

# **Does Allergen-Specific Immunotherapy Provide Cost Benefits for Children and Adults with Allergic Rhinitis? Results from Large-Scale Retrospective Analyses Jointly Funded by AAAAI and ACAAI**

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and Immunotherapy and the American College of Allergy, Asthma,  
and Immunology

## Background: Pre-Post Study in Children (JACI 2008)

- 7-year (1997-2004) retrospective claims analysis of Florida Medicaid-enrolled children (age <18 years) newly diagnosed with AR (with or without asthma) and naïve to SIT
- We compared health care use and costs of SAME CHILDREN: 6 months pre-SIT initiation versus 6 months post-SIT discontinuation

HEALTH SERVICES	CHANGE IN MEAN <u>NUMBER OF CLAIMS</u> (6 MONTHS PRE- VS 6 MONTHS POST-SIT)		CHANGE IN MEAN <u>COSTS</u> (6 MONTHS PRE- VS 6 MONTHS POST-SIT)	
	CHANGE	P VALUE	CHANGE	P VALUE
PHARMACY	-3.2 FILLS	<.0001	-\$54	<.0001
OUTPATIENT	-7.8 VISITS	<.0001	-\$233	<.0001
INPATIENT	-0.8 STAYS	.02	-\$2,316	<.0001

**AVERAGE 6-MONTH WEIGHTED COST SAVINGS PER PATIENT: \$401**

## Background: Matched Cohort Study in Children (*Annals* 2010)

- 10-year (1997-2007) retrospective, matched cohort, claims analysis of Florida Medicaid-enrolled children (age <18 years) newly diagnosed with AR (with or without asthma) and naïve to SIT
- Compared 18-month health care use and costs: SIT versus matched noSIT groups\*
- Pharmacy, Outpatient w/ SIT, Outpatient w/o SIT, Total Costs significant ( $P < 0.001$ ) at all time points
- Inpatient Costs were not significant at any time point

### CHILDREN: Net Savings Conferred (SIT Group Minus NoSIT Group)

HEALTH SERVICES	Δ AT 3 MONTHS	Δ AT 6 MONTHS	Δ AT 12 MONTHS	Δ AT 18 MONTHS	P VALUE (BETWEEN GROUP DIFFERENCES)
PHARMACY	-\$44	-\$68	-\$107	-\$208	$P < .001$ at all time points
OUTPATIENT (WITH SIT)	-\$405	-\$691	-\$1,131	-\$1,519	
OUTPATIENT (WITHOUT SIT)	-\$170	-\$281	-\$529	-\$765	
INPATIENT	-\$803	\$303	-\$1,764	-\$513	NS at all time points
<b>TOTAL</b>	<b>-\$248</b>	<b>-\$527</b>	<b>-\$1,061</b>	<b>-\$1,625</b>	<b><math>P &lt; .001</math></b>

\*Matched on age at AR diagnosis, gender, race/ethnicity, comorbid illness burden, and the presence of asthma, conjunctivitis or dermatitis

## Research Question

Does allergen-specific immunotherapy (SIT) reduce health care costs similarly among adults with AR?

# Methods: Florida Medicaid (1997-2008)

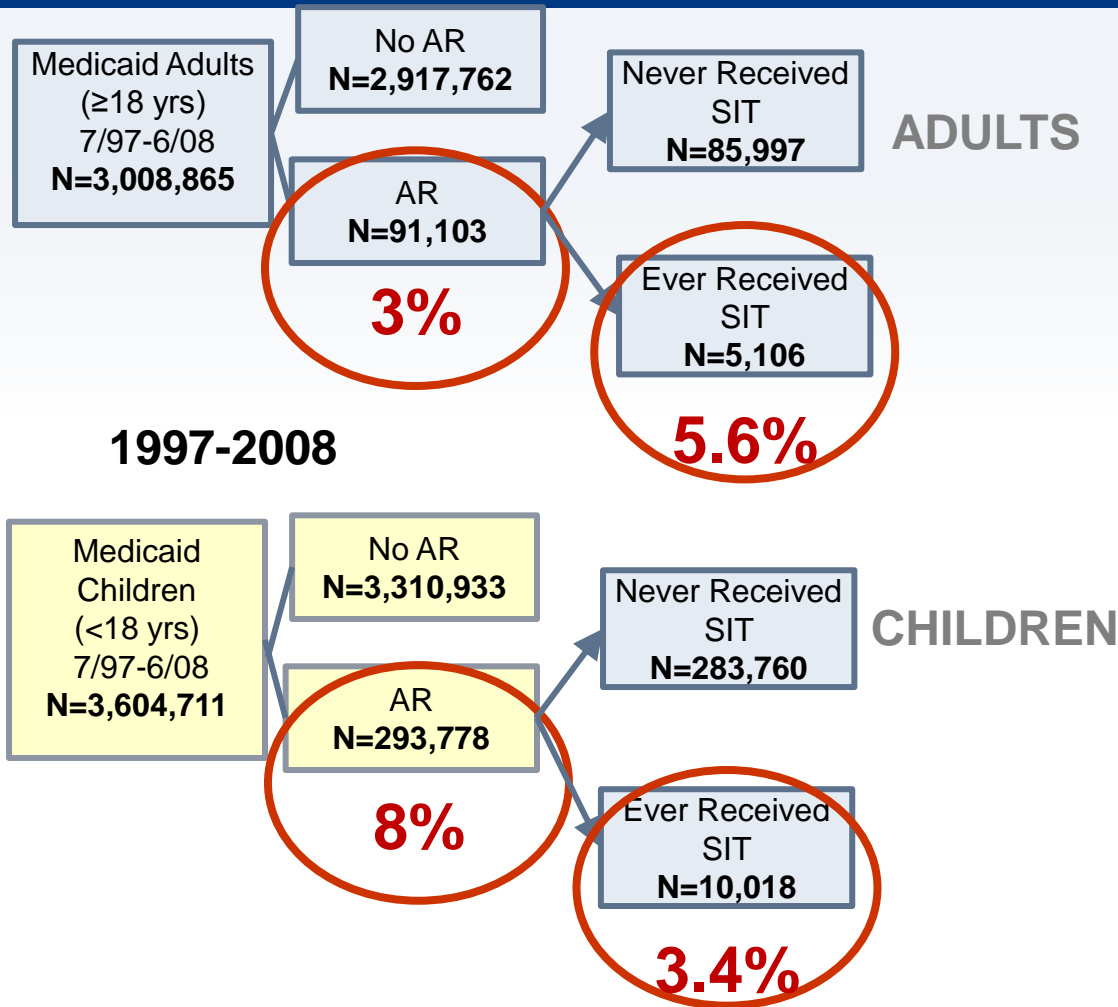
- Computerized Florida Medicaid claims records contain
  - HIPAA-compliant unique patient identifiers
  - Basic demographics (e.g., sex, age, and race/ethnicity)
  - Family identifiers (e.g., mother-child)
  - Health services use
    - ICD diagnosis and HCPCS/CPT treatment codes
      - By settings, dates, physician specialties
    - NDC prescription drug claims
      - Include doses, quantities filled, dates of fill
  - Primary and secondary insurers (e.g., Medicaid with Medicare or self-pay )

# Methods: Analysis

- ➔ Data were obtained from Florida Medicaid (July 1997 to June 2008)
- ➔ We used t-tests<sup>1</sup> to compare continuous variables and chi-square tests<sup>2</sup> for categorical variables
- ➔ If the overall test was significant, additional analyses were conducted to compare subgroups
- ➔ Logistic regression<sup>3</sup> was used to calculate likelihood estimates for variables associated with SIT utilization and Cox proportional hazard analysis<sup>4</sup> to evaluate predictors of premature SIT discontinuation

1. Assesses whether the means of two groups are statistically different from each other.
2. Assesses whether observed frequencies differ significantly from expected frequencies.
3. A regression technique for predicting the likelihood of an outcome; used when the dependent variable is dichotomous and independent variables are continuous and/or discrete.
4. A method of survival analysis that examines and models the time during which events may occur.

