



Asthma and Absenteeism

The relationship between pediatric asthma and student outcomes

December 2019

The Green & Healthy Homes Initiative (GHHI), founded in 1986, is a national 501(c)3 nonprofit, nonpartisan organization that provides evidence-based direct services and technical assistance to create healthy, safe and energy efficient homes to improve health, economic and social outcomes for low-income families while reducing public and private healthcare costs.

Authors:
Kevin Chan, Senior Social Innovation Specialist

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Executive Summary

Pediatric asthma continues to be a significant, intractable health issue in the United States and is a significant contributor to school absenteeism for school-age children. In 2013, children aged 5 to 17 years old missed 13.8 million school days.¹ That is a staggering figure by itself, but it is difficult to comprehend the impact it has on those students and the communities where they live. The link between asthma and school absenteeism is generally known, but the effect to which they are linked is difficult to quantify.

The goal of this publication is to disentangle the relationship between asthma and absenteeism, and to estimate the impact to which absenteeism negatively affects the student and her broader community. To illustrate the steps in analyzing this relationship, we use data from Grand Rapids, Michigan, a city where the Green & Healthy Homes Initiative (GHHI) has been working with local partners on a pediatric home visiting project.

The analysis finds that for some individuals, asthma may lead to chronic absenteeism (defined as missing more than 10% of school days) and failure to graduate from high school. As a result, those individuals pay the biggest price for their disease- future lost wages from the absence of a high school diploma total a present value of \$745,000 over one's lifetime. Federal, state, and local income tax revenue is thus reduced throughout the individual's years in the workforce.

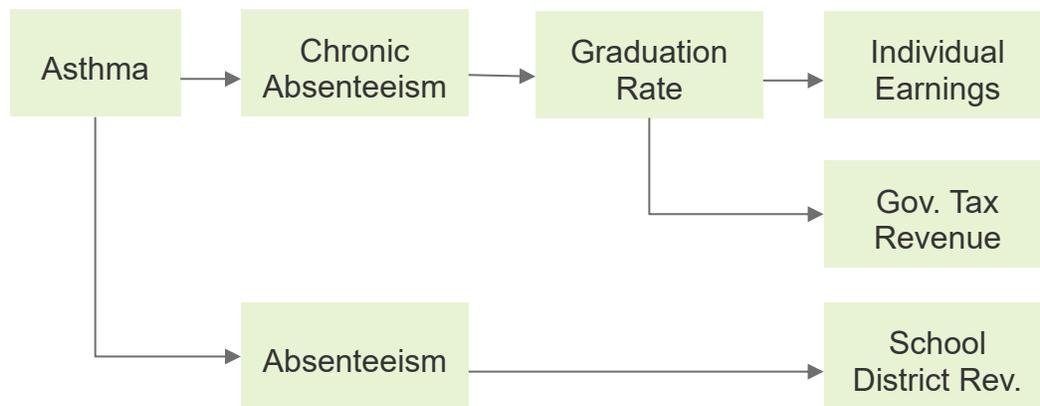
Background

The effects of uncontrolled pediatric asthma are far-reaching for the individual, the family, and society. For school-age children, asthma is one of the leading causes of health-related school absenteeism.² Children with uncontrolled asthma may miss school due to visits to the doctor or emergency room. The broader effects of childhood asthma extend to employee absenteeism for the caregiver (e.g. missing work to take the child to the doctor), high medical costs of emergency room visits and hospitalizations, and poor quality of life for the family. Fortunately, research evidence shows that asthma can be effectively controlled by comprehensively addressing the disease, including environmental control of asthma triggers. GHHI has decades of experience combatting asthma by addressing home-based triggers and providing self-management education and has seen first-hand how doing so can improve student outcomes.

