St. Paul's Hospital Millennium Medical College

Graduate Study Program

Skin Prick Test Reactivity and Associated Factors in Pediatric Patients at Chest Clinic St. Paul Hospital Millennium Medical College: A 6-Year Study (2017–2023)

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Pediatrics Resident

Addis Ababa, Ethiopia Jan, 2026

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Academic Research Proposal Submission Guide

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Abstract

Introduction: Allergic diseases, including asthma and allergic rhinitis, are increasingly affecting children worldwide, with a rising trend observed in low- and middle-income countries like Ethiopia. Skin prick testing (SPT) remains a gold standard for identifying allergen sensitization in pediatric populations. However, local data on the prevalence of SPT positivity and its associated risk factors are limited.

Objective: This study aimed to assess the prevalence of skin prick test (SPT) positivity and identify associated factors among children attending follow-up chest clinic at a tertiary hospital over 6 years.

Methods: A hospital-based retrospective study was conducted from March 2017 to December 2023. Data on demographics, clinical, and SPT results for ten common allergens were extracted from medical records and analyzed using SPSS version 28. Both descriptive statistics and bivariate analysis were used as appropriate and multivariable logistic regression was employed to identify factors associated with SPT positivity.

Results: The study included 103 children with a median age of 4 years (IQR 2–6). The overall prevalence of sensitization to at least one allergen was **26.2% (27/103)**. House dust mite was the most prevalent allergen (16.5%), followed by grass (6.8%) and herbs (5.8%). Polysensitization (≥2 allergens) was observed in 37.0% of SPT-positive children. In multivariable analysis, independent predictors of a positive SPT were age 5–10 years (AOR = 2.96; 95% CI: 1.05–8.39) and a family history of allergy (AOR = 3.03; 95% CI: 1.08–8.53).

Conclusion: A significant proportion of children on follow-up who were tested with SPT showed sensitization to common allergens, predominantly house dust mites. Age and family history were key risk factors. These findings underscore the need for standardized allergy testing and targeted preventive strategies in similar clinical settings in Ethiopia.

Keywords: SPT, allergy test, children, Ethiopia

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1. Introduction

1.1 Background

Allergic diseases such as asthma, allergic rhinitis, eczema (atopic dermatitis), and food allergies are among the most common chronic conditions in children globally. The prevalence of these diseases has been rising, particularly in urban areas of low- and middle-income countries (LMICs), due to environmental changes, urbanization, and lifestyle modifications that influence immune system development and allergen exposure patterns (1, 2). The SPT is the gold standard for detecting IgE-mediated hypersensitivity to environmental and food allergens. It is widely used due to its safety, affordability, reproducibility, and utility in outpatient pediatric settings. The results of SPT provide valuable diagnostic information that guides allergen avoidance strategies, immunotherapy decisions, and personalized patient education (3). Several epidemiological factors influence SPT reactivity, including age, sex, genetic predisposition (such as family history of atrophy), environmental exposures (dust mites, mold, pollens and dander), early life infections, mode of delivery, and breastfeeding practices (4).

In LMICs, additional factors such as overcrowding, poor ventilation, indoor biomass fuel exposure**,** and parasitic infections may modulate immune responses, potentially altering sensitization profiles (5, 6)

A growing body of literature highlights geographic and regional variations in allergen sensitization. For example, in Sub-Saharan Africa, sensitization to house dust mites, cockroach allergens, and molds has been reported as predominant in urban children (7).

A cross-sectional study conducted among 541 rural school-age children reported a skin sensitization prevalence of 3.6% among primary school-aged children, with eczema and rhinitis being the most common allergy-related disorders. Significant risk factors identified included the use of insecticides and a family history of allergic diseases (8).

Another study focusing on asthmatics in East Africa found that 91% of Ethiopian participants had at least one positive SPT result. The most common allergens identified were house dust mites, Blomia tropicalis, and German cockroach (9).

This study aims to examine the prevalence of SPT positivity and identifying socio-demographic, environmental, and clinical factors associated with allergic sensitization among children attending follow-up at St. Paul Hospital Millennium Medical College Chest Clinic over six years (March 2017–December 2023).

1.2 Statement of the Problem

The global burden of allergic diseases among children is increasing, with environmental and genetic factors playing major roles in their development. In Ethiopia, childhood allergies such as asthma and allergic rhinitis are becoming more frequent, yet the patterns of allergen sensitization and associated risk factors remain poorly understood. Despite the availability of diagnostic tools like the SPT, limited research has been conducted to assess allergen reactivity in pediatric populations within clinical settings. At St. Paul's Pediatric Chest Clinic, a growing number of children are presenting with recurrent respiratory symptoms suggestive of allergic conditions. However, due to the lack of local evidence, clinical management is often empirical and not guided by allergen-specific data. This knowledge gap undermines the potential for targeted interventions, early diagnosis, and effective allergy prevention strategies.

