
Heat-Related Impacts of the Healthy Homes Pilot Program in Maricopa County: 2021, 2022, 2023, & 2024

Report prepared by
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Arizona Public Service (APS)

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2021 - 2024 Project Partners:



Additional 2024 Project Partner:



Additional 2021 Project Partners:



Introduction

This report summarizes results from an on-going, independent evaluation of a Healthy Homes Pilot Program delivered in Maricopa County, Arizona. This Healthy Homes Pilot Program is exclusively an emergency HVAC repair/replacement program provided to eligible households in Maricopa County by the Foundation for Senior Living (FSL). The 2021 cooling season pilot program was funded by Arizona Public Service (APS), PhoenixIDA, and Phoenix Community Development & Investment Corporation (CDIC)—the 2022, 2023 and 2024 cooling season pilots were funded by APS. Additional funding for 2024 was provided by Salt River Project (SRP). All recipients of the emergency HVAC pilot program were asked to complete a 10–15-minute impact survey both before and after the service ('intervention').

The survey posed questions related to the following themes:

- Respondent demographics
- Home occupancy
- Dwelling comfort and safety
- Select health conditions (i.e., heat stress, asthma, chronic obstructive pulmonary disorder (COPD), and arthritis) and related medical encounters
- General health, mental health, and sleep
- Energy insecurity and affordability

The baseline surveys were administered by FSL pre-intervention (between July through September), and the follow-up surveys were administered in October or November; in each of the 2021, 2022, 2023, and 2024 seasons. Across all cooling season samples, 217 respondents completed the baseline survey; 175 of those completed the follow-up survey.

Data analysis was conducted using the Statistical Package for Social Sciences (SPSS) software. The study team conducted frequencies, crosstabulations, and tests of statistical significance using the McNemars Test, Wilcoxon Signed Rank Test, and Paired-Samples t-Test when appropriate. Three³, Inc., a non-profit research organization located in Tennessee, provides technical support to FSL with survey design, data analysis and dissemination of results.¹

In this report, observed outcomes and impacts of the Healthy Homes Pilot Program are presented in three ways within each subsection to capture differences between the 2021, 2022, 2023 and 2024 cooling seasons and with all years combined for aggregate findings.

¹ <http://www.threecubed.org/>

Results

1. Respondent Demographics

The total number of respondents that completed both the baseline and follow up survey was 175; 39 in the 2021 sample, 18 in the 2022 sample, 37 in the 2023 sample, and 81 in the 2024 sample.

Cooling Season 2021

Including all respondents that completed both surveys in 2021, the average age was 68 (ranging from 32 to 95) with the majority identifying as female (77%). Seventy percent identified as White, 19% as Hispanic or Latino origin, and 9% as Black or African American. Ten percent had served on active duty in the military at some point in time. (Table 1)

Cooling Season 2022

A total of 34 households completed the baseline survey in 2022. Including all respondents that completed both surveys in 2022 (n=18), the average age was 63 with over 70% of the sample identifying as female and White. Twenty two percent identified as being of Hispanic or Latino origin, and 11% as Black or African American. No households in the 2022 sample that completed both surveys reported someone having been on active duty in the military at some point in time (Table 1).

Cooling Season 2023

A total of 42 households completed the baseline survey in 2023. Including all respondents that completed both surveys in 2023 (n=37), the average age was 68 with over 65% of the sample identifying as female and 74% identifying as White. Nineteen percent identified as being of Hispanic or Latino origin, and 16% as Black or African American. Sixteen percent serve or had served on active duty in the military at some point in time (Table 1).

Cooling Season 2024

A total of 89 households completed the baseline survey in 2024. Including all respondents that completed both surveys in 2024 (n=81), the average age was 62 with 62% of the sample identifying as female and 79% identifying as White. One third of the sample identified as being of Hispanic or Latino origin (higher than any other program year), and 15% as Black or African American. Fifteen percent serve or had served on active duty in the military at some point in time (Table 1).

Cooling Seasons 2021, 2022, 2023, and 2024 Combined

Participant demographics were analyzed for all individuals who completed the baseline survey in either 2021, 2022, 2023, or 2024. The percentage of individuals who identified as Hispanic or Latino increased during the 2024 program year contributing to a total of 30% across all program years. The program consistently assists households with people in their 60s.

Table 1. Demographics of Aggregated (Full) Sample

Demographic	2021 Paired Sample (n=39)	2022 Paired Sample (n=18)	2023 Paired Sample (n=37)	2024 Paired Sample (n= 80-81)	Paired Sample All years Combined (n=172-175)	Full Sample All years Combined (n=213-216)
Age (mean)	67	62	68	62	64	64
Female*	80%	72%	65%	62%	68%	67%
White or Caucasian	70%	71%	73%	79%	74%	72%
Hispanic or Latino/a	18%	22%	19%	33%	27%	30%
Black or African American	8%	11%	16%	15%	13%	13%
American Indian or Alaska Native	3%	-	-	4%	2%	2%
Asian or Asian American	3%	-	-	1%	1%	2%
Native Hawaiian or other Pacific Islander	-	6%	-	1%	1%	1%
Prefer not to answer	3%	-	3%	4%	3%	3%
Other (Israeli, Portuguese and Mexican)	-	-	-	1%	1%	1%
Served in the U.S. Armed Forces, Reserves, or National Guard	13%	-	16%	15%	13%	11%

*32% reported being male and <1% reported being transgender

2. Home Occupancy

At baseline, the majority of households (80% of the 2021 sample, 67% of the 2022, 77% of the 2023 sample, and 70% in 2024) reported being inside their homes most of the day. Across the pooled sample for both cooling seasons, the percentage of households reported being away from their home reduced by 5%. It should be noted that the COVID-19 pandemic likely impacted the amount of time people spent inside their homes during 2021 (Table 2-6).

