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# Parents' knowledge, attitude, and practice toward the prevention and treatment of dust mite allergy

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Parents' knowledge, attitude, and practice toward the prevention and treatment of dust mite allergy

Running title: KAP of dust mite allergy

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# Abstract

**Objective:** This cross-sectional study aimed to evaluate parents' knowledge, attitudes, and practices (KAP) concerning the prevention and treatment of dust mite allergy in children.

**Design:** Conducted between September and December 2022, this cross-sectional study involved multiple healthcare facilities, including primary and secondary care settings, ensuring a comprehensive representation of the target population.

**Participants:** A total of 503 parents of children with dust mite allergies participated, with 253 parents having children undergoing desensitization treatment and 250 parents whose children did not. Selection criteria were carefully defined to include parents directly responsible for the care of children with dust mite allergies.

**Interventions:** Two distinct questionnaires were administered to parents, tailored for those with and without children undergoing desensitization treatment. These questionnaires covered demographic information, allergy diagnosis, treatment details, and KAP related to dust mite allergy.

**Primary and secondary outcome measures:** Primary outcomes included parents' scores on knowledge, attitudes, and practices regarding dust mite allergy prevention and treatment. Secondary outcomes involved analyzing the interaction between these factors using pathway analysis.

**Results:** Parents of children undergoing desensitization treatment exhibited higher levels of knowledge, attitude, and overall practice scores compared to those without desensitization therapy. Pathway analysis revealed varying influences of knowledge and attitude on practice between the two groups.

**Conclusions:** The study highlighted differing levels of KAP among parents of children with dust mite allergies, influenced by desensitization therapy status. While attitudes tended to be favorable, practices were suboptimal, particularly among parents whose children did not

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receive desensitization treatment. These findings emphasize the importance of targeted educational interventions to enhance parental awareness and practices regarding dust mite allergy management, especially in cases where desensitization treatment is not pursued. Further research is warranted to explore effective strategies for improving parental engagement and adherence to preventive measures.

**Key words:** dust mites, house; dust mite allergy; health knowledge, attitudes, practice; desensitization, immunologic; cross-sectional study.

#### Strengths and limitations of this study

Utilizing separate questionnaires for parents of children with and without desensitization treatment allowed for targeted exploration of relevant factors, enhancing the study's specificity. Incorporating six dimensions in the questionnaire ensured a thorough examination of parents' knowledge, attitudes, and practices, providing a holistic understanding of their KAP towards dust mite allergy prevention and treatment.

With 503 participants, the study's sample size is sufficiently large to provide reliable statistical analysis and meaningful insights into parental perceptions and behaviors related to dust mite allergy management.

Conducting the study at Shengjing Hospital Affiliated to China Medical University ensures consistency in data collection procedures and minimizes potential confounding variables related to healthcare settings, enhancing the internal validity of the findings.

#### **1 INTRODUCTION**

House dust mites mainly include *Dermatophagoides pteronyssinus*, *Dermatophagoides farinae*, and *Euroglyphus maynei* (1). They are non-parasitic microscopic bugs that live on desquamated dead skin cells from humans and pets. They prefer warm and moist environments and are found in bedding, linens, carpets, and furniture (2-4). Although the mite's exoskeleton can contribute to the allergic reaction, the main allergens are found in the mite's fecal pellets (5, 6). Each mite produces about 20 pellets daily, each the size and weight of a pollen grain (5, 6). Therefore, they are easily inhaled and can cause sensitization of the respiratory tract mucosa, leading to epithelial permeability and the movement of the mite's antigens to antigen-presenting dendritic cells (5, 6). Dust mite allergy affects about 20 million people in the United States of America (USA) alone (2). Dust mite allergy contributes to the development of allergic rhinitis and asthma, affecting 800 million people worldwide (1, 5, 7, 8). The prevalence of asthma in children in the USA is 8.3% (9). Therefore, dust mites represent a serious public health problem. The most effective management method for dust mite allergy is allergen avoidance (e.g., frequently washing bedding, removing carpets, room air cleaners, and humidity control) (5, 10-12). Over-the-counter medications (antihistamines, nasal corticosteroids, leukotriene receptor antagonists, cromolyn sodium, and decongestants) and allergen immunotherapy can also help (5, 10).

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Since allergen avoidance involves specific lifestyle habits (5, 10-12), parents' proper knowledge, attitudes, and practice (KAP) toward dust mites are essential to managing the allergic symptoms in their children. KAP surveys are tools that provide quantitative and qualitative data about a specific subject in a specific population (13, 14). They can be used to identify gaps and design tailored teaching and training activities (13, 14). It is known that parents who visited an allergist demonstrated higher dust mite KAP (15). Generally, parents display very high KAP toward food allergies in their children (16-18), mainly because several

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of these allergies can be fatal, which is not the case with dust mite allergy. Studies revealed poor parental KAP for allergic rhinitis (19, 20) and poor KAP regarding allergic disorders in general (21), including in parents of asthmatic children (22). Still, the KAP of parents toward dust mites is poorly known, especially in China.

Therefore, this study aimed to evaluate the KAP of parents toward preventing and treating dust mite allergy and to examine the differences between the parents of children who were treated with desensitization treatment and the parents of children who were not. Parents are the primary actors in house cleaning and management, and evaluating their KAP toward house mite allergy should help design future teaching activities.

# 2 MATERIALS AND METHODS

# 2.1 Study design and participants

This cross-sectional study survey was conducted from September to December 2022 at Shengjing Hospital Affiliated to China Medical University. The participants were the parents of children with dust mite allergies. The study was approved by the Medical Ethics Committee of Shengjing Hospital Affiliated to China Medical University (approval #2022PS935K). Informed consent was obtained from the participants before completing the survey.

The inclusion criteria were 1) parents of children who tested positive for dust mite-specific serum IgE (measured by Phadia ImmunoCAP) and 2) voluntarily completed the questionnaire. The participants were grouped according to whether the children were treated with desensitization treatment or not.

#### 2.2 Questionnaires

The questionnaire was designed by two senior experts in allergy with reference to the literature (15, 23, 24). The final questionnaire had two versions: one for the parents of children who did not undergo desensitization treatment (Questionnaire A) and one for the parents of children

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who underwent desensitization treatment (Questionnaire B). Thirty parents were randomly selected to complete the questionnaire to test its reliability. Cronbach's  $\alpha$  was 0.726 for Questionnaire A and 0.702 for Questionnaire B.

The questionnaire contained six dimensions: demographic information of the parents, demographic information of the child, diagnosis and treatment information related to dust mite allergy in children, knowledge dimension, attitude dimension, and practice dimension. The specific questions and scoring instructions for both questionnaire versions can be found in the Supplementary Materials. The data were collected by on-site inquiry and questionnaire when the parents visited the hospital.

#### 2.3 Statistical analysis

The continuous variables were expressed as means  $\pm$  standard deviations (SD) and analyzed using Student's t-test or ANOVA. The categorical data were expressed as n (%) and analyzed using the chi-square test. All statistical analyses were performed using two-sided tests, and P-values <0.05 were considered statistically significant. Pathway analysis was constructed, and the hypotheses were 1) knowledge has direct effects on attitude, 2) attitude has direct effects on practice, and 3) knowledge has direct effects on practice. By analyzing the influencing factors of good practice through multiple factors, define it as 70% of the highest possible score for practice. STATA 17.0 (Stata Corporation, College Station, TX, USA) was used for statistical analysis.

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#### 2.4 Patient and public involvement

No patient involved

### **3 RESULTS**

#### **3.1** Characteristics of the participants

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A total of 503 participants completed the questionnaires: 250 in the non-desensitization group and 253 in the desensitization group. Most participants were women (81.91%), most participants had a bachelor's degree or higher education, and only a small proportion had a history of dust mite allergy. There were more fathers in the desensitization group (25.69% vs. 9.20%, P<0.001), and the mothers' education was higher in the non-desensitization group (P=0.028) (Table 1). There were no differences between the children of the two groups, except for the residence area (P=0.001) and means of transportation to the hospital (P=0.003) (Supplementary Table S1). Compared with the non-desensitization group, the children in the desensitization group had higher proportions of dust mite allergy diagnosis (P=0.009), less rhinitis (P=0.004), and shorter rhinitis attacks (P<0.001) (Supplementary Table S1).

