Final HUD Evaluation Report*

(From Project Implementation to December 7, 2007)

Reviewed December 12, 2007

The Healthy Home Resources AT HOME Environmental Asthma Intervention

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* Results represent final project data; there is still considerable missing 6 month follow-up data

Executive Summary

The Healthy Home Resources' (HHR) AT HOME - Asthma Trigger Home Evaluation Project has concluded quite successfully. The program has exceeded its recruitment and participant retention goals. To date approximately 187 children have completed the program, well over the project delivery total of 150 children and 6 month follow-up has been accomplished in 36 cases. This program has been quite successful at recruitment, retention and service delivery as well as the fact it has significantly decreased environmental asthma exacerbations as measured by a significant decrease in symptom days and rescue medication days. This fact is realized by local public health officials and foundations and media outlets.

An outcome evaluation of the main asthma severity indicators of lost school days (LSD), rescue medication usage (RES) and symptom days (SYM) and the effectiveness of the program at improving scores on a caretaker knowledge, attitudes and beliefs (KAB) questionnaire was performed for all of the participants/caregivers who finished the program. **All outcome indicators showed improvement post-intervention compared to pre-intervention values, although the results were not significant statistically for LSD.** RES, SYM and KAB showed statistically significant improvement, meaning the results achieved occurred at a probability level of less than .05-or can be thought of as occurring by chance less than or equal to 1 in 20.

The mean of the post-intervention KAB scores increased by 19.9 points over pre-intervention scores; this is significant at the p=< .0001 level (these results would only be due to chance one ten-thousandth of the time) and the 95% confidence interval of the point gain is 12.8 to 26.8 points, inclusive. Additionally in this final evaluation we were able to evaluate the persistence of the post-intervention effect, as 36 participant caretakers received a 6-month follow-up KAB questionnaire. We found that the program has a significant persistent effect on KAB scores over time. The mean of the 6 month follow-up KAB scores increased by 23.3 points over pre-intervention scores; this is significant at the p= .006 level (these results would only be due to chance six one-thousandths of the time) and the 95% confidence interval of the point gain is 7.3 to 39.4 points, inclusive. **We conclude that the program has an immediate post intervention and persistent 6-month effect on increasing KAB regarding asthma, its causes, and prevention of asthma exacerbations.** From this we can expect, given health theories linking increased knowledge and more positive attitudes and assertive beliefs with changed health behaviors, caretakers to positively change behaviors regarding caring for their children with environmental asthma.

The outcome indicator of symptom days (SYM) improved post-intervention by decreasing 2.52 days over a 14-day period over pre-intervention levels. This was significant at a p value <. 0001. The improvement in symptom days as measured post intervention continues to be dramatic. We were able to evaluate the persistence of effect of the decrease in SYM by comparing 25 participants, 6-month follow-up SYM with their pre-intervention SYM. The ratio of paired differences of SYM (Visits 1-5) improved with a mean of 0.24; this translates into a decrease of 3.36 days of SYM over the 14-day period. This finding was statistically significant at the .032 probability level. The 95% Confidence Internal of the mean difference is between 0.29 and 6.4 days per 14-day period. This indicates a persistence of the SYM effect of the program at 6 months follow-up.

The outcome indicator, days of use of rescue medication (RES) improved post-intervention by

decreasing 1.68 days over a 14-day period over pre-intervention levels. This was significant at a p value of .001. Stated in statistical term the true decrease in rescue medication usage days can be said to lie between 0.70 days and 2.66 days with 95% confidence. We were able to evaluate the persistence of effect of the decrease in RES by comparing 25 participants, 6-month follow-up RES with their pre-intervention RES. The ratio of paired differences of RES (visit 1-visit 5) improved with a mean of 0.16; this translates into a decrease of 2.27 days of rescue medication usage over the 14-day period at 6 months follow-up compared to pre-intervention levels. This finding was statistically significant at the .047 probability level. The 95% Confidence Internal of the mean difference is between .042 and 4.48 days per 14-day period. This indicates a persistence of the RES effect of the program.

The outcome indicator lost school days (LSD) improved post-intervention by decreasing .10 days over a 14-day period over pre-intervention levels. Unfortunately this difference was not statistically significant (p=.49). We were able to evaluate the persistence of effect of the decrease in LSD by comparing 17 participants, 6-month follow-up LSD with their pre-intervention RES. The mean of the difference of LSD rates is .50 days per 2-week period. This difference though is also not significant at or below the p= .05 level, the achieved p value was p=.155 (which is an improvement over previous p values).

LSD Statistical Analysis Problems-- The achieved p value for the 6 month follow-up group has decreased dramatically from over post intervention score. Further follow-up of the entire group over the complete 6 months post intervention is recommended-this could indeed clarify this improving trend and stabilize for summer irregularities. The variable of LSD is not like the other outcome indicators since the school year varies seasonally (no school in the summer) and for holidays. Attempts have been made to account for lost camp days in the summer but these reports are sporadic and considered unreliable to be grouped with true in-school lost days. Additionally many caretakers are involved in home-schooling or other processes further complicating the issue.
Once all 6 month follow-up data is accumulated, an analysis of longer term results, matching seasons of pre-intervention LSD and 6 month follow-up LSD might aid in making this a more valuable outcome measure. It is still of note that the means of LSD for both comparisons fell- although the result was not statistically significant.

There is more than adequate statistical information that the HHR AT HOME program has had an impact on post-intervention outcome measures; KAB, SYM, and RES and that these effects appear to be persistent to 6-month post-intervention follow-up. Additionally, environmental outcomes have improved substantially. LSD seems less impacted but further work is needed to standardize these rates to season and this can only be accomplished by obtaining a compete 6 month follow-up of LSD.

The HHR AT HOME program has surpassed all recruitment, retention and program service goals that constitute its charge as outlined in HUD project plans. Outcome indicators on whole support the conclusion that the program process is quite effective at lowering RES and SYM of participants and raising KAB of caretakers. There is also evidence of persistence of effect of these measures to 6-month post-intervention follow-up. The HHR AT HOME program has also been successful at raising the consciousness of the region regarding environmental causes of asthma and has become an important and well-known community resource.

Report Format

The numbers of children in the program are above levels set for successful project performance and can therefore be used to generate meaningful demographic and epidemiological characteristics of the study group; these are reported in Part I of this report. Part A of Part I presents descriptive statistics of demographic variables such as the ages, gender, race, height and weight of children enrolled in the study as well as information on caretakers age, race and type and household information. Part B of Part I presents selected participant, caregiver and parental epidemiological characteristics regarding the onset age of asthma in study participants and the asthma status of parents and caregivers. Part II of this report presents descriptive statistics and hypothesis testing concerning improvements in the entire panel of outcome variables on the Asthma Severity Questionnaire (ASQ). Statistical tests were performed using SPSS Version 15.0, under license to Conrad D. Volz, DrPH, MPH, through the University of Pittsburgh.

Evaluators Credentials

Dr. Volz is on faculty of the Department of Environmental and Occupational Health at the University of Pittsburgh's, Graduate School of Public Health (GSPH). He has 30 years of experience in environmental program evaluation, exposure assessment, fate and transport of contaminants and hazard and risk communication. Dr. Volz has performed numerous large program evaluations including the American Cancer Society's, Teen Fresh Start, Smoking Cessation Program and assessments of the release of radiation from underground nuclear detonations and the effectiveness of asbestos management programs for the Department of Defense worldwide. He has evaluated the HHR program since inception and has incorporated program modifications, as made by HHR and HUD, into the evaluative process. Dr. Volz is Scientific Director of the Center for Healthy Environments and Communities at the GSPH; he is also Co-Director, Division of Environmental Assessment, Monitoring and Control at the University of Pittsburgh Cancer Institute, Center for Environmental Oncology. Dr Volz's research interests are primarily focused on how point and non-point source toxins move through the air, water, soil and groundwater to reach people and how to block this movement. In addition to being the GSPH Principal Investigator for Evaluation of the HHR AT HOME program he is also a Co-Investigator in the new Centers for Disease Control Environmental Health Tracking Grant, which has a major focus on environmentally induced asthma. Dr. Volz is also investigating the association between asthma, autism and low birth weight delivery with inhalation of particulate matter, 2.5 micrometers in diameter.

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Part I, Demographic and Epidemiological Characteristics of the Study Group
__(These data are unchanged from the quarterly report in October of 2007)__
As of September 30, 2007 the project had 285 interviewed cases in its database, this represents a 42% increase in cases since the last data set point of June 2007, when the program had 201 cases in its database. A total of 187 children have completed the program. The demographic and epidemiological descriptions, narratives, tables and figures presented below are based on this population group.

Part A: Demographic Characteristics

Age, Height and Weight of Children

Table 1 Baseline Characteristics of the Study Population presents the mean age of study participants; it is 8.94 years of age, with a minimum age of 3 and a maximum age of 17. The distribution of ages of study participants, shown in Figure 1 Age Distribution, is becoming somewhat log normally distributed with modes approximately 4-5, 7-8 and 10-11 years of age. The standard deviation of children's age is 3.33. The distribution of height of study participants, presented in Figure 2 Height Distribution, has a mean and mode, which is relatively close, and the distribution, appears normal; the distribution of weight, shown in Figure 3 Weight Distribution, is skewed positively.