Table 2. Home Occupancy Behavior 2021

Survey Question/Paired Samples (n=39)	Pre- Intervention	Post- Intervention	Change (+/-)	(p-value) ¹
<i>Over the past 30 days, did you spend more time...?</i>				
Inside your home during the day	80%	80%	0%	(1.000)
Away from your home during the day	15%	5%	-10%	(.219)
Equal amounts of time at home and away during the day	5%	15%	10%	(.289)

¹ Change (+/-) was found to be statistically significant at the * p< .05, ** p<.01, or *** p< .001 level in a McNemars Test or Wilkoxon Signed Rank Test comparing pre-/post- intervention responses between paired samples (same respondent).

Table 3. Home Occupancy Behavior 2022

Survey Question/Paired Samples (n=18)	Pre- Intervention	Post- Intervention	Change (+/-)	(p-value) ¹
<i>Over the past 30 days, did you spend more time...?</i>				
Inside your home during the day	67%	56%	-11%	(.625)
Away from your home during the day	6%	11%	5%	(1.000)
Equal amounts of time at home and away during the day	27%	33%	6%	(1.000)

¹ Change (+/-) was found to be statistically significant at the * p< .05, ** p<.01, or *** p< .001 level in a McNemars Test or Wilkoxon Signed Rank Test comparing pre-/post- intervention responses between paired samples (same respondent).

Table 4. Home Occupancy Behavior 2023

Survey Question/Paired Samples (n=35)	Pre- Intervention	Post- Intervention	Change (+/-)	(p-value) ¹
<i>Over the past 30 days, did you spend more time...?</i>				
Inside your home during the day	77%	91%	14%	(.180)
Away from your home during the day	11%	0%	-11%	(.125)
Equal amounts of time at home and away during the day	11%	9%	-2%	(1.000)

¹ Change (+/-) was found to be statistically significant at the * p< .05, ** p<.01, or *** p< .001 level in a McNemars Test or Wilkoxon Signed Rank Test comparing pre-/post- intervention responses between paired samples (same respondent).

Table 5. Home Occupancy Behavior 2024

Survey Question/Paired Samples (n=78-80)	Pre- Intervention	Post- Intervention	Change (+/-)	(p-value) ¹
<i>Over the past 30 days, did you spend more time...?</i>				
Inside your home during the day (N=80)	70%	81%	+11%	(.096)
Away from your home during the day (N=78)	8%	3%	-5%	(.125)
Equal amounts of time at home and away during the day (N=78)	19%	14%	-5%	(.454)

¹ Change (+/-) was found to be statistically significant at the * p< .05, ** p<.01, or *** p< .001 level in a McNemars Test or Wilkoxon Signed Rank Test comparing pre-/post- intervention responses between paired samples (same respondent).

Table 6. Home Occupancy Behavior 2021, 2022, 2023, & 2024 Combined

Survey Question/Paired Samples (n=170-185)	Pre-Intervention	Post-Intervention	Change (+/-)	(p-value) ¹
<i>Over the past 30 days, did you spend more time...?</i>				
Inside your home during the day (N=170)	76%	81%	+5%	(.211)
Away from your home during the day (N=170)	9%	4%	-5%	(.021)
Equal amounts of time at home and away during the day (N=170)	15%	15%	-	(1.000)

¹ Change (+/-) was found to be statistically significant at the * p< .05, ** p<.01, or *** p< .001 level in a McNemars Test or Wilcoxon Signed Rank Test comparing pre-/post- intervention responses between paired samples (same respondent).

3. Dwelling Comfort and Safety

One hundred percent of recipients in the 2021 and 2022 reported that their homes were at ‘comfortable’ indoor temperatures during the summer post-intervention; 94% and 98% of the 2023 and 2024 samples reported being comfortable post-intervention (Tables 7-11). Of those households that completed both surveys, 69% of the 2021 sample, 89% of the 2022, and 82% of the 2023 sample. During the summer of 2024, 94% of respondents reported being hot or very hot inside their home pre-intervention – the highest percentage for any program year. Differences from pre- to post-intervention were found to be statistically significant across all samples and with samples combined. Post-intervention reports of unsafe or unhealthy temperatures significantly decreased by 70% in the combined sample with no households reporting being at these temperatures after the intervention. Frequency of temporary relocation due to heat dropped – significantly – from 21% to 2% in the combined samples.

Table 7. Dwelling Comfort and Safety 2021

Survey Question/Paired Samples (n=39)	Pre-Intervention	Post-Intervention	Change (+/-)	(p-value) ¹
<i>Over the past 30 days...</i>				
<i>Which of the following describes the indoor temperature of your home? (% Yes)</i>				
Comfortable	31%	100%	+69%	***(<.001)
Hot	46%	0%	-46%	***(<.001)
Very hot	23%	0%	-23%	***(<.001)
<i>Has your home been at a temperature that you felt was unsafe or unhealthy? (% Yes)</i>	47%	0%	-47%	***(<.001)
<i>Did you have to temporarily move out of your home because your home was too hot? (% Yes)</i>	18%	0%	-18%	** (0.008)

¹ Change (+/-) was found to be statistically significant at the * p< .05, ** p<.01, or *** p< .001 level in a McNemars Test or Wilcoxon Signed Rank Test comparing pre-/post- intervention responses between paired samples (same respondent).