Table 1. Characteristics of the parents, r	1 (%)

	Without	With	Р
	desensitization	desensitization	
Total	250 (49.70)	253 (50.30)	
Parental relationship			< 0.001
Father	23 (9.20)	65 (25.69)	
Mother	223 (89.20)	184 (72.73)	
Other family members	4 (1.60)	4 (1.58)	
Father's education	4		0.167
Primary school and below	19 (7.60)	13 (5.14)	
Middle school	28 (11.20)	44 (17.39)	
High school/technical secondary school	33 (13.20)	41 (16.21)	
Bachelor's degree/junior college	131 (52.40)	128 (50.59)	
Master's degree	30 (12.00)	20 (7.91)	
Doctorate	9 (3.60)	7 (2.77)	
Mother's education			0.028
Primary school and below	1 (0.40)	3 (1.19)	
Middle school	22 (8.80)	39 (15.42)	
High school/technical secondary school	32 (12.80)	44 (17.39)	
Bachelor's degree/junior college	154 (61.60)	143 (56.52)	
Master's degree	35 (14.00)	21 (8.30)	
Doctorate	6 (2.40)	3 (1.19)	
Annual household income (RMB)			0.379
<30,000	18 (7.20)	24 (9.49)	
30,000-50,000	29 (11.60)	43 (17.00)	
50,000-100,000	76 (30.40)	73 (28.85)	
100,000-200,000	61 (24.40)	61 (24.11)	
200,000-300,000	32 (12.80)	26 (10.28)	

>300,000	34 (13.60)	26 (10.28)	
Are the parents allergic to dust mites?			0.373
None	102 (40.80)	126 (49.80)	
Father only	21 (8.40)	18 (7.11)	
Mother only	24 (9.60)	19 (7.51)	
Both	6 (2.40)	6 (2.37)	
Unclear	97 (38.80)	84 (33.20)	
Ways to learn about allergies [multiple choice]			-
Newspaper & Books	49 (19.60)	19 (7.51)	
Radio & TV	36 (14.40)	21 (8.30)	
Web Search	104 (41.60)	82 (32.41)	
Short videos	76 (30.40)	40 (15.81)	
Doctor's guidance during the consultation	164 (65.60)	228 (90.12)	
Never knew about it	26 (10.40)	8 (3.16)	

# 3.2 Knowledge, attitudes, and practice

For the items common to the two questionnaires, compared with the non-desensitization group, the desensitization group showed higher correct response rates about dust mites, the complications of dust mite allergies, the source of dust mites, and how to manage dust mite populations (all P<0.05) (Supplementary Table S2). Both groups showed relatively poor knowledge regarding the group-specific items (Supplementary Table S3).

About half of the participants cannot stand dust mites in their homes. More participants in the desensitization group were very worried about the possible health risks of dust mites in children (P<0.001). More participants in the desensitization group remained worried after following the doctors' advice to decrease dust mites (P=0.016). Most participants in the two groups agree that it is necessary to remove dust mites regularly (P=0.053) (Supplementary Table S4). The participants in the non-desensitization group are willing to undergo treatments, but cost appears to be a barrier, while most participants in the desensitization group have a favorable attitude toward treatment (Supplementary Table S5).

Compared with the non-desensitization group, subjects in the desensitization group displayed higher rates of positive behavior regarding all practice items (all P $\leq$ 0.001), except for the

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weekly cleaning of bedding and daily vacuuming (P=0.345 and P=0.142) (Supplementary Table S6). There were no significant differences between the two groups regarding the pillow and bedding materials (Supplementary Table S7).

#### 3.3 Pathway analysis

The root mean square error of approximation (RMSEA, P<0.001), comparative fit index (CFI, P=1.000), Tucker-Lewis index (TLI, P=1.000), and standardized root mean square residual (SRMR, P<0.001) all indicated that the model fit was acceptable. In the non-desensitization group, knowledge directly affected attitude ( $\beta$ =0.22, P<0.001), and attitude directly affected practice ( $\beta$ =0.16, P<0.001, Table 2), but the knowledge did not affect practice ( $\beta$ =-0.01, 0.06, P<0.001). In the desensitization group, knowledge directly affected attitude ( $\beta$ =0.08, P<0.001) or knowledge ( $\beta$ =0.03, 0.12, P<0.001).

<b>Table 2.</b> Estimates of hypothesis paths of KAP	

	β (95% CI)	P-value
Without desensitization	4	
K -> A	0.22 (0.10, 0.35)	< 0.001
A -> P	0.16 (0.09, 0.22)	<0.001
K -> P	-0.01 (-0.07, 0.06)	0.871
Desensitization		
K -> A	0.13 (0.01, 0.25)	0.028
A -> P	0.08 (-0.01, 0.17)	0.095
K -> P	0.03 (-0.05, 0.12)	0.439

CI: confidence interval; K: knowledge; A: attitude; P: practice.

# **3.4 Factors influencing practice among parents of children who underwent desensitization treatment**

Among parents of children who underwent desensitization treatment, bachelor's degree or above (OR=3.816, 95%CI: 1.483-9.818, P=0.005), suspected dust allergy based on symptoms (OR=4.299, 95%CI: 1.429-12.929, P=0.009), and children having rhinitis (OR=0.352, 95%CI: 0.170-0.272, P=0.005) were associated with the parents' practice (Table 3).

**Table 3**. The factors influencing good practices (n=44 parents with good practice) among

 parents of children who have undergone desensitization treatment (n=253)

	Univariate		Multivariate	
	95%CI	Р	95%CI	Р
Knowledge	0.966 (0.846- 1.102)	0.604		
Attitude	1.16 (0.99-1.36)	0.067		
Parental relationship	-			
Mother	REF			
Father/ Other family members	0.449 (0.19- 1.061)	0.068		
Father's education				
Junior college or below	REF			
Bachelor's degree or above	1.44 (0.721- 2.877)	0.302		
Mother's education				
Junior college or below	REF	0.	REF	
Bachelor's degree or above	3.928 (1.589- 9.709)	0.003	3.816 (1.483- 9.818)	0.005
Annual household income (RMB)				
<100,000	REF			
≥100,000	1.297 (0.676- 2.487)	0.434		
Are the parents allergic to dust mites?				
None	REF			
One of the parents/Both	1.83 (0.814- 4.112)	0.144		
Unclear	0.639 (0.286- 1.428)	0.275		
Learned about allergies				
No	REF			

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Yes	0.621	(0.121-	0.567		
	3.182)				
Pre-visit knowledge of child's dust					
mite allergy					
Unaware	REF			REF	
Aware	1.81	(0.887-	0.103	1.679 (0.792-	0.176
	3.694)			3.561)	
Suspected based on symptoms	3.08	(1.118-	0.03	4.299 (1.429-	0.009
	8.481)			12.929)	
Child's sex					
Male	REF				
Female	1.111	(0.564-	0.761		
	2.187)				
Child's age	0.855	(0.738-	0.039	0.895 (0.764-	0.17
	0.992)			1.049)	
Only child					
Yes	0.552	(0.286-	0.076		
	1.065)				
No	REF				
Child's Diagnosed Conditions:					
Rhinitis	0.432	(0.222-	0.013	0.352 (0.17-	0.005
	0.841)			0.727)	
Bronchial Asthma	0.87	(0.428-	0.699		
	1.767)				
Cough-Variant Asthma	0.833	(0.362-	0.669		
	1.921)				
Allergic Cough	1.01	(0.521-	0.977		
	1.957)				

# **4 DISCUSSION**

This study investigated parents' KAP regarding the prevention and treatment of dust mite allergy and examined the differences between the parents of children who were treated with desensitization treatment and those of children who were not. The results showed that the parents of children with dust mite allergy had relatively good KAP regarding dust mites. The parents of children who did not undergo desensitization therapy had poor knowledge, favorable attitudes, and poor practice regarding dust mites, while the parents of children who underwent desensitization therapy had good knowledge, favorable attitudes, and poor practice.

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Although dust mite allergy is bothersome for the patients and can evolve into allergic rhinitis and asthma, the condition is not as dangerous as food allergies, probably explaining why the KAP toward food allergies is very high in parents of food-allergic children (16-18) but lower in parents of children with dust mite allergy, as observed in the present study. Indeed, the relatively low KAP observed here is supported by previous studies on allergic rhinitis (19, 20) and allergies in general (21). Even parents of children with chronic asthma (in whom allergens can be triggers for asthma attacks) have a poor KAP toward allergies (22). A study covering 29 Chinese cities showed that the KAP of parents toward allergic rhinitis was low (25). In the present study, the total KAP scores and knowledge scores were higher in the desensitization group than in the non-desensitization group, as supported by Callahan et al. (15), who reported higher KAP in the parents who met an allergist compared with those who did not (to receive desensitization treatment, all patients must consult an allergist in China). Still, in the present study, the non-desensitization group included parents of children newly diagnosed with dust mite allergy and parents of children with known dust mite allergy who did not receive or did not yet receive desensitization treatment. The attitude scores were relatively high in both groups, but the practice scores were low. These results indicate that although the willingness to take measures against house dust mites to improve their child's health was high, the actual application of these measures was low. Indeed, for example, vacuuming each day is timeconsuming, boring, and bothersome. The same goes for changing and laundering sheets more often. Since house dust mite allergy is not a serious condition, many parents do not feel the need to perform all those tasks.

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This study showed significantly better scores for several knowledge areas, such as the dust mite species causing allergies, the diseases that can be due to dust mite allergies, the objects in which dust mites are more likely to thrive, methods to eliminate dust mites, and whether cleaning can completely eliminate dust mites. It is probable that the parents who opted for desensitization

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therapy in their children obtained more information from the physicians or other sources when discussing the treatment options or by themselves to understand better what they were getting into. Indeed, a study showed that the parents of children with life-threatening illnesses were actively seeking information about the illness (26); although dust mite allergy is far from being life-threatening, a similar protective behavior could be involved. Furthermore, parents of children with allergies are actively seeking information from different sources (27). Desensitization therapy is relatively expensive, and parents might fear some adverse effects on their children, encouraging them to take more information. Compared with the nondesensitization group, the parents in the desensitization group also reported a more worried attitude toward the possible health risks related to dust mites in their children and more worries toward dust mites despite active measures taken to decrease them. These worries could come from a better knowledge of the diseases and complications related to dust mite allergies. Regarding the practice items, compared with the non-sensitization group, the parents in the desensitization group declared more efforts being taken to gain knowledge about dust mites (which could relate to the knowledge scores), as previously suggested (27) and reported a higher use of mite-proof bedding and pillowcase and a lower use of dust mite-prone decoration, which could be related to a better knowledge of the sources of dust mites. Still, both groups reported poor practice regarding washing bedding weekly and vacuuming every day. In the desensitization group and higher education, suspected dust mite allergy based on symptoms (suggesting a higher knowledge of dust allergy) were independently and positively associated with the practice. On the other hand, rhinitis was independently and negatively associated with practice.