Gender and Ethnicity of Study Children

Table 1 presents a breakdown of both the gender and ethnicity of children in the study group. Approximately 58.5% of children enrolled in the program are male and their caretakers consider 71.4% of children African American.

Age, Race and Type of Caretakers

Table 1 shows the mean age of caretakers and the percentage breakdowns of caretaker race and type. The mean age of reporting caretakers is 36.8 with a range from 21 to 70 years of age. Figure 4, Age Distribution of Caretakers appears to be normally distributed, although there is a skew to the right-indicating grandmother care. Most caretakers are between the ages of 30 and 43. 97.1% of caretakers are female and "mother" accounts for 90% of all caretakers. A breakdown of type of caretaker is shown graphically in Figure 5. The racial characteristics of caretakers match exactly those of the children in the study.

Household Characteristics and Smoking Behaviors of Caretakers

Table 1 presents % of households with at least one smoker as well as the % of households with more than 1 asthmatic child. Table 2 presents maximums, minimums, means and standard deviations for the total number of children in households and the total number of people in each household. Over 61% of households have more than 1 child in the family; the mean number of children in each family is 2.0 with a maximum of 8 and a standard deviation of 1.3. The mean of the total number of people in each household is 4.13 with a range from 2 to 9 people and a standard deviation of 1.41. Final statistics show that approximately **25% of caretakers define their families as single parent families. Among the caretakers defining themselves, as single parent families about 80% are single-mother families and about 85%, of single parent families are African American.**

29% of caretakers report being smokers (Table 1 and Table 4). Table 5 reports the amount of daily cigarette smoking by caretakers who reported smoking. Approximately 54% of care giving smokers smoke between 5 and 9 cigarettes per day. Table 3 and Figure 6 indicate that approximately 42% of study participants share a bedroom with another household member. Table 6 shows that 5 study participants (2.4%) share a room with a smoker.

Table 1, Baseline Characteristics of the Study Population
N=287

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Age of Child (years, %)
   3-5                                              20.8
   6-9                                              33.2
   10-12                                            30.5
   13-17                                            15.5
   Mean  (years)                                    8.94

Gender of Child (%)
   Female                                           41.5
   Male                                             58.5

Race of Child
   African American                                 71.4
   White                                            24.0
   Hispanic                                         1.0
   Other                                            3.6

Caretaker's Age (mean years)                        36.8

Caretaker's type  (%)
   Mother                                           90.0
   Grandmother                                      4.7
   Father                                           2.4
   Aunt                                             2.4
   Other                                            0.5


Households with >1-asthmatic children  (%)          38.6


Smoking Caretakers  (%)                             28.8

Asthma Onset Age    (%)
   <=1 year                                         50.5
   2-5 years                                        33.2
   > 5 years                                        16.3