Table 8. Dwelling Comfort and Safety 2022

Survey Question/Paired Samples (n=17)	Pre-Intervention	Post-Intervention	Change (+/-)	(p-value) ¹
Over the past 30 days...				
<i>Which of the following describes the indoor temperature of your home? (% Yes)</i>				
Comfortable	11%	100%	+89%	***(<.001)
Hot	56%	0%	-56%	***(<.001)
Very hot	33%	0%	-33%	***(<.001)
<i>Has your home been at a temperature that you felt was unsafe or unhealthy? (% Yes)</i>	56%	0%	-56%	**(<.004)
<i>Did you have to temporarily move out of your home because your home was too hot? (% Yes)</i>	12%	0%	-12%	(0.500)

Table 9. Dwelling Comfort and Safety 2023

Survey Question/Paired Samples (n=17)	Pre-Intervention	Post-Intervention	Change (+/-)	(p-value) ¹
Over the past 30 days...				
<i>Which of the following describes the indoor temperature of your home? (% Yes)</i>				
Comfortable	17%	94%	+77%	***(<.001)
Hot	31%	3%	-28%	**(<.006)
Very hot	51%	3%	-48%	***(<.001)
<i>Has your home been at a temperature that you felt was unsafe or unhealthy? (% Yes)</i>	77%	0%	-77%	***(<.001)
<i>Did you have to temporarily move out of your home because your home was too hot? (% Yes)</i>	25%	6%	-19%	(.065)

Table 10. Dwelling Comfort and Safety 2024

Survey Question/Paired Samples (n=80)	Pre-Intervention	Post-Intervention	Change (+/-)	(p-value) ¹
Over the past 30 days...				
<i>Which of the following describes the indoor temperature of your home? (% Yes)</i>				
Comfortable	6%	98%	+92%	***(<.001)
Hot	51%	3%	-48%	**(<.001)
Very hot	43%	0%	-43%	***(<.001)
<i>Has your home been at a temperature that you felt was unsafe or unhealthy? (% Yes)</i> (N=75)	79%	0%	-79%	***(<.001)

<i>Did you have to temporarily move out of your home because your home was too hot? (% Yes)</i> (N=79)	24%	3%	-21%	***(<.001)
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Table 11. Dwelling Comfort and Safety 2021, 2022, 2023, & 2024 Combined

Survey Question/Paired Samples (n=171-173)	Pre- Intervention	Post- Intervention	Change (+/-)	(p-value) ¹
Over the past 30 days...				
<i>Which of the following describes the indoor temperature of your home? (% Yes) (N=173)</i>				
Comfortable	14%	98%	+74%	***(<.001)
Hot	46%	2%	-44%	***(<.001)
Very hot	41%	1%	-39%	***(<.001)
<i>Has your home been at a temperature that you felt was unsafe or unhealthy? (% Yes)</i> (N=155)	70%	0%	-70%	***(<.001)
<i>Did you have to temporarily move out of your home because your home was too hot? (% Yes)</i>	21%	2%	-19%	***(<.001)

An overwhelming majority of households reported that there were times inside their home that they could not get enough rest or sleep because their homes were too hot pre-intervention – 84% across all samples (Table 12).

Table 12. Impacts of Heat on Sleep 2021, 2022, 2023, & 2024

Survey Question/Full Samples	2021 (n=51)	2022 (n=33)	2023 (n=42)	2024 (n=87)	2021, 2022, 2023 + 2024 Combined (n=213)
<i>Was there ever a time living in this home that you did not get enough rest or sleep because it was too hot inside? (% Yes)</i>	77%	88%	86%	85%	84%

4. Heat Stress – Medical Encounters

Pre-intervention, responses from each of the summer samples indicated that several people needed to seek medical treatment because their home was too hot. The emergency department was the most common care setting people went to for treatment. Post-intervention, there was only one report of a medical encounter due to exposure to hot indoor temperatures. (Tables 13-14).

Table 13. Heat Stress – Medical Encounters 2021

Survey Question/Paired Samples (n=39)	Pre- Intervention	Post- Intervention	Change (+/-)
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Over the past 30 days...			
<i>Has anyone in the household had to seek medical treatment because your home was too HOT? (# Yes)</i>	3	0	-3
<i>If yes, [to seeking medical treatment because home was too hot] which care setting? (Full sample; N=52)</i>	Pre-Intervention	Post-Intervention	Change (+/-)
Office Visit	2	0	-2
Emergency Department (ED)	1	0	-1
Hospital	2	0	-2
Other	1	0	-1

Table 14. Heat Stress – Medical Encounters 2022

Survey Question/Paired Samples (n=18)	Pre-Intervention	Post-Intervention	Change (+/-)
Over the past 30 days...			
<i>Has anyone in the household had to seek medical treatment because your home was too HOT? (# Yes)</i>	5	0	0
<i>If yes, [to seeking medical treatment because home was too hot] which care setting? (Full sample; N=34)</i>	Pre-Intervention	Post-Intervention	Change (+/-)
Office Visit	3	0	-3
Emergency Department (ED)	1	0	-1
Hospital	0	0	-
Other	1	0	-1