Therefore, there is a critical need to investigate the prevalence of SPT positivity and identify its associated risk factors among children in LMICs. This study will provide essential data to inform evidence-based clinical decisions and improve pediatric allergy care in Ethiopia and similar settings.

1.3 Rationale of the Study

Allergic diseases are becoming increasingly prevalent among children globally, particularly in Urbanizing and low- to middle-income countries like Ethiopia. These conditions not only impair quality of life but also place a burden on healthcare systems due to recurrent visits, long-term treatment, and missed school days. Despite this rising trend, there is limited local data on allergen sensitization patterns and their determinants in Ethiopian children.

The SPT is a simple, safe, and cost-effective tool widely used to identify sensitization to specific allergens. However, in Ethiopia, its use in routine pediatric allergy assessment is still limited, and its results are rarely supported by contextual local data. A better understanding of the prevalence of SPT positivity and related risk factors is essential for guiding diagnostic approaches, informing public health

strategies, and improving clinical management of pediatric allergic conditions.

This study focuses on children attending follow-up at St. Paul's pediatric Chest Clinic, a referral center for respiratory and allergic diseases. By analyzing data collected over six years, the study aims to generate reliable evidence on the burden of allergen sensitization and its predictors in this population. The findings will help clinicians deliver more personalized and effective care and contribute to the broader effort of building allergy-related data in Ethiopia and similar settings.

1.4 Significance of the Study

This study holds significance for clinical practice, public health, and future research in pediatric allergy in Ethiopia. This study addresses a major gap in the local medical literature by providing data on allergen sensitization patterns and associated factors among Ethiopian children—a topic that has received limited attention despite rising allergy cases. By identifying the most common allergens and associated factors, this study will enable more accurate, evidence-based clinical decisions. Physicians will be better equipped to personalize treatment and reduce unnecessary empirical therapy. Findings will advocate for the standardized use of SPT in routine pediatric allergy evaluations, reinforcing its role as a cost-effective diagnostic tool in resource-limited settings. The results will help public health stakeholders develop targeted interventions to reduce exposure to prevalent allergens (*e.g.,* house dust mites, cockroaches). This is especially relevant in urbanizing areas where environmental exposures are rapidly changing. Evidence from this study can be used to inform national pediatric allergy guidelines, promote training programs, and advocate for improved allergy services in Ethiopia. It also will act as a baseline data for future researchers.

1.5 Conceptual framework

[Age | Sex | Residence | Asthma | Allergic rhinitis | Atopic dermatitis | Family history]

↓

[Skin Prick Test (SPT) Reactivity]

(Positive vs Negative)

2.Literature review

2.1 Prevalence and Patterns of SPT Reactivity

In a study of 3025 children from Ankara, Turkey, between 1995 and 2000, with bronchial asthma, aged 3 months to 16 years,,1902 had undergone the SPT, and 60.3 %of these patients were atopic. The most common allergens were house dust mite, 63.3 %, followed by pollens, 49.3 % (10).

On the other hand, a fifteen-year review of skin allergy testing in Irish patients with symptomatic rhinitis, *49%* of patients tested positive to at least one aeroallergen. Common allergens were house dust mites (23%), Timothy grass: 22%, Dog: 17%, and cat. Patients born during the Irish pollen season (April–July) were between 5 and 7 times more likely to be sensitive to timothy and ryegrass pollens compared to those born outside this period. Males exhibited more severe reactions to house dust mites compared to females. 75% of sensitized patients resided in urban areas (11)

Studies from East Africa indicate a high prevalence of SPT positivity among asthmatic patients. A multi-country study involving Ethiopia, Uganda, and Kenya reported that 90% of asthmatic participants had at least one positive allergen reaction, with common sensitizations to house dust mites (66%), Blomia tropicalis (62%), and German cockroach (52%) (9). In contrast, a study focusing on Ethiopian schoolchildren found a lower overall SPT positivity rate of 3.6%, with German cockroach (2.9%) and dust mite (1.7%) being the most common allergens (8). These disparities highlight the variability in allergen sensitization patterns based on population and environmental factors.

2.2 Risk Factors Associated with SPT Reactivity

The risk factors associated with SPT reactivity in children are multifaceted. Age and atopic conditions play a significant role, as younger children and those with active eczema are at higher risk for generalized allergic reactions during testing. Furthermore, children with allergic rhinitis demonstrate higher SPT positivity to aeroallergens. Influences also extend to family structure, supported by the hygiene hypothesis, which posits that children with fewer siblings—and thus reduced early-life microbial exposures—have higher atopy rates; a study in Indonesia specifically found higher SPT positivity in children with fewer than three siblings. Finally, socioeconomic and environmental factors are influential, with maternal education level, urban residence, and exposure to indoor allergens such as cockroaches and dust mites all being associated with increased SPT reactivity (12)**.**

3.Objectives

3.1. General Objective

To assess the prevalence of SPT positivity and identify associated factors among children attending follow-up at St. Paul's pediatric Chest Clinic from March 2017 to December 2023.