The pathway analysis showed different patterns of association among the KAP dimensions between the non-desensitization and desensitization groups. Indeed, in the non-desensitization group, knowledge affected attitude, which in turn affected practice, while in the desensitization

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group, only knowledge affected attitude. It is possibly because the parents in the desensitization group had already taken action for their children's condition. Still, these differences should be investigated more in-depth to tailor future interventions to the specific target populations. In addition, pathway analyses are only statistical surrogates for causality (28, 29), and the results should be confirmed.

Nevertheless, the present study provides clues for designing teaching brochures, videos, podcasts, or activities to increase the KAP of parents toward dust mites. In particular, the knowledge about the dust mites themselves and the methods to kill them was low. The practice of minimizing the living habitats of dust mites and using actual means to get rid of them should be emphasized.

This study had limitations. It was performed at a single center, and the sample size is relatively small. In addition, because the two subpopulations of participants (i.e., with children with or without desensitization treatments) had two different KAP questionnaires, a direct comparison of the KAP scores was not possible between the two groups. Furthermore, as for all KAP surveys, the data represent the situation of a specific population at a specific point in time (13, 14). In addition, KAP surveys are subject to a social acceptability bias, i.e., the participants can be tempted to answer what they should do instead of what they really do (13, 14). Nevertheless, the present study might provide a comparator point to evaluate the KAP in a similar population after an intervention to increase health literacy on house dust mites.

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# **5 CONCLUSIONS**

In conclusion, the parents of children who did not undergo desensitization therapy had poor knowledge, favorable attitudes, and poor practices regarding dust mites, while the parents of children who underwent desensitization therapy had good knowledge, favorable attitudes, and poor practices. Still, the practice was generally poor in all participants, highlighting the need

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> to emphasize the importance of decreasing the house dust mite to maintain the children's health. There is still a need to spread awareness and educate the general population about the importance of controlling house dust mites.

#### List of abbreviations

KAP: knowledge, attitudes, and practices

SD: standard deviations

### Declarations

#### Ethics approval and consent to participate

The research was carried out in accordance with the Declaration of Helsinki. The study was approved by the Medical Ethics Committee of Shengjing Hospital Affiliated to China Medical University (approval #2022PS935K). Informed consent by electronic questionnaire was obtained from the participants before completing the survey.

#### **Consent for publication**

Not applicable.

#### **Data Availability Statement**

All data generated or analyzed during this study are included in this published article [and its supplementary information files].

#### **Conflict of Interest**

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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# **Authors' contributions**

Conceptualization, Si Liu and Qianlan Zhou; Methodology, Bing Dai; Software, Li Chen; Validation, Qinzhen Zhang; Formal Analysis, Lina Han; Investigation, Xiaowen Li; Resources, Wenxin Shen; Data Curation, Si Liu; Writing – Original Draft Preparation, Si Liu; Writing – Review & Editing, Qianlan Zhou; Visualization, Qianlan Zhou; Supervision, Lishen Shan; Project Administration, Lishen Shan; Funding Acquisition, Lishen Shan. 

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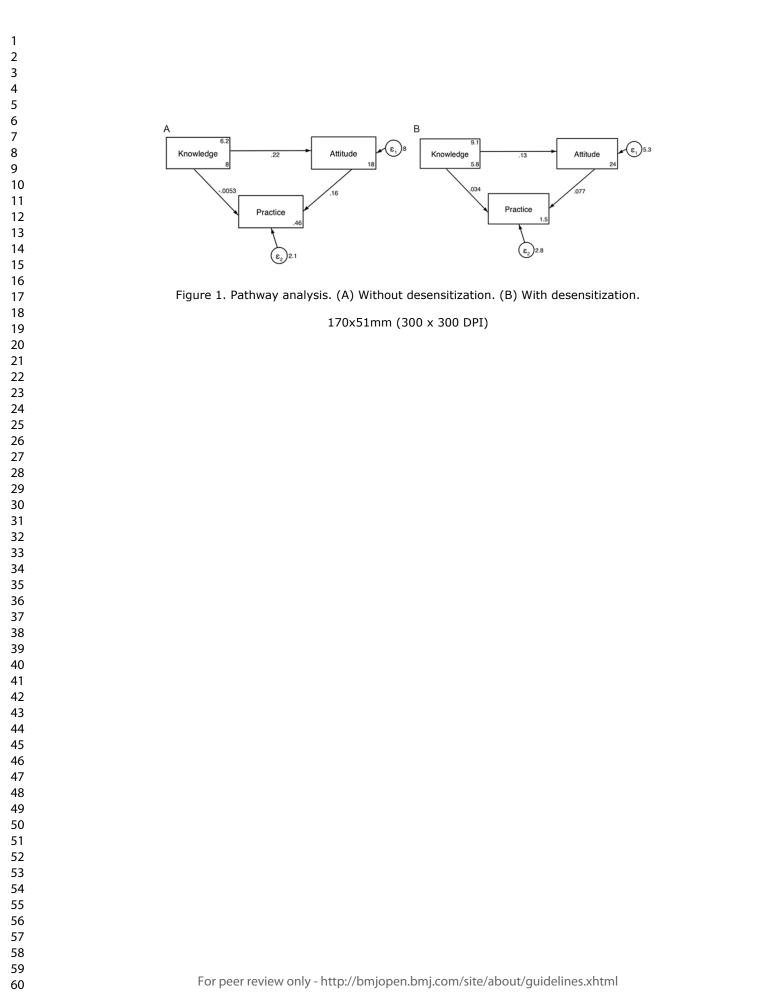
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# **Figure Legends**

Figure 1. Pathway analysis. (A) Without desensitization. (B) With desensitization.

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	Without	Desensitization	Р
	desensitization (1	n=253)	
	(n=250)		
Gender			0.30
Male	153	166 (65.61)	
	(61.20)		
Female	97	87 (34.39)	
	(38.80)		
Age, mean±SD	6.37±3.13	8.80±2.36	-
Ethnicity			0.934
the Han nationality	180	183 (72.33)	
	(72.00)		
Minorities	70	70 (27.67)	
	(28.00)		
Yes	147	-	
	(58.80)		
No	103	-24	
	(41.20)		
Knowing your child's	dust		0.00
mite allergy before going t	to the		
doctor			
Know	58	79 (31.23)	
	(23.20)		
Don't know	150	152 (60.08)	

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2				
3		(60.00)		
4		(00.00)		
5	Suspected dust mite allergy	42	22 (8.70)	
6	Suspected dust linte allergy	42	22 (8.70)	
7 8	in the child based on him/her	(16.80)		
9				
10 11	symptoms			
12				0.004
13	Season when rhinitis is more			0.004
14				
	kely to occur			
16				
17	Without rhinitis	68	33 (13.04)	
18				
19		(27.20)		
20	Spring	× ,		
21	Spring	27	41 (16.21)	
22	Spring	21	11 (10.21)	
23		(10.80)		
24		(10.80)		
25 26				
20	Summer	10 (4.00)	12 (4.74)	
28				
29	Autumn	66	72 (28.46)	
30				
31		(26.40)		
32				
33	Winter	24 (9.60)	26 (10.28)	
34	w linter	24 (9.00)	20 (10.20)	
35	A 11		(0, (27, 27))	
36	All year round	55	69 (27.27)	
37		4		
38		(22.00)		
39				
40	Duration of rhinitis attack			< 0.001
41				
42	Without rhinitis	77	40 (15.81)	
43				
44		(30.80)		
45		(30.80)		
46		00	101 (47.02)	
47	The duration of symptoms	89	121 (47.83)	
48		/··		
49	<4 days/week, or <4 consecutive	(35.60)		
50 51				
51 52	weeks			
52				
54	The duration of symptoms	84	92 (36.36)	
55	er ejmptomb	~ -		
56	$\geq$ 4 days/week, or $\geq$ 4 consecutive	(33.60)		
57		(33.00)		
58	weeks			
59	weeks			

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Frequency	of	desensitization
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# treatments

First medication	-	16 (6.32)
Within 3 months	-	49 (19.37)
3 months to 6 months	-	22 (8.70)
6 months to 1 year	-	38 (15.02)
More than 1 year	-	128 (50.59)

# Outcome of desensitization

# treatment

First medication	-	27 (10.67)
Significant improvement (no	-	61 (24.11)
symptoms or close to normal)		
Improvement (few or	Ö.	70 (27.67)
occasional mild symptoms)		
Remission (fewer symptoms	- 0	55 (21.74)
and less frequent recurrences)		
Effective (all symptoms still	-	34 (13.44)
present but less frequent		
recurrences)		
Ineffective (hardly any	-	6 (2.37)
improvement and worse		
symptoms)		

Time for desensitization to complete initial treatment

Initial treatment has not been - 71 (28.06)

