their structural deficit or risk financial calamity.45 The Heritage Foundation reports that anti-poverty spending surged 49 percent in inflation-adjusted dollars between 2002 ($402 billion) and 2012 ($600 billion)46.

Further, tax policy to pay for this burden is unfairly aimed at businesses that further damages U.S. competitiveness. “The number of Americans who pay taxes continues to shrink—and the United States is close to the point at which half of the population will not pay taxes for

government benefits they receive. In 2009, 64.3 million Americans depended on the government (read: their fellow citizens) for their daily housing, food, and health care."

However, this analysis does not describe reasons for increased reliance on poverty relief programs or the lower wages that make collection of federal taxes impossible. The problem of poverty is deeply systemic, with corporations bound by fiduciary mandates to provide shareholders with highest possible profits, coupled with the U.S. economy shifting in large part from manufacturing to service sector jobs. Peter B. Edelman, policy maker and law professor at Georgetown University Law Center recently wrote an opinion piece in The New York Times about the stubbornness of American poverty. He argues that low wages are to blame for the high rates of poverty, and that America has been flooded by low-wage jobs for the past forty years.

104 million people — a third of the population — have annual incomes below twice the poverty line, less than $38,000 for a family of three. Half of American jobs pay less than $34,000 a year, according to the Economic Policy Institute. A quarter pay below the poverty line for a family of four, less than $23,000 annually. Families with two wage earners fare better, but poverty among families with children headed by single mothers exceeds 40 percent. The federal government’s laissez faire attitude toward immigration policy has increased the supply of unskilled workers by the millions and damaged low-income communities’ ability to earn competitive wages.

While many claim poverty programs have failed, a combination of programs now keeps 40 million Americans out of poverty. Poverty would be nearly double what it is now without

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47 William W. Beach and Patrick Tyrrell, The 2010 Index of Dependence on Government.
these measures, according to the Center on Budget and Policy Priorities. “To say that “poverty won” is like saying the Clean Air and Clean Water Acts failed because there is still pollution.”

Ideally social structure, religion and educational opportunities would allow parents of all children with asthma to mitigate the effects of the condition. But unfortunately many caretakers do not have the means or ability to undertake the task. In these cases, it is to the benefit of society, financially and otherwise, that government intervenes to give families the tools for basic asthma management. In many cases, this will be the only chance for the children to take full advantage of educational and career opportunities and become contributing members of society. These issues will be more fully examined in the cost-benefit analysis.

2. Increasing Asthma Prevalence is due to Over-diagnosis

Incidence of pediatric asthma more than doubled between 1980 and 1995. Some may point to previous misdiagnosis or current over-diagnosis as the cause. It is true that awareness of asthma has increased greatly in the past 30 years and that asthma was previously more difficult to diagnose. Even today, scientists have yet to pinpoint etiology, and triggers and symptoms can vary between patients. However, many specific tests have been designed recently for accurate asthma diagnosis and new asthma medications can be diagnostic as well as therapeutic tools.

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These biotechnology innovations may partially explain the rise of asthma rates in the 1990s, as experts consider asthma to have been underdiagnosed in the 1980s\textsuperscript{51} and previously.

When cough and wheezing are present and not due to asthma, practitioner “(k)nowledge of the natural history of asthma and close observation of the response to therapy should quickly lead to an index of suspicion that diagnoses other than asthma need to be considered\textsuperscript{52}.” Because physician skill is one aspect of accurate diagnosis for pediatric asthma as it is for many conditions, a child receiving low-quality health care may receive an inaccurate diagnosis. Therefore nationwide diagnosis statistics could be inflated or under-reported to some degree. Also, as recently as 2011, the Robert Wood Johnson Foundation published an article on reducing the numbers of undiagnosed pediatric asthma cases\textsuperscript{53}.

In a frequently-cited study by M.L. Burr et al., researches went to the same area of South Wales twice –- 15 years apart in time. Questionnaires and post-exertion physical exams of 12-year old children were conducted each time. This study found that while diagnosis of asthma had increased, so had the frequency of eczema, hay fever, and the actual incidence of asthma, which had doubled. Burr concluded, “the prevalence of asthma has risen, and that this cannot be wholly explained by a greater readiness to diagnose the disease\textsuperscript{54}.”

\textsuperscript{54} M L Burr et al., “Changes in Asthma Prevalence: Two Surveys 15 Years Apart.,” \textit{Archives of Disease in Childhood} 64, no. 10 (October 1989): 1452.
I. Disciplinary Foundations

Increasing access to care for low-income children with asthma in St. Louis is a solution rooted in several disciplines: political science, economics and social justice and stability. From an economics standpoint, parents represent lost productivity on days they do not go to work to take care of their sick children. Also, children missing school is a serious problem. Absenteeism in school at any grade (K-12) is one of the top four risk factors for dropping out of high school. Low socioeconomic status is another of the top four dropout risk factors, so the dice become loaded against poorer kids with asthma.

While asthma patient costs and benefits can be quantified in many ways, this policy memo will use an *ex ante* cost-benefit analysis to examine the number of hospitalizations and ED visits, among other factors. Hospital charges are some of the most costly items to Medicaid, and managing chronic conditions in the hospital is widely regarded as inefficient and ineffective.

J. Stakeholders

The stakeholders will have benefits and costs associated with the various proposed solutions. Their interests must be weighed and compared, and this analysis will ultimately decide which is the best proposal for the city.

Stakeholders are:

- Childhood asthma patients
- Parent(s)/guardian(s)
- St. Louis Public Schools
- Area health care providers and hospitals, especially Children’s Hospital St. Louis and Grace Hill Health Centers
• The Public, including the City of St. Louis and the State of Missouri, the Federal Government
• Game and computer manufacturers, software vendors

One weakness in this policy memo is that there are other stakeholders who are not specified. For example, nonprofit asthma groups and coalitions are not providers, but work toward a stated goal of better asthma management in St. Louis.

K. Explanation of Cost-Benefit Analysis Methods

A detailed cost-benefit analysis will predict whether or not funds spent on preventive measures are a benefit to society because of a sufficient cost reduction for factors such as hospitalizations and ED visits. Other quantifiable measures include a student’s lost school days and parent’s lost work days that occur when a child is sick. There are multiple intangible costs associated with asthma, such as play and sports that are often restricted, obesity that is often linked to the disease, how medications affect how one feels and one’s mood, and a sense of vulnerability and mortality can pervade one’s life from a very young age.

Also, it is possible that while acute care costs fall, other health care costs rise. This is desirable. Children with asthma should be seen regularly by health professionals to establish an asthma maintenance routine and to get checkups and refreshers. They should be utilizing primary care instead of urgent care, which in the end is predictably more cost-efficient than heading to the hospital in an emergency situation.

There are several published cost-benefit analyses that assisted my iteration of options for increased access to care for St. Louis pediatric asthma patients. I closely examined the research on these programs as well as their CBAs; in what ways have they been judged to be beneficial or
not beneficial. My analysis synthesized the research I have done, keeping in mind budgetary considerations, the multiplier effect, opportunity cost, multiple stakeholders, and the political capital it will take to get the various options through. Cost-benefit data for Option III, educational video games in schools, was the hardest to come by and remains the least robust. This is probably because the phenomenon is relatively new.

For the cost-benefit analysis, I categorized qualitative benefits and costs before monetizing. Hopefully this helped me avoid double counting and mistaking a cost for a benefit. The goal of my analysis was to clearly and comprehensively examine and present options, and ultimately make a recommendation to policymakers to increase access to care for asthmatic children in the City of St. Louis.

V. Proposed Solutions

This memo will analyze three approaches to help elementary and middle school age children to increase access to health care and better manage their asthma. Because Option II begins as a pilot program for residents of two zip codes, I have restrained all three options to the same scope for the sake of comparison. The two adjacent zip codes in northeast St. Louis are 63106 and 63113 (See map, Figure 8). Residents there had the first and second highest ED visit and hospitalization rates between 2006 and 2008, according to the Missouri Department of Health and Senior Services Missouri Asthma Prevention and Control Program (see Figures 9 and 10).

Encompassing historic neighborhoods near downtown such as Columbus Square and Old North St. Louis, these zip codes tend to have high crime rates, high poverty rates and large percentages of single parents. The census tracts located in and overlapping these zip codes have populations that are between 73 and 96 percent African American. A local investigative news

team recently profiled zip code 63106, which led the City of St. Louis in pediatric hospitalization and ED visit rates between 2006 and 2008. They reported that a child growing up in that neighborhood has a 58 percent likelihood of graduating high school, will have an average annual income of $22,923 and a life expectancy of 69.2 years, a lower life expectancy than could be anticipated in Iran, Iraq or Egypt.  

**A. Option One: Status Quo**

Because of changes to the nation’s health care system put in motion by the Affordable Care Act (ACA) there will likely be improvements to the health of asthma sufferers in St. Louis without additional policy programs. Money and time have already been allocated to improving the public’s health under Obamacare and it can easily be argued that it should be given a chance to work while limited additional public funds are spent on other worthy projects.