Research³ has shown that there is a strong association between attendance and academic outcomes (i.e. high school graduation); this report looks at this relationship in terms of economic value. The analysis in this brief uses the following logic model, as is presented in Figure 1. The logic is as follows:

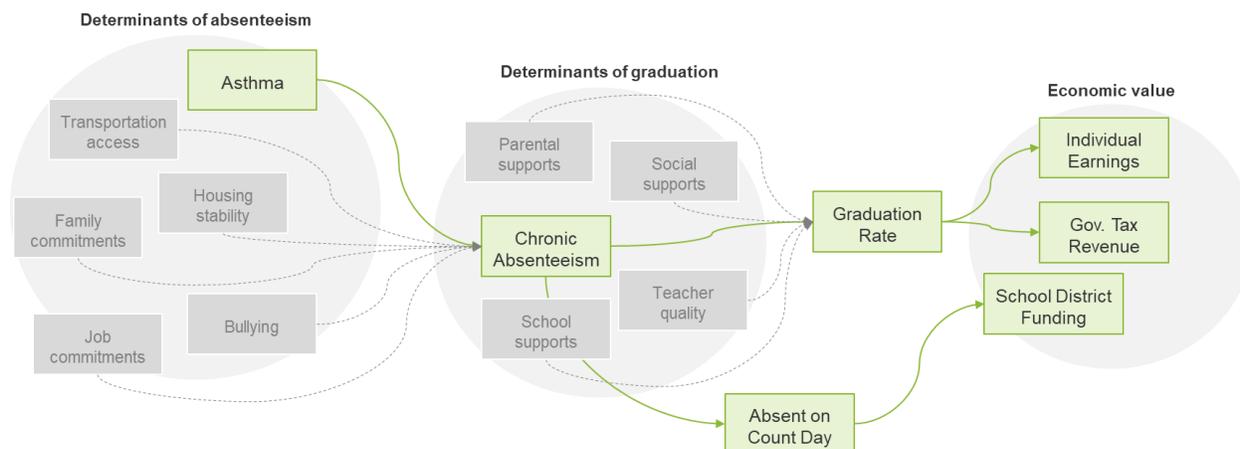
- asthma is one factor that contributes to chronic absenteeism;
- chronic absenteeism contributes to high school graduation rate;
- high school graduation is one of many factors that contribute to future earnings for an individual;
- additionally, asthma-related absenteeism contributes to reduced revenue to the school district.

Figure 1
Logic Model for Asthma and School Absenteeism



We recognize that research into these associations are limited, and that there are many potential confounding variables that affect the relationship between asthma, absenteeism, and future earnings (see Figure 2). This brief does not intend to solve for any precise economic value that asthma-related absenteeism holds in relation to other contributing factors; rather, our aim is that this analysis empowers practitioners to think about the broader benefits of asthma program services that extend into the education sector- something that is generally understood but not quantified.

Figure 2
Asthma is one of many determinants of chronic absenteeism



Summary of Research

Existing research offers valuable insight into the association between asthma and school absenteeism. For example, the CDC published a 2011 estimate that asthma contributes to 10.5 million missed school days across the country in a single year.⁴ More recently, a 2016 research paper found that half of children in school who had asthma missed at least one school day because of asthma in the past 12 months.⁵

Despite the evidence that suggests correlation between asthma and absenteeism, there is limited evidence that establishes causal relationship between the two issues. We focus on *chronic* absenteeism because this is a common flag that the education sector uses to indicate a level of absenteeism that will likely lead to poor educational outcomes. To demonstrate how we estimate economic value of asthma programs within the education sector, we walk through calculations and assumptions below for Grand Rapids, Michigan.