Other Breathing Problems
   Yes                                              6.8
   No                                               93.2
```

Table 2, Minimum and Maximum Values of Selected Group Characteristic Interval Variables

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Age of Child	213	3	17	8.94	3.33
Childs Height/Inches	124	36.00	77.00	55.4	9.06
Childs Weight/Pounds	146	32.00	220.00	92.8	41.53
Total Number of Children < 12 in Household Before ID 1282, Total Number of Children in Household after ID 1282	210	1	8	2.0	1.3
Total Number of People in Household	209	2.00	9.00	4.1	1.4
Valid N (listwise)	285				

Figure 1, Age Distribution of Participant Children
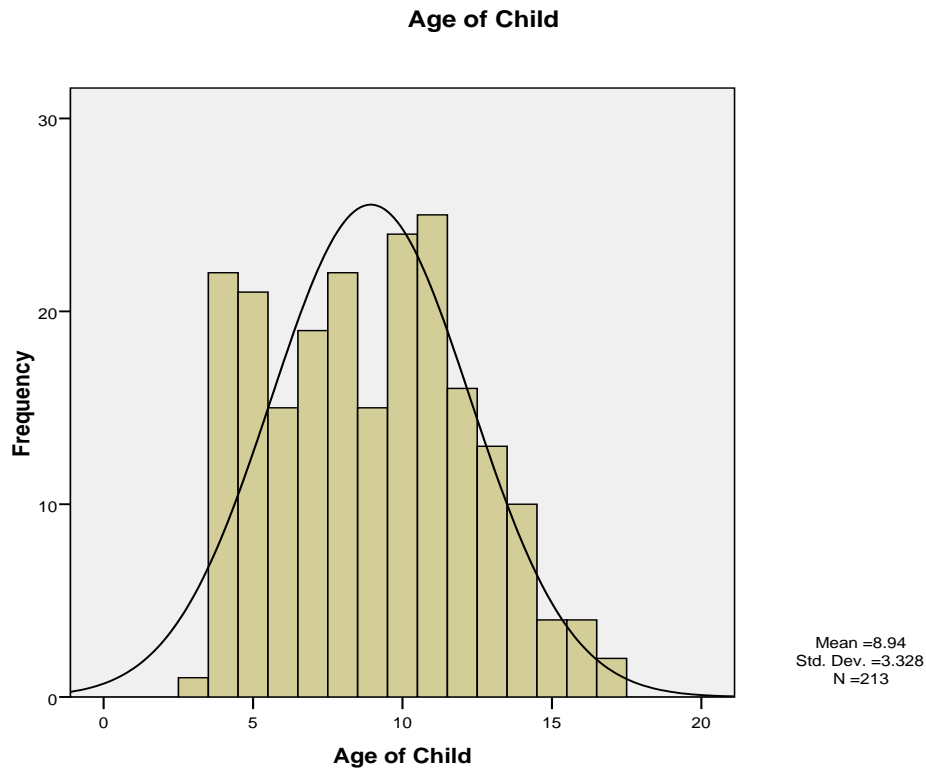
Age of Child

Mean =8.94
Std. Dev. =3.328
N =213

Figure 2, Height Distribution of Participant Children

Childs Height/Inches

Mean =55.42
Std. Dev. =9.057
N =124

Figure 3, Weight Distribution of Participant Children

Childs Weight/Pounds

Mean =92.77
Std. Dev. =41.526
N =146

Figure 4, Age Distribution of Participant Caretakers

Age of Caretaker

Mean =36.77
Std. Dev. =8.46
N =197
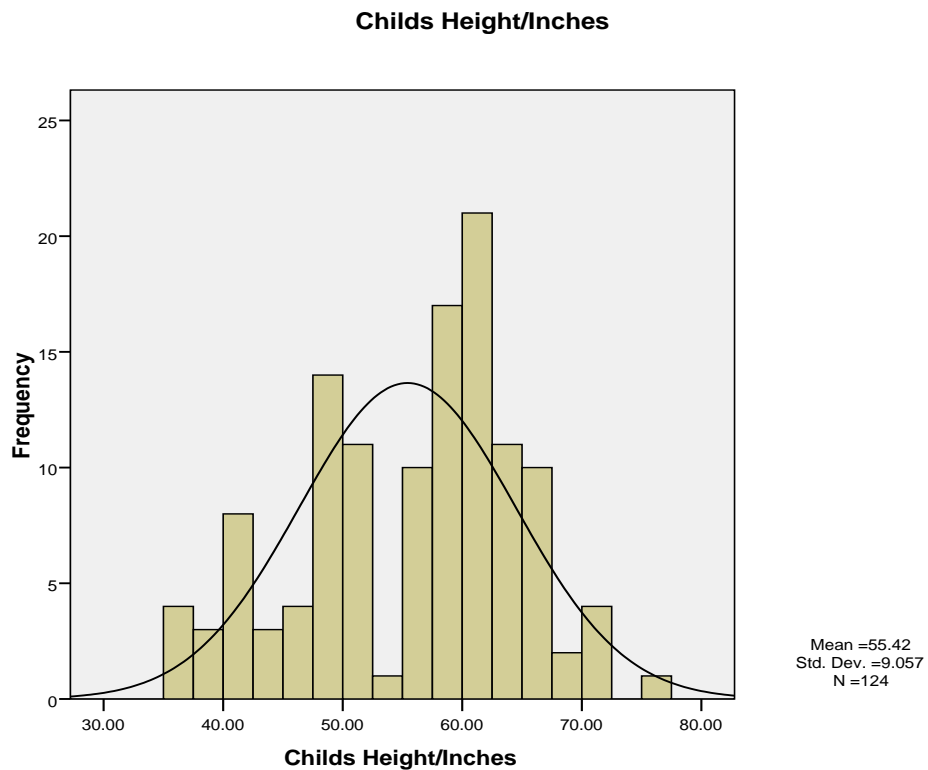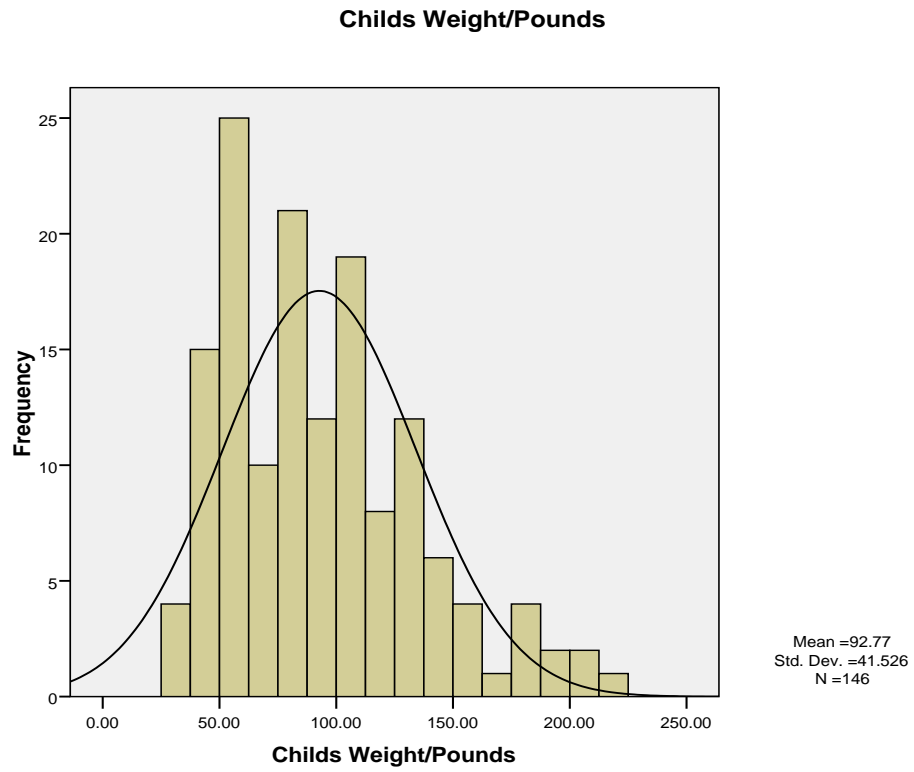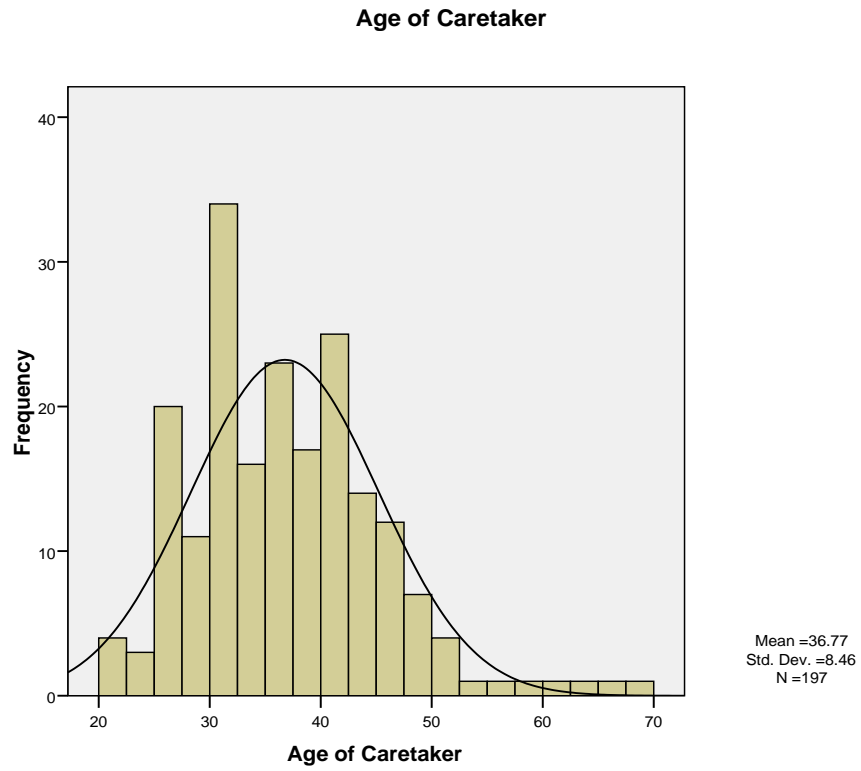
Figure 5

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Caretaker of Record Identification

Legend:
- Mother
- Father
- Grandmother
- Aunt
- Other Blood Relative
- Missing
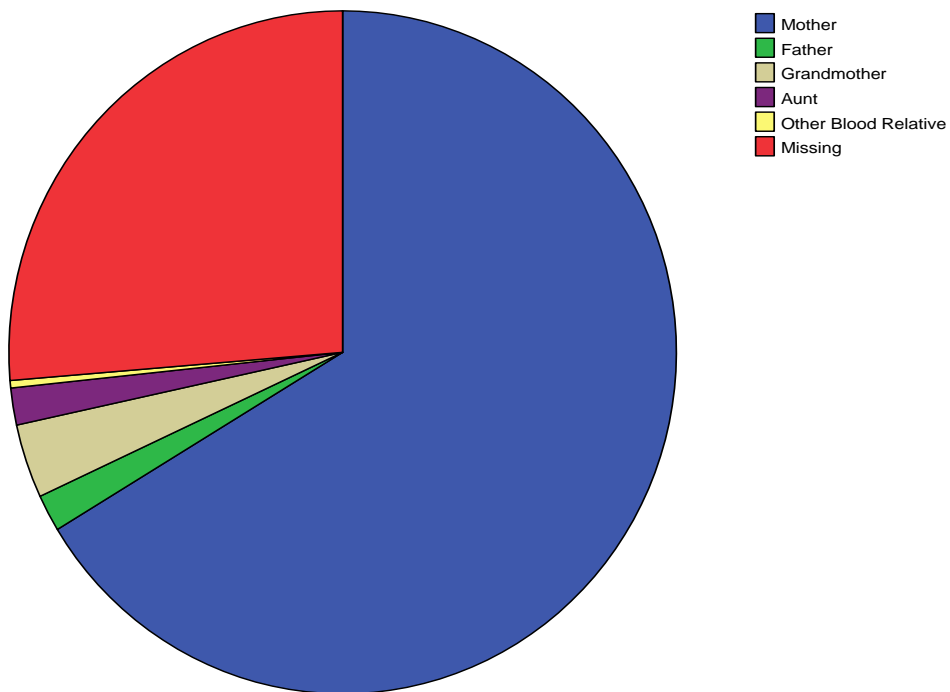
Caretaker of Record Identification

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Mother	189	66.3	90.0	90.0
	Father	5	1.8	2.4	92.4
	Grandmother	10	3.5	4.8	97.1
	Aunt	5	1.8	2.4	99.5
	Other Blood Relative	1	.4	.5	100.0
	Total	210	73.7	100.0	
Missing	System	75	26.3		
Total		285	100.0		

Table 3

Does Child Share a Bedroom With Others?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	88	30.9	41.9	41.9
	No	122	42.8	58.1	100.0
	Total	210	73.7	100.0	
Missing	3	1	.4		
	System	74	26.0		
	Total	75	26.3		
Total		285	100.0		

Figure 6

Does Child Share a Bedroom With Others?

Does Child Share a Bedroom With Others?
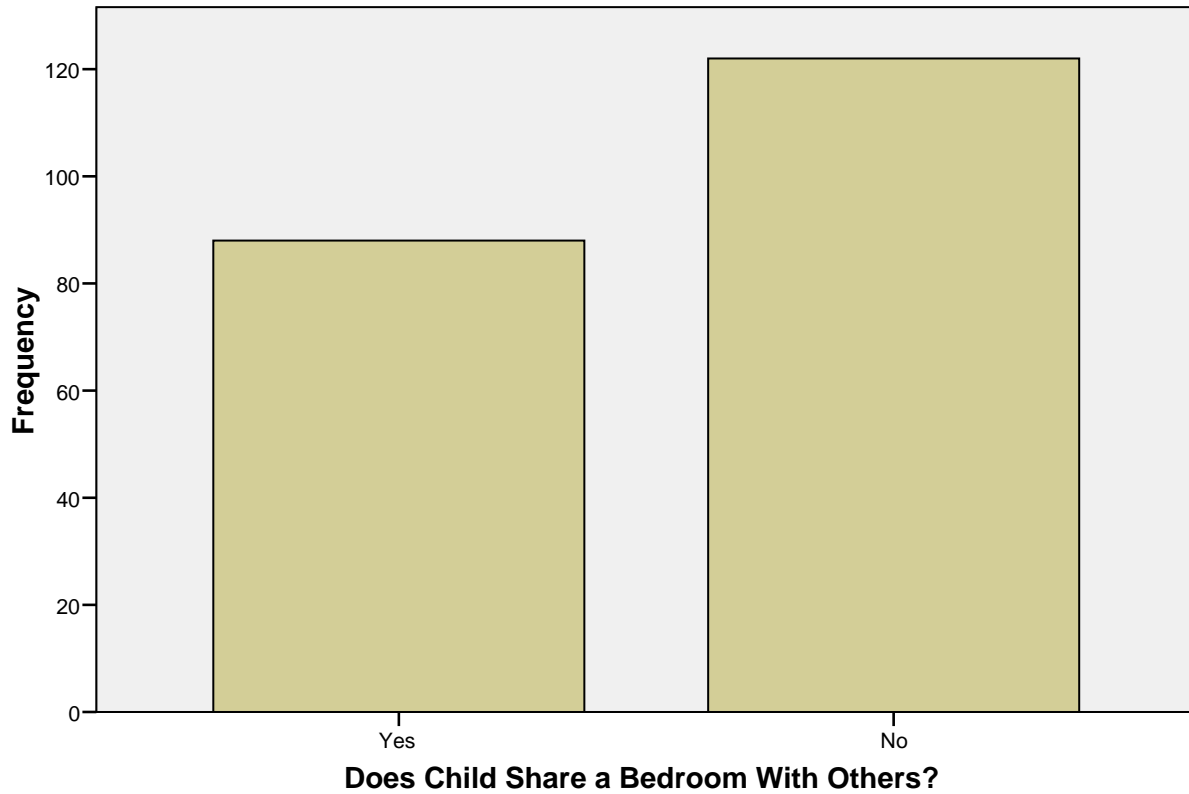
Table 4

Does Caretaker Smoke?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	59	20.7	28.8	28.8
	No	146	51.2	71.2	100.0
	Total	205	71.9	100.0	
Missing	10	3	1.1		
	System	77	27.0		
	Total	80	28.1		
Total		285	100.0		

Does Caretaker Smoke?

Does Caretaker Smoke?

16
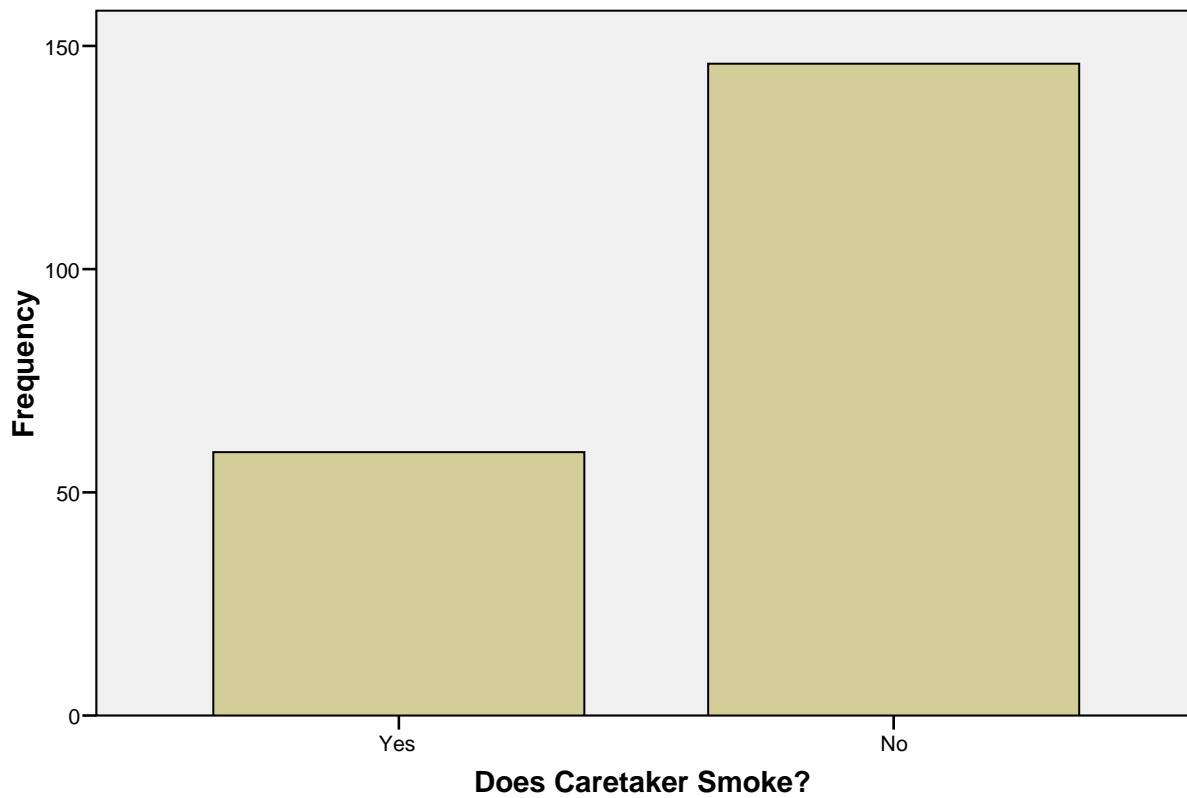
Table 5, if caretaker is a smoker, How Much do you smoke?
If Smoke, How Much?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 5 Cigarettes	10	3.5	5.0	5.0
	5-<10 Cigarettes	33	11.6	16.3	21.3
	11-15 Cigarettes	9	3.2	4.5	25.7
	16-20 Cigarettes	7	2.5	3.5	29.2
	20- 30 Cigarettes	1	.4	.5	29.7
	> 2 Packs Cigarettes	1	.4	.5	30.2
	Don't Know	1	.4	.5	30.7
	Answered no to previous question	140	49.1	69.3	100.0
	Total	202	70.9	100.0	
Missing	12	3	1.1		
	System	80	28.1		
	Total	83	29.1		
Total		285	100.0		

Table 6 Does Child Share a Room With a Smoker?
Does Child Share a Room With a Smoker?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	5	1.8	2.4	2.4
	No	135	47.4	64.6	67.0
	Answer no to previous question	69	24.2	33.0	100.0
	Total	209	73.3	100.0	
Missing	4	2	.7		
	System	74	26.0		
	Total	76	26.7		
Total		285	100.0		

Part B: Epidemiological Characteristics of the Study Group Regarding Asthma

The study group caretakers were asked a number of questions regarding potential determinants of their children's asthma including; the onset age of asthma; parents status regarding asthma; caregivers status regarding asthma; and other children in the home with asthma.

**Onset Age of Asthma in Study Children**

Table 7 has a breakdown of the onset age of asthma in the study group; approximately 51% of group members had onset of asthma less than or equal to 1 year of age. An additional 33.2 % of cases reported asthma onset between greater than one to 5 years of age. As shown in Table 7, Frequencies of Age of Asthma Onset in Study Population, a cumulative total of 77.2% of children had asthma onset before or during their third year of life. Figure 7 is a histogram of the age of onset of asthma in the study group; the mean onset age is 2.8, the histogram is positively skewed and may indicate a log normal distribution.