According to the American Academy of Pediatrics, two provisions in the ACA have the potential to “significantly improve access to care”. These are an unprecedented $8.3 billion in federal funds to bring Medicaid payments to at least Medicare rates and a new enforcement mechanism for Medicaid’s “equal access clause”. Recent court decisions in the Sixth and Tenth Circuits have ruled that children covered by Medicaid do not have an enforceable right to medically-necessary services. The ACA reaffirmed and codified Congressional intent so that Medicaid by definition includes the provision of necessary health care services in addition to the financing of those services. The American Academy of Pediatrics has stated that these two provisions will enable a substantial number of providers, many of whom have previously cut

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Medicaid case load because of inadequate funding rates, to care for more Medicaid- and CHIP-covered children.\footnote{Ibid.}

Incentives in the ACA to increase the number of primary care providers may increase access to care in St. Louis. Emphasis on the Patient Centered Medical Home or Medical Home (MH) is considered by experts to be a promising initiative for pediatric asthma patients. Introduced in 1967 by the American Academy of Pediatrics (AAP), it became academy policy within ten years. Originally the term “medical home” signified that all patient information was located at a single site, but the idea was expanded to include a partnership approach with families “to provide primary health care that is accessible, family-centered, coordinated, comprehensive, continuous, compassionate, and culturally effective.\footnote{Robert Graham Center, “The Patient Centered Medical Home: History, Seven Core Features, Evidence and Transformational Change” (Robert Graham Center, 2007), 4, http://www.aafp.org/online/etc/medialib/aafp_org/documents/about/pchm.Par.0001.File.dat/PCMH.pdf.}”

The MH is a natural fit for children and families managing asthma because of the ongoing and variable nature of the condition, the ability of pediatric offices to provide care and disease support from various approaches (medical, social, educational) and the personal relationship that can be formed between the patient, family and medical office. While many states already have Medicaid-sponsored MH programs for individuals with chronic conditions, the ACA also created a Medicaid state option for “Health Homes”, which is even more comprehensive. The health home model offers social and behavioral support to patients and families as well as wide-ranging and coordinated medical care. Asthma is one of the chronic conditions listed that would qualify patients for enrollment, although a second qualifying condition – e.g. obesity – would need to be present as well. Missouri has been one of the first
states to sign up for the health home model under the ACA as they previously had no state MH program.

Under other provisions of the ACA, coverage would be expanded. Missouri Governor Jay Nixon (D) has backed Medicaid expansion, although the Republican-dominated legislature has voted it down in recent appropriation committee meetings. At the time of this paper, the issue is undecided. If Medicaid were to be expanded in Missouri, 308,000 people will be added to the state roles, including some families.

Missouri residents purchasing health coverage through state-based insurance exchanges will be eligible for federal tax credits to subsidize insurance costs. However, those who do not have insurance will be penalized, which could be a hardship for lower-income families and individuals. Health care exchanges be fully operational by January 1, 201460. The Henry J. Kaiser Family Foundation ACA Coverage Expansion Calculator estimates that non-elderly individuals living in St. Louis zip code 63106 would see about 22% of its population benefit from coverage expansions, while about 25% of 63113 residents could see positive effects of coverage expansion61 62. These increases will occur regardless of the legislature’s final budget decision on the state’s Medicaid expansion.

More school-based health centers may be opening in St. Louis, as Health and Human Services (HHS) Secretary Kathleen Sebelius announced in May, 2012 that $75 million is available nationwide for the construction and renovation of school-based health centers. This is part of the ACA’s School-Based Health Center Capital (SBHCC) Program, which was created by

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62 Missouri Department of Health and Senior Services, Missouri Asthma Prevention and Control Program, Asthma in St. Louis City: Promoting Healthy and Active Children.
the Affordable Care Act. Asthma stakeholders are particularly assisted by SBHCs, as studies have shown they significantly reduce hospitalizations and Ed visits. A 2011 cost-benefit analysis of childhood asthma management was published in the *Journal of Community Health*. This analysis estimated the cost of nurse staffing for a nationwide SBHC program to be $4.55 billion compared to the estimated savings of $1.69 billion for medical care, including ED, hospital, and outpatient care. However, an additional savings of $23.13 billion in benefit was identified for reducing absenteeism and premature deaths.

ACA programs are not without cost, however. The ACA is expected to add as much as $530 billion to federal deficits while increasing spending by more than $1.15 trillion. These enormous costs, amplified by the federal budget deficit, threaten to crowd out other spending, especially health spending. This includes funding the newly announced *Coordinated Federal Action Plan to Reduce Racial and Ethnic Asthma Disparities*, part of the President’s Task Force on Environmental Health Risks and Safety Risks to Children, which was announced in May 2012. The action plan was the result of the collaborative interagency Asthma Disparities Working Group, co-chaired by the U.S. Department of Health and Human Services (HHS), the U.S. Environmental Protection Agency (EPA), and the U.S. Department of Housing and Urban Development (HUD). It has four main goals: reduce barriers to guidelines-based asthma management, enhance capacity for delivery of comprehensive care in communities with racial and ethnic asthma disparities, improve the ability to identify children most affected by

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disparities, accelerate the effort to identify and test interventions that may prevent asthma onset among ethnic and racial minority children.\textsuperscript{64}

The American Lung Association quickly published a response on their Web site that offered criticism as well as praise: “The American Lung Association…is deeply troubled that the Obama Administration has released this plan at the same time they have proposed eliminating the (CDC’s) National Asthma Control Program. The National Asthma Control Program works with states and community-based organizations to implement proven public health responses to asthma and to ensure that surveillance measures that track progress in reducing asthma attacks are in place. The (EPA’s) indoor air programs have been cut, including the proven Tools for Schools program that has succeeded in improving environmental conditions and reducing asthma triggers in schools across the country. This program must be restored. We applaud the commitment to go beyond departmental and agency boundaries to organize this work. We support the priorities in the plan. The Coordinated Federal Action Plan marks an important step to reducing the burden of asthma among racial and ethnic minorities. Yet serious hurdles remain and must be addressed through policy change. For this plan to succeed, the nation must maintain strong funding and legal authority for the federal agencies to act. Continued reductions in federal resources – as well as state and local budget cuts – make the job even harder.\textsuperscript{65}”

While it is tempting to want to alleviate suffering and introduce more programming to reduce asthma costs, waiting for the ACA to become fully activated and funded might be the


prudent approach. Gains made by Obamacare would be hard to quantify if other new methods are working toward the same goal. A wait and see approach, in which the opportunity cost of limited public dollars is carefully considered, can be argued.

B. Option Two: Community-Based Intervention

Method II, community based intervention to increase access to care for pediatric asthma patients has proven successful in programs around the country. This approach, combining culturally-appropriate medical and social support for patients and families, makes health care more accessible because it is less threatening, easier to understand (plain language is used – less medical jargon), and includes health education and home visits.

Many asthma patients do not take their medications properly and often need the skill and technology that a medical office can offer to set them up on good regimen for asthma maintenance. Once that is in place, however, health education, home visitations and ongoing management can keep the patient healthier. A team made up of a nurse practitioner/case manager and health educator can support the family on an ongoing basis from both a medical and social/education standpoint. They can help the family enroll in CHIP or Medicaid, if appropriate. They can teach patients and parents how and when to use various maintenance and rescue medications and help families with environmental interventions that target a multitude of asthma triggers in the home, such as smoke, dust, cockroaches and mold. Environmental interventions have been endorsed by The National Asthma Education and Prevention Program (NAEPP) the CDC and the Environmental Protection Agency (EPA) as cost-effective components of asthma care that decrease urgent medical visits.

Several studies, including a one published in 2006 that documents the “Yes We Can” urban asthma partnership run by the University of California/San Francisco show that this
approach has been successful. Children’s Hospital in Boston created a coalition of medical providers, patients, and community groups to create the Community Asthma Initiative (CAI) that has also been successful in dramatically reducing ED visit and hospitalization rates as well as overall costs\textsuperscript{66}. This initiative was put in place as a result of community-based participatory research. Columbia University’s Harlem Health Promotion Center (a CDC Prevention Research Center), followed significant improvement in AIR Harlem, a program that focused on medical/social and legal/housing aspects to patients’ lives\textsuperscript{67}. Participants in that program saw school absenteeism for asthma decrease from 23\% to 8\%, emergency and unscheduled medical visits decline from 35\% to 8\% and hospitalization decrease from 8.6\% to 0\%.

A culturally-appropriate health education program run through an inner city hospital in Chicago led to a 46\% decrease in hospitalization per year (average decrease of 1.05 days), 58\% decrease in emergency department visits per year (average decrease of 1.38 days), an average increase in clinic visits of 96\% per year (average increase of 1.54 days per year), and a 32\% reduction in sick days at school per year (average decrease of 2.75 days out sick). This program also improved overall knowledge of asthma in 62\% of patients, knowledge of medication in 43\% of patients, knowledge of monitoring in 54\% and knowledge of the pathophysiology (biology of asthma) in 49\% of patients\textsuperscript{68}.

\textsuperscript{66} Sommer et al., “Children’s Hospital Boston Community Asthma Initiative.”