Case Study: Grand Rapids

Linking asthma and chronic absenteeism

The first step of this analysis is to estimate the extent to which asthma contributes to chronic absenteeism. A 2017 study that analyzed data from 2006-2010 Behavioral Risk Factor Surveillance System (BRFSS) Child Asthma Call-back Survey (ACBS) revealed that approximately half of children in school with asthma missed at least one school day because of asthma in the past 12 months.⁶ Using this figure as a marker, we propose that the percentage of students with asthma who are chronically absent because of the disease is likely less than 50%; we estimate 10%. This seems to be a conservative estimate given that nationally, 38.4% of children with asthma have uncontrolled asthma.⁷ “Uncontrolled asthma” is defined as someone having any of the following: in past 30 days, asthma symptoms more than two days a week, nighttime awakenings (more than one times a month in ages 0-4 years and two or more times a month in ages 5-11 years, and one to three times a week in ages 12 years and older), and in past three months, short-acting β 2-agonists use more than two days a week.⁸

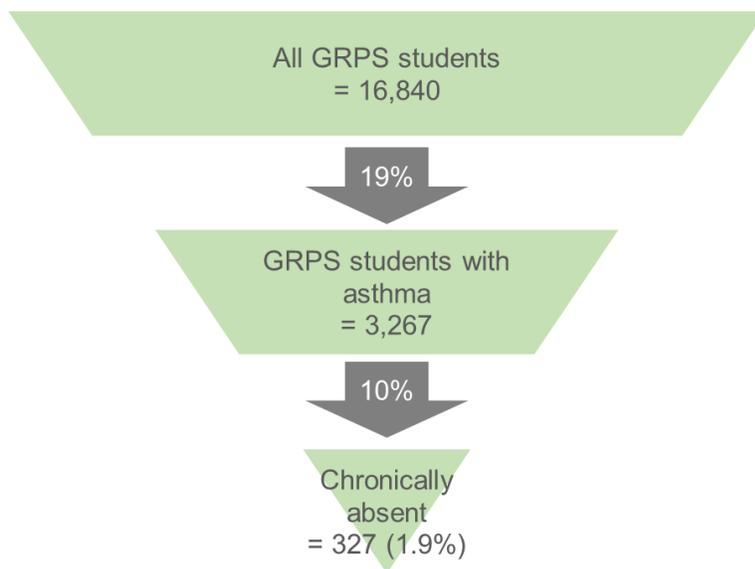
4 Asthma and student chronic absenteeism - December 2019

- In Grand Rapids, we start with the total number of students in the Grand Rapids Public School (GRPS) System, 16,840 in 2016.⁹
- Michigan Department of Health and Human Services reports that between 2011 and 2013, 19.4% of school-age children had asthma.¹⁰ We assume the same rate for 2016.
- We estimate that 10% of asthmatic students are chronically absent due to their asthma.

Figure 3 below shows how our estimates result in a final count of 327 students in GRPS who are chronically absent due to asthma. This equates to 1.9% of the total student population.

Figure 3

Students who are chronically absent due to asthma



Linking chronic absenteeism to high school graduation

Of students who are chronically absent due to asthma, we next estimate how many will drop out of high school. Existing research gives us some data to work with:

- Overall chronic absenteeism rate in Grand Rapids is 27% as of 2016.¹¹

- Chronically absent students are 7.4 times more likely to drop out of school in a future year than their peers who are not chronically absent, according to a study in Utah.¹²
- Dropout rate in Grand Rapids in 2017 was 15%.¹³
 - We calculate that the dropout rate is **5.5% for non-chronically absent students** and **40.7% for chronically absent students**.
 - Algebraically, this is calculated as follows:

$$x = 7.4y$$

$$0.15 = 0.27x + 0.73y$$

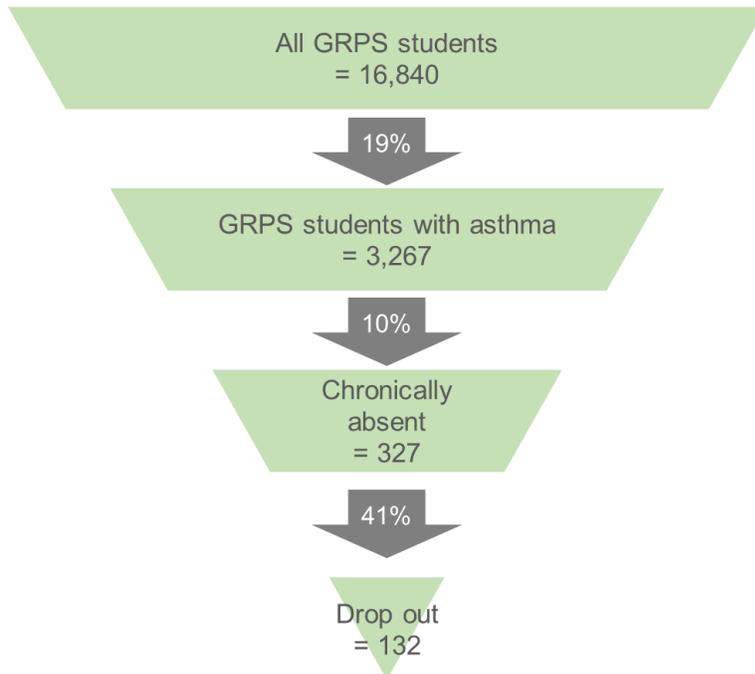
$$x = \text{Dropout rate for chronically absent students} = 0.4069;$$

$$y = \text{Dropout rate for non-chronically absent students} = 0.0550$$

Figure 4 below shows the additional layer of drop out rate for those students who are chronically absent. Based on these calculations, 132 students ultimately do not graduate high school because of asthma-related chronic absenteeism.

Figure 4

Students who drop out due to asthma chronic absenteeism



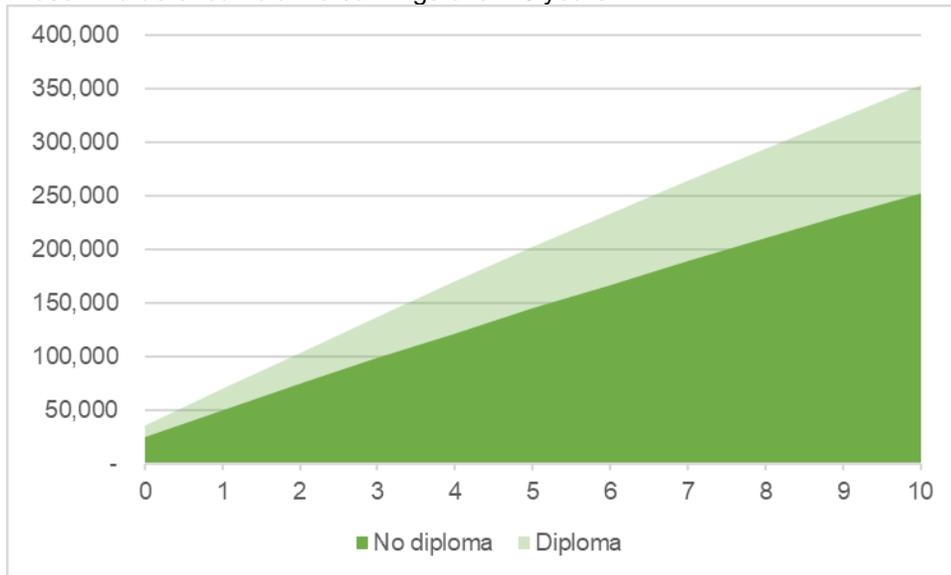
Economic value to the individual

Research suggests that graduating with a high school diploma leads to greater earning potential in one’s lifetime. The Bureau of Labor Statistics¹⁴ provides the following information for 2017:

Median usual weekly earnings without high school diploma	\$520
Unemployment rate without high school diploma	6.5%
Median usual weekly earnings, high school diploma	\$712
Unemployment rate, all workers	4.6%

In the short- and medium-term, the difference in cumulative earnings becomes significant very quickly. Figures 5 and 6 show the present value of cumulative earnings for a single individual (a product of expected wages and likelihood of employment) over a 10-year horizon.