Table 7, Frequencies of Age of Asthma Onset in Study Population

When was Asthma First Diagnosed?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<= 1 year	102	35.8	50.5	50.5
	2	35	12.3	17.3	67.8
	3	19	6.7	9.4	77.2
	4	4	1.4	2.0	79.2
	5	9	3.2	4.5	83.7
	6	6	2.1	3.0	86.6
	7	7	2.5	3.5	90.1
	8	6	2.1	3.0	93.1
	9	4	1.4	2.0	95.0
	10	4	1.4	2.0	97.0
	11	3	1.1	1.5	98.5
	12	1	.4	.5	99.0
	13	1	.4	.5	99.5
	15	1	.4	.5	100.0
	Total	202	70.9	100.0	
Missing	18	4	1.4		
	System	79	27.7		
	Total	83	29.1		
Total		285	100.0		

Figure 7

When was Asthma First Diagnosed?

Mean =2.83
Std. Dev. =2.865
N =202
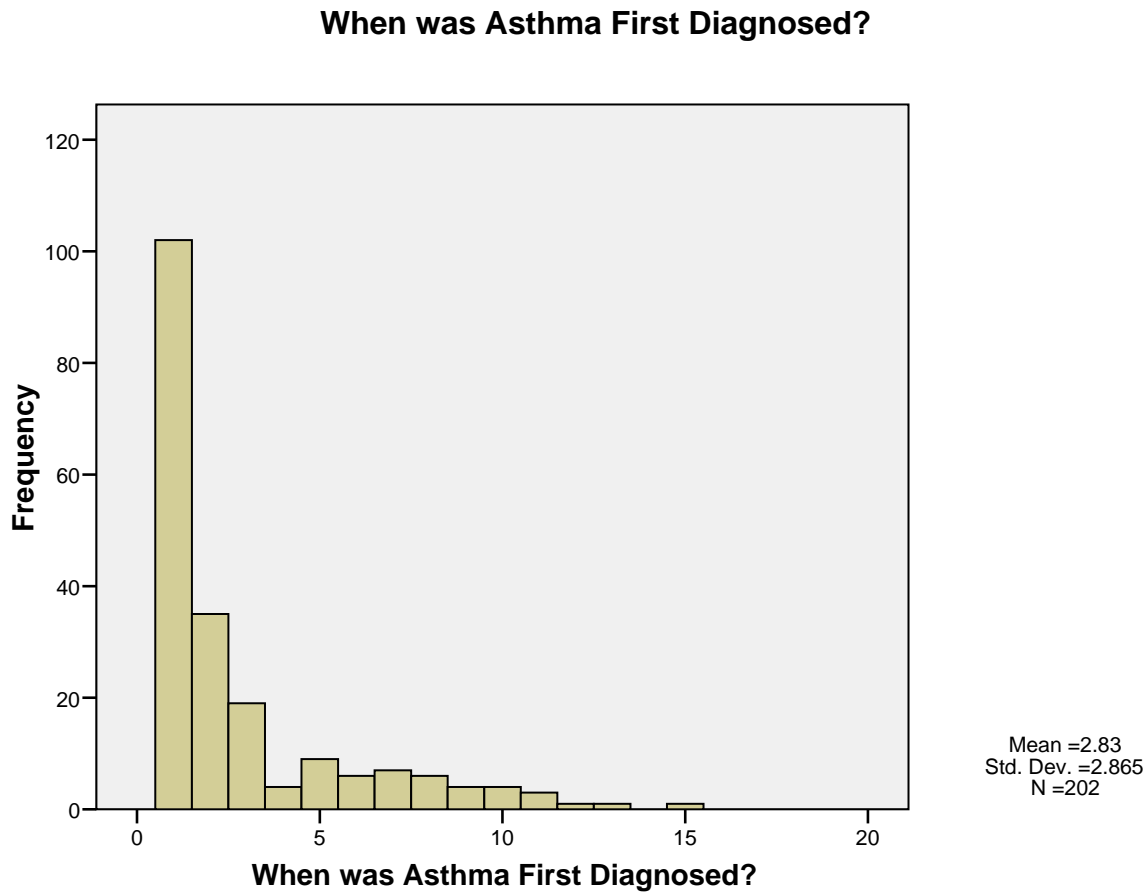
Multiple Children in Household with Asthma and Multi-Children Families

Table 8, Other Children in the Home with Asthma?, documents that 81 of 210 homes or 38.6% contain additional children who have asthma.

TABLE 8

Other Children in Home With Asthma?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	81	28.4	38.6	38.6
	No	129	45.3	61.4	100.0
	Total	210	73.7	100.0	
Missing	System	75	26.3		
Total		285	100.0		

Other Persons in Home with Asthma; Caregivers and Asthma and Parents and Asthma

Table 9, Other Persons in Home with Asthma?, has a breakdown showing, and Figure 8, graphically depicts, that 81 out of 208 families have adults or other children with asthma in the same household as the child enrolled in the study. Thus 39% percent of enrolled households have more than one person with asthma. Table 10 presents data on caregivers reporting to have asthma, 70 caretakers or 34.1% of households have a caretaker who has asthma. There is thus significant overlap between households that have additional children and/or caretakers and/or other asthmatic home occupants. Table 11 contains data on the number of participant children that have at least one parent with asthma; 90 out of 198 children or 45.5% have at least one parent with asthma.

Table 9

Other Persons in Home with Asthma?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	1	.4	.5	.5
	Yes	81	28.4	38.9	39.4
	No	126	44.2	60.6	100.0
	Total	208	73.0	100.0	
Missing	3	3	1.1		
	System	74	26.0		
	Total	77	27.0		
Total		285	100.0		

Figure 8

Other Persons in Home with Asthma?
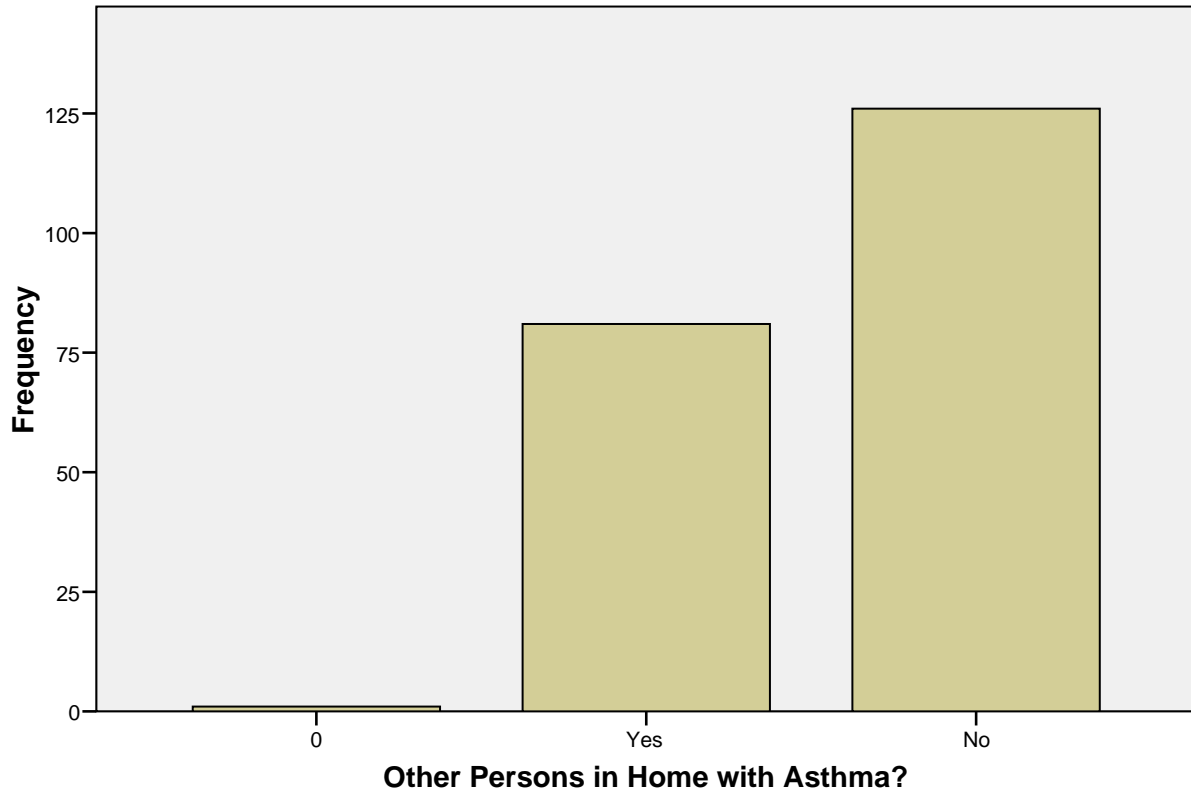
Table 10

Does Caretaker have Asthma?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	70	24.6	34.1	34.1
	No	135	47.4	65.9	100.0
	Total	205	71.9	100.0	
Missing	10	2	.7		
	System	78	27.4		
	Total	80	28.1		
Total		285	100.0		

Figure 9

Does Caretaker have Asthma?

Does Caretaker have Asthma?
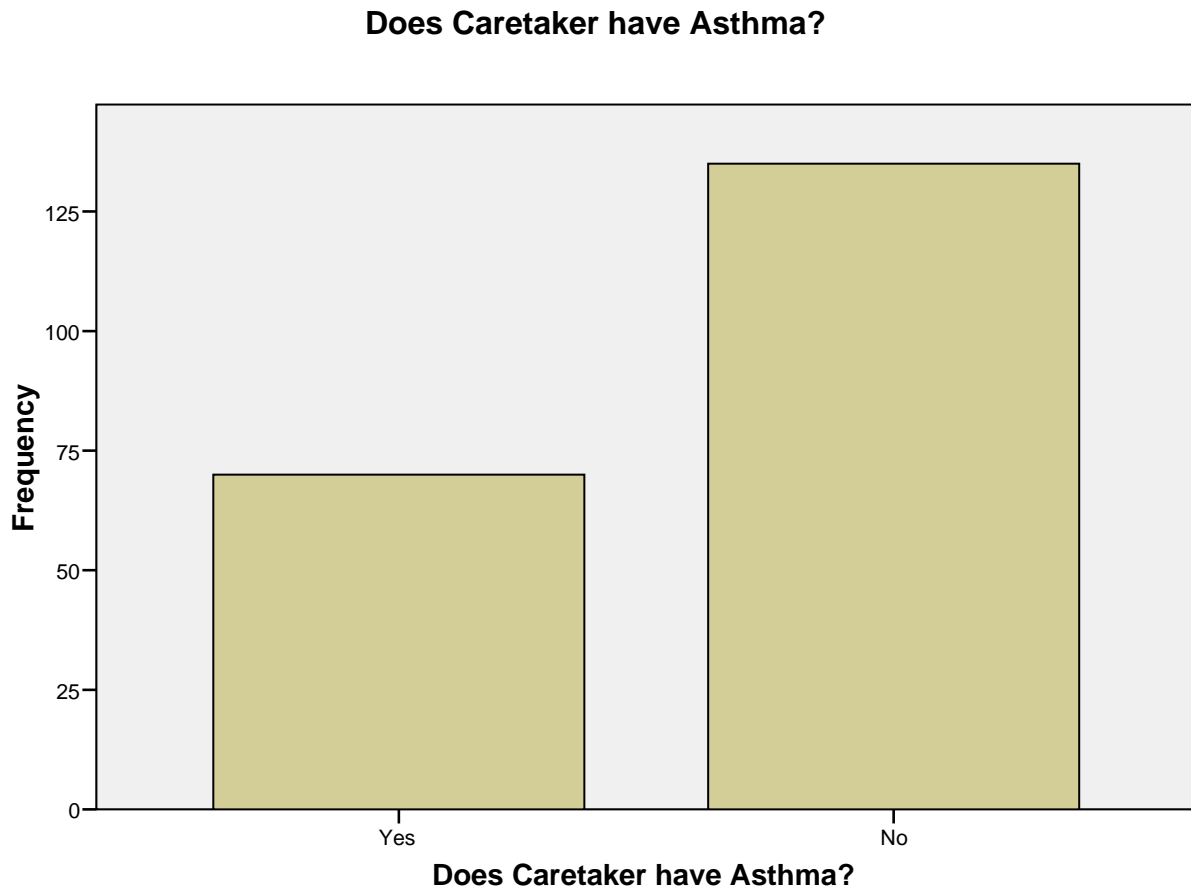
Table 11

Parents with Asthma?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	90	31.6	45.5	45.5
	No	108	37.9	54.5	100.0
	Total	198	69.5	100.0	
Missing	3.00	8	2.8		
	System	79	27.7		
	Total	87	30.5		
Total		285	100.0		

Figure 10

## Parents with Asthma?

Parents with Asthma?
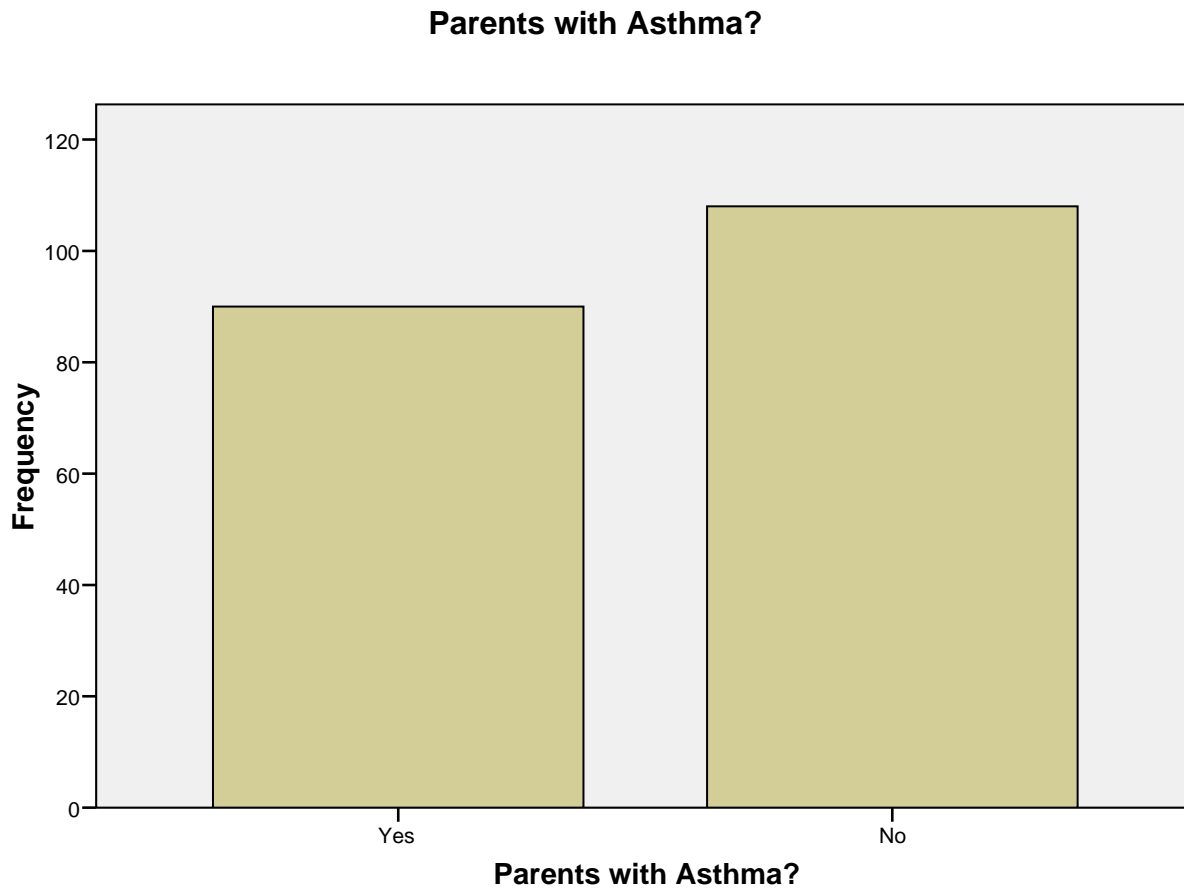
Other Breathing Problems

Table 12 presents data on the existence of other breathing problems in study participants. Only 14 out of 195 valid answers to this question indicated that children enrolled in the study have other breathing problems. This was actually one of the intake requirements in the program but the question was asked in the initial meeting to see if "other breathing problems" could be a confounding variable to the evaluation. Of the breathing problems listed by caretakers "other than asthma" 4 caretakers listed disorders that were not related to pulmonary problems.

Table 12

Does Child Have Other Breathing Problems?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	14	4.9	6.8	6.8
	No	191	67.0	93.2	100.0
	Total	205	71.9	100.0	
Missing	miss	1	.4		
	System	79	27.7		
	Total	80	28.1		
Total		285	100.0		