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ו ר				
2				
3 4	completed			
5	14 weeks		-	95 (37.55)
6 7				
8	15-20 weeks		_	45 (17.79)
8 9	15 20 Weeks			13 (17.75)
9 10	21.29			10 (2.05)
10	21-28 weeks		-	10 (3.95)
12				
13	More than 28 wee	ks	-	32 (12.65)
14				
15	Adverse rea	ctions during		-
16		0		
17	desensitization trea	tment		
18	ucsensitization trea	unent		
19	Na			0.9(29.74)
20	No		-	98 (38.74)
21				
22	Only rednes	s and swelling at	-	146 (57.71)
23				
24	the injection site			
25	0			
26	Large a	rea urticaria	_	6 (2.37)
27	Luige	area areara		0(2.37)
28	through out the he	der		
29	throughout the bo	bdy		
30	~ 1			
31	Severe al	lergic reaction		3 (1.19)
32				
33	(difficulty breath)	ing, shock, etc.)		
34	· •	-		
35	Frequency	of adverse		_
36	rrequency	of auverse		
37	reactions during de	consitization		
38	reactions during de	sensitization		
39				
40	None		-	105 (41.50)
41				
42	1 - 2 times		-	64 (25.30)
43				
44	3 - 5 times		_	34 (13.44)
45				
46	Often			25 (12 82)
47	Often		-	35 (13.83)
48 40	<b>.</b> .			15 (5.02)
49 50	Every time		-	15 (5.93)
50 51				
51				

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	Correct rate		Р	
	Without	Desensitization		
	desensitization			
Q1. Which of the following	148	216 (85.38)	<0.001	
species of dust mite can cause an	(59.20)			
allergic reaction?				
Q2. Only live dust mites can act	105	119 (47.04)	0.256	
as allergens to cause allergic	(42.00)			
reactions.				
Q3. Which of the following	153	187 (73.91)	< 0.00	
diseases can be caused by dust mite	(61.20)			
allergy?				
Q4. Dust mites in the house	171	192 (75.89)	0.061	
mainly breed in bed sheets and	(68.40)			
bedding; carpets and curtains are not				
prone to breeding dust mites.				
Q5. Plush toys are prone to	226	245 (96.84)	0.003	
breeding dust mites.	(90.40)			
Q6. UV light can kill dust mites.	68	54 (21.34)	0.126	
	(27.20)			
Q7. Freezing the plush toys or	44	68 (26.88)	0.012	
	6			

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pillowcases in the refrigerator	(17.60)		
overnight can kill dust mites.			
Q8. How many degrees of hot	127	151 (59.68)	0.0
water for washing bed sheets will be	(50.80)		
most effective in removing dust			
mites?			
Q9. Indoor dust mites can be	185	215 (84.98)	0.0
completely eliminated with a good	(74.00)		
job of cleaning.			