# Sample Identification

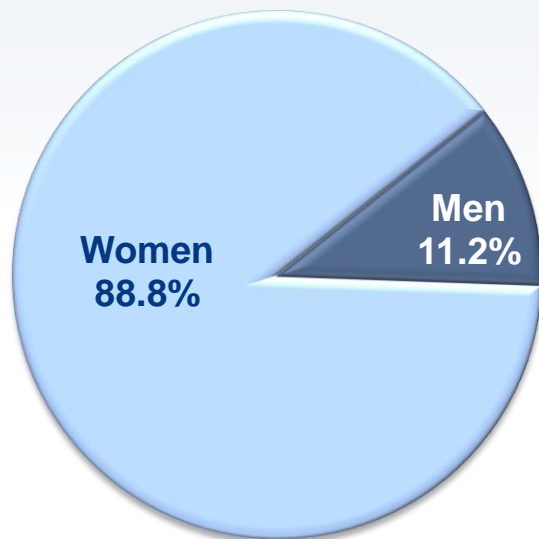


## Definitions of Terms

- AR
  - ICD-9 477.X
- SIT
  - CPT 95115, 95117, 95120, 95125, 95144, 95165, 95180, 95199
- Comorbid allergy-related illness
  - Asthma
    - 493.X
  - Atopic dermatitis
    - ICD-9 691.8
  - Conjunctivitis
    - ICD-9 372.X
- Comorbid illness severity (Charlson Comorbidity Index)<sup>1</sup>
  - None to mild
  - Moderate
  - Severe
- Premature SIT discontinuation
  - SIT <3 years
- Newly diagnosed AR
  - Index AR preceded by a full year in which no AR diagnoses occurred
- De novo SIT
  - New AR diagnosis and 1<sup>st</sup> SIT claim followed (rather than preceded) newly diagnosed AR
- Buildup phase
  - 1<sup>st</sup> 6 months of SIT
- Maintenance phase
  - SIT following build-up phase

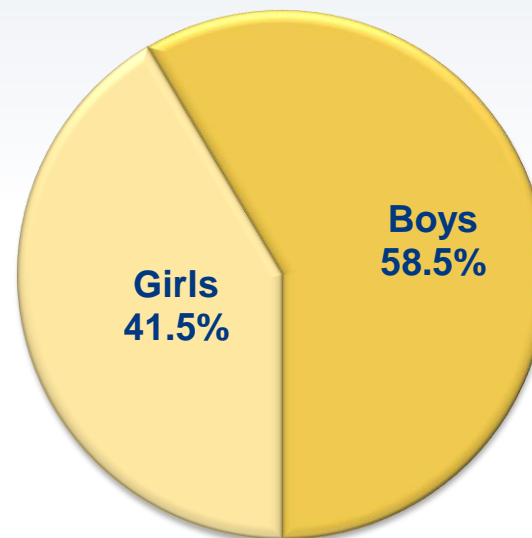
# Distribution by Sex of Patients with AR Who Received SIT at Any Time During Study Period

Adults  
(N=5,106)



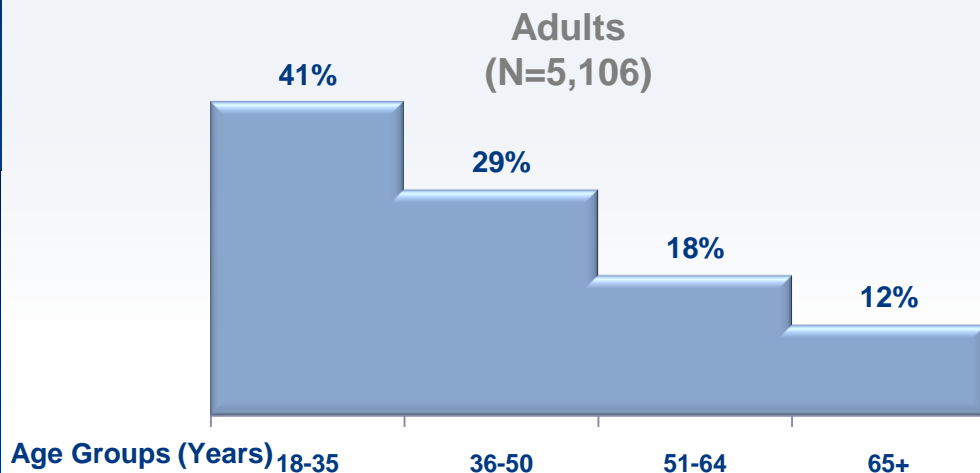
Among adults with AR who received SIT during the 11-year study period, women were 2.6 times more likely to receive SIT than men (OR 2.62, 95% CI 2.40 to 2.87,  $P < .0001$ ).

Children  
(N=10,018)

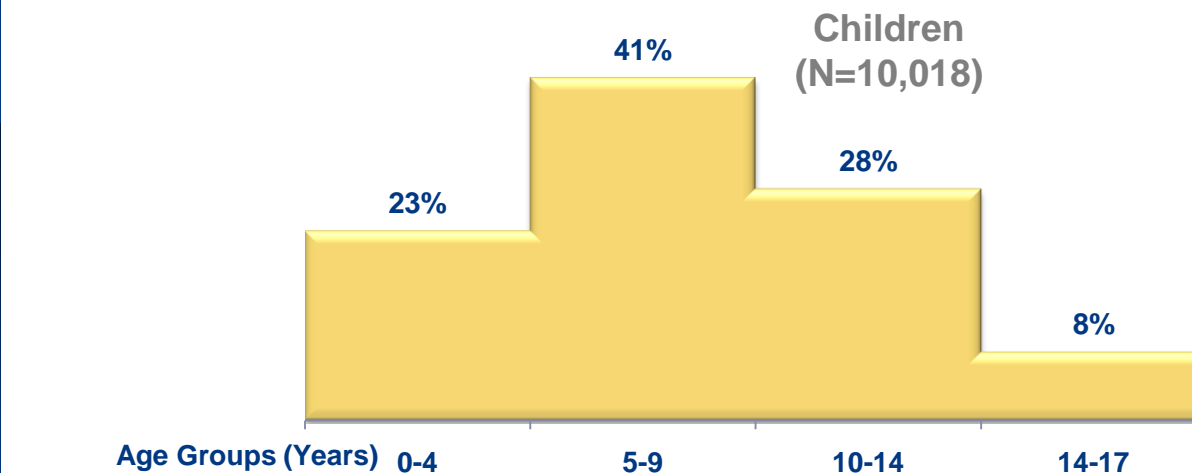


Among children with AR who received SIT during the 11-year study period, girls were 20% less likely to receive SIT following AR diagnosis than boys (OR 0.80, 95% CI 0.77 to 0.83,  $P < .0001$ ).