Table 15. Heat Stress – Medical Encounters 2023

Survey Question/Paired Samples (n=37)	Pre-Intervention	Post-Intervention	Change (+/-)
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Over the past 30 days...			
<i>Has anyone in the household had to seek medical treatment because your home was too HOT? (# Yes)</i>	7	1	-6
If yes, [to seeking medical treatment because home was too hot] which care setting? (Full sample; N=42)	Pre-Intervention	Post-Intervention	Change (+/-)
Office Visit	2	0	-2
Emergency Department (ED)	5	0	-5
Hospital	2	0	-2
Other	3	0	-3

Table 16. Heat Stress – Medical Encounters 2024

Survey Question/Paired Samples (n=81)	Pre-Intervention	Post-Intervention	Change (+/-)
Over the past 30 days...			
<i>Has anyone in the household had to seek medical treatment because your home was too HOT? (# Yes)</i>	15	1	-14
If yes, [to seeking medical treatment because home was too hot] which care setting? (Full sample; N=89)	Pre-Intervention	Post-Intervention	Change (+/-)
Office Visit	9	0	-9
Urgent Care	4	0	-4
Emergency Department (ED)	2	1	-1
Hospital	2	0	-2
Other	1	0	-1

At baseline (pre-intervention), across all samples, 14% of households reported that someone in the home had to seek medical attention because their home was too hot (Table 14). Only 1% of respondents reported someone in the home seeking medical attention because their home was too hot after the intervention. Across all summer samples, post-intervention, there were 40 fewer medical encounters reported from household members being too hot inside their homes.

Table 17. Heat Stress – Medical Encounters 2021, 2022, 2023, & 2024 Combined

Survey Question/Paired Samples (n=169-171)	Pre-Intervention	Post-Intervention	Change (+/-)
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Over the past 30 days...			
<i>Has anyone in the household had to seek medical treatment because your home was too HOT? (# Yes)</i>	39	3	-36
<i>If yes, [to seeking medical treatment because home was too hot] which care setting? (Full sample; N=217)</i>	Pre- Intervention	Post- Intervention	Change (+/-)
Office Visit	16	0	-16
Urgent Care	4	0	-4
Emergency Department (ED)	9	1	-8
Hospital	6	0	-6
Other	6	0	-6

5. Asthma Prevalence and Medical Encounters

Including all respondents from the 2021, 2022, 2023 and 2024 cooling seasons, 38% reported having been diagnosed (at any point in their lives) with asthma – 32% reported that they “still have asthma” (n=69). Reductions in the frequency of individuals experiencing asthma symptoms ‘less than one week ago’ were observed pre- to post-interventions; but not at statistically significant rates. For the matched pair sample for all years combined, only a few medical encounters for asthma were reported making it difficult to detect patterns or impacts on this outcome attributable to the program. It should be noted that for personal illnesses, such as asthma, COPD, and arthritis, best practice is to analyze responses from the same individual (i.e., matched pairs, paired analysis). Seventy-five percent of respondents reported that the person in their home with the worst asthma has symptoms that worsen with increased heat (Tables 18-24).

Table 18. Asthma Prevalence 2021, 2022, 2023, & 2024

Survey Question/Full Samples (n=215)	2021	2022	2023	2024	2021, 2022, 2023, + 2024 Combined
<i>Have you or anyone in the home ever been told by a doctor or health professional that you or they have asthma?</i>	47% (n=24)	29% (n=10)	22% (n=9)	44% (n=39)	38% (n=82)
<i>Do you or they still have asthma?</i>	35% (n=18)	18% (n=6)	20% (n=8)	42% (n=37)	32% (n=69)

Table 19. Asthma Symptoms and Medical Encounters 2021

Survey Question/Paired Samples (n=12)	Pre- Intervention	Post- Intervention	Change (+/-)	(p-value)
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<i>How long has it been since that person [with the worst asthma] last had any symptoms ['flare-ups'] of asthma? (% Yes) (n=12)</i>				
Less than one week	68%	42%	-26%	(.375)
1 week to 3 months	0%	58%	+58%	(1.000)
3 months +	8%	17%	+9%	(1.000)
Over the past 30 days...				
<i>Has that person ever had to go to seek urgent medical treatment because of worsening symptoms of asthma?</i>	10%	0%	-10%	(1.000)
Number of Medical Encounters for Worsening Asthma Symptoms (# of encounters)	(1 'Other' visit)	(1 Urgent Care Visit)	-	-

Table 20. Asthma Symptoms and Medical Encounters 2022

Survey Question/Paired Samples (n=4)	Pre-Intervention	Post-Intervention	Change (+/-)	(p-value)
<i>How long has it been since that person [with the worst asthma] last had any symptoms ['flare-ups'] of asthma?</i>				
Less than one week	25%	0%	-25%	(1.000)
1 week to 3 months	0%	100%	50%	(.500)
3 months +	50%	25%	-25%	(1.000)
Over the past 30 days...				
<i>Has that person ever had to go to seek urgent medical treatment because of worsening symptoms of asthma?</i>	33%	67%	34%	(1.000)
Number of Medical Encounters for Worsening Asthma Symptoms (# of encounters)	(1 ED Visit)	(1 ED visit; 1 Urgent Care Visit)	+1	-

Table 21. Asthma Symptoms and Medical Encounters 2023

Survey Question/Paired Samples (n=3)	Pre-Intervention	Post-Intervention	Change (+/-)	(p-value)
<i>How long has it been since that person [with the worst asthma] last had any symptoms ['flare-ups'] of asthma?</i>				
Less than one week	33%	0%	-33%	(1.000)
1 week to 3 months	0%	33%	+33%	(.500)
3 months +	67%	33%	-33%	(1.000)
Over the past 30 days...				
<i>Has that person ever had to go to seek urgent medical treatment because of worsening symptoms of asthma?</i>	17%	0%	-17%	(1.000)
Number of Medical Encounters for Worsening Asthma Symptoms (# of encounters)	(1 ED Visit)	-	-1	(1.000)