3.2. Specific objectives

- To determine the proportion of children with positive SPT results during the study period.
- To identify the most common allergens causing sensitization among pediatric patients.
- To determine the socio-demographic and clinical factors associated with a positive SPT.

4. Methods

4.1. Study Setting and Period

This study was conducted at St. Paul's Hospital Millennium Medical College pediatric Chest Clinic, in Addis Ababa, Ethiopia. The clinic is a specialized referral center that provides diagnostic and follow-up services for patients with respiratory and allergic conditions.

The study covered a review of medical records from March 2017 to December 2023, encompassing 6 years. Data were collected from pediatric patients who underwent SPT and were on regular follow-up at the clinic during this time.

4.2.Study Design

This study employed a retrospective crossectional design. It involved the review and analysis of medical records of pediatric patients who underwent SPT at St. Paul's Chest Clinic between March 2017 and December 2023

4.3. Source and Study Population

The source population consisted of all pediatric patients (1 month–16 years) attending follow-up care at St. Paul's pediatric Chest Clinic during the study period (March 2017 to December 2023). The study population are those patients evaluated for allergic conditions who were eligible for skin prick testing based on clinical indications, and have documented SPT results.

4.4. Inclusion Criteria

- ✓ All pediatric patients on follow-up at Chest Clinic between March 2017 and March 2023.
- ✓ Patients who underwent an SPT during the study period.

Patients with complete medical records, including demographic, clinical, and test result data.

4.5. Sample Size

All eligible records of children with SPT result were included (census method)

4.6. Sampling Procedures:

All eligible children were included in the study

4.7. Data Collection and Procedures

Data were collected by review of medical records of pediatric patients who underwent SPT from March 2017 to December 2023. A structured data extraction checklist was developed based on the study objectives.

The checklist was used to collect relevant information from patient charts, including:

- Demographic data: age, sex, residence (urban/rural);
- Clinical history: diagnosis, presence of asthma, allergic rhinitis, atopic dermatitis, family history of allergy;
- SPT results: type of allergens tested, number, and size of positive reactions;
- Medications: recent use of antihistamines

Skin prick testing was conducted using standardized 10 allergen extracts (dust mites,grass,herbs,tree,egg,milk,cat,dog,chicken and beef) with histamine as a positive control and saline as a negative control. The test was applied to the volar surface of the forearm, and results were read after 15–20 minutes. A wheal diameter ≥3 mm greater than the negative control was considered positive. Data regarding tested allergens and results were extracted retrospectively from patient charts.

Trained data collectors were medical students manually retrieved data from paper-based charts . Before inclusion, the completeness and consistency of each record were systematically verified. Throughout the process, all data were anonymized to maintain participant confidentiality.

4.8 Data Quality Control and Management

4.8.1. Training of Data Collectors

Data collectors received training on the objectives of the study, use of the data extraction tool, and ethical considerations, including confidentiality and accurate data abstraction. Emphasis was placed on consistent interpretation of clinical terms and SPT results.

4.8.2. Pretesting of Data Collection Tool

A pretest was conducted on 10 medical records that were not included in the main study to evaluate the clarity and relevance of the checklist. Necessary modifications were made to the data collection instrument based on pretest feedback.

4.8.3. Supervision and Monitoring

The principal investigator closely supervised the data collection process, provided ongoing guidance, and conducted daily reviews of completed checklists. Randomly selected records were cross-checked for accuracy and consistency.

4.8.4. Data Entry and Cleaning

Data were entered into a statistical software package (SPSS version 28)Double data entry check was

performed for a subset of records to check for entry errors. The dataset was then cleaned by checking for missing values, outliers, and logical inconsistencies before analysis.

4.8.5. Data Confidentiality and Security

No personal identifiers were recorded during data extraction. All extracted data was kept in password-protected files and accessible only to the research team.

4.9. Data Analysis Plan and Procedures:

Data were coded and entered into **SPSS 28 version** for statistical analysis.

4.9.1. Descriptive Analysis

Frequencies, percentages, means, and standard deviations were calculated to summarize demographic and clinical characteristics.

The prevalence of SPT positivity was calculated as the proportion of children with at least one positive allergen test.

4.9.2. Bivariate Analysis

Chi-square tests (for categorical variables) and independent t-tests (for continuous variables) were used to assess the association between SPT positivity and potential risk factors (e.g., age, sex, family history of allergy).Variables with a p-value < 0.25 in bivariate analysis were considered for inclusion in multivariable analysis.

4.9.3. Multivariable Analysis

Logistic regression analysis was conducted to identify independent predictors of SPT positivity and Adjusted odds ratios (AORs) with 95% CIs were reported and astatistical significance was taken as p-value < 0.05.

4.9.4. Model Diagnostics

The model's fitness was checked using the Hosmer-Lemeshow goodness-of-fit test. Multicollinearity among independent variables was assessed using the Variance Inflation Factor (VIF)**.**

4.9.5. Presentation of Results

Results were presented using tables, graphs, and narrative descriptions for clarity and easy interpretation.