# Distribution by Age of Patients with AR Who Received SIT at Any Time During Study Period

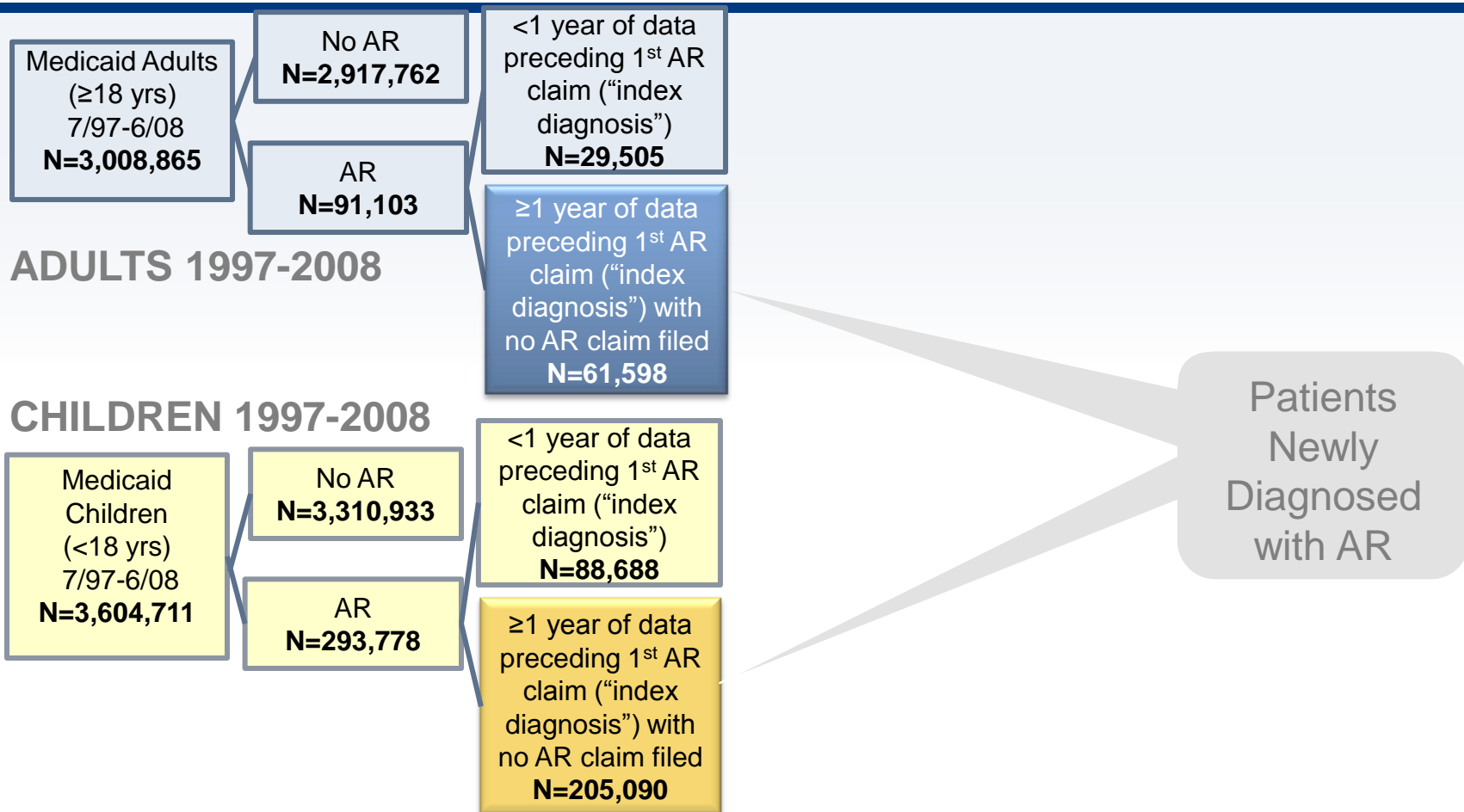


Adults: Mean(SD) age at first AR	
SIT (N=5,106)	NON-SIT (N=85,997)
38.2 (14.9)	42.3 (16.9)
<b>P&lt;.0001</b>	
<p>Among adults with AR, those who received SIT at any time during the 11-year study period were significantly older at 1<sup>st</sup> AR diagnosis than those who did not receive SIT.</p>	



Children: Mean(SD) age at first AR	
SIT (N=10,018)	NON-SIT (N=283,760)
8.0 (4.2)	6.2 (4.8)
<b>P&lt;.0001</b>	
<p>Among children with AR, those who received SIT at any time during the 11-year study period were significantly older at 1<sup>st</sup> AR diagnosis than those who did not receive SIT.</p>	

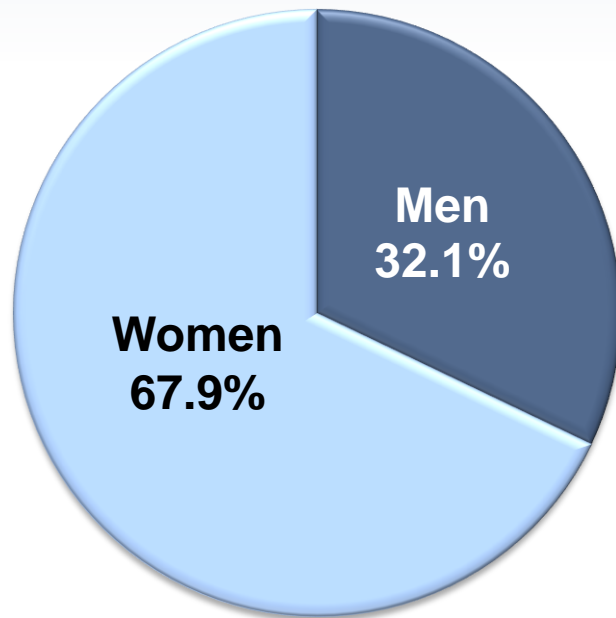
# Identification of Patients Newly Diagnosed with AR



# Distribution by Sex of Patients Newly Diagnosed with AR

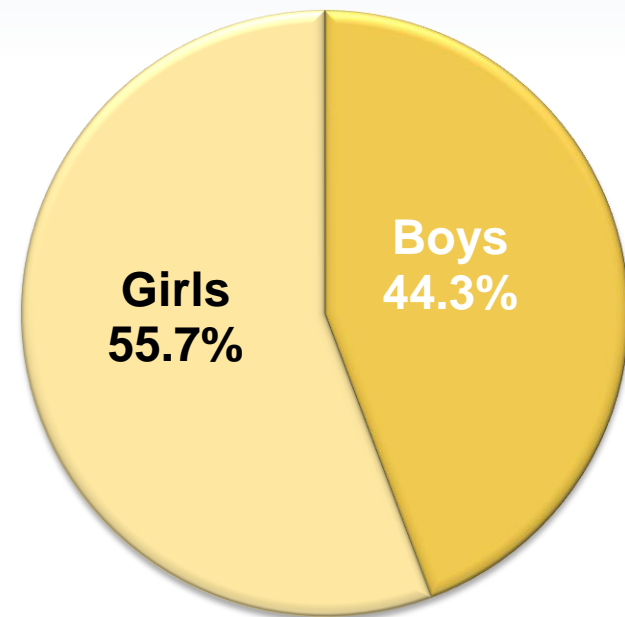
Among adults newly diagnosed with AR,  
67.9% were women.