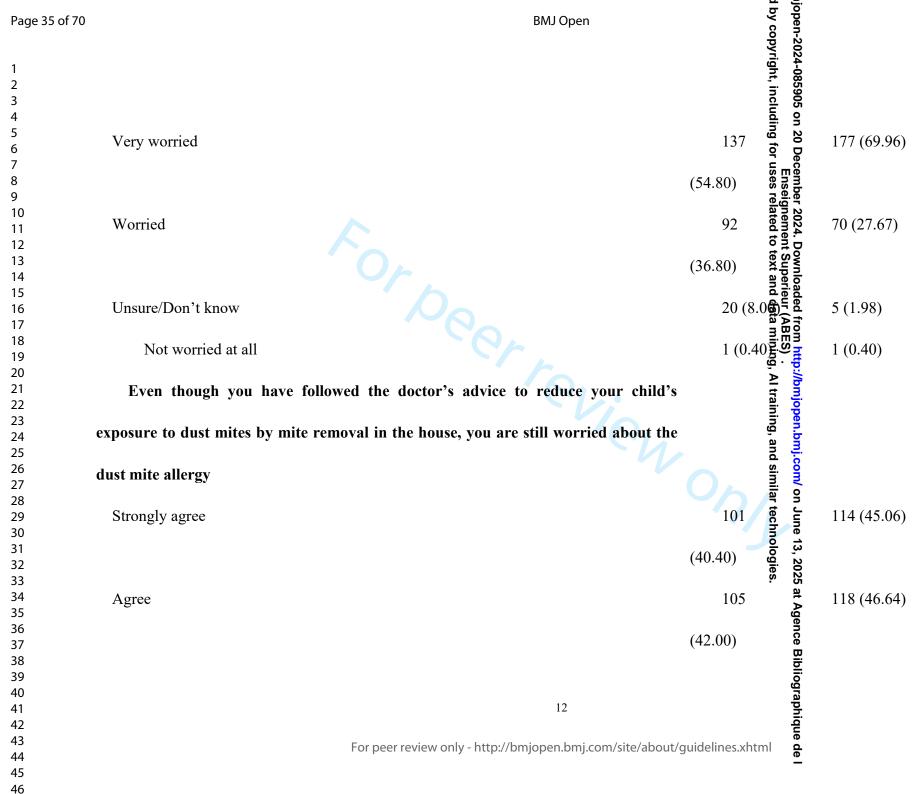
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S	Supplementary Table S3. The distribution of the remaining problems in the k	nowledge dimensior	jopen-2024-085905 on 20 De I by copyright, including for n, n		
	Questionnaire A Without desensitization treatment	Correct	uses re	Don't know	
	Q10. There is no cure for a child with dust mite allergy, but keep	43 (17.20)	ate 39% 55.60)	68 (27.20)	
tł	he house as hygienic as possible to avoid dust mites		bownloa t Super text an		
	Q11. Dust mite allergy will heal itself as the child grows up	39 (15.60)	d data deg(47.60)	92 (36.80)	
	· ()	Haven't heard of	heard of	Understand th	
	it		≥ È it bu∰t den't know	process an	
		01	the details	procedure of it	
	Q12. Have you heard of or know about desensitization treatment for	91 (36.40)	and similar techno	33 (13.20)	
ď	lust mites?		n June r techn		
	Questionnaire B Desensitization treatment		13, 2025 ologies,		
	Q10. The desensitization treatment for dust mite allergy usually	231 (91.30)	غر (1 من عند) 4 (1 من 58)	18 (7.11)	
ta	akes 3-5 years		nce Bit		
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Q11. The medications of nasal spray hormone therapy for rhinitis or	78 (30.83)	on 2045.85) on 2045.85) Iding for uses related to	59 (23.32)	
nebulized hormone therapy for asthma can be stopped during		cember Enseig uses rel		
desensitization treatment		2024. [ nemen ated to		
Q12. There is no need to pay attention to removing and avoiding	9 (3.56)	of texts and data mint SUB texts and data min	13 (5.14)	
dust mites during desensitization treatment		ided fro eur (Al d data		
Q13. The desensitization of dust mites can treat rhinitis caused by	65 (25.69)	<b>a</b> · <b>a</b>	84 (33.20)	
dust mite allergy, but it can't prevent rhinitis from developing into		o://bmjopen.t		
asthma	0	an 🛅		
	Itching of the	simmediate	Difficulty	
	palms of the hands	5 0	breathing. Rapid	
	and feet. Itchy scalp.	mentel state. Cold	breathing.	
	Flushed skin all over	<b>N</b>		
	the body. The	Decrease in blood	other symptoms	
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, 8 9				
10 11 12	Q14. Those adverse reactions in desensitization treatment that 212 (83.79)			
13 14	require attention are (Multiple choice)			
15 16	d eur (A tau tau tau tau tau tau tau tau tau tau			
17 18 19	require attention are (Multiple choice)			
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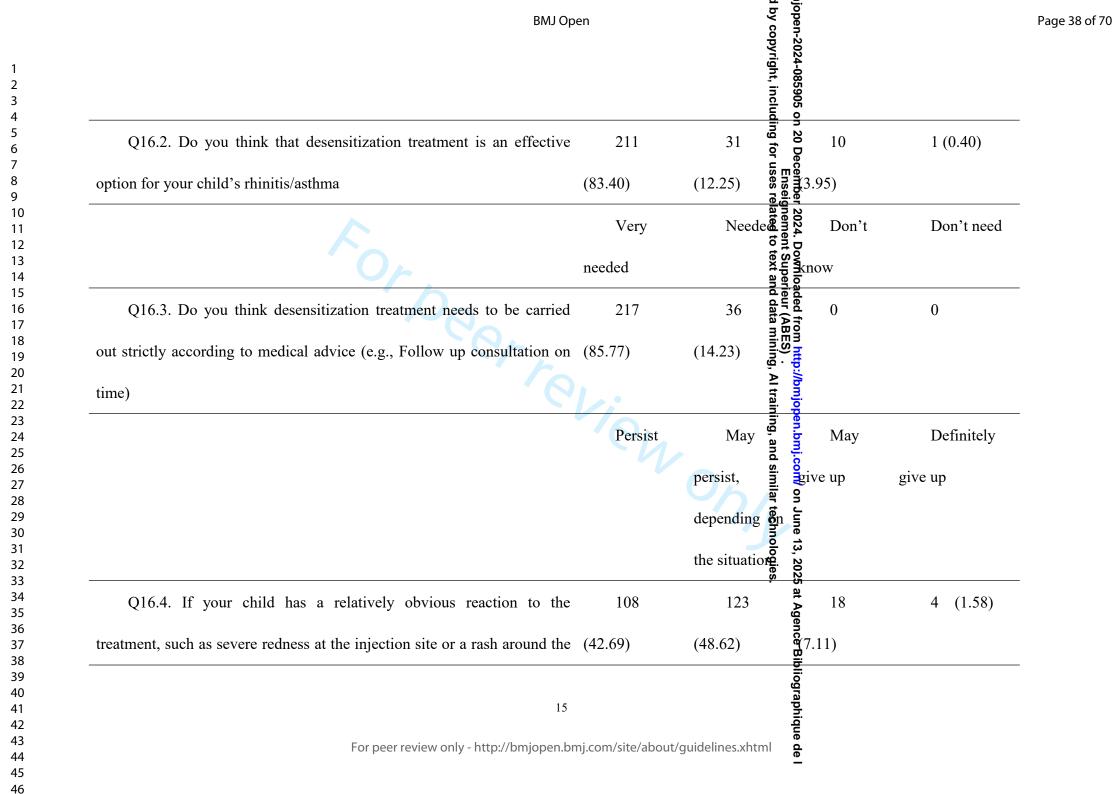
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10 11 12		desensitization 2024.			
13You can't sta14	and dust mites infesting your home	ext a		0.481	
<ul><li>15</li><li>16 Strongly agree</li><li>17</li></ul>	now	d data r 111 at r	122 (48.22)		
18 19 20		(44.40) (44.40)			
21 Agree		95 Al training, and similar technologies (14.00) 9 (3.600gies	98 (38.74)		
23 24 25		(38.00) (38.00) (38.00)			
26 Unsure/Don't k	now	35 d similar	28 (11.07)		
28 29 30		(14.00) technic			
31 32 Disagree 33		9 (3.600 s, 2025	5 (1.98)		
What is you What is you	r attitude towards the possible health risks of dust mite infestation	•		0.001	
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8 9 10 11 12	Strongly disagree	(15.60) es related to t 5 (2.000 to t	4 (1.58)	
13 14	Do you think it is necessary to remove mites from your home regularly	Supo Supo		0.053
15 16 17	Very necessary	and data m 182	188 (74.31)	
18 19 20 21 22 23	Do you think it is necessary to remove mites from your home regularly   Very necessary   Possibly necessary   Unsure   Unnecessary	(72.80) (72.80	54 (21.34)	
24 25 26 27	Unsure	(22.00) <sup>g</sup> , and 13 (5.2 <sup>c</sup> ) iia	6 (2.37)	
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	Questionnaire A Without desensitization treatment	Ver	y	PossibByreig	Unsure	Unnecessary
		necessar	У	necessary difference to	2024. [	
	Q14.2. If there have a therapy to make your child non-allergic to	159	)	71 t Super	lownloa	1 (0.40)
Ċ	dust mites, do you think it is necessary to undergo it	(63.60)		(28.40) d data i	adeq (7.60)	
	Cr b	Мо	re	500-1000 .	<b>H</b> 100-500	Less than
		than	1000	0 Al train	CNY/month	100 CNY/month
		CNY/mo	onth	CNY/month	ven.bmj	
	Q14.3. How much do you think is acceptable to spend for your child	47		81 disimilar	82 9	40 (16.00)
C	on the prevention and treatment of dust mite allergy (RMB)	(18.80)		(32.40) Ir techn	ב שנ 32.80)	
					13, 202!	
	Questionnaire B Desensitization treatment	Yes	5	•	01	No
					at Don't genceknow/Unsure	
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Supplementary Table S6. Practice dimension, n (%)	jopen-2024-085905 on 20 De I by copyright, including for I		
	Positive behavior		Р
	Without d t	Desensitization	
	desensitization		
P1. Due to your child's dust mite allergy, have you and your family made a	154 (61.60) at a more data from market and the market at a more data and the market at a more da	216 (85.38)	< 0.001
special effort to learn about relevant knowledge (including dust mites. dust mite	inii		
allergy and desensitization treatment, etc.)	Al training, 94 (37 60)		
P2. Does your child use mite-proof bedding such as mite-proof pillowcases and	ng, Al training, and similar techr 94 (37.60) 162 (64.80)	105 (41.50)	< 0.001
bedclothes	d simila		
P3. Do you use a dust mite controller to remove mites in your home	162 (64.80) r tech	162 (64.03)	< 0.001
P4. Do you use instruments such as dehumidifier/air-conditioning, air cleaner,		85 (33.60)	< 0.001
etc., to remove mites in your home	· · · at Ag		
P5. Do you use decoration prone to mites, such as carpet in your home	20 (8.00) 20 (8.00) bout/guidelines.xhtml	4 (1.58)	0.001
17	iographi		
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5 6	P6. Do you or your family weekly wash your pillowcases and bedclothes	161 (64.40) <b>fo</b>	173 (68.38)	0.345
7 8 9	P7. Do you or your family use a vacuum cleaner to clean your house every day	114 (45.60) us estimate	99 (39.13)	0.142
10 11 12 13 14 15 16	P7. Do you or your family use a vacuum cleaner to clean your house every day	Ing for uses related to text and data mining, Al training, and similar technologies.	· 2024. Downloaded 1	
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Supplementary Table S7. Material of the bedding items, n (%)	Jopen-2024-085905 on 20 De I by copyright, including for			
	Without eiger		Р	
	desensitization			
Your child is currently using a pillow with the content material of	t Super text an		0.700	
Latex	123 (49.20) 123 (49.20) 123 (49.20)	122 (48.22)		
Down		1 (0.40)		
Latex Down Artificial fiber Buckwheat hulls	24 (9.60) A training	30 (11.86)		
Buckwheat hulls	75 (30.00) an m	82 (32.41)		
Cotton	17 (6.80) d similar	10 (3.95)		
Other	10 (4.00) If techning	8 (3.16)		
Your child is currently using bedding with the content material of	123 (49.20)         1 (0.40)         1 (0.40)         24 (9.60)         75 (30.00)         17 (6.80)         10 (4.00)		0.830	
Latex				
Down	9 (3.60)	10 (3.95)		
19	5 (2.00) 9 (3.60) 9 (3.60) e/about/guidelines.xhtml			
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1 2 3 4				024-085905 o yright, incluc	
5 6	Artificial fiber		39 (15.60)	n 20 De ling for	38 (15.02)
7 8 9	Silk		138 (55.20)	cember Enseig uses re	135 (53.36)
10 11 12	Cotton		50 (20.00)	2024. E gnemen lated to	60 (23.72)
13 14	Other	°Or	9 (3.60)	Downloa t Super text an	5 (1.98)
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Questionnaire A Dear Parents: Hello! We are researchers at Shengjing Hospital of C conducted to collect information to understan			; including for	
Dear Parents:			uses	
Hello!			seigr	
We are researchers at Shengjing Hospital of (	China Medical University and we than	k you for part	ticipating has	r research! This study is
conducted to concet information to understan	iu the knowledge, attitudes and plactic	e or parents t		
mite allergy, and aims to provide a basis for t in the future and improve their condition. You			<u> </u>	
Approval Committee. If you agree to particip		-		F
patiently by circling the corresponding sym		no wing motru	ata	
1. There are no certain correct or wrong answ		nnaire accord	ling to your go	ual situation, any questions
during the answering process can be asked to	us, after finishing, please submit it in	time.	ing,	
2. This study is only a simple questionnaire a				
questions, such as your gender, age, etc. We				
will be derived from the overall statistical and	-			
3. As a participant, you can be kept informed study, please let us know and your data will r				
Finally, we sincerely thank you for taking tim			c research	
			ar te	-
			echn	
$\Box$ I have been informed of and agree to	the use of the data collected for scient	ific research.	technologies	00 Line 13 2025
			yies.	0 0 0 2 5
	Participation date:	Year	Mouth	Pav Dav
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5	Questionnaire A on the prev
6	
7 8	I. Please fill in your basic in
8 9	1. Your relationship with your
9 10	a. Father
11	
12	b. Mother
13	c. Other family member
14	
15	2. Father's education:
16	a. Primary school and below
17	b. Middle school
18 19	
20	c. High school/Technical seco
20	d. Bachelor's degree/Junior co
22	e. Master's degree
23	f. Doctorate
24	
25	
26	3. Mother's education:
27	a. Primary school and below
28	b. Middle school
29 30	c. High school/Technical seco
30 31	d. Bachelor's degree/Junior co
32	e. Master's degree
33	e
34	f. Doctorate
35	
36	4. Annual household income
37	a. <30,000
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-soon and treatment of dust mite allergy (for patients without description of the source publication of the source of the source