\textsuperscript{68} Daniel Johnson et al., “Report on the Findings and Recommendations of the Pediatric Asthma Intervention December 1, 1999 -- June 30, 2002, Mount Sanai Hospital, La Rabida Children’s Hospital and Research Center” (September 2002).
In St. Louis City, structuring a project that is somewhat similar to Children’s Asthma Initiative (CAI) in Boston makes sense because that program was based in a strong urban children’s hospital - which St. Louis has - and St. Louis’s asthma support agencies already have certain aspects of the Boston program in place. While CAI is an expensive program (approximately $2,300 per family for staff time, and materials to be used in the home such as plastic bins, mattress and pillow covers, and the vacuum cleaners that filters out fine dust) every dollar spent on the program returned $1.46 in direct medical costs due to an 80% decrease in the number of hospitalizations and a 56% reduction in ED visits. (See Figure 11. Also see Appendix E for an in-depth explanation of CAI.)

While it can be unwise to pick up a program that was successful in one area of the country and move it to another without taking cultural factors into account, the principles of CAI are based in health education, medical homes

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Community-Based Pediatric Asthma Interventions

What do they entail?
Specialty clinical care, case management, education, home environmental assessments, and supplies to reduce exposure to environmental triggers.

Return on Investment
>CAI – Boston (current)  
For every $1 spent, $1.46 saved  
80% reduction in hospitalizations  
56% reduction in ED visits

>Monroe Plan for Medical Care (2002)  
Medicaid-funded managed care organization (MCO) in New York State  
For every $1 spent, $1.48 saved  
60% reduction in hospitalizations  
78% reduction in ED visits  
Other MCOs implementing similar community asthma interventions have yielded comparable results.

Gaining momentum...
In 2012, the Institute of Medicine’s Committee on Integrating Primary Care and Public Health recognized the value of leveraging Medicaid reimbursement to implement community-based asthma education.

SOURCE: Using Medicaid to Advance Community-Based Childhood Asthma Interventions: A Review of Innovative Medicaid Programs in Massachusetts and Opportunities for Expansion under Medicaid Nationwide  
February, 2013, childhoodasthma.org

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Richard Knox, To Control Asthma, Start With The Home Instead Of The Child : NPR, 2013,  
and access to care. These are universally regarded as positive drivers of health outcomes and they will be uniquely fashioned for St. Louis.

Children’s Hospital St. Louis and the Grace Hill Health Centers have a strong history in St. Louis and trusted community relationships and could be used as lynchpins of a community-wide program. There are four local organizations that are already doing asthma health education in the community; by continuing their work they would provide support to this new project.

Children’s Hospital St. Louis (CHSL) was founded in 1879 to provide for the medical and social needs of indigent and underserved children, and has never turned a child away because of inability to pay. The hospital regularly receives uninsured or underinsured asthma patients in its ED, and often this leads to a hospital stay. It is a highly regarded research facility as well, serving as the teaching hospital for Washington University School of Medicine\textsuperscript{70}; and it ranked number 9 nationally for pediatric pulmonology for 2012-13. Two community asthma outreach programs are already established within the Allergy, Immunology and Pulmonary Medicine Department and 5,000-6,000 patients are seen in its asthma clinic each year\textsuperscript{71}. CHSL is located about 2 miles from zip code 63106, within a mile of 63113. Grace Hill Health Centers has a strong working relationship with CHSL and has conveniently-located health centers in or near the target zip codes. Grace Hill has long-established community connections, current asthma and medical home programs, and proven commitment to serving the poor and medically underserved.

**Community Intervention Proposal: St. Louis CAN (Community Asthma Network)**

\textsuperscript{70} Children’s Hospital St. Louis Foundation, *Children’s Hospital St. Louis Foundation Overview* (Children’s Hospital St. Louis Foundation, 2012), https://access.foundationsource.com/nonprofit/st-louis-childrens-hospital-foundation.

\textsuperscript{71} STL-TV, *Asthma in St. Louis - Are We Doing Enough?*. 

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St. Louis Community Asthma Network (SL-CAN) would improve access to health care through case management, home visits and links to agencies in the community that help families with other aspects of asthma control. Local and regional asthma agencies would support SL-CAN by continuing to provide support training workshops for school personnel, dissemination of health educational materials at community events and health fairs, and creating a strong advocacy consortium to address policy in the state.

- SL-CAN would recruit a total of 250 families from two zip codes (63106 and 63113). All children would receive case management services over the course of 1 year. All families would receive a home visit by a community health worker at which time an environmental assessment would be done, bedding encasements and HEPA vacuum loans would be facilitated from Asthma Friendly St. Louis discussed and pest management would be tailored to the needs of the family. Also, connection to other community resources would be emphasized during the home visit. This will keep program costs down because many asthma reduction materials for the home are already available through Asthma Friendly St. Louis and other agencies.

- An SL-CAN Family Advisory Board would be created to identify gaps in services, provide feedback, and participate in community forums.

- Nurse Case Managers would be responsible for individualized care plans and coordination with primary care and asthma specialists. This would be achieved by hiring 2-1/2 FTE nurse case managers. It is essential that these nurses are African American and preferred that they come from the St. Louis area. This would enable better communication, understanding and a higher degree of trust among participant families and case managers. Case managers would be available by telephone as needed, as improving patient-provider communication is one of
the keys to better health care access under SL-CAN. Even more important is the CHWs (2-1/2 FTE) come from the area and represent the culture of 63106 and 63113 so that they are welcome in the families’ homes and are spoken to honestly and openly.

- The Caretakers’ Advisory Board (CAB) would be recruited from participating parents and guardians. 13 or 15 members would be optimal, and these caretakers will meet monthly at one of the Grace Hill Health Center sites. A staff member from SL-CAN would be present and lead discussions on community needs and concerns, program implementation and health education dissemination activities.

- Dissemination of asthma education information and pest control in broader community would be provided by programs already established in St. Louis: Asthma Ready, Healthy Kids Express, Asthma and Allergy Foundation of American (AAFA) and Asthma Friendly St. Louis.

The following is a review of programs and recent legislation in place in St. Louis and Missouri that would support SL-CAN:

**State and Local Initiatives.** Four main initiatives based in Missouri are currently in place to reduce the asthma burden to children and families and their associated costs. The first is Asthma Ready Communities (ARC), an overarching endeavor that is partially funded by the CDC. The ARC team is located in the division of Pulmonary Medicine & Allergy, Department of Child Health, University of Missouri School of Medicine. The goal of Asthma Ready is to provide standardized, evidence-based educational programs for health professionals, children with asthma and their families. It offers a variety of programs, including Web-based accredited training of health educators in medical practices. These educators are then provided with materials and are ready to educated preschool, elementary and middle school-age children and
parents with techniques that qualify for third party reimbursement. These programs enhance the ability of health care professionals and facilities to provide cost-efficient care that is compliant with the National Asthma Education and Prevention Program’s 2007 Guidelines for the Diagnosis and Management of Asthma: Expert Panel Report 3. Parents and caregivers are trained through the program to improve asthma control in infants and children. Training for children incorporates IMPACT Asthma Kids, an evidence-based, interactive, multimedia, self-management program for school-aged children and families. For medical facilities, “Asthma Ready” is a designation that indicates that the facility has participated in asthma training, has the resources and is committed to delivering appropriate services, maintaining communication standards, and conducting quality improvement efforts to ensure best practices for the care of children with asthma.

Asthma Ready also includes a pharmacist-training component and a one-time education and data-gathering session that uses the multimedia software, IMPACT Asthma Kids. These sessions, called Asthma Control Everyday (ACE), focus on very poorly-controlled 5-14 year old asthma patients and their families. Health educators will be trained and certified online and receive $50 for every session they complete. ACE is also offered through Children’s Hospital St. Louis.

The second program established in St. Louis is the Healthy Kids Express, a mobile program funded by St. Louis Children’s Hospital Foundation that brings a team of asthma experts in a bus to underserved area schools, health fairs and community events. Medical staff onboard help school nurses and local doctors care for children with asthma and provide education and resources for children and their families. Staff on the bus have targeted several St. Louis area schools to provide:
• individual asthma care while working with the child's primary doctor
• asthma education for students, school staff and parents
• asthma supplies
• family friendly asthma events
• flu shots to enrolled students with asthma and school workers\(^\text{72}\)

Third, the AAFA’s St. Louis Chapter helps children and young adults who are uninsured/underinsured pay for prescriptions and medical equipment on a first-come first-served basis and up to $925 per person per year through a program called Project Concern. A new piece of the Project Concern program is providing school nurses with some rescue medication for asthma. This stems from the 2012 passage of Missouri House Bill 1188, which authorizes schools to maintain a supply of asthma-related rescue medications and equipment. Peggy Gaddy, Asthma Program Coordinator at Missouri’s Department of Health and Senior Services wrote that while all St. Louis public schools have nurses, not all have asthma training. Therefore this program must not be seen as a universal solution, as untrained nurses might not recognize symptoms, administer the medication improperly, or otherwise potentially cause harm.