Table 22. Asthma Symptoms and Medical Encounters 2024

Survey Question/Paired Samples (n=29)	Pre-Intervention	Post-Intervention	Change (+/-)	(p-value)
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<i>How long has it been since that person [with the worst asthma] last had any symptoms [‘flare-ups’] of asthma?</i>				
Less than one week	41%	14%	-27%	(.021)
1 week to 3 months	38%	38%	-	(.543)
3 months +	21%	48%	-27%	(.021)
<i>Has that person ever had to go to seek urgent medical treatment because of worsening symptoms of asthma? (n=</i>	32%	7%	-25%	(.039)
Number of Medical Encounters for Worsening Asthma Symptoms (# of encounters)	(4 Urgent Care, 4 ED, 1 Hospital)	(3 Urgent Care, 1 ED, 1 Hospital)	-4	-

Table 23. Asthma Symptoms and Medical Encounters 2021, 2022, 2023, and 2024

Survey Question/Paired Samples (n=19)	Pre-Intervention	Post-Intervention	Change (+/-)	(p-value)
<i>How long has it been since that person [with the worst asthma] last had any symptoms [‘flare-ups’] of asthma?</i>				
Less than one week	53%	26%	-25%	(.125)
1 week to 3 months	0%	50%	25%	(.219)
3 months +	19%	19%	9%	(1.000)
Over the past 30 days...				
<i>Has that person ever had to go to seek urgent medical treatment because of worsening symptoms of asthma? (n=16)</i>	16%	11%	-5%	(1.000)
Number of Medical Encounters for Worsening Asthma Symptoms (# of encounters)	(4 Urgent Care, 6 ED, 1 Hospital, and 1 Other Visit)	(5 Urgent Care, 2 ED visit, 1 Hospital)	-4	-

Table 24. Asthma Symptoms Worsen with Heat 2021, 2022, 2023, and 2024

Survey Question/Full Samples (n=66)	2021	2022	2023	2024	2021, 2022, 2023 + 2024 Combined
Does that person’s symptoms of asthma seem to worsen when they are hot?	81%	75%	75%	88%	83%

6. COPD+ Prevalence and Medical Encounters

Twenty-five percent of respondents reported they or someone else in the home had been diagnosed (at any point in their lives) with COPD, emphysema, or chronic bronchitis. An overwhelming majority (87%) stated that their or the other person’s symptoms of respiratory illness worsen with increased heat. Although not statistically significant, the number of was medical encounters for symptoms related to shortness of breath, bronchitis or COPD was

reduced from 30% to 10% post-intervention – for all cooling season samples combined (Tables 25-31).

Table 25. COPD+ Prevalence 2021, 2022, 2023 and 2024

Survey Question/Full Samples (n=128)	2021	2022	2023	2024	2021, 2022, 2023 + 2024 Combined
<i>Have you or anyone in the home ever been told by a doctor or health professional that you have COPD, emphysema, or chronic bronchitis?</i>	28%	17%	17%	28%	22%

Table 26. COPD+ Medical Encounters 2021

Survey Question/Paired Samples (n=8)	Pre-Intervention	Post-Intervention	Change (+/-)	(p-value)
Over the past 30 days...				
<i>Other than a routine visit, has that person ever had to seek medical treatment for symptoms related to shortness of breath, bronchitis, or other COPD or emphysema flare-ups?</i>	13%	25%	+12%	(1.000)

Table 27. COPD+ Medical Encounters 2022

Survey Question/Paired Samples (n=3)	Pre-Intervention	Post-Intervention	Change (+/-)	(p-value)
Over the past 30 days...				
<i>Other than a routine visit, has that person ever had to seek medical treatment for symptoms related to shortness of breath, bronchitis, or other COPD or emphysema flare-ups?</i>	33%	0%	-33%	(1.000)

Table 28. COPD+ Medical Encounters 2023

Survey Question/Paired Samples (n=3)	Pre-Intervention	Post-Intervention	Change (+/-)	(p-value)
Over the past 30 days...				
<i>Other than a routine visit, has that person ever had to seek medical treatment for symptoms related to shortness of breath, bronchitis, or other COPD or emphysema flare-ups?</i>	27%	14%	-13%	(1.000)

Table 29. COPD+ Medical Encounters 2024

Survey Question/Paired Samples (n=16)	Pre-Intervention	Post-Intervention	Change (+/-)	(p-value)
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Over the past 30 days...				
<i>Other than a routine visit, has that person ever had to seek medical treatment for symptoms related to shortness of breath, bronchitis, or other COPD or emphysema flare-ups?</i>	44%	6%	-38%	(.031)

Table 30. COPD+ Medical Encounters 2021, 2022, 2023 and 2024 combined

Survey Question/Paired Samples (n=30)	Pre- Intervention	Post- Intervention	Change (+/-)	(p-value)
Over the past 30 days...				
<i>Other than a routine visit, has that person ever had to seek medical treatment for symptoms related to shortness of breath, bronchitis, or other COPD or emphysema flare-ups?</i>	30%	10%	-20%	(.070)

Table 31. COPD+ Symptoms Worsen When Hot 2021, 2022, 2023 and 2024

Survey Question/Full Samples	2021	2022	2023	2024	2021, 2022, 2023 + 2024 Combined
Does that person's symptoms of respiratory illness seem to worsen when they are hot?	92%	75%	78%	92%	87%

7. Arthritis+ - Prevalence and Medical Encounters

Close to 60% of participating households in the 2021 and 2022 samples, 80% of the 2023 sample, and 68% of the 2024 sample reported that they or someone else in the home has ever been diagnosed with some form of arthritis, rheumatoid or osteoarthritis, gout, lupus, fibromyalgia, or Complex Regional Pain Syndrome (i.e., arthritis+). When asked how long ago the person with arthritis had had symptoms, the frequency in responses reporting symptoms less than one week ago reduced by 11% in the combined sample. A 37% decrease in reports of seeking medical care for worsening arthritis symptoms was reported post-intervention. (Tables 32-31).