<ul> <li>b. 30,000-50,000</li> <li>c. 50,000-100,000</li> <li>c. 200,000-300,000</li> <li>f. &gt; 300,000</li> <li>f. &gt; 300,000</li> <li>f. &gt; 300,000</li> <li>f. Are the parents allergic to dust mites?</li> <li>a. None</li> <li>b. Father only</li> <li>c. Mother only</li> <li>d. Both allergic to dust mites</li> <li>e. Haven't followed it, don't know yet</li> <li>f. You learn about allergies through:</li> <li>a. Newspaper &amp; Books</li> <li>b. Radio &amp; TV</li> <li>c. Web Search</li> <li>d. Short videos (Tiktok)</li> <li>e. Doctor's guidance during consultation</li> <li>f. Never knew about it</li> </ul> <b>I. Please fill in your child's basic information:</b> <ul> <li>l. Name:</li> <li>2. Age:</li> </ul>		BMJ Open
<ul> <li>e. 50,000-100,000</li> <li>e. 100,000-200,000</li> <li>f. &gt; 300,000</li> <li>e. 200,000-300,000</li> <li>f. &gt; 300,000</li> <li>e. 200,000-300,000</li> <li>f. &gt; 300,000</li> <li>e. 4 are the parents allergic to dust mites?</li> <li>a. Nome</li> <li>a. Nome</li> <li>b. Both allergic to dust mites</li> <li>c. Haven't followed it, don't know yet</li> <li>b. Adatio &amp; TU</li> <li>a. Nowspaper &amp; Books</li> <li>b. Both videos (Tiktok)</li> <li>a. Doctor's guidance during consultation</li> <li>f. Never knew about it</li> </ul> <b>Hersen Ell in your child's basic information:</b> a. Name: a. Arge:		
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<ul> <li>e. 200,000-300,000</li> <li>f. &gt; 300,000</li> <li>s. Are the parents allergic to dust mites?</li> <li>a. None</li> <li>b. Tahter only</li> <li>d. Both allergic to dust mites</li> <li>e. Haven't followed it, don't know yet</li> <li>f. You learn about allergies through:</li> <li>a. Newspaper &amp; Books</li> <li>b. Radio &amp; TV</li> <li>e. Web Search</li> <li>d. Short videos (Tiktok)</li> <li>e. Doctor's guidance during consultation</li> <li>f. Never knew about it</li> </ul> I Please fill in your child's basic information: <ul> <li>a. Name:</li> <li>a. Age;</li> </ul>	c. 50,000-100,000	
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<ul> <li>e. Doctor's guidance during consultation</li> <li>f. Never knew about it</li> <li><b>II. Please fill in your child's basic information:</b></li> <li>1. Name:</li> <li>2. Age:</li> </ul>		
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<ul> <li>f. Never knew about it</li> <li><b>II. Please fill in your child's basic information:</b></li> <li>1. Name:</li> <li>2. Age:</li> </ul>		
II. Please fill in your child's basic information: <ol> <li>Name:</li> <li>Age:</li> </ol>		.011
1. Name: 2. Age: 23	1. Never knew about it	
1. Name: 2. Age: 23		
2. Age: 23		iformation:
23	1. Name:	
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## II. Please fill in your child's basic information:

## 3. Gender:

## 4. Ethnicity:

- 5. Whether your child is the only-child?
- a. Yes
- b. No
- 6. The exercises your children usually enjoy to do (Multiple choice):
- a. Outdoor running and walking
- b. Playing basketball
- c. Swimming
- d. Taekwondo
- e. Indoor dancing
- f. Cycling
  - g. Other
    - 7. The floor your child live on:
  - a. Single-storey house
  - b. First floor
- c. Floor 2-10
- d. Floor 10-20
  - e. Floor 21 and above
    - f. Top Floor

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- a. Within Shenyang City
- b. Rural areas of Shenyang
- c. Towns of Shenyang
- d. City of Liaoning Province (except Shenyang)
- e. Rural areas within Liaoning Province (except Shenyang)
- f. Towns within Liaoning Province (except Shenyang)
- g. Outside Liaoning Province
- 9. The transportation to visit a doctor:
- a. On foot

- b. Bus
- c. Metro
- d. High-speed Rail
- e. Long distance bus
- f. Private Car
  - g. Other

## III. Please fill in your child's medical information:

- beer review or 1. The doctor has diagnosed your child with (multiple choice):
- a. Rhinitis
- b. Bronchial asthma
- c. Cough variant asthma
- d. Allergic cough