**Adults**  
(N=61,598)



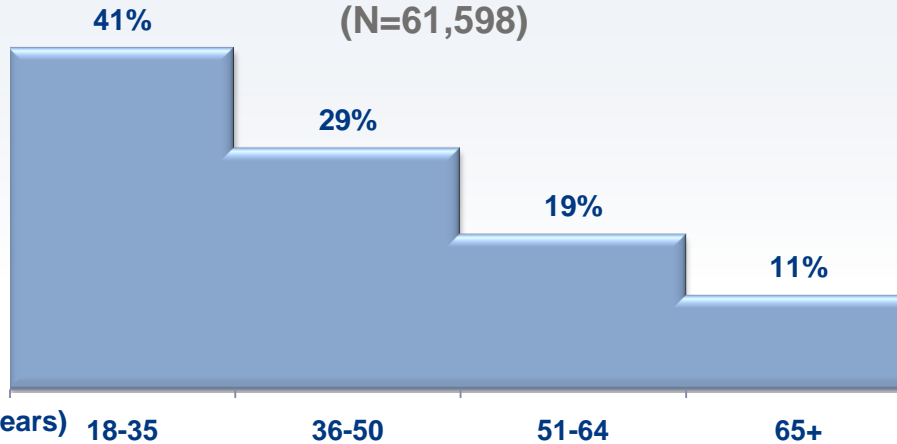
Among children newly diagnosed with AR,  
55.7% were girls.

**Children**  
(N=205,090)

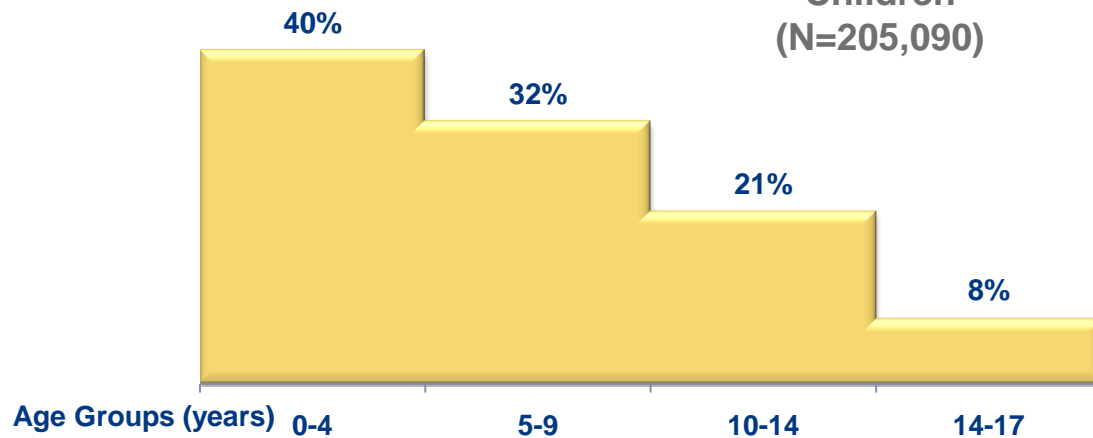


# Distribution by Age of Patients Newly Diagnosed with AR

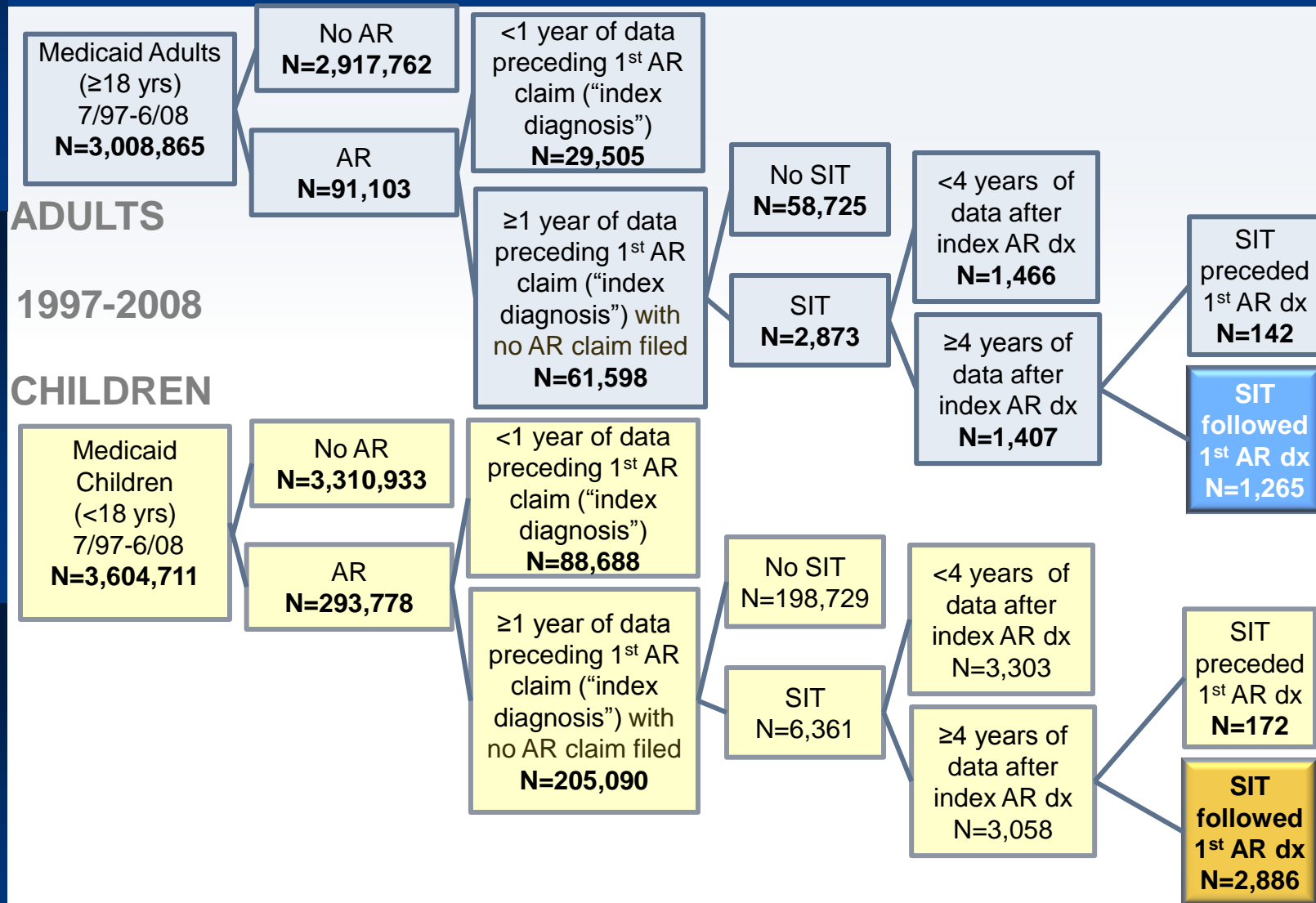
**Adults**  
(N=61,598)