Table 32. Arthritis+ - Prevalence and Medical Encounters 2021

Survey Question/Paired Samples (n=25)	Pre- Intervention	Post- Intervention	Change (+/-)	(p-value)
<i>Have you or anyone else in the home ever been told by a doctor or other health professional that you have some form of arthritis, rheumatoid or</i>	65%			

<i>osteoarthritis, gout, lupus, fibromyalgia, or Complex Regional Pain Syndrome? (Full sample, n=52)</i>				
<i>How long has it been since that person last had any symptoms of arthritis? (n=25)</i>				
Less than one week	84%	80%	-4%	(1.000)
1 week to 3 months	8%	8%	0%	No Change
3 months +	8%	12%	4%	(1.000)
Over the past 30 days...				
<i>Did that person see a doctor, nurse, or other health professional for urgent treatment of worsening arthritis symptoms?</i>	50%	4%	-46%	*** ($<.001$)

Table 33. Arthritis+ - Prevalence and Medical Encounters 2022

Survey Question/Paired Samples (n=8)	Pre-Intervention	Post-Intervention	Change (+/-)	(p-value)
<i>Have you or anyone else in the home ever been told by a doctor or other health professional that you have some form of arthritis, rheumatoid or osteoarthritis, gout, lupus, fibromyalgia, or Complex Regional Pain Syndrome? (Full sample, n=32)</i>	50%			
<i>How long has it been since that person last had any symptoms of arthritis? (n=8)</i>				
Less than one week	88%	50%	-23%	(.250)
1 week to 3 months	0%	0%	0%	No Change
3 months +	12%	50%	38%	(.250)
Over the past 30 days...				
<i>Did that person see a doctor, nurse, or other health professional for urgent treatment of worsening arthritis symptoms?</i>	50%	13%	-37%	(0.250)

Table 34. Arthritis+ - Prevalence and Medical Encounters 2023

Survey Question/Paired Samples (n=31)	Pre-Intervention	Post-Intervention	Change (+/-)	(p-value)
<i>Have you or anyone else in the home ever been told by a doctor or other health professional that you have some form of arthritis, rheumatoid or osteoarthritis, gout, lupus, fibromyalgia, or Complex Regional Pain Syndrome? (Full sample, n=42)</i>	80%			

<i>How long has it been since that person last had any symptoms of arthritis? (n=31)</i>				
Less than one week	77%	64%	-13%	(.508)
1 week to 3 months	9%	9%	0%	No Change
3 months +	14%	27%	+13%	(.453)
Over the past 30 days...				
<i>Did that person see a doctor, nurse, or other health professional for urgent treatment of worsening arthritis symptoms?</i>	35%	12%	-23%	(.289)

Table 35. Arthritis+ - Prevalence and Medical Encounters 2024

Survey Question/Paired Samples (n=49)	Pre- Intervention	Post- Intervention	Change (+/-)	(p-value)
<i>Have you or anyone else in the home ever been told by a doctor or other health professional that you have some form of arthritis, rheumatoid or osteoarthritis, gout, lupus, fibromyalgia, or Complex Regional Pain Syndrome? (Full sample, n=57)</i>	68%			
<i>How long has it been since that person last had any symptoms of arthritis? (n=49)</i>				
Less than one week	88%	77%	-11%	(.125)
1 week to 3 months	4%	6%	+2%	(.1000)
3 months +	8%	17%	+9%	(.219)
Over the past 30 days...				
<i>Did that person see a doctor, nurse, or other health professional for urgent treatment of worsening arthritis symptoms? (n=49)</i>	43%	10%	-33%	*** (<.001)

Table 36. Arthritis+ - Prevalence and Medical Encounters 2021, 2022, 2023 and 2024

Survey Question/Paired Samples (n=99)	Pre- Intervention	Post- Intervention	Change (+/-)	(p-value)
<i>Have you or anyone else in the home ever been told by a doctor or other health professional that you have some form of arthritis, rheumatoid or osteoarthritis, gout, lupus, fibromyalgia, or Complex Regional Pain Syndrome? (Full sample, n=136)</i>	67%			
<i>How long has it been since that person last had any symptoms of arthritis? (Paired sample, n=99)</i>				

Less than one week	85%	74%	-11%	(.027)
1 week to 3 months	6%	7%	+1%	(1.000)
3 months +	9%	19%	+10%	(.041)
Over the past 30 days...				
<i>Did that person see a doctor, nurse, or other health professional for urgent treatment of worsening arthritis symptoms? (n=97)</i>	43%	8%	-37%	*** ($<.001$)

When asked if the symptoms of individual with some form of arthritis worsen when they are hot, an overwhelming majority reported that they do (77% for the combined samples).