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4.10.Operational Definations

-Skin Prick Test (SPT) Positivity

A child was considered skin prick test positive if the recorded wheal diameter for any tested allergen was ≥ 3 mm , measured 15–20 minutes after allergen application

- Skin Prick Test Negativity

A child was considered skin prick test negative if all tested allergens produced a wheal diameter < 3 mm

4.11. Ethical Consideration:

Ethical approval was obtained from the Institutional Review Board (IRB) of St. Paul's Hospital Millennium Medical College before data collection. Since the study involves retrospective review of medical records**,** informed consent from patients or guardians was not required. Confidentiality and anonymity of all patient information were strictly maintained throughout the research process. No personal identifiers such as names, medical record numbers, or addresses was collected.

4.12. Dissemination of Results

The findings of the study will be presented to the department of pediatric at Saint Paul Hospital Millennium Medical College . It will also be presented at professional society conferences. The results will then be published in a peer-reviewed journal .

5. Result

5.1 Sociodemographic and Clinical Characteristics

The study included 103 children aged 1 to 14 years (median age 4 years, IQR 2-6) who underwent SPT between March 2017 and December 2023. The cohort was predominantly composed of young children under 5 years old, 62.1% (64/103), and residents of urban areas, 94.2% (97/103). The majority, 70.9% (73/103), had no reported family history of allergy or atopy. The major clinical indication for testing was the presence of asthma, which was noted in 99.0% (102/103) of the cases.

Table 1: *Baseline sociodemographic and clinical characteristics of children undergoing SPT at SPHHMC, March 2017–December 2025 (n=103)*

Variables		**Frequency**	**Percent (%)**
Age groups			
	< 5 years	64	62.1
	5 to 10 years	33	32.0
	≥10 years	6	5.8
Sex			
	Female	51	49.5
	Male	52	50.5
Residency			
	Urban	97	94.2
	Rural	6	5.8
Family History of allergy/atopy			
	Yes	30	29.1
	No	73	70.9
Indication SPT			
	Presence of asthma	102	99.0
	Allergic rhinitis	15	14.6
	Atopic dermatitis	23	22.3
	Others		

5.2: Proportion of Positive Skin Prick Test-Positive Patients

Sensitization to at least one allergen was found in 26.2% (27/103) of patients. The most prevalent allergen was dust mites, affecting 16.5% (17/103) of patients, followed by grass at 6.8% (7/103) and herbs at 5.8% (6/103). Notably, no patient tested positive for an allergy to beef (0.0%, 0/103).

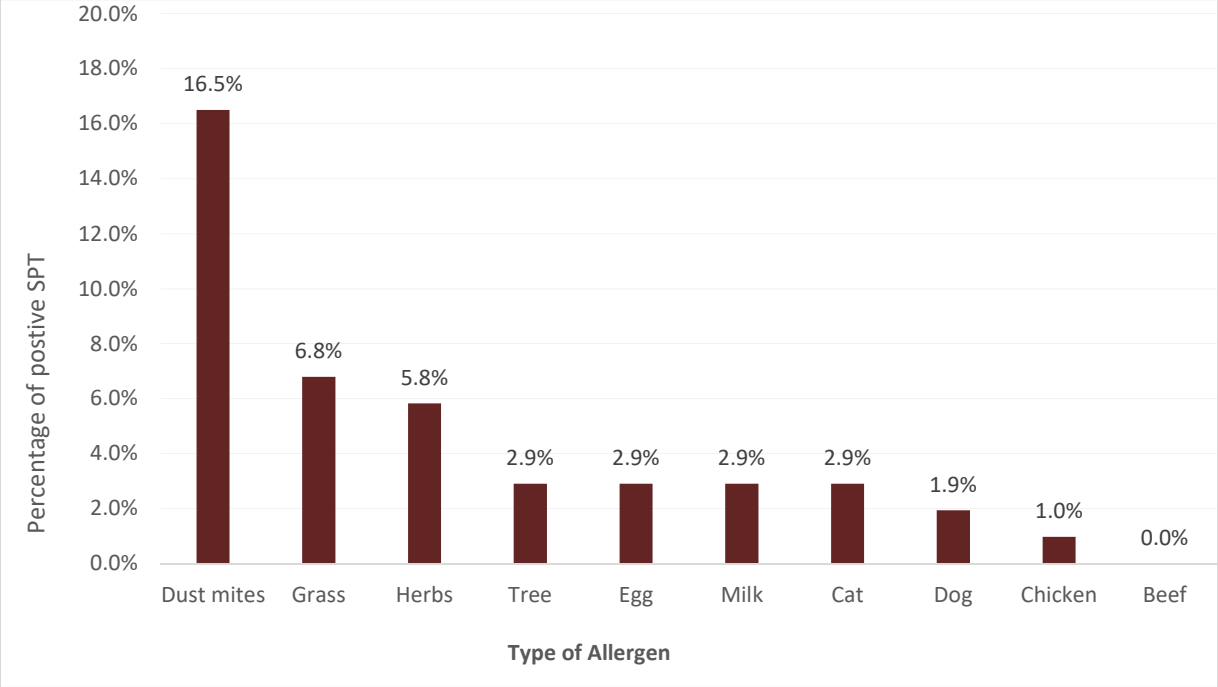

Figure 1: Type of allergen sensitization among children undergoing SPT at SPHHMC, March 2017–December 2025 (n=103).