**Children**  
(N=205,090)

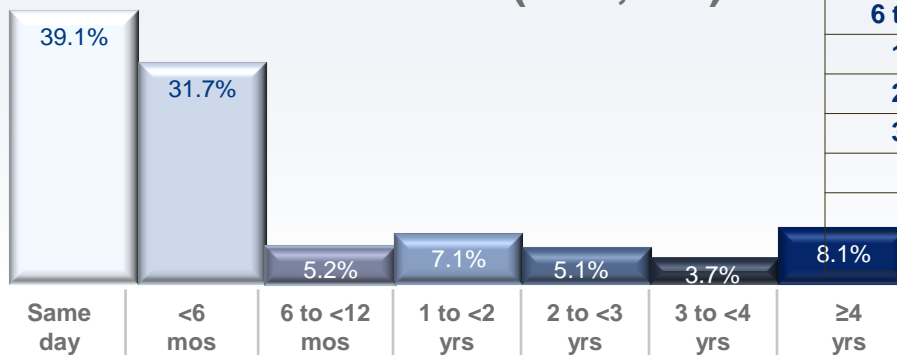


# Identification of Patients Newly Diagnosed with AR Who Received De Novo SIT



# Time from AR Diagnosis to SIT Initiation

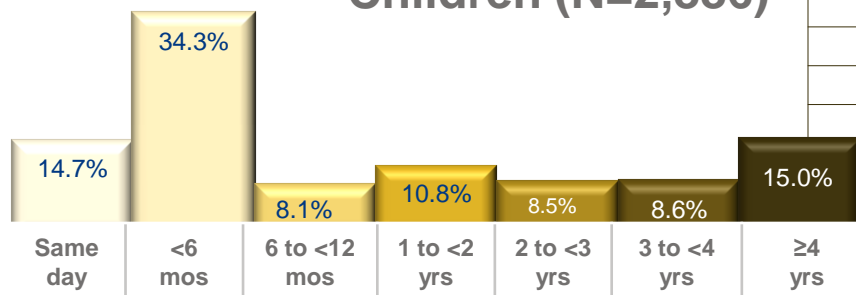
## Adults (N=1,265)



Adults (N=1,265)	N	%	Cum %
Same day	494	39.1%	39.1%
<6 months	401	31.7%	70.8%
6 to <12 months	66	5.2%	76.0%
1 to <2 years	90	7.1%	83.1%
2 to <3 years	64	5.1%	88.2%
3 to <4 years	47	3.7%	91.9%
≥4 years	103	8.1%	100.0%
Mean (SD)	324 (612) days		
Median	12 days		

*24% of adults initiated SIT ≥1 year after 1<sup>st</sup> AR diagnosis*

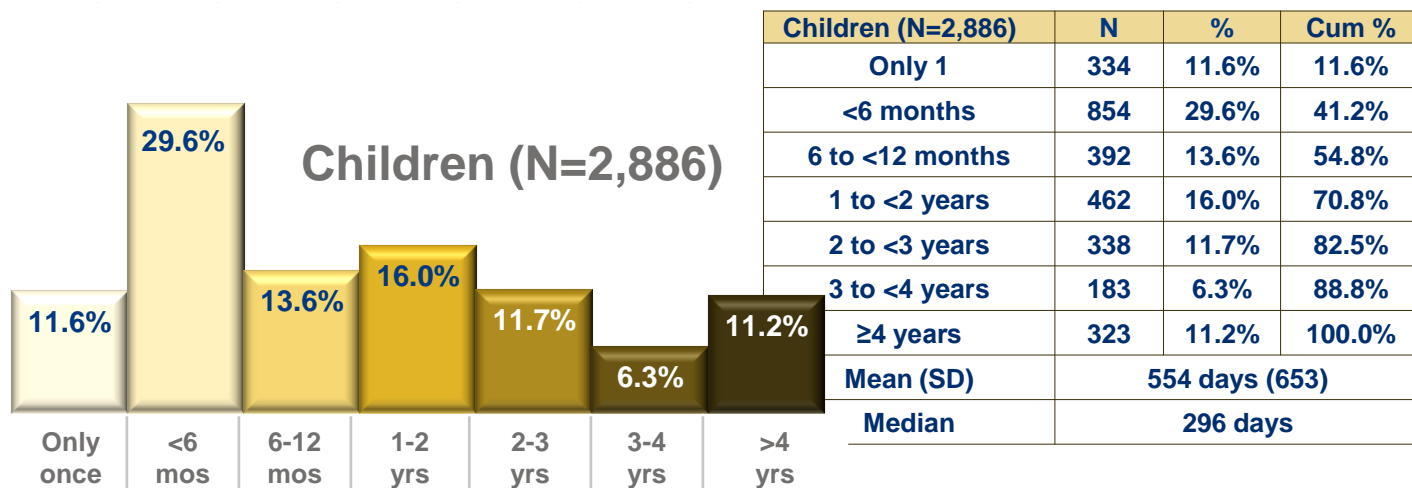
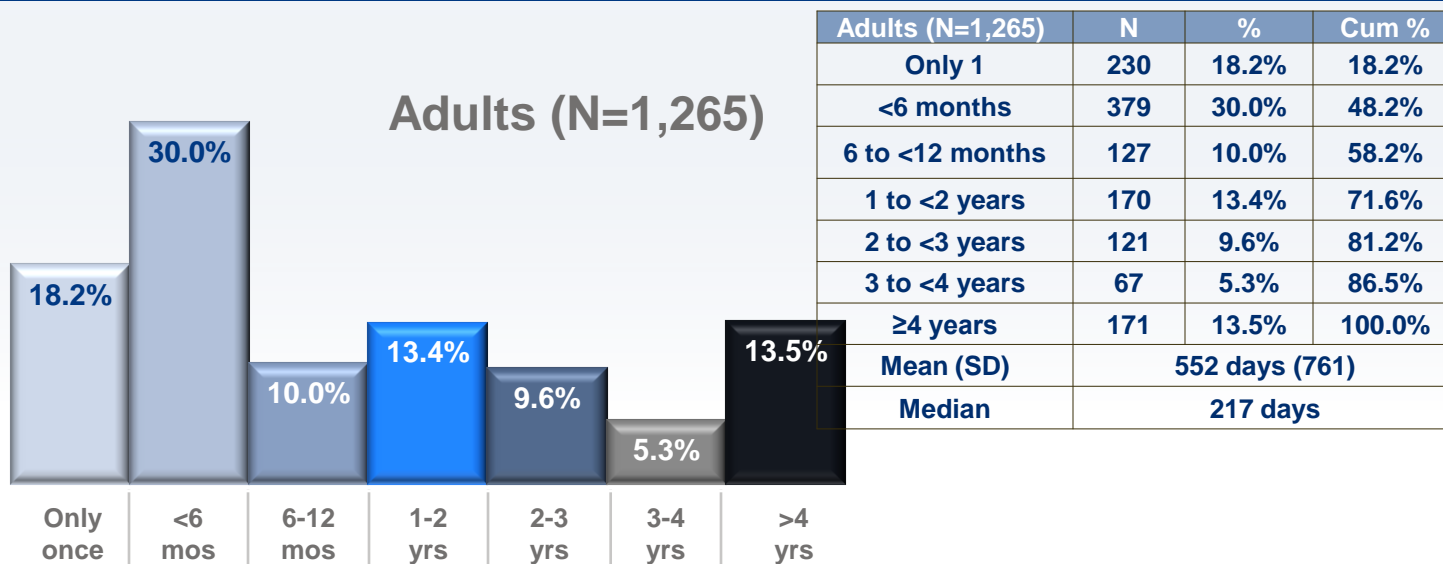
## Children (N=2,886)