The AAFA also conducts one-time health education meetings for school personnel, parents and the community. This program, the “ABCs of Asthma and Allergies”, focuses on the identification of asthma and allergy signs, symptoms, triggers and how to effectively manage these chronic diseases\(^\text{73}\).


Finally, Asthma Friendly St. Louis is a community program designed to help school-aged children and teens manage their asthma sponsored by the City of St. Louis Department of Health and funded by a grant from the Missouri Foundation for Health. Families have to enroll, but once they do, participants can receive HEPA vacuum and bedding encasement loans, air filters, Asthma Action Plan coordination between physician’s office and school and other benefits.

C. Option Three: School-Based Electronic Health Education Initiative

Health Education in Schools. Multiple studies have found school-based health education to be an effective complement to health care and family support. It can round out the asthma care programs as defined by the CDC and NAEPP. The School Health Education Evaluation, conducted in collaboration with the CDC, “suggests that exposure to health education curricula in schools can result in substantial changes in students’ knowledge, attitude, and self-reported practices." Starting proper disease management with children makes sense because these good habits can benefit asthma patients throughout their lives. A 2009 article in the journal Pediatrics reviewed 25 studies on school-based asthma education programs and found that they improved knowledge of asthma (7 of 10 studies), self-efficacy (6 of 8 studies), and self-management behaviors (7 of 8 studies). Fewer studies reported positive effects on quality of life (4 of 8 studies), days of symptoms (5 of 11 studies), nights with symptoms (2 of 4 studies), and school absences (5 of 17 studies).

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In 2001, CDC began funding inner-city programs as part of the Controlling Asthma in American Cities Project (CAACP). Its goal was to develop comprehensive and intensive community asthma control plans, proven in multiple studies to be effective approaches to asthma control. Seven metropolitan areas received funding, including St. Louis. This project ended in St. Louis in 2008, but was designed to have long-lasting benefits. One aspect of the program, “Asthma 411” encouraged schools to adopt long-term policies and procedures that minimize the effects of asthma on their students. It included staffing a nurse in every school; health education for students, staff and faculty; inclusion of asthma in physical education curriculum; and coordination of care between the home, school and physician, including an Asthma Action Plan for every student with the condition.

**Budget Crunch in St. Louis.** A November 2012 update from Peggy Gaddy, Asthma Program Coordinator at Missouri’s Department of Health and Senior Services revealed that the hopes and planning for program continuity may have been dampened by the financial realities of recession: “In St. Louis all public schools have access to school nurses but not all have been trained in asthma.” She continued, “The asthma program in Missouri is still making great strides in providing training and resources for asthma but schools are continuing to lose funding. One of the first things to be cut is the school health programs.”

**Computer-Based Health Education.** Since the Great Recession, financial and personnel resources in the school district, city and state have severely shrunk, and innovative, low-cost solutions must be considered to keep asthma education and awareness an integral part of school life. Introducing computer-based health education into the schools is an attractive option because it is low-cost, low-maintenance and health education studies are showing that it is

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76 Peggy Gaddy, “2 Questions from Researcher in Denver,” November 27, 2012, peggygaddy@health.mo.gov.
effective. Whereas traditional asthma education can be time-consuming and limited in terms of access and availability\textsuperscript{77}, health education via multimedia software/video game at a computer station offers more convenient and flexible scheduling for families, especially when installed at school. Asthma education software has been used in various settings: schools, at home and in medical offices.

In 2003, researchers Krishna, Francisco, Balas and Konig published a study in the journal \textit{Pediatrics} that showed Interactive Multimedia Program for Asthma Control and Tracking significantly increased asthma knowledge of children and caregivers, decreased asthma symptom days (81 vs 51 per year), and decreased number of emergency department visits (1.93 vs 0.62 per year. Increased asthma knowledge in all 7- to 17-year-old children correlated with fewer urgent physician visits ($r = 0.37$) and less frequent use of quick-relief medicines ($r = 0.30$)\textsuperscript{78}. Another study by the same researchers in 2006 showed significant improvement in days of asthma symptoms, in emergency room visits, in school days missed when multimedia education was integrated into pediatric practice to supplement existing asthma care\textsuperscript{79}. A 2012 \textit{Journal of Public Health} review of asthma education program for 7-18 year olds found that computer/web-based programs tended to report statistically significant outcomes in more outcome areas than traditional asthma educational programs\textsuperscript{80}.

Various studies draw conflicting conclusions as to whether or not asthma multimedia education and video games reduce ED visits and hospitalizations. Some studies show a positive correlation between increased patient self-management and pediatric asthma education but no


\textsuperscript{79} Krishna et al., “Effective and Sustainable Multimedia Education for Children With Asthma,” 1.

reduction in hospitalizations or ER visits. Others, like *An Evaluation of an Innovative Multimedia Educational Software Program for Asthma Management: Report of a Randomized, Controlled Trial*, found substantial and approximately equal reductions in ED and hospitalization rates for traditional and software-based education\(^81\). However, given the low cost of the installing and maintaining a program in each of the ten public elementary and middle school in zip codes 63106 and 63113, it is a solution that should be considered.

**ST. LOUIS PUBLIC ELEMENTARY SCHOOLS IN 63106 and 63113**

- Columbia Elementary Community Education Center 63106
- Dunbar Elementary 63106
- Gateway MST Elementary (Math, Science & Technology Magnet) 63106
- Jefferson Elementary 63106
- Cote Brilliante 63113
- Washington Montessori 63113

**ST. LOUIS PUBLIC MIDDLE SCHOOLS IN 63106 and 63113**

- Carr Lane VPA (Visual and Performing Arts) Middle School 63106
- Gateway Math and Science Preparatory 63106
- Fresh Start at Sumner 63113
- Alternative South at Stephens 63113

**Video Games for Health Education.** Video games and electronic entertainment can attract and maintain the attention of a large and diverse audience. Video game designers and behavioral scientists have collaborated to create the latest health education multimedia programs. “Video games offer potential behavior change channels by embedding functional knowledge and change procedures such as goal setting, modeling, and skill development activities into a personally meaningful, entertaining, and immersive game environment. (They) also promote learning and

social interaction, create an environment in which their actions and decisions have an effect, promote creative problem solving, and enhance understanding by promoting systems thinking or helping the player see the “big picture.” A 2008 study compared 25 video games that promoted health behavior changes. Various game components, such as strategy, narrative, interactivity, fantasy, goal-setting all work to enhance memory and/or change behavior in different ways.

*Quest for the Code* is an interactive asthma video game that teaches kids and teens such things as early warning signs and symptoms, how to identify and avoid asthma triggers, how asthma affects the lungs, proper use of asthma medication and quick-relief medicine. National Jewish Hospital in Denver endorses its use as part of its asthma program in the Denver Public Schools. Celebrities are featured in the video the game and it is created by Starlight Children’s Foundation, a non-profit based in Los Angeles. New CD-ROMs of the game are currently available on Amazon.com for between 99 cents and $9.99, and a downloadable version is available to schools from the company Web site. (See Printout of digital brochure, Appendix F.)

**Computer Kiosks in the 10 St. Louis Schools.** Installing ten computer stations in quiet locations, such as the school library or tech room if available, would require ten personal computers and a software license for ten copies of the game or ten CD-ROMs. Students with asthma would be scheduled to play the game monthly at a time that would be convenient to the family and school faculty. Making the asthma kiosk program as similar as possible between schools is important; a

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Government Accounting Office report cited that children in poverty change schools frequently. Therefore continuity between schools becomes important to reduce stress and distraction. Asthma kiosks could provide the added social benefit of slightly decreasing the stress of school transitions for children with asthma, by providing them a familiar protocol and game in each school.

VI. STRATEGIC RECOMMENDATIONS

Making a recommendation based on the net present value of the cost-benefit analysis (CBA) was not as clear-cut as one might have hoped. (Section VIII and Appendix B present CBA findings and calculations in depth.) CBA revealed that Option III is not currently a competitive option, while analysis of Options I and II produced net present value (NPV) ranges that overlap, especially in year one. Using a 7% social discount rate (SDR) to anticipate the NPV of the options in their 3rd and 5th years still led to ambiguous figures, although calculations begin to favor Option II more strongly. Conducting a sensitivity analysis with a 3% and 9% SDR showed that the higher the discount rate, the more the results leaned toward Option II.

However, at this point in time I recommend St. Louis proceed only with Option I, the status quo as enhanced by the Affordable Care Act and its consequences (intended and unintended). This new legislation should be given a chance have an effect on access to care and better control pediatric asthma in St. Louis. There are several reasons for this recommendation. First, if the SDR used in my cost-benefit analysis should be adjusted in any direction for this project, it should be lowered. This if often indicated for low-income health care, especially

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pediatric health care, because of the myriad consequences and long-lasting benefit that can be derived from it. SDR rates are discussed further in Section VIII. Lowering the SDR aligns the NPV of Option I and II more closely.

Secondly, it is important to be able to distinguish the benefit derived from the ACA without clouding it with additional programming. This is a broad, enormous, expensive program and the effectiveness of its programming and funding mechanisms needs to be determined.