5.2 Pattern of Sensitization

Among SPT-positive children, polysensitization—defined as sensitization to two or more allergens—was observed in 37.0% of cases, with 18.5% being sensitized to three or more allergens (figure 2). Within this group, the most frequent co-sensitivity pairs (each occurring in three patients) were dust mite and herbs, grass and herbs, and grass and dog. Several other pairs were seen in two patients, and the triplet dust mite, grass, and herbs was also notable. Some individuals were sensitized to four allergens, with a representative combination being dust mite, grass, herbs, and egg. A distinct cluster linking food and pet allergens—egg, milk, and cat—was present in two patients.

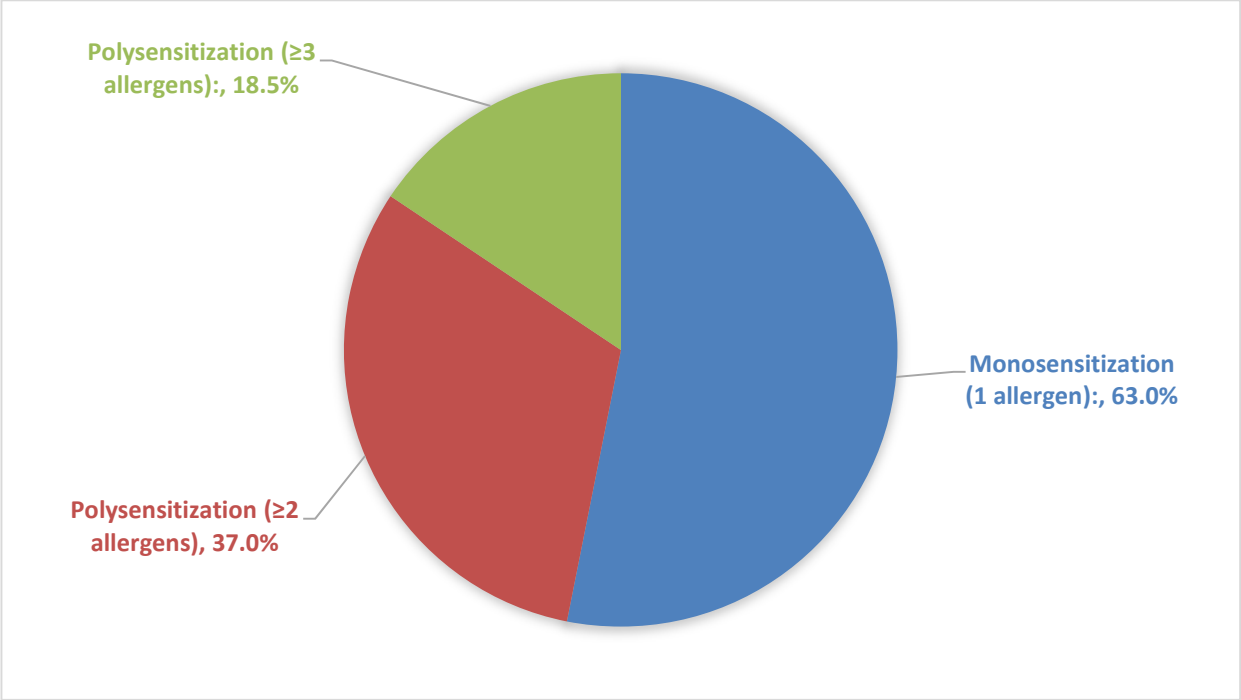

Figure 2 : Pattern of polysensitization among children undergoing SPT at SPHHMC, March 2017–December 2023 (n=103).

5.3 Wheal diameter among skin prick test-positive patients

Among skin prick test-positive patients, wheal diameters ranged from 3 mm to 10 mm**,** with a median of 4.5 mm and a mean of 4.9 mm (±2.3 mm)**.** Dust mites elicited the widest range of reactions (3–10 mm) and the highest mean wheal size among common allergens (4.9 mm). Grass reactions ranged from 3–9 mm (mean 4.7 mm), while herbs showed consistently mild wheals (3–4 mm, mean 3.3 mm). Tree and egg allergens, though less frequent, produced some of the strongest individual wheals (up to 9 mm and 10 mm, respectively). The distribution of wheal sizes for the top three allergens is further illustrated in in Figure 3.