Does Child Have Other Breathing Problems?

Does Child Have Other Breathing Problems?
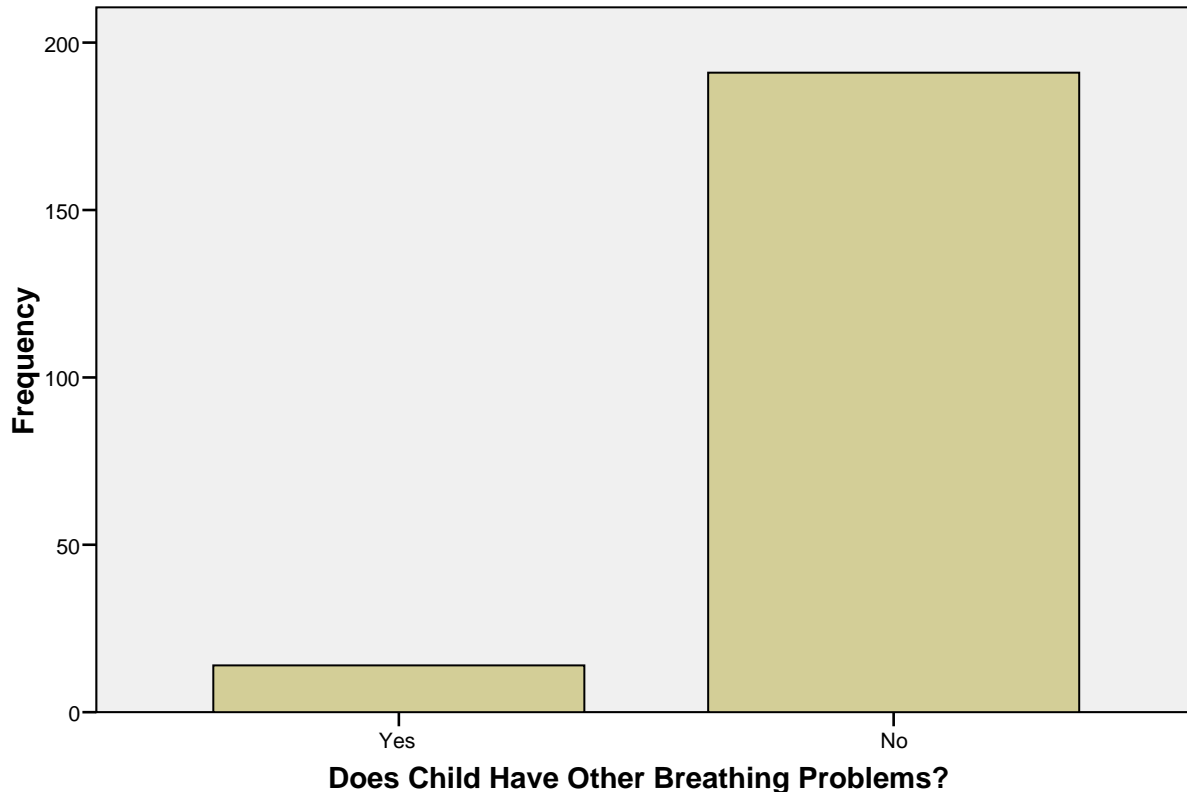
Part II: Outcome Evaluation for Participants who have Completed the HHR AT HOME Program --Statistical Analysis

Analysis was based on 116 valid cases that have had the intervention (and have all necessary data points for statistical comparison) and on 36 valid cases that have had a 6-month follow-up evaluation. We employed SPSS 15.0 for statistical tests. The paired t test was used to examine within-group baseline-to-exit changes in the major evaluation outcome variables of Scores on the Knowledge, Attitudes and Beliefs Questionnaire (KAB), Lost School Days, Rescue Medication Usage and Symptom Days. There have been inadequate pre-intervention Emergency Room Visits to do comparison work.

 Research Question # 1, Is there significant improvement in caretaker performance on the Knowledge, Attitudes and Beliefs (KAB) questionnaire post intervention compared to baseline intake measurements? And has any treatment effect been persistent through the 6 month follow-

Under a number of theories of health and program evaluation mechanics basic knowledge, attitudes and beliefs regarding a subject are an important predictor of behavior change. We developed a questionnaire to measure caretakers KAB concerning asthma and their ability to care for their children. We believe that the educational and physical intervention should increase caregiver KAB scores on this test and that that an increase in the KAB score of the caretaker will indicate behavior change concerning cleaning techniques, home health care and adherence to drug regimens. If there is any behavioral benefit to the intervention, we would expect an increasing trend in the KAB score; conversely, if the KAB score shows a descending trend, we would deduce that the intervention is not effective. The mean of the KAB2 (after intervention score) questionnaire has increased 19.9 points over the KAB1 (baseline before-intervention score). Figure 11 shows the distribution of KAB scores pre intervention and Figure 12 the distribution of KAB scores post intervention; notice the shift of scores positively. The mean of the 6 month KAB score shows enhancement of effect and is approximately 23.3 points over the KAB1 (baseline before-intervention score)

To test the hypothesis that the program caused a significant increase in KAB scores, we used the paired-t test to determine if there is a difference between the pre and post intervention KAB scores. The null hypothesis is stated as: KAB1-KAB2==0 and the alternative hypothesis is: KAB1 - KAB2! =0 (! = indicates not equal to). 116 valid cases completed the intervention and finished the second KAB survey. The statistics and test are shown in Table 14 below.

The t-statistic with 115 degree of freedom is –5.6, and the p-value is < .0001. We than conclude that the KAB of caretakers have significantly improved after the intervention. The 95% confidence interval of the improvement in KAB score is 12.8 <=X<= 26.8.

To test the hypothesis that the program has had a persistent significant increase in KAB scores at 6-month follow-up, we used the paired-t test to determine if there is a difference between the pre and 6 month KAB scores. The null hypothesis is stated as: KAB1-KAB (6 months) ==0 and the alternative hypothesis is: KAB1 – KAB (6 months)! =0 (! = indicates not equal to). 36 valid cases completed the 6-month KAB questionnaire. The statistics and test are shown in the second row in Table 14 below.

The t-statistic with 35 degree of freedom is –2.3, and the p-value is .006. We than conclude that the KAB of caretakers has persisted following the post-intervention follow-up and indeed their appears to be an enhanced effect at the 6 month follow-up. It is quite important to evaluate the entire sample for this effect to insure that the statistics based on the remaining cases continue to show the same effect. The 95% confidence interval of the improvement in KAB score at 6 months compared to pre-treatment is 7.3 <=X<= 39.4.