Third, as mentioned earlier, the ACA includes many other services in addition to asthma management, that children and families may find just as valuable or more valuable than strictly an asthma intervention.

Finally, Missouri was one of the first states to enroll in the “health home” option of the ACA, and asthma has been included in the list of chronic conditions that can qualify Medicaid recipients for a “health home”. Inclusion this program will provide patients with an array of services: comprehensive care management, care coordination and health promotion, comprehensive transitional care (including follow-up after inpatient care), patient and family support, referral to community and social support services, and the use of health information technology to link services. While Missouri has opted to enroll some of its Medicaid recipients in the program, the number of patients eligible for the program is unknown and whether home visits would be included in the health home is unknown. Nevertheless, a health home program in our target area of St. Louis may demonstrate a community-based methodology that is quite similar to Option II.

Because this is an crisis affecting so many disproportionately, an in medias res CBA of the ACA and the health home regarding pediatric asthma is recommended beginning in 2016 to judge its effectiveness so that health policy makers can adjust or change course if necessary.
VII. WEAKNESSES AND LIMITATIONS

Much of asthma research is very medical, technical and chemical in nature. I lack the expertise to address the disease from these perspectives. Data from journals in the pharmaceutical or medical field likely shed light on the topic, but the scope of this memo is limited.

Because the causes of asthma are not entirely clear and the condition is multifactorial, the medical profession and policymakers focus on management and cost containment, which can be more difficult than standard problem solving. Unlike some other health challenges that may be prevented or reversed, asthma offers no easy solution to a growing problem.

For the most part, the strategic recommendations are realistic and politically feasible because they are already in play (Option I), save money (Option II) or are inexpensive (Option III). However, the City and County of Saint Louis as well as the state of Missouri face significant budgetary problems, and will be hard pressed to adopt any policy that is not revenue neutral or revenue generating. The FY2012 budget for St. Louis City faced a shortfall of over $8 million despite furloughs of city employees, the sale of the some city property, reductions in parks and recreation, and police and fire fighter pay cuts.

While the ACA faces significant political opposition, it is now the law of the land and its programs are quickly becoming the status quo. On the other hand, the community-based intervention (Option II) would be the most challenging to promote politically. While the top range of its NPV is consistently higher than those of the other options, the public funding of home visit programs has proven difficult in other cities.

A limitation of Option III is that it does not have a preponderance of research behind it, perhaps because electronic learning is a relatively new phenomenon. Because video game impact
on asthma patient behavior was lacking, some consideration was given to alternate available data including the impact of video games on health learning and on learning in general. Also, results of studies that are focused on asthma tend to be mixed as to impact on cost savings.

Our current health care system is not designed to support the custom interventions that might be optimal to treat a multi-causal, chronic condition like asthma. However, evidence-based practices, initiatives in new health care legislation, creativity and collaboration can lead to cost-effective solutions that can help improve lives for children with asthma in St. Louis.

VIII. COST-BENEFIT ANALYSIS

Cost-benefit analysis (CBA) advances the most cost-efficient policy option by calculation of a net present value (NPV). The NPV is determined by monetizing benefits and costs, discounting future values and subtracting the sum of discounted costs from the sum of discounted benefits. The CBA conducted for this analysis is *ex-ante*, or before program implementation. The three proposed options herein are assumed to begin in 2013 and reflect 2013 dollars.

NPV was calculated for each option in year 1 (2013), year 3 (2015), and year 5 (2017). To reflect the present value of future costs and benefits, the social discount rate (SDR) of 7% was used. Included in this section is a summary of the NPV for the 3 years plus the sensitivity analysis, whereas the complete CBA with notes can be found in Appendix B.

Cost-benefit analysis of the three proposed options offered challenges. Option I, the status quo includes the Affordable Care Act is a moving target both in terms of costs and benefits. The number of participating states and individuals is fluctuating and the impact of new programs, many which have been designed for medium- and long-term benefit, make costs and results difficult to quantify.
Costs and benefits for the 250 members of our pilot project would not be limited just to asthma when considering the ACA. While it can be presumed that most medical visits for the 250 children would be asthma-related, they could also receive health care under the status quo option for broken arms, strep throats, traumatic injury, etc. However, it was impossible to disaggregate expenses and payments just for asthma under this program at this time. Community-based intervention for asthma and computer-based asthma education in schools target the condition, while health care provided by the ACA would cover a wide range of health issues.

The CBA only measured the economic value of the proposals to increase access to care, but the value of reduced asthma severity in children is worth a great deal more than the economic value the current literature attributes to it. It is quite difficult to measure the total qualitative value of physical and emotional health in children and its further impact on their families and communities. Therefore there is a not readily available study that measures these impacts in quantitative terms. Willingness to pay (WTP) to avoid hospitalization or an asthma attack have been cited in the CBA. Usually WTP to avoid something is understated and these figures must be considered underestimated compared to the true benefit one would derive from absence of the condition overall.

Also intangible are some of the benefits to primary care physicians who, under Options I and II stand to have higher job satisfaction. Various provisions in Option I (ACA) have the potential to raise their status in the medical community by increasing payment rates and stressing the essential nature of primary care in the US. Both options (particularly Option II) have the potential to increase patient health, which can lead to higher job satisfaction.
**Net Present Values, Year 1, 3, 5**

<table>
<thead>
<tr>
<th></th>
<th>Option I</th>
<th>Option II</th>
<th>Option III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Benefits</td>
<td>$227,028 to $233,555</td>
<td>$499,533 to $690,250</td>
<td>$38,583</td>
</tr>
<tr>
<td>Total Costs</td>
<td>$109,114 to $131,749</td>
<td>$350,973 to $468,473</td>
<td>$52,605</td>
</tr>
<tr>
<td>NPV (year 1)</td>
<td>$95,279 to $124,441</td>
<td>$31,060 to $339,227</td>
<td>($14,022)</td>
</tr>
<tr>
<td>NPV (year 3), 7% SDR</td>
<td>$116,720 to $152,445</td>
<td>$38,050 to $415,567</td>
<td>($7,745)</td>
</tr>
<tr>
<td>(This year Option III's baseline costs are reduced by $7,700 because there is no need to replace computers and software.)</td>
<td></td>
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<tr>
<td>NPV (year 5) 7% SDR</td>
<td>$133,634 to $174,535</td>
<td>$53,367 to $475,783</td>
<td>($19,667)</td>
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</tbody>
</table>

**Sensitivity Analysis**

The range of total benefit and costs in Option I, and particularly in Option II resulted in NPV results that had fairly broad ranges as well. While on the positive side, these results show that the options have variability, however it makes it difficult to choose a best fiscal option. Adjustments in the social discount rate may heighten the differences between the options and make the choice between Options I and II clearer. Therefore, a sensitivity analysis was conducted to analyze how NPVs would be affected by calculating years 3 and 5 using a 3% and 9% SDR.

SDR reflects the time preference of money: A lower rate indicates that future benefits are valued highly in the present and that higher costs now are acceptable. A higher discount rate indicates that avoiding costs in the present is preferable to avoiding costs in the future. Because
of the far-reaching and long-lasting economic and qualitative benefit that improving poor health in children can have, one could easily argue for a lower SDR. On the other hand, in a 2009 brief, Rose Cunningham of Independent Economic Advisors cautioned that policies based on an unrealistically low discount rate risk devoting too many current resources to future benefits. Examining a range (3% and 9%) will help decide which option is most beneficial.

**3% Social Discount Rate**

<table>
<thead>
<tr>
<th></th>
<th>Option I</th>
<th>Option II</th>
<th>Option III</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPV (year 1)</td>
<td>$95,279 to $124,441</td>
<td>$31,060 to $339,227</td>
<td>($14,022)</td>
</tr>
<tr>
<td>NPV (year 3)</td>
<td>$104,114 to $135,980</td>
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<tr>
<td>NPV (year5)</td>
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<td>$36,007 to $393,256</td>
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**9% Social Discount Rate**

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<th>Option I</th>
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<tbody>
<tr>
<td>NPV (year 1)</td>
<td>$95,279 to $124,441</td>
<td>$31,060 to $339,227</td>
<td>($14,022)</td>
</tr>
<tr>
<td>NPV (year 3)</td>
<td>$123,389 to $161,155</td>
<td>$40,224 to $439,309</td>
<td>($8,187)</td>
</tr>
<tr>
<td>NPV (year5)</td>
<td>$146,598 to $191,467</td>
<td>$47,790 to $521,941</td>
<td>($21,575)</td>
</tr>
</tbody>
</table>

(In year 3 Option III’s baseline costs are reduced by $7,700 because there is no need to replace computers and software.)
APPENDIX 1.

Figure 1.

Asthma prevalence in U.S. children (0-17 years), 1980-2009

Due to changes in NHIS questions in 1997, asthma prevalence data collected from 1980-1996 are not directly comparable to the data collected from 1997-2009.

Lifetime asthma diagnosis is determined by asking survey participants if they were “ever” told their child has asthma.

Current asthma prevalence is determined by asking if the child still has asthma.