Children (N=2,886)	N	%	Cum %
Same day	424	14.7%	14.7%
<6 months	991	34.3%	49.0%
6 to <12 months	234	8.1%	57.1%
1 to <2 years	311	10.8%	67.9%
2 to <3 years	246	8.5%	76.4%
3 to <4 years	248	8.6%	85.0%
≥4 years	432	15.0%	100.0%
Mean (SD)	582 (731) days		
Median	197 days		

*43% of children initiated SIT ≥1 year after 1<sup>st</sup> AR diagnosis*

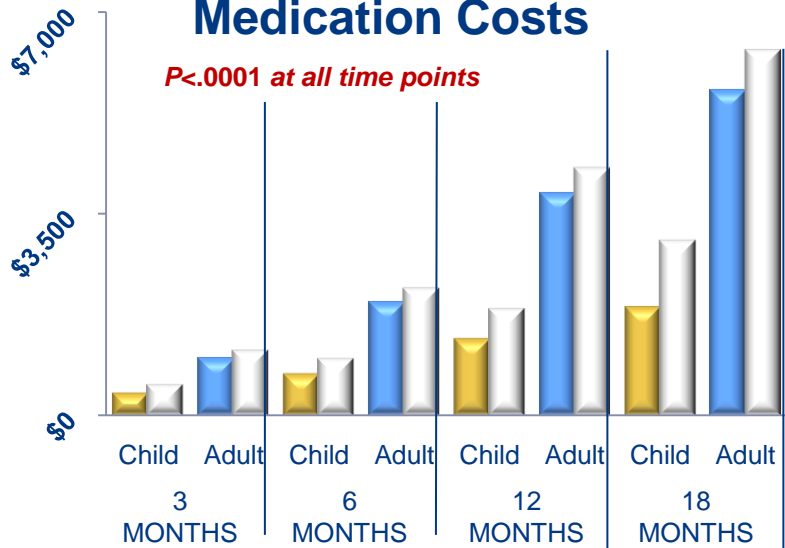
# SIT Duration



# **18-Month Costs of Care: SIT versus Non-SIT Matched Controls**

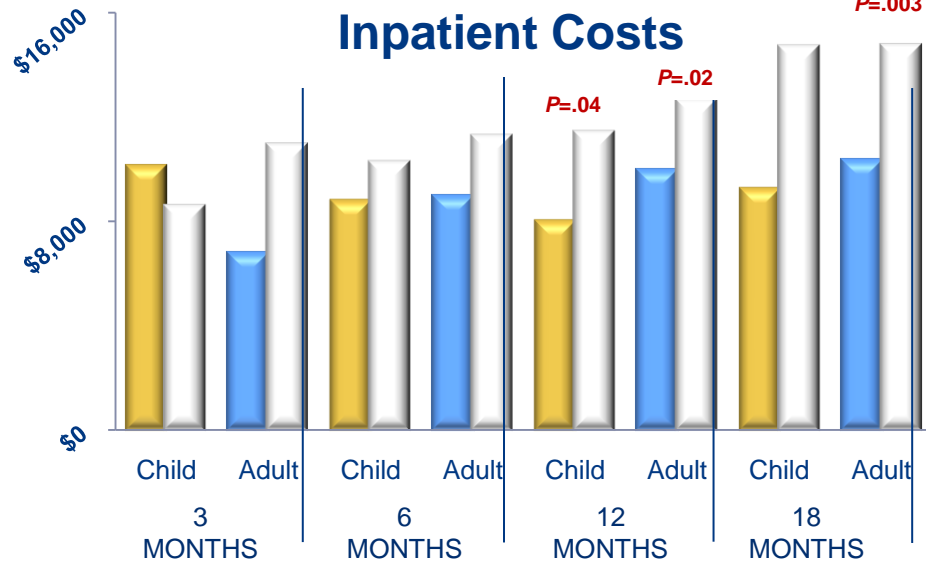
## Medication Costs

*P<.0001 at all time points*



## Inpatient Costs

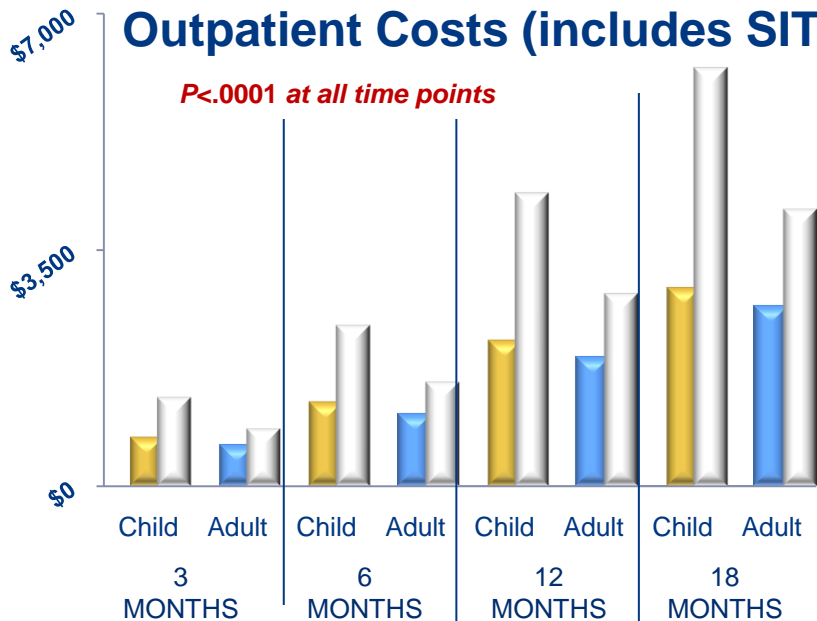
*P=.003*



■ Adult SIT   
 ■ Child SIT   
 ■ Adult or Child Non-SIT

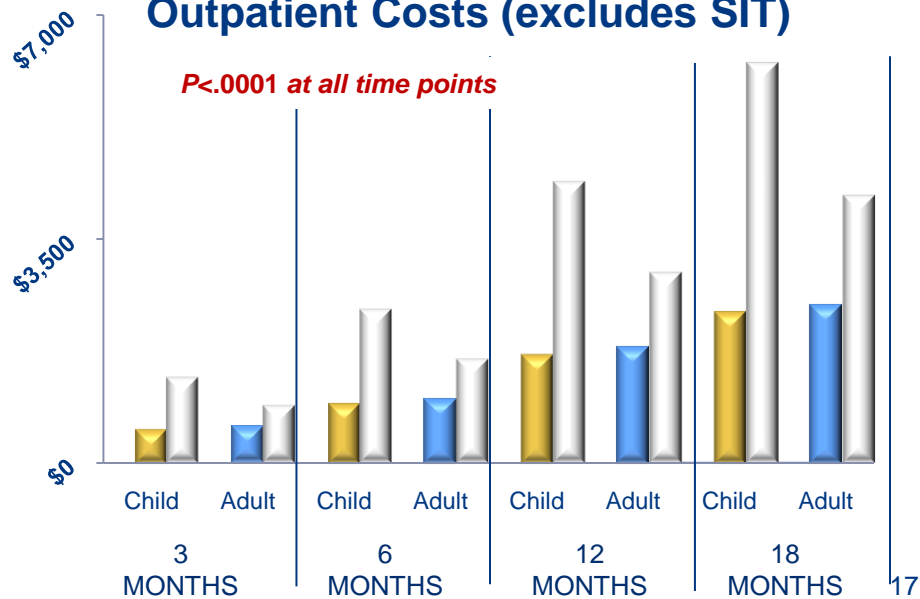
## Outpatient Costs (includes SIT)