Figure 5
Present value of cumulative earnings over 10 years



We further project annual earnings, multiplied by likelihood of employment, for an individual’s full working career, from age 18 to age 65. After applying a discount rate of 4%, the net present value (NPV) of both workers is shown below:

Group	Lifetime earnings (NPV)
With high school diploma	\$1,113,512
No high school diploma	\$797,043
<i>Differential</i>	<i>\$316,469</i>

Thus, the per-person lost lifetime earnings are \$316,469. This figure can also be calculated on a cohort basis, where a cohort is defined as the total number of school-aged children in the Grand Rapids Public School System (GRPS) at any given time. For this cohort, we assume 16,840 students in GRPS as reported in 2016. The total cohort-wide lost income that results from asthma-induced chronic absenteeism is about \$42 million.

Economic value to government

Lost individual earnings results in lost income tax revenue for governments. Figure 6 shows income tax rate at the local, state, and federal levels. It also shows the potential tax revenue lost per-person.

Figure 6

Potential lost tax revenue per person

	Tax rate	5-year	10-year	Lifetime
Grand Rapids	1.50% ¹⁵	\$861	\$1,506	\$4,747
Michigan	4.25% ¹⁶	\$2,440	\$4,267	\$13,450
Federal	10% ¹⁷	\$5,741	\$10,040	\$31,647

Assuming 132 individuals drop out of high school annually due to asthma-induced chronic absenteeism, as calculated above, this would translate into lost lifetime tax-revenue of \$626,604 (Grand Rapids), \$1,775,400 (Michigan), and \$4,177,404 (Federal) per cohort.

Economic value to the school system

School systems receive funding from state and federal sources, but there is no national standard formula by which schools are funded. In many cases, enrollment is used to determine how funding should be divided among districts and/or individual schools.

Depending on the state, student attendance may also be one variable in the school funding calculation formula.

For our Grand Rapids case study, we found that GRPS funding depends on attendance measured on Student Count Days. On a Student Count Day, students are counted if they are present or are in attendance within a specified timeframe after the Count Day depending on the nature of their Count Day absence (excused absence: 30 days, unexcused absence: 10 days, suspension: 45 days).¹⁸

For students who are chronically absent due to asthma, the potential economic value to the school system becomes a question of probability. What is the probability that such a student will be present during Count Day? And if the student is absent, what is the probability that she will be in attendance within the specified window? Using estimates established in previous sections, we use the following figures:

Figure 7
Probability of Count Day absences

Type of asthmatic student	No. students	Prob. of absence	Prob. of absence post-Count Day	No. students who are not counted
Chronically absent	327	10%	0.167%	0.54
Non-chronically absent	2,940	2%	0.33%	0.20
Total				0.74

Note that for the probability of absence post-Count Day, we are using the 30-day window for excused absences, which provides a more conservative estimate than an unexcused absence:

$$\begin{aligned}
 & (10\% \text{ probability of absence on Count Day}) * \\
 & [(10\% \text{ probability of absence on a single day}) * (30 \text{ day window} / 180 \text{ school days})] \\
 & = 0.167\%
 \end{aligned}$$

$$\begin{aligned}
 & 327 \text{ students} * 0.167\% \\
 & = 0.54 \text{ chronically absent students who are not counted on Count Day or within} \\
 & \text{30 days of a Count Day}
 \end{aligned}$$

$$\begin{aligned}
 & \$7,631 \text{ per student} * 0.54 \text{ students} \\
 & = \$4,155 \text{ lost revenue}
 \end{aligned}$$

GRPS is provided \$7,631 per counted student¹⁹, so the total amount of potential lost revenue to GRPS from this target population is \$4,155 per Count Day.

Discussion and Recommendations

Comparing total economic value lost from asthma-related absenteeism across stakeholders, the value to the individual is by far the greatest. Although school system revenue is based on attendance, the Count Day approach only results in a small number of students who are not ultimately counted. Figure 8 shows the estimated value lost for the individual and government stakeholders.