Asthma attack prevalence is determined by asking if the child has had an asthma attack within the past 12 months.

Data source: Adapted from Akinbami, 2009; NCHS, 2006b; NCHS, 2007b; NCHS, 2008b; NCHS, 2009b; NCHS, 2010b
Figure 2.

Rate of asthma ED visits among children 0-17 years of age, St. Louis City and Missouri, 2000-2008

Source: Missouri Department of Health and Senior Services

Figure 3.

Rate of asthma hospitalizations among children 0-17 years of age St. Louis City and Missouri, 2000-2008
Source: Missouri Department of Health and Senior Services

Figure 4.

Deaths Due to Asthma / St Louis Region 1993-1996

Source: St. Louis Regional Asthma Consortium

Figure 5.

Source: CDC
Figure 6.

Source: CDC
Figure 7.

Source: CDC
Figure 8.

Source: Grace Hill Health Centers, Inc.
Number and rate of asthma ED visits among children 0-17 years of age by zip codes, St. Louis City, 2006-2008

<table>
<thead>
<tr>
<th>Zip Code</th>
<th>Number</th>
<th>Rate per 1,000</th>
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<tr>
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<td>509</td>
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<td>63106</td>
<td>567</td>
<td>58.1</td>
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<td>63110</td>
<td>337</td>
<td>20.5</td>
</tr>
<tr>
<td>63111</td>
<td>439</td>
<td>26.5</td>
</tr>
<tr>
<td>63112</td>
<td>539</td>
<td>37.5</td>
</tr>
<tr>
<td>63113</td>
<td>501</td>
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<td>367</td>
<td>29.6</td>
</tr>
<tr>
<td>63147</td>
<td>349</td>
<td>34.2</td>
</tr>
</tbody>
</table>

*Zip codes with more than 300 ED visits for asthma among children 0-17 years of age during this 3-year period.

Figure 9. Zip codes 63106 and 63113 have the first and third highest ED visit rates for asthma in the city.

Number and rate of asthma hospitalizations among children 0-17 years of age by zip codes, St. Louis City, 2006-2008

<table>
<thead>
<tr>
<th>Zip Code</th>
<th>Number</th>
<th>Rate per 10,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>63106</td>
<td>112</td>
<td>114.7</td>
</tr>
<tr>
<td>63107</td>
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<td>63112</td>
<td>113</td>
<td>78.7</td>
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<tr>
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<td>63115</td>
<td>150</td>
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<td>63116</td>
<td>111</td>
<td>31.5</td>
</tr>
<tr>
<td>63118</td>
<td>134</td>
<td>44.7</td>
</tr>
</tbody>
</table>

*Zip codes with more than 100 hospital stays for asthma among children 0-17 years of age during this 3-year period.

Figure 10. 63106 and 63113 have the highest hospitalization rates for asthma in the city.

Source: Missouri Department of Health and Senior Services
Missouri Asthma Prevention and Control Program
Figure 11  Boston Children’s Hospital Community Asthma Initiative

Source: Community Asthma Initiative: Evaluation of a Quality Improvement Program for Comprehensive Asthma Care, p.469
APPENDIX B.

Cost-Benefit Analysis

ANNUAL BENEFITS

YEAR 1

<table>
<thead>
<tr>
<th>Stakeholders</th>
<th>Weight</th>
<th>Option 1: Status Quo</th>
<th>Option 2: Community-Based Pediatric Asthma Intervention</th>
<th>Option 3: Computer-Based Health Education in Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients</td>
<td>0.3</td>
<td>$8,598 to $9,130 (a) and $445(b)</td>
<td>$25,793 to $27,390(a) and $1,780(b)</td>
<td>$8,598 to $9,130 (a) and $2,250(ii)</td>
</tr>
<tr>
<td>Parents/Guardians</td>
<td>0.2</td>
<td>$59,000(c)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Schools</td>
<td>0.1</td>
<td>$82,525(d)</td>
<td>$82,525(d)</td>
<td>$27,508(d)</td>
</tr>
<tr>
<td>Providers/Hospitals</td>
<td>0.2</td>
<td>76,460(e)</td>
<td>$62,435 to 97,555 (g)</td>
<td>0</td>
</tr>
<tr>
<td>City/State (The Public)</td>
<td>0.1</td>
<td>$0 - $5,995(f)</td>
<td>$327,000 to $481,000(h)</td>
<td>0</td>
</tr>
<tr>
<td>Game Publisher, Computer Mfr.en.</td>
<td></td>
<td></td>
<td></td>
<td>Manufacturers = $177 Retailers = $50</td>
</tr>
<tr>
<td>Vendors, IT Support Service Co.</td>
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<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Totals</td>
<td>1</td>
<td>$227,028 to $233,555</td>
<td>$499,533 to $690,250</td>
<td>$38,583</td>
</tr>
</tbody>
</table>

Note: According to the Congressional Budget Office, assessing the financial effects of the ACA is difficult as it involves and influences technical, behavioral, and economic factors. Separating the incremental effects of the provisions in the ACA that affect spending for ongoing programs and revenue streams becomes more uncertain as the time since enactment grows. The recent Supreme Court decision that essentially made the expansion of the Medicaid program a state option has also increased the uncertainty of the estimates. "However, CBO and the Joint Committee on Taxation, in consultation with outside experts, have devoted a great deal of care and effort to the analysis of health care legislation in the past few years, and the agencies have strived to develop estimates that are in the middle of the distribution of possible outcomes." (http://www.cbo.gov/publication/43471)

(a) According to an EPA report detailing the benefits and costs of the Clean Air Act 1990 to 2010, adults with asthma were willing to pay (WTP) between $32.30 and $34.30 to avoid an asthma attack in 2010. (attackbooks.google.com/books?isbn=1428902384). There is no existing version of WTP data, so the adult estimate will be used herein.
1 fewer asthma attack (in 2013 dollars) = $34.39 - $36.52 x 250 = $8,598 to $9,130
3 fewer asthma attacks (in 2013 dollars) = 34.39-36.52 x 250 x 3 = $25,793 to $27,390
(b) Some health benefits will come from asthma's inclusion as one of the chronic conditions that may qualify Medicaid patients for a health home (ACA Statute 855, March 2010). This status will provide patients with an array of services: comprehensive care management, care coordination and health promotion; comprehensive transitional care (including appropriate follow-up after inpatient care), patient and family support, referral to community and social support services, and the use of health information technology to link services. Other benefits will be derived from increasing numbers of school-based health centers, increased primary care payments through Medicaid and increased numbers of primary care physicians through incentive programs, medical home programs and possible Medicaid expansion.
All these may reduce hospitalizations in the case of the ACA. Reduced hospitalization rates can be expected with Option II. The Journal of Contemporary Economic policy published a willingness to pay study (WTP) in 2006. They found that WTP out of an adult chronic respiratory,
acute respiratory or cardiac patient's own pocket to avoid a 2-day hospital stay (the average length of a pediatric asthma stay) was $412 (mean) $75 (median). Because our population is low-income and comprised of children, I will base the calculation on $75 = $89 in 2013 dollars. For the ACA, I conservatively estimate that in 2013 5 hospitalizations will be avoided due to new provisions and coverage. ($445)

For Option II, I estimate a reduction in hospitalizations by 20 ($1,780).

c) Those with household earnings $30,000 or less will gain $236 in 2019. Those with household incomes of $30-$50,000 will gain $293 in 2019 (Source: Families USA). Because a majority of households in 63106 and 63107 earn under $30,000 (Source: mapzicode.com) benefit is estimated for the 250 participating asthma families assuming that level of income. $236 x 250 = $59,000

d) As the funding formula is based on average daily attendance (ADA), the St. Louis Public School (SLPS) stand to gain dollars when students have higher attendance. A 2006 study of St. Louis's school absenteeism (http://www.asthma-stlouis.org/PDF/AsthmaStatusSeverity.pdf) found that children with asthma that was diagnosed at a more severe level than mild intermittent were absent on average an additional 4.3 days per year. Options I and II would likely reduce days missed to 1 per year.

St. Louis City School District spends $14923 per pupil (education.com http://www.education.com/schoolfinder/us/missouri/district/st-louis-city-school-district/), and is required by the MO Department of Education to provide 1,044 hours of student instruction annually. This calculates to $14.29 per hour. 6-1/2 hours of instruction daily = $100.03 per day x 250 x 3.3 missed days = $82,525

Option III will likely not eliminate days absent due to asthma (data collection is in infancy and conflicts at this point), but would likely reduce them by 25% = $27,508

e) Pediatricians nationally saw 10.5% increase in income 2012 over 2011, due to the ACA and its ramifications from $164,813 to $182,048. (Forbes article by Bruce Japsendescribes the Medical Group Management Association’s 2012 survey analysis, in which pediatrician compensation increased (10.5 percent).