Table 37. Arthritis+ Symptoms Worsen When Hot 2021, 2022, 2023 and 2024

Survey Question/Full Samples	2021	2022	2023	2024	2021, 2022, 2023 + 2024 Combined
Does that person's symptoms of arthritis seem to worsen when they are hot?	81%	69%	75%	77%	77%

8. Changes in General Sleep, Physical Health, and Mental Health

Post-intervention, improvements in rest and sleep were observed along with statistically significant improvements in mental health. This pattern was observed in each of the 2021, 2022, 2023 and 2024 samples, as well as with all cooling season samples combined. Post-intervention there was a mean increase in about 7 'good' mental health days in the last month for this pooled sample. The mean number of days people reported not getting enough rest or sleep decreased significantly in combined samples: from approximately 17 days to 7 days. A statistically significant decrease (10 days) in the mean number of days poor physical or mental health kept individuals from doing their usual activities, such as self-care, work or recreation, was observed in the combined cooling season samples. (Tables 38-42).

Table 38. General Health, Mental Health, and Sleep 2021

Survey Question/Paired Samples (n=39) (Mean # of Days)	Pre- Intervention (n=39)	Post- Intervention (n=39)	Change (+/-)	(p-value) ¹
<i>During the past 30 days, for about how many days do you feel you did not get enough rest or sleep?</i>	12.5	10.3	-2.2	(0.251)
<i>Thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?</i>	13.3	4.5	-8.8	***($<.001$)

<i>During the past 30 days, for about how many days did poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation?</i>	11.1	7.7	-3.4	(0.169)
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¹ Change (+/-) was found to be statistically significant at the * p< .05, ** p<.01, or *** p< .001 level in a paired-sample t-test.

Table 39. General Health, Mental Health, and Sleep 2022

Survey Question/Paired Samples (n=17)	Pre-Intervention (n=17)	Post-Intervention (n=17)	Change (+/-)	(p-value) ¹
<i>During the past 30 days, for about how many days do you feel you did not get enough rest or sleep?</i>	18.9	2.5	-16.4	***(<.001)
<i>Thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?</i>	13.2	4.1	-9.1	**(.006)
<i>During the past 30 days, for about how many days did poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation?</i>	13.2	7.9	-5.3	(0.111)

¹ Change (+/-) was found to be statistically significant at the * p< .05, ** p<.01, or *** p< .001 level in a paired-sample t-test.

Table 40. General Health, Mental Health, and Sleep 2023

Survey Question/Paired Samples (n=17)	Pre-Intervention (n=30)	Post-Intervention (n=30)	Change (+/-)	(p-value) ¹
<i>During the past 30 days, for about how many days do you feel you did not get enough rest or sleep?</i>	19.4	4.5	-14.9	***(<.001)
<i>Thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?</i>	13.3	5.6	-7.7	**(.007)
<i>During the past 30 days, for about how many days did poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation?</i>	15.7	8.7	-7.0	*(.032)

¹ Change (+/-) was found to be statistically significant at the * p< .05, ** p<.01, or *** p< .001 level in a paired-sample t-test.

Table 41. General Health, Mental Health, and Sleep 2024

Survey Question/Paired Samples (n=77)	Pre-Intervention (n=77)	Post-Intervention (n=77)	Change (+/-)	(p-value) ¹
<i>During the past 30 days, for about how many days do you feel you did not get enough rest or sleep?</i>	16.2	7.0	-9.2	***(<.001)
<i>Thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?</i>	15.3	5.2	-10.1	***(<.001)

<i>During the past 30 days, for about how many days did poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation?</i>	14.6	6.6	-8.0	***(<.001)
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¹ Change (+/-) was found to be statistically significant at the * p< .05, ** p<.01, or *** p< .001 level in a paired-sample t-test.

Table 42. General Health, Mental Health, and Sleep 2021, 2022, 2023, and 2024 Combined

Survey Question/Paired Samples (n=157-161)	Pre-Intervention (n=161)	Post-Intervention (n=161)	Change (+/-)	(p-value) ¹
<i>During the past 30 days, for about how many days do you feel you did not get enough rest or sleep?</i>	16.5	6.8	-9.7	***(<.001)
<i>Thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?</i>	14.6	5.0	-9.6	***(<.001)
<i>During the past 30 days, for about how many days did poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation?</i>	14.0	7.3	-6.7	***(<.001)

¹ Change (+/-) was found to be statistically significant at the * p< .05, ** p<.01, or *** p< .001 level in a paired-sample t-test.

9. Energy Burden

A substantial and highly significant decrease in respondent worry about not having electricity and cooling was observed across the samples. A decrease by 70% was observed for the 2021, 2022, 2023, and 2024 cooling seasons combined. Statistically significant improvements in energy security (better able to afford energy bills) were also reported post-intervention for the combined samples. The percentage of households that reported it being 'very hard' to pay bills decreased post-intervention by 20%. (Tables 43-47).

Table 43. Energy Burden 2021

Survey Question/Paired Samples (n=38)	Pre-Intervention (n=38)	Post-Intervention (n=38)	Change (+/-)	(p-value) ¹
<i>Over the last 30 days, did you worry that your home would not have electricity or cooling?</i>	76%	5%	-71%	***(<.001)
<i>How hard is it to pay for your energy bills?</i>				
Very easy or easy	0%	16%	16%	*(.031)
Neither hard nor easy	32%	50%	18%	*(.016)
Very hard or hard	68%	34%	-34%	***(<.001)

Very hard	32%	0%	-32%	***(<.001)
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¹ Change (+/-) was found to be statistically significant at the * p< .05, ** p<.01, or *** p< .001 level in a McNemars Test or Wilkoxon Signed Rank Test comparing pre-/post- intervention responses between paired samples (same respondent).