Figure 8

Total economic value lost per person and per cohort

Stakeholder	Economic value per person	Asthma-Related Per Cohort
Individual lifetime earnings	\$316,470	\$41,872,682
Grand Rapids tax revenue	\$4,747	\$628,090
Michigan	\$13,450	\$1,779,589
Federal	\$31,647	\$4,187,268

**GRPS loses \$4,155 per cohort per Count Day*

The analysis shows that failure to graduate high school can have significant impact on an individual’s earning potential later in life. Of 16,840 total students attending GRPS in a single year, we estimate that 132 will not graduate due to asthma-related chronic absenteeism.

Government also loses out on potential tax revenue for each student who does not graduate from high school, especially at the federal level. The school system (GRPS) realizes some economic loss from asthma absenteeism but to a minimal extent. We would expect that calculations for the individual and government losses to be similar for

other jurisdictions in the country. Depending on state and local funding models in the education sector, schools and school system loses could vary widely.

Below is a list of recommendations for next steps that come out of this analysis that is not only applicable to Grand Rapids, but also to other jurisdictions interested in studying the relationship between asthma and education outcomes.

- **Build the evidence base:** additional research should be undertaken to study possible causal relationships between asthma, absenteeism, high school graduation, and future earning potential. Research that currently exists suggests correlation between asthma and student outcomes but does not offer evidence for causation.
- **Absenteeism data collection:** to support additional research for asthma and absenteeism, schools need to improve data collection to include cause of absenteeism, including asthma. In some jurisdictions this may be a conversation with the school system directly. In others this may be a conversation with a third-party organization who manages the school's data tracking efforts. In Grand Rapids, for example, the Kent Intermediate School District (ISD) is a separate agency that manages the school's data warehouse, which includes attendance data.

If and when asthma can be recorded as a reason for absenteeism, administrators could identify when a student is at risk of becoming chronically absent due to asthma. Those students could then be referred to a comprehensive asthma program and other resources if additional reasons for absenteeism are identified.

- **Attendance-based funding:** understand if and how absenteeism affects school funding: in Grand Rapids, Count Days play a large role in calculating how much funding school systems receive. The Count Day process includes a window of time after the actual day that schools take attendance, so a standalone absence

caused by asthma or otherwise does not ultimately have a significant effect on a school's funding. In Memphis, for example, the public-school district receives funding from the state based on enrollment, not attendance. The attendance calculation is different across the country, so we recommend that you understand the formulas used in your state or jurisdiction.

- **Form community partnerships to address the root causes of student asthma:** to address the root causes of student asthma (and thus absenteeism) local organizations should coordinate efforts around comprehensive asthma control, including control of environmental triggers. Health care providers, insurance companies, health departments, community-based providers, school-based providers, and others often have their own datasets and program services that target very specific aspects of asthma. Existing services should be coordinated through referrals and data sharing to maximize the benefit of otherwise disparate program services.²⁰ Gaps in care, which often exist for remediation of environmental triggers, should be identified and addressed. Funding gaps should also be identified and addressed- for example, there may be an opportunity to advance innovative health care payment mechanisms to pay for home-based services and remediation.²¹

For more information about how asthma affects student absenteeism in your community, contact info@ghhi.org. GHHI provides technical assistance to policy makers, local agencies, health care organizations, community-based organizations and other stakeholders to advance partnerships, programs, and policies that support healthy housing interventions nationwide.

End Notes

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²⁰ Refer to GHHI's publication on how to build a multi-sector healthy homes program:
<https://www.greenandhealthyhomes.org/publication/healthy-homes-and-asthma-a-healthy-housing-blueprint-to-improving-asthma-outcomes/>

²¹ Refer to GHHI's publication on innovative financing for healthy homes services:
<https://www.greenandhealthyhomes.org/publication/using-pay-for-success-to-invest-in-social-determinants-of-health-a-short-guide-for-policymakers-funders-and-mcos/>