*P<.0001 at all time points*

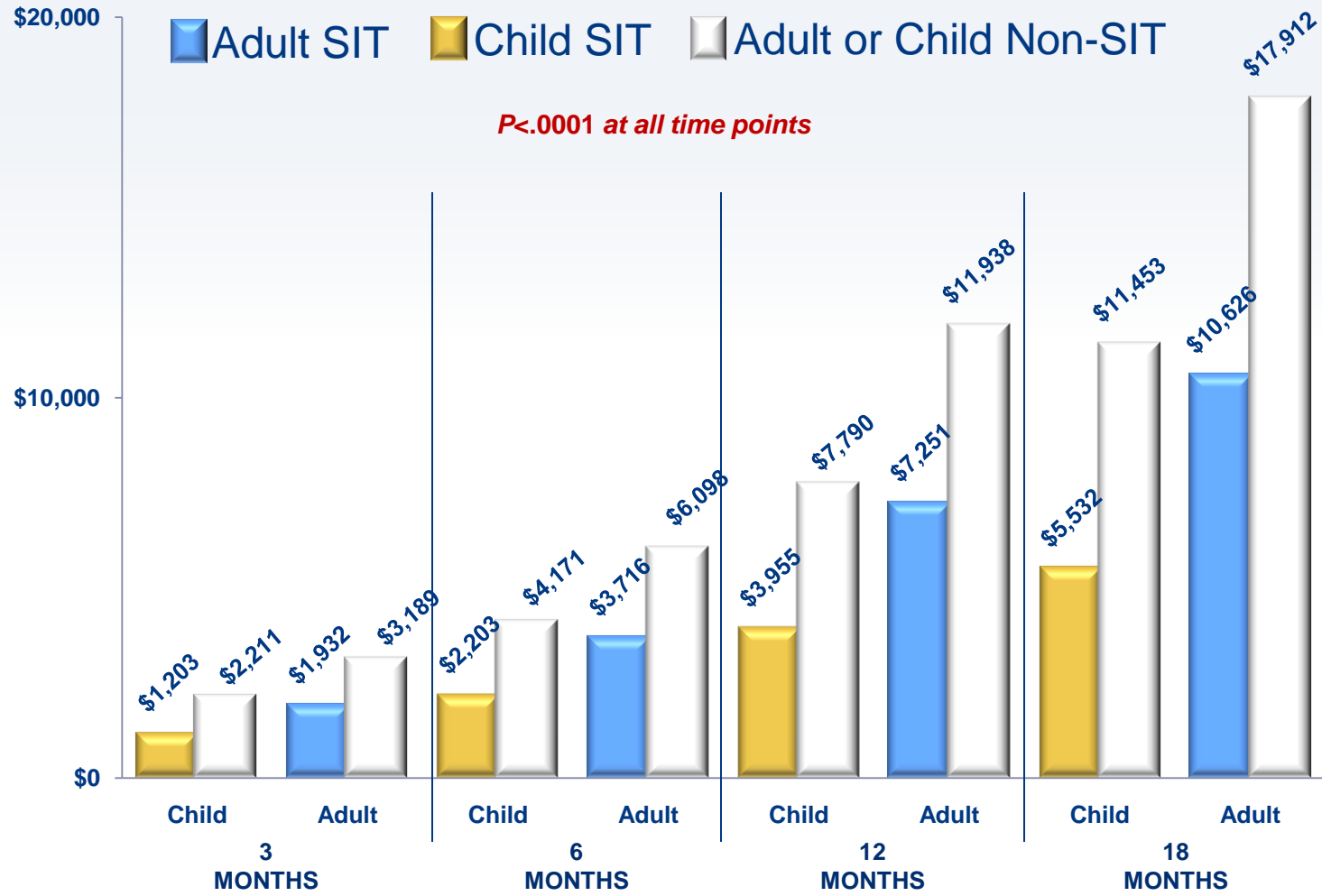


## Outpatient Costs (excludes SIT)

*P<.0001 at all time points*



# Mean, per-Patient, Total Health Care Costs over 18 Months



# Results: Mean, per-Patient, 18-Month Savings for Patients with Newly Diagnosed AR Who Received versus Did Not Receive SIT\*

Negative Values Denote Savings Conferred by SIT versus Non-SIT

TYPE OF HEALTH SERVICES 1997-2008	AGE GROUP	TIME FROM SIT INITIATION			
		3 MONTHS	6 MONTHS	12 MONTHS	18 MONTHS
PHARMACY	CHILDREN	-\$148 <i>P</i> <0.0001	-\$271 <i>P</i> <0.0001	-\$531 <i>P</i> <0.0001	-\$1,166 <i>P</i> <0.0001
	ADULTS	-\$151 <i>P</i> <0.0001	-\$246 <i>P</i> <0.0001	-\$454 <i>P</i> <0.0001	-\$685 <i>P</i> <0.0001
OUTPATIENT (INCLUDING SIT)	CHILDREN	-\$589 <i>P</i> <0.0001	-\$1,136 <i>P</i> <0.0001	-\$2,182 <i>P</i> <0.0001	-\$3,256 <i>P</i> <0.0001
	ADULTS	-\$248 <i>P</i> <0.0001	-\$477 <i>P</i> <0.0001	-\$943 <i>P</i> <0.0001	-\$1,433 <i>P</i> <0.0001
OUTPATIENT (EXCLUDING SIT)	CHILDREN	-\$804 <i>P</i> <0.0001	-\$1,469 <i>P</i> <0.0001	-\$2,709 <i>P</i> <0.0001	-\$3,902 <i>P</i> <0.0001
	ADULTS	-\$341 <i>P</i> <0.0001	-\$626 <i>P</i> <0.0001	-\$1,173 <i>P</i> <0.0001	-\$1,715 <i>P</i> <0.0001
INPATIENT	CHILDREN	+\$1,505 NS	-\$1,497 NS	-\$3,417 <i>P</i> =0.04	-\$5,463 NS
	ADULTS	-\$4,207 NS	-\$2,340 NS	-\$2,667 <i>P</i> =0.02	-\$4,444 <i>P</i> <0.0001
TOTAL	CHILDREN	-\$1,008 <i>P</i> <0.0001	-\$1,968 <i>P</i> <0.0001	-\$3,835 <i>P</i> <0.0001	-\$5,921 <i>P</i> <0.0001
	ADULTS	-\$1,257 <i>P</i> <0.0001	-\$2,382 <i>P</i> <0.0001	-\$4,687 <i>P</i> <0.0001	-\$7,286 <i>P</i> <0.0001

\*Matched on age at AR diagnosis; gender; race/ethnicity; and the presence of asthma, conjunctivitis, or dermatitis.