Table 14, Paired t-test; Improvement in KAB Scores
Paired Samples Statistics

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Total Knowledge/Attitudes /Beliefs Questionnaire 1, Month 0	273.72	36	38.701	6.450
	Knowledge/Attitudes /Beliefs Questionnaire 3, 6 Months	297.06	36	39.197	6.533
Pair 2	Total Knowledge/Attitudes /Beliefs Questionnaire 1, Month 0	275.51	116	37.962	3.525
	Knowledge/Attitudes /Beliefs Questionnaire 2, Postremediation	295.33	116	30.841	2.864

Paired Samples Test

|		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Upper	Lower			
Pair 1	Total Knowledge/Attitudes /Beliefs Questionnaire 1, Month 0 - Knowledge/Attitudes /Beliefs Questionnaire 3, 6 Months	-23.333	47.385	7.897	-39.366	-7.301	-2.955	35	.006
Pair 2	Total Knowledge/Attitudes /Beliefs Questionnaire 1, Month 0 - Knowledge/Attitudes /Beliefs Questionnaire 2, Postremediation	-19.819	38.159	3.543	-26.837	-12.801	-5.594	115	.000

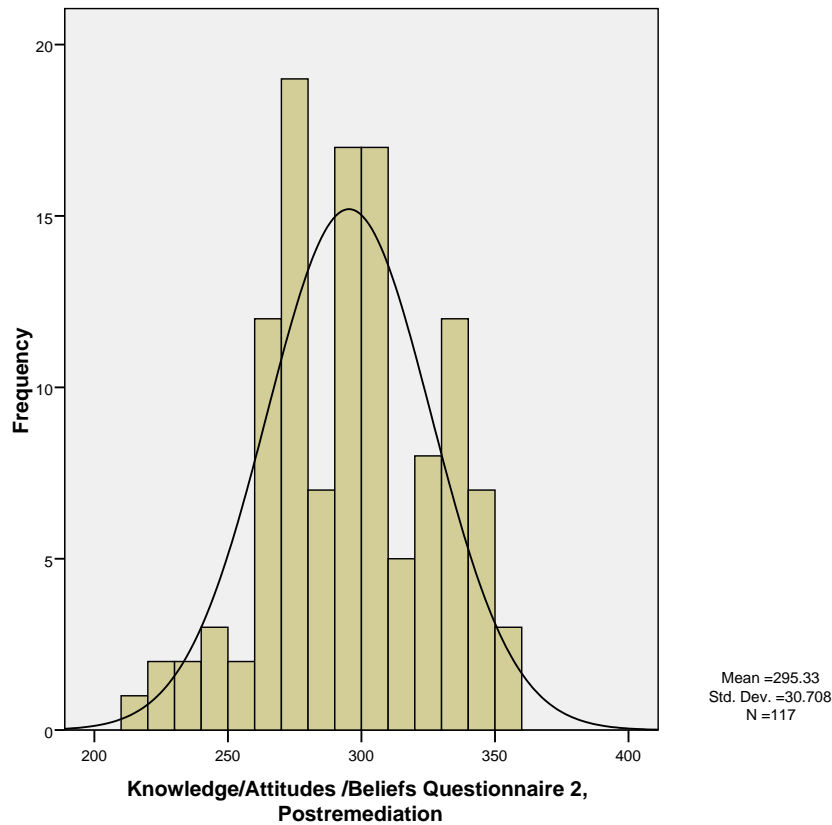# Figure 11, Distribution of KAB Scores Pre-Intervention

Mean =276.99
Std. Dev. =36.096
N =218

Total Knowledge/Attitudes /Beliefs Questionnaire 1, Month 0
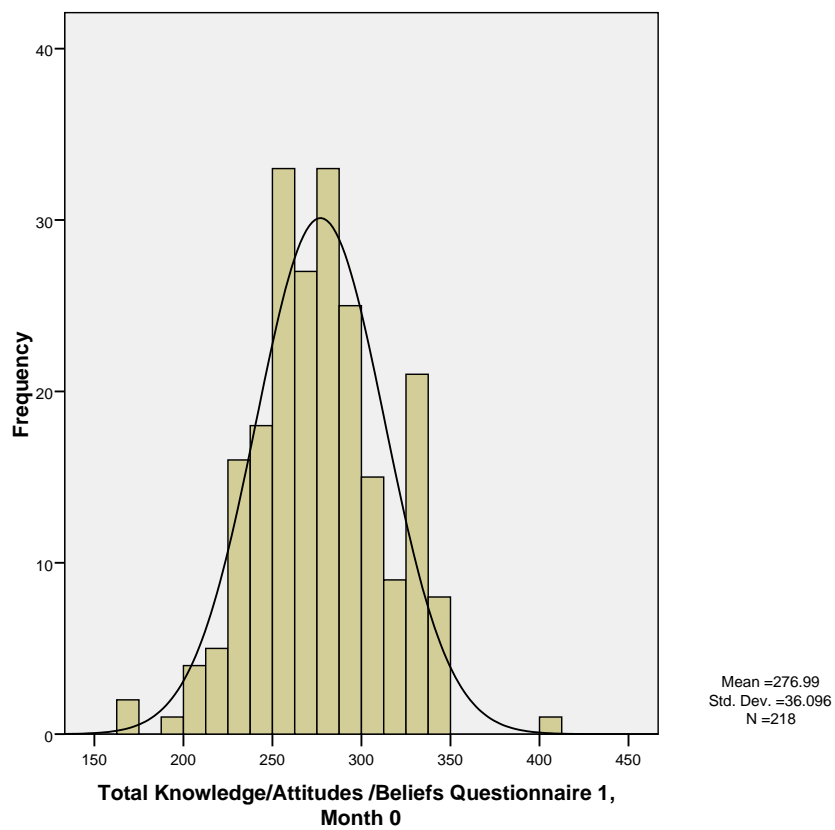
Figure 12, Distribution of KAB Scores Post-Remediation

Mean =295.33
Std. Dev. =30.708
N =117

Lost School Days

A major outcome indicator of the study is lost school days. We would expect that an effective program would lead to a decrease in lost school days. To test the hypothesis that the program significantly decreased lost school days we used the paired t- test to examine within group paired differences 2 weeks before visit 1 and at program conclusion (visit 4), we also compared LSD2 weeks before visit 1 to those at 6 month follow-up. Lost school days were reported over the last two-week period, and since there are 10 school days in that period the reported days were all transformed into rate data by dividing by 10. We will use alpha= .05 and do a two-tailed test.

a. Comparison 2 weeks before visit 1 and at program conclusion (visit 4).

Ho; Mean of LSD (Visit 1-4) Paired Differences = 0
Ha; Mean of LSD (Visit 1-4) Paired Differences != 0   (!= indicates not equal too)

Table 15 presents means, paired difference means, t statistic and 2 tailed significance.

The mean of the difference of LSD rates is .01 equating to an improvement of 0.1 days per 2-week period. This difference is not significant at the p= .05 level, the achieved p value was p=0.49.

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b. Comparison 2 weeks before visit 1 and 6 months following program conclusion (visit 5).

Ho; Mean of LSD (Visit 1-5) Paired Differences = 0
Ha; Mean of LSD (Visit 1-5) Paired Differences != 0   (!= indicates not equal too)

Table 15 presents means, paired difference means, t statistic and 2 tailed significance.

The mean of the difference of LSD rates is .05 equating to an improvement of .50 days per 2-week period. This difference though is NOT significant at the p= .05 level, the achieved p value was p=.155. The achieved p value for the 6 month follow-up group has decreased dramatically from over post intervention score. Further follow-up of the entire group over the complete 6 months post intervention is recommended-this could indeed clarify this improving trend and stabilize for summer irregularities.

The variable of LSD is not like the other outcome indicators since the school year varies seasonally and for holidays. Further analysis shows that some participants entered the program during the summer, when LSD is not a meaningful question- they than exited the program during the school during the height of the heating season. The evaluators have determined that the full 6 month follow-up data set needs to be in place before a systematic review of this variable is performed.

Table 15, Lost School Days, Paired Sample t-test Results