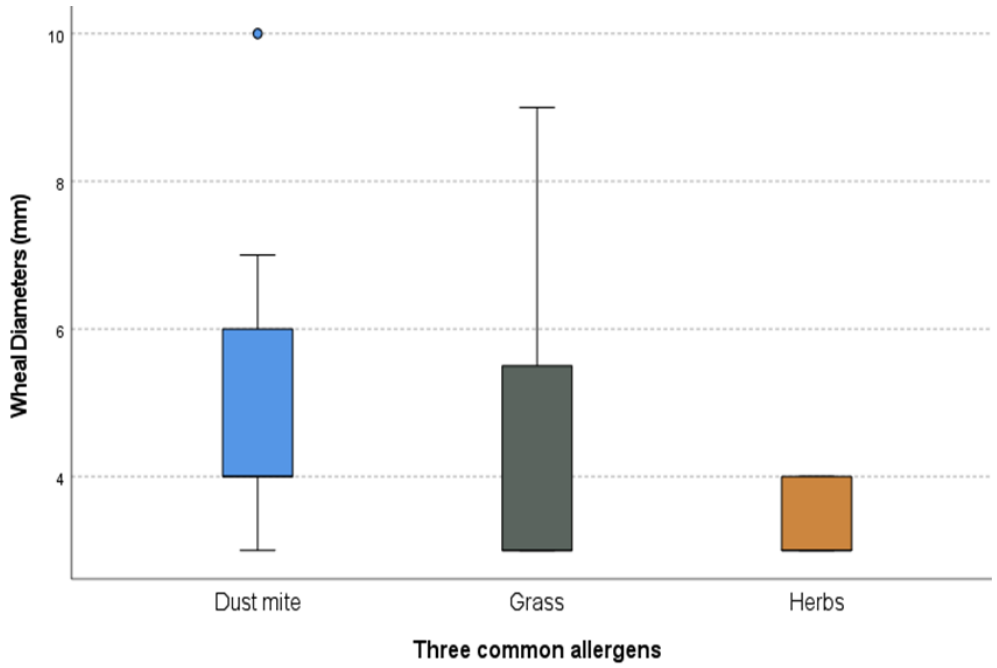

Figure 3: Comparison of SPT wheal diameters among three common allergens.

5.4 Risk factors for a positive SPT

In the univariate logistic regression analysis, variables with a p-value of less than 0.25 were considered eligible for inclusion in the multivariable model. Based on this, four factors were selected: age 5–10 years ($p = 0.002$), age >10 years ($p = 0.28$), female sex ($p = 0.24$), and a family history of allergy ($p = 0.003$) (Table 2).

In the multivariable logistic regression analysis, two factors emerged as significant independent predictors of a positive SPT. Children aged 5–10 years had nearly three times higher adjusted odds of sensitization compared to those under 5 years (AOR = 2.96; 95% CI: 1.05–8.39; $p = 0.041$). A family history of allergy was also a strong independent predictor, associated with a three-fold increase in odds (AOR = 3.03; 95% CI: 1.08–8.53; $p = 0.036$) (table 2).

Table 2:Factors for Allergen Sensitization (Positive SPT) among Children.

Variables		COR(95%CI)		AOR(95%CI)	
		COR(95%CI)	P value	AOR(95%CI)	P value
Age					
	< 5 years	1			
	5 to 10 years	4.50(1.720,11.77)	0.002	2.96(1.05,8.39)	0.041
	>10 years	2.70(0.44,16.77)	0.28	2.75(0.41,18.43)	0.29
Sex					
	Female	1.70(0.69,4.15)	0.24	1.71(0.65,4.49)	0.28
	Male	1			
Family history of allergy					
	Yes	4.03(1.58,10.29)	0.003	3.03(1.08,8.53)	0.036
	No	1			

6.Discussion

This six-year hospital-based study identified sensitization to at least one allergen in 26.2% of children referred for allergy evaluation. House dust mite was the most prevalent allergen, followed by grass pollen, and more than one-third of SPT-positive children exhibited polysensitization. Independent predictors of a positive SPT included age 5–10 years and a family history of allergy. The allergen sensitization pattern identified in this study is consistent with findings from studies conducted among Ethiopian primary school children, as well as studies from East Africa, Turkey, and Ireland, all of which report house dust mite as the most prevalent allergen among children undergoing skin prick testing [8–11]. In contrast, studies from temperate regions have reported higher overall sensitization rates and greater contributions from seasonal pollens, with polysensitization being more prevalent[7]. These differences may reflect variations in climate, environmental exposure, and lifestyle factors

The overall prevalence of sensitization (26.2%) observed in this tertiary cohort aligns with rates reported in similar hospital-based or referral populations, though it is predictably lower than the elevated rates documented in studies enrolling exclusively symptomatic individuals. For instance, investigations limited to children with bronchial asthma have reported atopy rates of 60–90% [9, 10], whereas community-based surveys of general pediatric populations report considerably lower figures. For example, a study of Ethiopian schoolchildren found an SPT positivity rate of only 3.6% [8]. This gradient underscores the profound influence of clinical selection criteria on observed sensitization frequencies. The present prevalence likely reflects the mixed case-mix of a tertiary referral center, which includes children with overt allergic disease alongside those with less definitive symptomatology, placing it between the high rates seen in purely asthmatic cohorts and the low rates seen in general community surveys.