The 2012 Kaiser Commission on Medicaid and the uninsured reported that nationwide Medicaid physician fees for primary care services will rise 73% in 2013 as they catch up with Medicare fee schedules. In this case, mean pediatrician income can be expected to increase another 10.5% in 2013. $19,115 per pediatrician x 4 pediatricians in the 2 zip codes that may be handling the 250 patients = $76,460

(f) The Urban Institute calculates that Missouri will receive an additional $3.2 to $3.4 billion annually from the federal government between 2014 and 2019 because of health reform. 2011 Missouri population 6,008,984. (Source: http://quickfacts.census.gov/qfd/states/29/2965000.html) 250/ 6,008,984 X $3.2 to $3.4 billion annually for pilot program in the City of St. Louis = $133,134 to $141,455

Subtracting from this what the households($59,000) and providers ($76,460) will be benefiting from ACA, the public stands to gain $0 - $5,995

g) Every year, St. Louis Children’s Hospital’s parent company, BIC, provides over $100 million to uninsured patients. A Georgetown University study of uninsured children 2009-2011 (http://ccf.georgetown.edu/wp-content/uploads/2012/10/Uninsured-Children-2009-2011.pdf) determined that 6.4% of African American children and 10% of all children under 100% of the federal poverty level were uninsured in 2011. They also found that school-age children (above age five) were much more likely to be uninsured that younger children. Therefore, using 6.4% to 10% of our 250 children as a range of possible

According to "Asthma in St. Louis City", there were 227 hospitalizations for 63106 and 63107 between 2006 and 2008, or 76 per year. 1 hospitalization in 2013 = $10,480 (p.8 of memorandum offers 2006 cost), which has been brought to current dollars) = $796, 480. There were 1, 068 ED visits between 2006-08 in 63106 and 63107 or 356 annually. 1ED visits per child in 2013 dollars X $503 (p.8 of memorandum offers 2009 cost), which has been brought to current dollars) = $179,068.

Total annual hospitalization and ED cost in 2013 dollars: $975,548.

Uninsured costs to hospitals based on Georgetown study: Range, 6.4% = $62,435 to 10% = 97,555

(h) Boston’s CAI program upon which St. Louis CAN is based had a ROI of $1.46 for every dollar spent. Because some of the asthma support is already in place, here it is estimated that SLCAN returns $1.30 for every dollar spent. $252,000 - $370,000 x 1.3 = $327,600. $370,000 x 1.3 = $481,000

Total annual benefit = between $327,000 and $481,000

(i) Most kids like video games and would consider playing one a benefit. Since they often cost $1 and up at arcades, 1 game per month X 9 months of school = $9 x 250 = $2,250

(j) While computer retail markups are low (about 5%) according to CSI market.com, computer hardware had a 44% gross margin in 2012 (http://cismarket.com/Industry/industry_Profitability_Ratios.php?id=1002). However, because higher gross margins are found on peripherals, phones and laptops, desktop computers have a lower gross margin, closer to 20%. For every $700 computer that means $35 goes to the dealer, and $133 goes to the manufacturer. Because the software manufacturer in this case is a non-profit agency, CSI market.com’s estimate that software's 2012 average gross margin does not apply. However, because of the low price of the software, an estimate of 50% is used. Amazon uses a referral fee of 15%. $10 x 10 schools - $100 x .15 = $15 to Amazon. $85 x .5 = $43

Manufacturers = $177 Retailers = $50

60
ANNUAL COSTS

<table>
<thead>
<tr>
<th>Stakeholders</th>
<th>Weight</th>
<th>Option 1: Status Quo</th>
<th>Option 2: Community-Based Intervention</th>
<th>Option 3: Computer-Based Health Education in Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients</td>
<td>0.3</td>
<td>(a) $21,440</td>
<td>(a) $21,440</td>
<td>(g) $32,130</td>
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<tr>
<td>Parents/Guardians</td>
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<tr>
<td>Totals</td>
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<td>$109,114 to $131,749</td>
<td>$350,973 to $468,473</td>
<td>$52,605</td>
</tr>
<tr>
<td>NPV (year 1)</td>
<td></td>
<td>$95,279 to $124,441</td>
<td>$31,060 to $339,227</td>
<td>($14,022)</td>
</tr>
<tr>
<td>NPV (year 3), 7% SDR</td>
<td></td>
<td>$116,720 to $152,445</td>
<td>$38,050 to $415,567</td>
<td>($7,745)</td>
</tr>
<tr>
<td>NPV (year 5) 7% SDR</td>
<td></td>
<td>$133,634 to $174,535</td>
<td>$53,367 to $475,783</td>
<td>-19,667</td>
</tr>
</tbody>
</table>

(a) Time and Effort. St. Louis City School District spends $14,923 per pupil (education.com http://www.education.com/schoolfinder/us/missouri/district/st-louis-city-school-district/), and is required by the MO Department of Education to provide 1,044 hours of student instruction annually. This calculates to $14.29 per hour. If a student with asthma misses 6 hours of instruction per school year (http://dese.mo.gov/schoollaw/freqaskques/calendar.htm), which indicates an economic loss of $85.76 annually if 6 hours are spent at the doctor. Multiplied x 250 children: 85.76 x 250 = $21,440
(b) Lost wages or paid time off. Increasing MD visits by 2 per year, 3 hours lost work time each visit (for transport, picking up dropping off child at school, getting a meal or snack for child) 6 hours per year x $7.25 (minimum wage) = $43.50 Multiplied x 250, $43.50 x 250 = $10,875
(c) Possible fatigue and lost leisure time from larger primary care caseloads. Source 2010 Pediatrics article: Between 2003–2005 38% of graduating pediatric residents sought and 21% accepted a part-time position as their first job. Residents who were seeking part-time work as pediatricians expected a workweek shortened by 39%. For this they willingly forfeited an average of $33,983 per year, roughly one third of the average starting wage for their peers. ($40,069.66 in 2013 dollars according to the usinflationcalculator.com) $40,070 per practitioner for 39% workweek reduction (working approximately 35 weeks/year). For these physicians, leisure is valued at $1,145 per week. (Assuming children our 250 children in 2 zip codes see their primary care doctors 2 additional times per year = 500 visits or 20 days of patient visits (source: Medscape Compensation Report) plus 2 days of administrative work = 4 weeks additional workdays =$4,580 total for our 2 zip codes in lost leisure time

(d) Note: Does not include savings on mental health costs and certain Medicaid eligibility cutbacks over 138% fpl included in national results.
Cost to MO: between $1,758 -$2,309 billion from 2014 - 2019. If passed by MO legislature, Medicaid enrollment will increase In MO by approximately 220,000, according to a study by the The Missouri Hospital Association and Missouri Foundation for Health ($1,332-1,750 per person annually). Does not include savings on mental health costs and certain Medicaid eligibility cutbacks over 138% fpl included in national results. Source: Urban Institute analysis, "Consider Savings As Well As Costs," HPSM 2014-2019. 2011: St. Louis City population 318,069 = 5.2% of Missouri population 6,008,984. (Source: http://quickfacts.census.gov/qfd/states/29/2965000.html) $1.758 -$2.309 billion x 5.2% = $91,416,000 to $120,068,000 annually for City of St. Louis.

Pilot project = 250 citizens of St. Louis or .079% of the city population. Cost of the ACA for the 250 = $72,219 - $94,854

(e) Time and effort: Increased visits to PCPs, increased accountability for following individualized care plan, medication protocols, communication. Annual costs: 1/2 hour per week minimum to manage medications (26 hours), 2 physician visits per year (6 hours including travel time), phone check-ins 30 minutes, health worker home visit 1 hour, contacting other agencies for bed encasements, etc. 2 hours, reading health education materials 1 hour. Total minimum annual hours= 36.5 at $7.25(minimum wage) = $264.63. Multiplied x 250 parents/guardians= $66,157.50 or $66,158 rounded up.

(f) 2-1/2 FTE Community Health Workers 2009 $35-42,000/yr Source: American Dental Education Association, Explore Health Careers http://explorehealthcareers.org/en/Career/157/Community_Health_Worker

=87,500-$105,000/year

2-1/2 FTE Nurse Case Managers @ $66K/year = $165,000

Based on the median wage for RNs (MO pays little for RNs, yet this is a case management job) http://www.bls.gov/oes/current/oes291111.htm

Total annual salaries $252,500 - $370,000

(g) 9 hours (1 hour per month per school year) lost time (a) before, after or during school = $128.52 per student per year x 250 students = $32,130

(h) Time taken to read supplemental materials: 3 hours/year x $7.25 (minimum wage) = $27.75 per person x 250 parents or guardians = $6,937.50 or $6,938 rounded up.

(i) The St. Louis School District publishes salaries for teachers and principals, but not for support staff. A teacher with a BA would have a starting salary of $38,250, while a vice principal of a small elementary school would have a base salary of $56,593. Using these as reference points for a program manager, it is estimated that 1/2 FTE district-wide Asthma Computer Education Administrator would earn $23,000. This employee would keep the program running at 60 elementary and middle schools, excluding alternative sites (http://www.slds.org/domain/5110). Therefore, 1/6 of his or her time and salary could be counted toward the 10 (Check # of schools) schools in our 2 zip codes: $3,833.33, rounded down = $3833.