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	ratlsd1	.0441	93	.10158	.01053
	Ratlsd4	.0333	93	.10868	.01127
Pair 2	ratlsd1	.0588	17	.14168	.03436
	ratlsd5	.0059	17	.02425	.00588

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper	Lower			
Pair 1	ratlsd1 – ratlsd4	.01075	.15070	.01563	-.02028	.04179	.688	92	.493
Pair 2	ratlsd1 - ratlsd5	.05294	.14628	.03548	-.02227	.12815	1.492	16	.155

Rescue Medication Usage

In a successful intervention with a good educational component and a decrease in airborne asthma triggers from cleaning operations we would expect to see a decrease in rescue medication usage. Rescue medication usage was determined in the 2-week period before first interview (pre-intervention), in the 2 week period following program completion, and for the 2-week period before the 1st visit and 6 month follow-up. Caretakers reported whether rescue medication was used in each day of the 14 day period; raw data were transformed into rates by dividing the number of days that rescue medication were used by 14.

a. Comparison 2-week period before first interview (pre-intervention) and following program completion.
To test the hypothesis that the program significantly decreased rescue medication usage (RES) we used the paired t- test to examine within group paired differences before and after intervention. We will use alpha= .05 and do a two-tailed test.

Ho; Mean of RES (visit 1-visit 4) Paired Differences = 0
Ha; Mean of RES (visit 1-visit 4) Paired Differences != 0   (!= indicates not equal too)

Table 16 presents means, paired difference means, t statistic and 2 tailed significance.

The ratio of paired differences of RES (visit 1-visit 4) improved with a mean of .12; this translates into a decrease of 1.68 days of rescue medication usage over the 14-day period. The t-statistic for the test is 3.40 and with 108 degrees of freedom gave a p value of .001. This result means that there continues to be a significant difference between pre and post intervention rescue medication rates. The 95% Confidence Interval for the mean of the difference is between .05 and .19 which translates into 0.70 days<=X<= 2.66 days. Stated in statistical term the true decrease in rescue medication usage days can be said to lie between 0.70 days and 2.66 days with 95% confidence.

b. Comparison 2-week period before 1st visit (pre-intervention) and 6 months following program completion.

To test the hypothesis that the program significantly decreased rescue medication usage days (RES) pre-intervention versus 6 months follow-up and to examine the persistence of effect we used the paired t- test to examine within group paired differences. We will use alpha= .05 and do a two-tailed test.

Ho; Mean of RES (visit 1-visit 5) Paired Differences = 0
Ha; Mean of RES (visit 1-visit 5) Paired Differences != 0   (!= indicates not equal too)

Table 16 presents means, paired difference means, t statistic and 2 tailed significance.

The ratio of paired differences of RES (visit 1-visit 5) improved with a mean of 0.16; this translates into a decrease of 2.24 days of rescue medication usage over the 14-day period. The t-statistic for the test is 2.10 and with 24 degrees of freedom gave a p value of .047. This result means that there is a significant difference between pre-intervention 1st visit and 6-month post

intervention rescue medication rates. The 95% Confidence Interval for the mean of the difference is between .003 and .317 which translates into 0.042 days<=X<= 4.48 days. Stated in statistical term the true mean decrease in rescue medication usage days can be said to lie between 0.042 days and 4.48 days with 95% confidence. These results indicate a persistence of effect and perhaps even an enhancement of effect of the intervention, 6 months post program completion.

Table 16

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	rres1	.3100	109	.38123	.03651
	rares4	.1874	109	.30519	.02923
Pair 2	rres1	.3143	25	.38465	.07693
	rares5	.1543	25	.25395	.05079