The allergen profile observed—with house dust mite (16.5%) as the dominant sensitizer, followed by grass pollen (6.8%)—corresponds to patterns commonly reported in temperate and urban environments. The primacy of house dust mite is consistent with findings from Turkey, where it accounted for 63.3% of sensitizations in asthmatic children [10], and from Ireland, where it was the most common aeroallergen (23%) in patients with rhinitis [11]. The prominence of grass pollen further aligns with reports from these and other mid-latitude regions [10, 11].

Notably, this profile contrasts with patterns described in some East African studies, where allergens such as Blomia tropicalis and cockroach feature prominently [9]. This divergence highlights the significant role of local environmental exposures, climate, and domestic conditions in shaping regional sensitization patterns.

A clinically pertinent finding was that 37.0% of SPT-positive children were polysensitized (≥2 allergens), with 18.5% sensitized to three or more. This is consistent with the understanding that atopic predisposition frequently manifests as reactivity to multiple allergens, particularly in clinical populations. Polysensitization has been associated with greater symptom severity and complexity of management. The recurrent combination of dust mite with grass or herbs in our data suggests concurrent sensitization to perennial indoor and seasonal outdoor allergens, a pattern frequently observed in temperate climates[7,12]

Multivariable analysis identified two independent determinants of SPT positivity: age 5–10 years and a family history of allergy. The strong association with family history corroborates the well-established hereditary component of atopic disease. The elevated odds among children aged 5–10 years likely reflect cumulative environmental exposure and the typical developmental window for the emergence of allergic sensitization. While other studies have identified factors such as urban residence, smaller family size, or higher socioeconomic status as modifiers of risk [11,12], these variables were not systematically evaluated in the present study and warrant inclusion in future investigations.

7.Strength and Limitation

7.1Strength

This study possesses notable strengths that support the validity and relevance of its findings. Its longitudinal design, spanning six years, provides a robust overview of sensitization trends in a clinical pediatric cohort. The use of a comprehensive, standardized allergen panel for SPT ensures reliable profiling of sensitization patterns and polysensitization. The application of multivariable logistic regression strengthens the analytical rigor by identifying independent risk factors while controlling for confounders. Finally, this research addresses a significant gap by providing much-needed local data on allergen sensitization and its determinants within a tertiary care setting in Ethiopia, offering a valuable evidence base for clinical practice and future research.

7.2 Limitations

The study's single-center retrospective design may limit generalizability. Data extracted from medical records could be incomplete, and important variables (*e.g.,* detailed environmental exposures) were not available. The tertiary clinic population likely over-represents symptomatic children, potentially overestimating sensitization prevalence. The sample size, though census-based, may be underpowered for some associations. Finally, SPT indicates sensitization but does not always reflect clinical allergy, and symptom correlation was not uniformly assessed.

8. Conclusion and recommendation

8.1 Conclusion

This 6-year hospital-based study found that 26.2% of children referred for allergy evaluation were sensitized to at least one allergen. House dust mite was the most prevalent sensitizer, followed by grass pollen. A considerable proportion of SPT-positive children (37.0%) exhibited polysensitization. The study identified age 5–10 years and a family history of allergy as significant independent predictors of SPT positivity. These findings highlight a substantial burden of allergen sensitization in this clinical pediatric population and underscore the influence of age and hereditary factors in the development of atopic sensitization. The allergen profile aligns with patterns reported in other urban, temperate settings but differs from some regional reports, emphasizing the role of local environmental factors.

8.2Recommendations

Based on the findings of this study, the following recommendations are made:

.For Clinical Practice

- Routine Use of SPT: Encourage the routine and standardized use of skin prick testing in the diagnostic workup of children with suspected allergic respiratory diseases at tertiary clinics to guide specific allergen avoidance and management.
- Targeted Counseling: Provide targeted counseling to families of children aged 5–10 years and those with a family history of allergy, as they are at higher risk. Focus on environmental control measures for prevalent allergens, particularly house dust mites.
- Manage Polysensitization**:** Develop clinical guidelines for the management of polysensitized children, who may have more complex or severe disease, ensuring they receive comprehensive care and education.

For Public Health and Policy

- Awareness and Education**:** Develop and disseminate public health educational materials for families and healthcare workers on common environmental allergens (especially dust mites) and evidence-based avoidance strategies.
- Resource Allocation: Advocate for the allocation of resources to support allergy diagnostic services, including the availability of standardized allergen extracts for SPT, within pediatric referral centers.
- Environmental Health Initiatives: Collaborate with urban planning and housing authorities to promote designs and practices that reduce indoor allergen exposure (*e.g.,* improved ventilation, reduced dampness).