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f 70	BMJ Open	ijopen-2024 1 by copyri
	BMJ Open 2. Has your child visits to a paediatric allergist in the past? a. Yes b. No 3. Were you aware of your child's dust mite allergy before you brought him/her to the paediatric allergy of a. Know b. Don't know	085905 on 20 Decem En: ght, including for use:
	<ul> <li>3. Were you aware of your child's dust mite allergy before you brought him/her to the paediatric allergy of a. Know</li> <li>b. Don't know</li> <li>c. Suspected dust mite allergy in child based on him/her symptoms</li> </ul>	ber 2024. Downloaded seighement Superieur s related to text and da
	<ul> <li>4. Which season your child's rhinitis is more likely to occur?</li> <li>a. No rhinitis</li> <li>b. Spring</li> <li>c. Summer</li> <li>d. Autumn</li> <li>e. Winter</li> <li>f. All year round</li> <li>5. What is the duration of your child's rhinitis attack?</li> <li>a. No rhinitis</li> </ul>	from (ABES) ta min
	<ul> <li>f. All year round</li> <li>5. What is the duration of your child's rhinitis attack?</li> <li>a. No rhinitis</li> <li>b. The duration of symptoms &lt;4 days/week, or &lt;4 consecutive weeks</li> <li>c. The duration of symptoms ≥4 days/week, or ≥4 consecutive weeks</li> </ul>	http://bmjopen.bmj.com/ on June 13, 2025 ) ing, Al training, and similar technologies.
	<ul><li>6. Does your child's rhinitis affect his/her study, cultural &amp; sports activities, and sleep?</li><li>a. Without rhinitis</li><li>b. Without significant effect</li><li>c. Have significant or severe effects</li></ul>	i025 at Agence Bibliographique de
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7. Which season your child's asthma is more likely to occur?		n 20 De
a. No asthma		icen Er use
b. Spring		ember 2024 Enseignem ses related
c. Summer		r 20; late
d. Autumn		d to
e. Winter		
f. All year round		nload t and
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8. The times of your child's asthma attack in the last six months is	:	ata r
a. No asthma		
b. No acute asthma		n http: ES) ·
c. 1-2 times		
d. 3-5 times		aini
e. ≥6 times		ng,
		and <u>mj</u> .
	review on	http://bmjopen.bmj.com/ on June 13, ) . ing, Al training, and similar technolo
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		tinolc
IV. Please choose the appropriate options for the following que	estions (the following are the knowl	edge dimension)
1. Which of the following species of dust mite can cause an allergi		
a. House dust mite only		••
b. Dermatophagoides farinae only		enco
c. Both house dust mite and dermatophagoides farinae		e Bibli
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1	gh 4-0 ht, 88
2 3	
4	
5 6	d. Don't know
7	2. Only live dust mites can act as allergens to causing allergic reactions: (assign 0 points for a, 1 point for b)
8 9	a. Correct
10	b. Wrong
11	c. Don't know
12 13	
14	3. Which of the following diseases can be caused by dust mite allergy: (assign 0.5 points for abcd, 1 points for e, 0 points for f)
15 16	a. Eczema
17	b. Allergic conjunctivitis
18	c. Rhinitis d. Asthma
19 20	d. All of them
21	e. Don't know
22 23	4. Dust mites in the house mainly breed in bed sheets and bedding, carpets and curtains are not prone to greeding dust mites: (assign 0 points for
23	
25	a, 1 point for b, 0 points for c) a. Correct
26 27	b. Wrong
28	c. Don't know
29	<ul> <li>a. Correct</li> <li>b. Wrong</li> <li>c. Don't know</li> <li>5. Plush toys are prone to breeding dust mites: (assign 1 point for a, 0 points for b, 0 points for c)</li> <li>a.Correct b.Wrong c.Don't know</li> </ul>
30 31	5. Plush toys are prone to breeding dust mites: (assign 1 point for a, 0 points for b, 0 points for c)
32	a.Correct b.Wrong c.Don't know
33 34	s is a
35	
36	a. Correct
37 38	b. Wrong
39	
40	
41 42	6. UV light can kill dust mites: (assign 0 points for a, 1 point for b, 0 points for c) a. Correct b. Wrong 28 For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml
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	1 udii on	
c. Don't know	ng fo	
7 Freezing the plush toys or pillowca	ses in the refrigerator overnight can kill dust mites: (assign 1 poing ஸ்கீஷ 0 points for b, 0 points for c)	
a. Correct		
b. Wrong	eigne at 20	
c. Don't know	ed to be the second sec	
8. How many degrees hot water for w	vashing bed sheets will be most effective in removing dust mites:	
points for e)	nd de la	
a. 25°C	ar (Afr ta ata	
b. 35°C		
c. 45°C		
d. 55°C		
e. Don't know	Al training	
9. Indoor dust mites can be completely	y eliminated with a good job cleaning: (assign 0 points for a, 1 points for b, 0 points for c)	
a. Correct		
b. Wrong		
c. Don't know		
10. There is no cure for a child with d	lust mite allergy but to keep the house as hygienic as possible to aveid dust mites: (assign 0 points for a, 1)	
point for b, 0 points for c)	gies 202	
a. Correct	ి సారా సారా సారా	
b. Wrong	Ag	
c. Don't know		
	y eliminated with a good job cleaning: (assign 0 points for a, 1 point for b, 0 points for c) thust mite allergy but to keep the house as hygienic as possible to avoid doust mites: (assign 0 points for a, 1 ges but to keep the house as hygienic as possible to avoid doust mites: (assign 0 points for a, 1 but to keep the house as hygienic as possible to avoid doust mites: (assign 0 points for a, 1 but to keep the house as hygienic as possible to avoid doust mites: (assign 0 points for a, 1 but to keep the house as hygienic as possible to avoid doust mites: (assign 0 points for a, 1 but to keep the house as hygienic as possible to avoid to the house as hygienic to avoid to the house as hygienic to the house	
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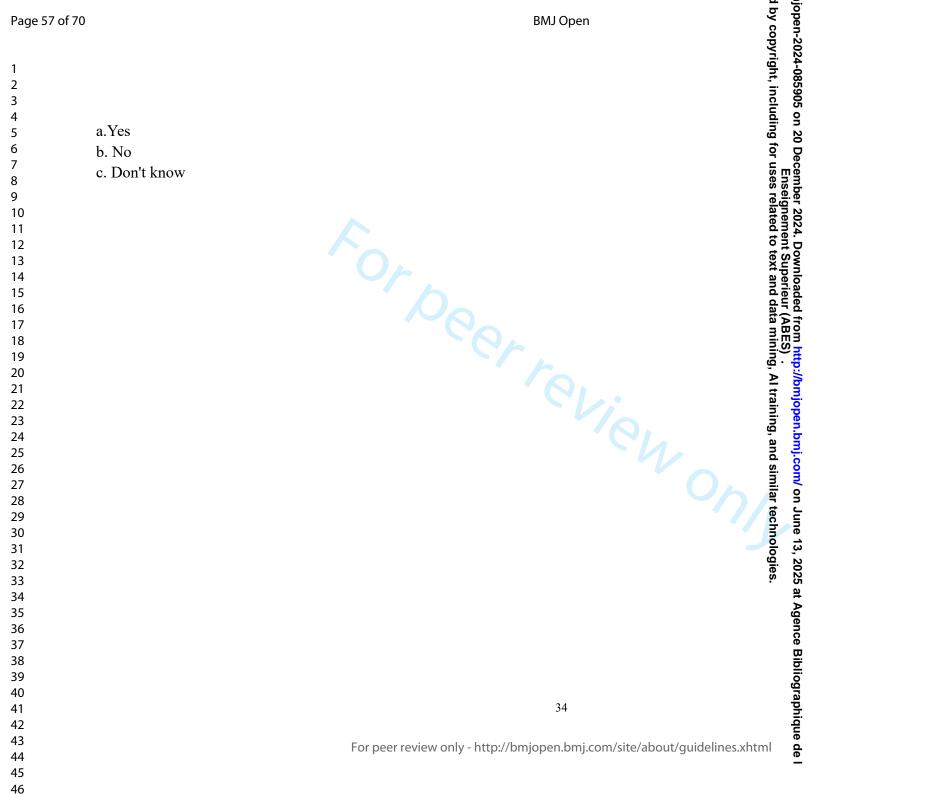
Page 53 of 70	BMJ Open	ijopen-z d by cop	
1 2 3 4 5 6	BMJ Open 11. Dust mite allergy will heal itself as the child grows up: (assign 0 points for a, 1 point for b, 0 points a Correct	oyright, including fo	
7	a. Correct	or u	<b>)</b>
8	b. Wrong	Ens Ses	
9	<ul> <li>a. Correct</li> <li>b. Wrong</li> <li>c. Don't know</li> <li>12. Have you heard of or know about desensitization treatment for dust mites?: (assign 0 points for a, 0</li> </ul>	eign rela	
10 11	12 How much for the set of the transformed for the start with the former of the set of t	iemi ited	for 1 1 moint former)
12	12. Have you heard of or know about desensitization treatment for dust mites?: (assign 0 points for a, 0		t for b, 1 point for c
13	a. Haven't heard of it	Sup	
14 15	b. Have heard of it but don't know the details	erie	
16	c. Understand the process and procedure of it	ur (	
17	V Places shares the annuantists options for the following questions	ABE:	
18 19	V. Please choose the appropriate options for the following questions (the following are the attitude dimension assign 4 points for a 3 points for b 2 points for a 1 po	<u> </u>	r -
20	(the following are the attitude dimension, assign 4 points for a, 3 points for b, 2 points for c, 1 po		
21	13. Your concerns about dust mite infestation and dust mite allergy	l tra	
22 23	13.1 You can't stand dust mites infesting your home:	Al training, and similar technologies.	
23	a. Strongly agree	ng, a	r F
25	b. Agree	and	) •
26	c. Unsure/Don't know	sim	
27 28	d. Strongly disagree	ilar	
29		tec	
30	13.2 What is your attitude towards the possible health risks of dust mite infestation in children?:	hno	, ▶
31 32	a. Very worried	logi	) )
33	b. Worried	gies.	י י ה
34	c. Unsure/Don't know	at	
35	d. Not worried at all	Age	
36 37		nce	,   
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		590; , inc	
		5 on	
13.3 Even though you have follow t	he doctor's advice to reduced your child's exposure to dust	t mites by amites rem	oval in the house, you are still
worried about the dust mite allergy.:		Dec Dr u	
a. Strongly agree		ises	
b. Agree		ver 2 rela	
c. Unsure/Don't know		2024 Temp	
d. Strongly disagree		ent : to t	
14 Vour attitude to mite removal and	1 Januaritization transmit	sup Sup	
14. Your attitude to mite removal and	egularly remove mites from your home:	load erie and	
a.Very necessary b.Possibly necessar		led f ur () data	
a. Very necessary 0.1 ossiony necessar	y c.onsure a.onnecessary	a min	
14.2 If there have a therapy to make	your child non-allergic to dust mites, do you think it is nece	essary to and go it	:
a. Very necessary		, Al trai	
b. Possibly necessary		njop	
c. Unsure/Don't know		ven.	
d. Unnecessary		pen.bmj.co ining, and s	
14.3 How much do you think is acce	ptable to spend for your child on prevention and treatment		: (CNY)
a. More than 1000 CNY/month;		aron	
b. 500-1000 CNY/month;		June techr	
c. 100-500 CNY/month;		13,	
d. Less than 100 CNY/month;		June 13, 2025 technologies.	
VI. Please choose the appropriate of	options for the following questions (the following are the	의 e practice di <b>d</b> ensio	on)
15. Targeted practice		en	
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7 8 9	BMJ Open       BMJ Open         15.1 Due to your child's dust mite allergy, have you and your family made a special effort to learn about differences of the special control of the specia
41 42 43 44 45	32 For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml
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BMJ Open 15.5 Do you use Dust Mite Controller to remove mites in your home (assign 1 point for Yes, 0.5 point	d by co	ijopen-	Page 56 of 70
	pyrig	2024	
	Jht, ir	-085(	
	nclud	)05 o	
15.5 Do you use Dust Mite Controller to remove mites in your home (assign 1 point for Yes, 0.5 point	nts	r <b>in</b> ten	d to purchase, 0 points for a.not
intend to purchase):	for u	Dec	
a.Yes	ISes	r ěm l	
b. Previously test showed dust mite allergy but not used	rela	ber	
c. Recent test show dust mite allergy and intend to purchase	ated	202	
d. Recent test show dust mite allergy but not intend to purchase	to t	4. D	
15 ( De very use instruments such as debumidifier/sir conditioning, sir clooner, and etc. to remove r	exte	own.	themes (agains 1 point for Vag
15.6 Do you use instruments such as dehumidifier/air-conditioning, air cleaner, and etc. to remove m 0.5 points for intend to purchase, 0 points for a.not intend to purchase):	llica n d d g		nome (assign 1 point for res,
a.Yes	ur (r data	ed f	
b. Previously test showed dust mite allergy but not used	mi		
c. Recent test show dust mite allergy and intend to purchase	s) . ning		
	J, Al	o://b	
<ul><li>d. Recent test show dust mite allergy but not intend to purchase</li><li>15.7 Do you use the decoration which prone to mites such as carpet in your home (assign 0 points)</li></ul>	trair	mjo	
15.7 Do you use the decoration which prone to mites such as carpet in your home (assign 0 points	fo	'e <mark>s</mark> , 1	point for No, 0 points for Don't
know):		.bmj	
a.Yes	d sii	.cor	
b. No	mila	<b>n/</b> 0	
c. Don't know	and similar techn	n June	
	thno		
15.8 Do you or your family weekly wash your pillowcases and bedclothes (assign 1 point for Yes, 0 p a.Yes	0011 <b>7</b> 5	tør N N	o, 0 points for Don't know $i$ :
a. Yes	ies.	2025	
b. No		at A	
c. Don't know		lgen	
15.9 Do you or your family use vacuum cleaner to clean your house every day(assign 1 point for Yes,	0 poi	nates for	r No. 0 points for Don't know):
	° r	iblic	
		ogra	
33		phiq	
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r or peer review only - nttp://binjopen.only.com/site/about/guidelines.xi	11111	le I	



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Questionnaire B			ng for	20 D	
Dear Parents: Hello!			ej		
We are researchers at Shengjing Hospita	•	•		N	
conducted to collect information to understan mite allergy, and aims to provide a basis for t		-			
in the future and improve their condition. You		-			
Approval Committee. If you agree to particip					
patiently by circling the corresponding sym		C	r (Al lata		
1. There are no certain correct or wrong	answers, you just need to fill in the que	estionnaire a	ccording t	ur actual situation, any	
questions during the answering process can be			-		
2. This study is only a simple questionnaire and will not harm your physical or psychological condition, but may involve some privacy					
questions, such as your gender, age, etc. We will keep your information strictly confidential and will not declose your information, the results will be derived from the overall statistical analysis of the data and will not involve any personal privacy, personal free to fill in.					
	-		· · ·		
3. As a participant, you can be kept infor the study, please let us know and your data w	11	1	ā		
Finally, we sincerely thank you for takin	g time out of your busy schedule to su	port our sci	entific researc		
Thanky, we sheetery thank you for takin	g time out of your ousy senedule to su	pport our ser	art t	<u>b</u> . 5	
			ech		
□I have been informed of and agree	e to the use of the data collected for so	eientific resea	arch.	June 13. 2025	
	Participation date:	Year		Day	
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	Questionnaire B on the prevention and treat	BMJ Open tment of dust mite allergy (for patients treated with hy	ng demic desensitization)
	I. Please fill in your basic information:		20 D
	1. Your relationship with your child is?		Г US
	a. Father		es r
	b. Mother		elat
	c. Other family member		ed to
	2. Father's education:		on 20 December 2024. Downloaded Enseignement Superieur Jing for uses related to text and da
	a. Primary school and below		nd c
	b. Middle school		ad fr Jata
	c. High school/Technical secondary school		nir BER
	d. Bachelor's degree/Junior college		S) - ttp
	e. Master's degree		, Al
	f. Doctorate		n http://bmjopen.bmj.com/ on June 13, 2025 ES) . ining, Al training, and similar technologies.
	3. Mother's education:		ng, ai
	a. Primary school and below		nd s
	b. Middle school		
	c. High school/Technical secondary school		ar te
	d. Daeneror 3 degree/Junior conege		une
	e. Master's degree		13,
	f. Doctorate		. 0
	4. Annual household income (CNY):		at Ag
	a. <30,000		Jeno
	b. 30,000-50,000		č D
	c. 50,000-100,000		iblic
	d. 100,000-200,000		) ýra
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e. 200,000-300,000 f. >300,000