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Upper	Lower			
Pair 1	rres1 - rares4	.12254	.37471	.03589	.05140	.19368	3.414	108	.001
Pair 2	rres1 - rares5	.16000	.38148	.07630	.00253	.31747	2.097	24	.047

Symptom Days – (SYM) The number of days in the 2-weeks previous to being given the asthma severity questionnaire.

As with RES, a successful intervention with a good educational component stressing adherence to maintenance medication and a decrease in airborne environmental asthma triggers from cleaning operations we would expect to see a decrease in symptom days. Symptom day data were compared in the 2-week period before first interview (pre-intervention) and following program completion (post-intervention) and in the 2-week period before the 1st visit (pre-intervention) and at 6 months following program completion Raw symptom day data were transformed into rates by dividing the number of symptom days reported by 14.

a. Comparison the 2-week period before first interview (pre-intervention) and following program completion (post-intervention, visit 4).

To test the hypothesis that the program significantly decreased SYM we used the paired t- test to examine within group paired differences before (visit 1) and after intervention (visit 4). We will use alpha= .05 and do a two-tailed test.

Ho; Mean of SYM (Visits 1-4) Paired Differences = 0
Ha; Mean of SYM (Visits 1-4) Paired Differences != 0   (!= indicates not equal too)

Table 17 presents means, paired difference means, t statistic and 2 tailed significance for the Difference in SYM (Visits 1-4).

The ratio of paired differences of SYM improved with a mean of 0.18; this translates into a decrease of 2.52 days of SYM over the 14-day period. The t-statistic for the test was 4.01 and with 109 degrees of freedom gave a p value of <.0001. We thus conclude that the alternate hypothesis is correct that the mean of the differences is not equal to 0. The 95% Confidence Internal of the difference is 0.09 <=X<= 0.27 this means that we have a 95% probability that the true improvement in symptom days is between 1.26 and 3.78.

b. Comparison the 2-week period before the 1st visit (pre-intervention) and 6 months following program completion (post-intervention, visit 5).

To test the hypothesis that the program significantly persisted in its effect of decreasing SYM we used the paired t- test to examine within group paired differences before (visit 1) and 6 months after intervention (visit 5). We will use alpha= .05 and do a two-tailed test.

Ho; Mean of SYM (Visits 2-5) Paired Differences = 0
Ha; Mean of SYM (Visits 2-5) Paired Differences != 0   (!= indicates not equal too)

Table 17 presents means, paired difference means, t statistic and 2 tailed significance for the Difference in SYM (Visits 1-5) in the 2nd row pair.

The ratio of paired differences of SYM (Visits 1-5) improved with a mean of 0.24; this translates into a decrease of 3.36 days of SYM over the 14-day period. The t-statistic for the test was 2.27 and with 24 degrees of freedom gave a p value of .032. We thus conclude that the alternate hypothesis is correct that the mean of the differences is not equal to 0. The 95% Confidence Internal of the difference is .021 <=X<= 0.458 this means that we have a 95% probability that the true improvement in symptom days is between 0.29 and 6.4 days. This indicates a persistence of effect of the program.

Table 17, Paired Samples Statistics and t-tests- SYM

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	rasym1	.3870	110	.41721	.03978
	rasym4	.2039	110	.29088	.02773
Pair 2	rasym1	.3829	25	.53646	.10729
	rasym5	.1429	25	.19233	.03847

Paired Samples Test

		Paired Differences							df	Sig. (2-ta
					95% Confidence Interval of the Difference					
		Mean	Std. Deviation	Std. Error Mean	Upper	Lower	t	Std. Deviation		
Pair 1	rasym1 - rasym4	.18312	.48072	.04583	.09227	.27396	3.995	109	.000	
Pair 2	rasym1 - rasym5	.24000	.52847	.10569	.02186	.45814	2.271	24	.032	