For Future Research

- Prospective Multi-center Studies**:** Conduct prospective, multi-center studies involving both community and hospital populations to establish national prevalence rates and better understand the progression from sensitization to clinical disease;

- Clinical Correlation Studies: Investigate the direct correlation between specific SPT results (including wheal size and polysensitization patterns) and clinical outcomes (symptom severity, asthma control, quality of life) to improve the prognostic value of testing;
- Interventional Research: Design and evaluate the impact of targeted allergen-reduction interventions in high-risk pediatric households in the local context.

9.Reference

1. Pawankar R, Holgate ST, Canonica GW, Lockey RF, Blaiss MS, editors. WAO White Book on Allergy: Update 2013. Milwaukee: World Allergy Organization; 2013

2.Asher MI, Montefort S, Bjorksten B, Lai CK, Strachan DP, Weiland SK, et al. Worldwide time trends in the prevalence of symptoms of asthma, allergic rhinoconjunctivitis, and eczema in childhood: ISAAC Phases One and Three repeat multicountry cross-sectional surveys. Lancet. 2006;368(9537):733-43.

3.Heinzerling L, Mari A, Bergmann KC, Bresciani M, Burbach G, Darsow U, et al. The skin prick test – European standards.; VolumClinical and Translational Allergy 2013e:1-10

4.Penard-Morand C, Raherison C, Charpin D, Kopferschmitt C, Lavaud F, Caillaud D, et al. Long-term exposure to close-proximity air pollution and asthma and allergies in urban children. Eur Respir J. 2010;36(1):33-40.

5.Flohr C, Tuyen LN, Lewis S, Quinnell R, Minh TT, Liem HT, et al. Poor sanitation and helminth infection protect against skin sensitization in Vietnamese children: A cross-sectional study. J Allergy Clin Immunol. 2006;118(6):1305-11.

6.Brandt O, Wegenstein B, Muller I, Smith D, Nqweniso S, Adams L, et al. Association between allergic sensitization and intestinal parasite infection in schoolchildren in Gqeberha, South Africa. Clin Exp Allergy. 2022;52(5):670-83.

7.Owens L, Laing IA, Zhang G, Turner S, Le Souef PN. Prevalence of allergic sensitization, hay fever, eczema, and asthma in a longitudinal birth cohort. J Asthma Allergy. 2018;11:173-80.

8.Mehanna N, Mohamed N, Wordofa M, Abera D, Mesfin A, Wolde M, et al. Allergy-related disorders (ARDs) among Ethiopian primary school-aged children: Prevalence and associated risk factors. PLoS One. 2018;13(9):e0204521.

9.Kwizera R, Wadda V, Mugenyi L, Aanyu-Tukamuhebwa H, Nyale G, Yimer G, et al. Skin prick reactivity among asthmatics in East Africa. World Allergy Organ J. 2020;13(6):100130.

10.Dibek Mısırlıoğlu E, Cengizlier MR. Skin prick test results of child patients diagnosed as bronchial asthma. Allergol Immunopathol. 2007;35(1):21–24.

11.Nae A, Hinchion K, Keogh IJ. A fifteen-year review of skin allergy testing in Irish patients with symptomatic rhinitis. World J Otorhinolaryngol Head Neck Surg. 2021;7(4):338-43.

12.Lowe AJ, Hosking CS, Bennett CM, Carlin JB, Abramson MJ, Hill DJ, et al. Skin prick test can identify eczematous infants at risk of asthma and allergic rhinitis. Clinical & Experimental Allergy. 2007;37(11):1624-31.

10.Annexes

Annex I: Data Collection Questionnaire: Pediatric Skin Prick Test (SPT) Study

Study ID: _____
Date of Data Collection: //_____

Variable / Section	Response Options / Data Entry
A. Sociodemographic Characteristics	
Sex	□ Female □ Male
Residency	□ Urban □ Rural
Family History of Allergy/Atopy	□ Yes □ No
B. Clinical History (Indication for SPT)	
	□ Presence of Asthma □ Allergic Rhinitis □ Atopic Dermatitis (Eczema) □ Others (Specify): _____
C.Control Tests	
Positive Control (Histamine)	□ Positive □ Negative
Negative Control (Saline/Glycerol)	□ Positive □ Negative
D.Positive Allergens	Positive (≥3mm) □ Dust mites □ Grass □ Herbs □ Tree □ Egg □ Milk □ Cat □ Dog □ Chicken □ Beef
E. SPT result of each allergen mm if positive	
SPT Result	□ Result in mm
F.Any Observed Adverse Reaction	
Reaction during/after SPT	□ Yes □ No *(If Yes, describe briefly):*_____

Assurance of Principal Investigator

I, the undersigned, agree to accept all responsibilities for the scientific and ethical conduct of the research project. I will provide a timely progress report to my advisor and seek the necessary advice and approval from my primary advisers in the course of the research. I will communicate promptly with my advisers and all stakeholders involved in the study, including any source of funding forthis research.

Name of the student: Mideksitu Jote

Signature: _____

Date: _____

Name of the primary advisor: Dr.Abate Yeshidinber

Signature: _____

Date: _____