Table 44. Energy Burden 2022

Survey Question/Paired Samples (n=18)	Pre- Intervention (n=18)	Post- Intervention (n=18)	Change (+/-)	(p-value) ¹
<i>Over the last 30 days, did you worry that your home would not have electricity or cooling?</i> (n=17)	82%	18%	-64%	***(<.001)
<i>How hard is it to pay for your energy bills?</i>				
Very easy or easy	0%	0%	-	No Change
Neither hard nor easy	22%	33%	11%	(.500)
Very hard or hard	78%	67%	-11%	(.500)
Very hard	44%	17%	-27%	(.125)

¹ Change (+/-) was found to be statistically significant at the * p< .05, ** p<.01, or *** p< .001 level in a McNemars Test or Wilkoxon Signed Rank Test comparing pre-/post- intervention responses between paired samples (same respondent).

Table 45. Energy Burden 2023

Survey Question/Paired Samples (n=34)	Pre- Intervention (n=34)	Post- Intervention (n=34)	Change (+/-)	(p-value) ¹
<i>Over the last 30 days, did you worry that your home would not have electricity or cooling?</i> (n=17)	86%	14%	-72%	***(<.001)
<i>How hard is it to pay for your energy bills?</i>				
Very easy or easy	6%	6%	-	No Change
Neither hard nor easy	27%	27%	-	No Change
Very hard or hard	78%	67%	-11%	(.500)
Very hard	32%	24%	-8%	(.549)

¹ Change (+/-) was found to be statistically significant at the * p< .05, ** p<.01, or *** p< .001 level in a McNemars Test or Wilkoxon Signed Rank Test comparing pre-/post- intervention responses between paired samples (same respondent).

Table 46. Energy Burden 2024

Survey Question/Paired Samples (n=77)	Pre- Intervention (n=77)	Post- Intervention (n=77)	Change (+/-)	(p-value) ¹
<i>Over the last 30 days, did you worry that your home would not have electricity or cooling?</i> (n=77)	82%	12%	-70%	***(<.001)
<i>How hard is it to pay for your energy bills?</i> (n=79)				
Very easy or easy	5%	5%	-	No Change
Neither hard nor easy	15%	17%	+2%	(1.000)
Very hard or hard	80%	79%	-1%	(1.000)

Very hard	37%	23%	-14%	(.027)
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¹ Change (+/-) was found to be statistically significant at the * p< .05, ** p<.01, or *** p< .001 level in a McNemars Test or Wilcoxon Signed Rank Test comparing pre-/post- intervention responses between paired samples (same respondent).

Table 47. Energy Burden 2021, 2022, 2023 and 2024 Combined

Survey Question/Paired Samples (n=166-168)	Pre- Intervention (n=168)	Post- Intervention (n=168)	Change (+/-)	(p-value) ¹
<i>Over the last 30 days, did you worry that your home would not have electricity or cooling? (n=166)</i>	82%	11%	-71%	***(<.001)
<i>How hard is it to pay for your energy bills? (n=168)</i>				
Very easy or easy	4%	7%	+3%	(.267)
Neither hard nor easy	22%	29%	+7%	(.029)
Very hard or hard	74%	64%	-10%	**(.004)
Very hard	36%	16%	-20%	***(<.001)

¹ Change (+/-) was found to be statistically significant at the * p< .05, ** p<.01, or *** p< .001 level in a McNemars Test or Wilcoxon Signed Rank Test comparing pre-/post- intervention responses between paired samples (same respondent).

Observations

The combined results from the summers of 2021, 2022, 2023, and 2024 provide the basis for several important observations that appear to persist over each program year:

- Program recipients are older and spend a great deal of time in their homes.
- An overwhelming majority of program recipients report that their homes are comfortable post-intervention; compared to being at unhealthy temperatures pre-intervention.
- Substantial improvements in physical and mental health were observed within each cooling season and across samples.
- The number of days participants experience poor sleep reduced significantly post-intervention. Improvements in sleep can reduce stress, improve cognitive functioning, and improve mental health outcomes.
- Respondents reported fewer instances where they needed to seek urgent medical care of arthritis symptoms, respiratory care, and heat-related symptoms post-intervention. In addition to the health benefits of household members, reductions in medical encounters – though small in number – provide the healthcare sector financial benefits. Reduced exposure to extreme temperatures can, some cases, save lives.
- Respondents self-reported that being exposed to heat worsens their or other household members' symptoms associated with asthma, COPD, and arthritis. Living in more comfortable homes helps alleviate the impact of these chronic illnesses on occupants and can – in some cases – lead to reduced need for medical interventions and/or reduced healthcare costs.
- The installation of more efficient and functional HVAC systems reduced the number of households worried that they would not have electricity or cooling that summer.

Improvements in energy security and affordable energy can lead to other direct and indirect household and health benefits.

Conclusion

In conclusion, findings from the impact survey indicate that the health and household-related non-energy impacts of a Healthy Homes Pilot Program delivered in Maricopa County continues to provide substantial, and in many cases, statistically significant outcomes for the recipients of the program. Improvements in comfort and safety, as well as reduced medical encounters, were observed. These impacts suggest improvements in the physical and mental health of recipients, reductions in energy insecurity, and potential societal benefits through reductions in the utilization of medical encounters. Significant impacts are observed across every cooling season.