(j) Time taken to familiarize themselves with school program for better communication with patients. One third of wages is approximately $40,070 (see c), so average annual income is approximately $120,210. 8 hours or 1 full day annually would be used to familiarize themselves with school programs for the St. Louis programs. This assumes 48 workweeks, so weekly income from billed services is $2,504, and daily income is $501 x 4 pediatricians at Grace Hill = $2,004

(k) 10 video games at $10 = $100 + 10 computers at $700 = $7,000 (year 1, not needed to be repeated for approximately 4 years) Outsource maintenance if possible. $50/month. Several computer support companies are thriving in St. Louis. A similar company in Miami publishes its rates: for 10 computers it costs $50/month for remote and on-site management and repair = $600 = $7,700
APPENDIX C.

Asthma Defined

Asthma is a common chronic disorder of the lungs in which air passages narrow in the lungs, because of inflammation and airway “hyperreactivity” which is caused by the contraction of small muscles surrounding the airways\(^1\). Exposures that trigger this reaction include respiratory infection, exercise, cold weather, excitement/stress and airborne irritants and allergens (including pollen, smoke and occupational chemicals)\(^2\). This can make it hard to breathe and leads to wheezing, coughing, pain and shortness of breath. Mild asthma can be bothersome, while severe asthma can interfere with daily activities and cause life-threatening asthma attacks. Although there have a few occupational exposures that have been identified as causal agents of asthma, scientists are as yet unsure how to prevent it and there is no cure\(^3\). Because of a rise in asthma prevalence in the U.S. and worldwide, most researchers believe causation is related to the byproducts of modernization that create a change or changes in the immune system that then stimulate airway inflammation. Some current asthma researchers are looking at the roles of non-disease causing bacteria that live inside and on the body, and rises in sedentary lifestyle and obesity on reduced lung function and increased inflammation\(^4\). Asthma development has been linked to high rates of exposure to household cleaners, lack of Vitamin D and large doses of acetaminophen (Tylenol) have all been shown to impact asthma development\(^5\). Finally, several studies link maternal health and welfare during pregnancy, delivery and early childhood to

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2 “Asthma & Children Fact Sheet - American Lung Association.”
asthma in children: “Asthma is emerging as a premier example of a health risk that can largely be molded by the status of the mother and the environmental conditions encountered during sensitive windows of prenatal and early childhood development.”

More than half of all persistent asthma cases of start between ages 0 and 2 and eighty percent of cases begin by age 5. Because the disease affects very young children, it can disrupt their education and other experiences that can shape their productivity and satisfaction levels later in life. Socioeconomic and racial differences in the prevalence of childhood asthma remain stubbornly fixed in the United States. Medical advances have made in-roads to maintenance of the disease, but asthma is a heavy burden to children and their families, providers and the public health system. It is the leading chronic cause of school absenteeism in the country accounting for an estimated 15 million lost school days.

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**APPENDIX D.**

**NAEPP Recommendations for Asthma Care and Management**

In 2007, the National Asthma Education and Prevention Program (NAEPP) published *Clinical Activities for Quality Asthma Care: Recommendations of the National Asthma Education and Prevention Program*, which identifies four components of care and recommends a 10 specific activities for asthma management:

<table>
<thead>
<tr>
<th>Components of Asthma Care</th>
<th>Key Associated Clinical Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment and monitoring</td>
<td>1. Establish asthma diagnosis.</td>
</tr>
<tr>
<td></td>
<td>2. Classify severity of asthma.</td>
</tr>
<tr>
<td></td>
<td>3. Schedule routine follow-up care.</td>
</tr>
<tr>
<td></td>
<td>4. Assess for referral to specialty care.</td>
</tr>
<tr>
<td>Control of factors contributing to asthma severity</td>
<td>5. Recommend measures to control asthma triggers.</td>
</tr>
<tr>
<td></td>
<td>6. Treat or prevent comorbid conditions.</td>
</tr>
<tr>
<td>Pharmacotherapy</td>
<td>7. Prescribe medications according to severity.</td>
</tr>
<tr>
<td>Education for partnership in care</td>
<td>9. Develop a written asthma management plan.</td>
</tr>
</tbody>
</table>
Appendix E.

Boston Community Asthma Initiative (CAI) Model

Children’s Hospital Boston CAI grew out of a community-based participatory research approach and the socio-ecological model of the Institute of Medicine. “We determined that asthma needed to be addressed at all levels of the socio-ecological model—individual/family, community and systemic change—to reduce health disparities and the impact of social determinants of health on families living with the disease.” The program also utilizes the Chronic Care Model, which emphasizes cultural competence and community partnerships. While CAI’s primary emphasis is on improving quality of care, the St. Louis application will use it to improve access to care. These two concepts have several overlapping ideas and should not be considered entirely separate entities.

According to the Institute of Medicine, quality health care is a multidimensional concept with seven primary attributes. Two of these attributes are that people get the care they need (when they don’t it is considered underutilization) and care is delivered equitably so health disparities are avoided. Access to health care refers to the ease with which an individual can obtain needed medical services. Social, cultural, economic, and geographic factors influence health care access. SL-CAN’s approach is to help eliminate underutilization and health care disparities by increasing the ease with which St. Louis’s children with asthma and their families get the care and support they need.

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9 Sommer et al., “Children’s Hospital Boston Community Asthma Initiative,” 329.
10 Ibid., 330.
• In 2005, Boston Children’s Hospital CAI began enrolling a total of 283 pediatric patients considered high risk by the nurse case manager because they had had a recent ED visit or hospitalization for asthma. Also, these children were from 4 zip codes with the highest asthma rates, and those with the highest ED visit/hospitalization rate in the past 12 months were prioritized for recruitment. Participants were between 2 and 18 years old, 55.1% male, 39.6% African American, 52.3% Latino with a mean age of 7.9 years. 72.7% had Medicaid; 70.8% had a household income below $25,000. Twelve month data showed a decrease in (any ≥ 1) asthma ED visits to be 68% and hospitalizations (84.8%), days of limitation of physical activity (42.6%), patient missed school (41%), and parent missed work (49.7%) (all P<.0001). Figure 11 illustrates the dramatic drop in ED visits and hospitalizations for asthma under the program. The return on investment was 1.46.

• CAI Methods and Costs: Services and follow-up care are provided for 1 year; groups of patients have been studied since 2005. CAI was expanded to other Boston zip codes after its initial success and had cumulatively enrolled 713 children by 2011.  

• 1. Nurse case management and coordination of care with primary care and referral services (1.0 FTE per 102 families). 2. Culturally-appropriate nurse or nurse-supervised community health worker (CHW, 1.0 FTE per 102 families) home visits for asthma education, environmental assessment and remediation materials: HEPA vacuum, bedding encasements, and pest management tailored to the needs of the family. Also, connection to community resources are emphasized during the home visit. 71.7% of families received a mean number of 1.27 home visits.  3. Referral to exterminator or pest

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13 Sommer et al., “Children’s Hospital Boston Community Asthma Initiative,” 331.
inspection services when indicated. 14.7% of families received extermination services referrals. 4. In 2006, CAI created and recruited members to a Family Advisory Board to identify gaps in services, provide feedback, and participate in community forums. Additional employees included .25 FTE program coordinator and .1 FTE program director per 102 patients. Costs in FY2006 dollars were $194,246 for personnel, $58,712 for materials and $5,000 for exterminator services for 102 families.¹⁴

Appendix F.


Life’s a mission. This is your quest.
Congratulations! Cyrus (Cuba Gooding, Jr.) has picked YOU to help him defeat a slimy, self-important team of asthma villains with a wicked agenda. These villains are trying to convince kids everywhere that asthma is an unmanageable force. Hmmmm ... sounds like a challenge.

About the Game
As you set off on your Quest, Cyrus will be there by your side to give you important information, special tips and fun facts about asthma. With cool online animations, real-world scenarios, and uber-cool celebrity voiceovers to help teach you how to cope with your asthma the villains won’t stand a chance! You’ll collect the lost pieces of the Quest code and put them back together again! Remember, you have the knowledge and power to complete the task at hand.

Don’t Hold Your Breath: The Lung Tour
Take an interactive tour inside your body and learn how asthma and asthma medications affect the lungs. 
Voiced by Cuba Gooding, Jr.

Red Alert: Early Warning Signs and Asthma Symptoms
He may be a cockroach but he sure knows his stuff. Take on General Robo-Roach as he challenges you to distinguish between the early warning signs and true asthma symptoms. Voiced by General H. Norman Schwarzkopf

Tool Time: Medication Devices
No number two pencils necessary for Chalktisa’s interactive test. How well do you know how to use the different asthma medication devices? Take our quiz and see! Voiced by Glenn Close

Take Control! The Quest Continues...
Having asthma can be hard but you don’t have to let it get you down. Only you have the power to take control of your life and fight asthma head on! Every day is a quest and the missing pieces are all around. Remember, the more you know the more power you have to prevent and control asthma attacks.
Visit www.starlight.org/asthma.

For Kids 7-15

Online Asthma Game
www.starlight.org/asthma

Quest for the Code™


http://www.cdc.gov/nchs/data/series/sr_03/sr03_035.pdf.

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