○ For children, there were 3,305 SIT patients matched to 13,151 non-SIT patients. For adults, there were 1,306 SIT patients matched to 5,137 non-SIT patients.

# Results: Mean, per-Patient, 18-Month Savings for Patients with Newly Diagnosed AR Who Received versus Did Not Receive SIT\*

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	ADULTS	-\$248 <i>P</i> <0.0001	-\$377 <i>P</i> <0.0001	-\$843 <i>P</i> <0.0001	-\$1,433 <i>P</i> <0.0001
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	ADULTS	-\$151 <i>P</i> <.0001	-\$246 <i>P</i> <.0001	-\$454 <i>P</i> <.0001	-\$685 <i>P</i> <.0001
OUTPATIENT (INCLUDING SIT)	CHILDREN	-\$589 <i>P</i> <.0001	-\$1,136 <i>P</i> <.0001	-\$2,182 <i>P</i> <.0001	-\$3,256 <i>P</i> <.0001
	ADULTS	-\$248 <i>P</i> <.0001	-\$477 <i>P</i> <.0001	-\$943 <i>P</i> <.0001	-\$1,433 <i>P</i> <.0001
OUTPATIENT (EXCLUDING SIT)	CHILDREN	-\$804 <i>P</i> <.0001	-\$1,469 <i>P</i> <.0001	-\$2,709 <i>P</i> <.0001	-\$3,902 <i>P</i> <.0001
	ADULTS	-\$341 <i>P</i> <.0001	-\$626 <i>P</i> <.0001	-\$1,173 <i>P</i> <.0001	-\$1,715 <i>P</i> <.0001
INPATIENT	CHILDREN	+\$1,505 NS	-\$1,497 NS	-\$3,417 <i>P</i> =0.04	-\$5,463 NS
	ADULTS	-\$4,207 NS	-\$2,340 NS	-\$2,667 <i>P</i> =0.02	-\$4,344 <i>P</i> <.0001
TOTAL	CHILDREN	-\$1,008 <i>P</i> <.0001	-\$1,968 <i>P</i> <.0001	-\$3,835 <i>P</i> <.0001	-\$5,921 <i>P</i> <.0001
	ADULTS	-\$1,257 <i>P</i> <.0001	-\$2,387 <i>P</i> <.0001	-\$4,687 <i>P</i> <.0001	-\$7,286 <i>P</i> <.0001

\*Matched on age at AR diagnosis; gender; race/ethnicity; and the presence of asthma, conjunctivitis, or dermatitis.

- For children, there were 3,305 SIT patients matched to 13,151 non-SIT patients. For adults, there were 1,306 SIT patients matched to 5,137 non-SIT patients.

# Results: Mean, per-Patient, 18-Month Savings for Patients with Newly Diagnosed AR Who Received versus Did Not Receive SIT\*

Negative Values Denote Savings Conferred by SIT versus Non-SIT

TYPE OF HEALTH SERVICES 1997-2008	AGE GROUP	TIME FROM SIT INITIATION			
		3 MONTHS	6 MONTHS	12 MONTHS	18 MONTHS
PHARMACY	CHILDREN	-\$148 <i>P</i> <.0001	-\$271 <i>P</i> <.0001	-\$531 <i>P</i> <.0001	-\$1,166 <i>P</i> <.0001
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INPATIENT	CHILDREN	+\$1,505 NS	+\$1,487 NS	+\$3,417 <i>P</i> =0.04	+\$3,463 NS
	ADULTS	+\$4,207 NS	+\$2,340 NS	+\$2,687 <i>P</i> =0.02	+\$4,444 <i>P</i> <.0001
TOTAL	CHILDREN	-\$1,008 <i>P</i> <.0001	-\$1,968 <i>P</i> <.0001	-\$3,835 <i>P</i> <.0001	-\$5,921 <i>P</i> <.0001
	ADULTS	-\$1,257 <i>P</i> <.0001	-\$2,387 <i>P</i> <.0001	-\$4,687 <i>P</i> <.0001	-\$7,286 <i>P</i> <.0001

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	ADULTS	-\$4,207 <i>NS</i>	-\$2,340 <i>NS</i>	-\$2,687 <i>P</i> =.02	-\$4,444 <i>P</i> =.003
TOTAL	CHILDREN	-\$1,008 <i>P</i> <.0001	-\$1,968 <i>P</i> <.0001	-\$3,835 <i>P</i> <.0001	-\$5,921 <i>P</i> <.0001
	ADULTS	-\$1,257 <i>P</i> <.0001	-\$2,382 <i>P</i> <.0001	-\$4,687 <i>P</i> <.0001	-\$7,386 <i>P</i> <.0001

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- NS=not significant.

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	ADULTS	-\$151 <i>P&lt;.0001</i>	-\$246 <i>P&lt;.0001</i>	-\$454 <i>P&lt;.0001</i>	-\$685 <i>P&lt;.0001</i>
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	ADULTS	-\$248 <i>P&lt;.0001</i>	-\$477 <i>P&lt;.0001</i>	-\$943 <i>P&lt;.0001</i>	-\$1,433 <i>P&lt;.0001</i>
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TOTAL	CHILDREN	-\$1,008 <i>P&lt;.0001</i>	-\$1,968 <i>P&lt;.0001</i>	-\$3,835 <i>P&lt;.0001</i>	-\$5,921 <i>P&lt;.0001</i>
	ADULTS	-\$1,257 <i>P&lt;.0001</i>	-\$2,382 <i>P&lt;.0001</i>	-\$4,687 <i>P&lt;.0001</i>	-\$7,286 <i>P&lt;.0001</i>

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- NS=not significant.

# Limitations

- ➔ Matching may have been incomplete
  - Unable to control for potentially important characteristics, such as patient adherence to pharmacologic medications and use of allergen avoidance interventions
- ➔ Retrospective nature of study precludes causality assumptions
- ➔ Cannot generalize to broader population (e.g., private health plan members)
- ➔ Limited duration of follow-up due to small number of SIT patients who were continuously enrolled throughout study
- ➔ No data available regarding reasons for SIT discontinuation

# Conclusions

- Previously, in a 10-year matched cohort retrospective claims analysis, we reported that SIT conferred significant 18-month health care cost savings among children newly diagnosed with AR
- In this current analysis, we found that the benefits of SIT are equally compelling for adults with AR
- At 18-months post-SIT initiation, compared to matched controls who did not receive SIT, those who did demonstrated significant
  - Pharmacy cost savings of 11% for adults and 38% for children
  - Outpatient cost savings (including SIT) of 35% for adults and 53% for children
  - Outpatient cost savings (excluding SIT) of 41% for adults and 62%
  - Inpatient cost savings of 30% for adults (findings were not significant for children)
  - Total health care cost savings of 41% for adults and 52% for children
- These health care cost savings occurred despite poor treatment persistence
  - Only 18.8% of adults and 17.5% of children completed a 3-year course of treatment
- Cost savings were conferred as early as 3 months following SIT initiation for children and adults
- Findings suggest that that more frequent use of SIT in the US could lead to improved clinical outcomes and to reduced direct medical expenditures in both adults and children with AR

**Thank you**