5. Are the parents allergic to dust mites?

a. None

b. Father only

c. Mother only

- d. Both allergic to dust mites
- e. Haven't followed it, don't know yet

6. You learn about allergies through:

a. Newspaper & Books

b. Radio & TV

c. Web Search

- d. Short videos (Tiktok)
- e. Doctor's guidance during consultation
- f. Never knew about it

beer review o II. Please fill in your child's basic information:

1. Name:

2. Age:

3. Gender:

4. Ethnicity:

6. Whether your child is the only-child?

c. Yes d. No

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a. Outdoor running and walking	
b. Playing basketball	
c. Swimming	
d. Taekwondo	
e. Indoor dancing	
f. Cycling	
g. Other	
7. The floor your child live on:	
a. Single-storey house	
b. First floor	
c. Floor 2-10	
d. Floor 10-20	
e. Floor 21 and above	
f. Top Floor	

a. Within Shenyang City

- b. Rural areas of Shenyang
  - c. Towns of Shenyang
  - d. City of Liaoning Province (except Shenyang)
  - e. Rural areas within Liaoning Province (except Shenyang)
  - f. Towns within Liaoning Province (except Shenyang)
  - g. Outside Liaoning Province

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	ight, in
10. The transportation to visit a doctor	:
h. On foot	ding
i. Bus	- for
j. Metro	
k. High-speed Rail	
1. Long distance bus	
m. Private Car	
n. Other	
III. Please fill in your child's medical	ar
1. The diagnose of your child (multiple	<u>0</u> -
a. Rhinitis	
b. Bronchial asthma	mining, Al
c. Cough variant asthma	, , , , , , , , , , , , , , , , , , ,
d. Allergic cough	l trair
2 Were you aware of your child's dust	mite allergy before you brought him/her to the paediatric allergy unit
a Know	
b Don't know	Sim
c. Suspected dust mite allergy in child b	mite allergy before you brought him/her to the paediatric allergy using similar technologies.
3 Which season your child's rhinitis is	more likely to occur?
a No rhinitis	
h Spring	ē. S
c Summer	
d. Autumn	
e. Winter	
f. All year round	
1.7 m your round	
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3 4	4. What is the duration of your child's rhinitis attack?
4 5	a. No rhinitis
6	b. The duration of symptoms <4 days/week, or <4 consecutive weeks
7	c. The duration of symptoms $\geq$ 4 days/week, or $\geq$ 4 consecutive weeks
8	
9 10	5. Does your child's rhinitis affect his/her study, cultural & sports activities, and sleep?
10	a. No rhinitis
12	
13	b. No significant effect
14	c. Have significant or severe effects
15	
16 17	6. Which season your child's asthma is more likely to occur?
18	a. No asthma
19	b. Spring
20	c. Summer
21	d. Autumn
22 23	a. No asthma b. Spring c. Summer d. Autumn e. Winter f. All year round
24	f. All year round
25	
26	7. The times of your child's asthma attack in the last six months is:
27 28	a. No asthma
28 29	
30	b. No acute asthma
31	c. 1-2 times
32	d. 3-5 times
33	e. ≥6 times
34 35	
36	8. The time your child has been receiving desensitization treatment is:
37	a. First medication
38	b. Within 3 months
39 40	c. 3 months to 6 months
40 41	40
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43	For peer review only - http://bmjopen.bmj.com/site/ab

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jopen-2024-085905 on 20 December 2024. Download Enseignement Superier by copyright, including for uses related to text and **BMJ** Open d. 6 months to 1 year e. More than 1 year 9. Your current evaluation for the outcome of desensitization treatment on your child is: a. First medication b. Significant improvement (no symptoms or close to normal) c. Improvement (few or occasional mild symptoms) d. Remission (fewer symptoms and less frequent recurrences) e. Effective (all symptoms still present but less frequent recurrences) f. Ineffective (hardly any improvement and worse symptoms) 10. How long have your child been stopped the use of inhaled or nasal spray hormones after desensitization grade at ment? .3) . ning, Al training, and similar technologies http://bmjopen.bmj.com/ on June 13, 2025 at Agence Bibliographique de I S) . a. Still on medication b. Within 3 months c. 3 months to 6 months d. 6 months to 1 year e. More than 1 year 11. How many weeks desensitization take your child to complete initial treatment? a. Initial treatment has not been completed b. 14 weeks c. 15-20 weeks d. 21-28 weeks e. More than 28 weeks 12.Has your child had any adverse reactions during desensitization treatment? a. No b. Yes, but not serious (only redness and swelling at injection site) c. Experienced a large area urticaria throughout the body For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

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-	copy 20
1	d Experienced a severe allergic reaction (Difficulty breathing, Shock, and etc.)
2 3	5. 85 m 90
4	BMJ Open       by cpp right, including to the severe allergic reaction (Difficulty breathing, Shock, and etc.)       by cpp right, including to the severe allergic reaction (Difficulty breathing, Shock, and etc.)       by cpp right, including to the severe allergic reaction (Difficulty breathing, Shock, and etc.)         13. Frequency of adverse reactions:       by cpp right, including to the severe allergic reaction (Difficulty breathing, Shock, and etc.)       by cpp right, including to the severe allergic reaction (Difficulty breathing, Shock, and etc.)
5 6	13. Frequency of adverse reactions:
7	a. None
8	b. 1 - 2 times
9 10	c. 3 - 5 times
11	d. Often
12 13	e. Every time
14	
15	IV. Please choose the appropriate options for the following questions (the following are the knowled 👳 🖻 🎄 mension)
16 17	1. Which of the following species of dust mite can cause an allergic reaction: (assign 0 points for ab, 1 pont for d):
18	a. House dust mite only
19	b. Dermatophagoides farinae only
20 21	c. Both house dust mite and dermatophagoides farinae
22	d. Don't know
23 24	2. Only live dust mites can act as allergens to causing allergic reactions: (assign 0 points for a, 1 point for b 0 points for c)
25	a. Correct
26 27	b. Wrong
28	
29	<ul> <li>c. Don't know</li> <li>3. Which of the following diseases can be caused by dust mite allergy: (assign 0.5 points for abcd, 1 point for e, 0 points for f)</li> <li>a. Eczema</li> <li>b. Allergic conjunctivitis</li> </ul>
30 31	3. Which of the following diseases can be caused by dust mite allergy: (assign 0.5 points for abcd, 1 point for e, 0 points for f)
32	a. Eczema
33	
34 35	c. Rhinitis d. Asthma
36	d. All of them
37	e. Don't know
38 39	c. Rhinitis d. Asthma d. All of them e. Don't know 42 For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml
40	graa geraa
41 42	
42 43	For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml
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	ht, ii	
4. Dust mites in the house mainly breed i	n bed sheets and bedding, carpets and curtains are not prone to preeding dust	mites: (assign 0 points
for a, 1 point for b, 0 points for c)		
a. Correct	20 De	
b. Wrong	us es	
c. Don't know	eic ei	
5 Plush toys are prone to breeding dust n	ites: (assign 1 point for a, 0 points for b, 0 points for c)	
a. Correct		
b. Wrong	Sup st the st th	
c. Don't know	and	
	da fr	
6. UV light can kill dust mites: (assign (	points for a, 1 point for b, 0 points for c)	
a. Correct	ning	
b. Wrong		
c. Don't know	n the refrigerator overnight can kill dust mites: (assign 1 points	
7. Freezing the plush toys or pillowcases	n the refrigerator overnight can kill dust mites: (assign 1 points)	for b. 0 points for c)
a Correct		for e, o points for e,
b. Wrong	Sin ĝ	
c. Don't know	iar on	
8. How many degrees hot water for wash	n the refrigerator overnight can kill dust mites: (assign 1 points similar technologies, 0 points ng bed sheets will be most effective in removing dust mites: (Refression 0 points of the second structure of the second stru	s for abc, 1 point for d, 0
points for e)		, <u>1</u> ,
a. 25°C	3S. 325 a	
b. 35°C	at A	
c. 45°C	gen	
d. 55°C	Cê e	
e. Don't know	3ibli	
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1 2 3 4 5 6	<ul> <li>9. Indoor dust mites can be completely eliminated with a good job cleaning: (assign 0 points for a, 1 points for b, 0 points for c)</li> <li>a. Correct</li> <li>b. Wrong</li> </ul>
7 8 9	c. Don't know 10. The desensitization treatment for dust mite allergy usually takes 3-5 years: (assign 1 point for a, 0 points for b, 0 points for c)
10 11 12 13 14 15	a. Correct b. Wrong c. Don't know
16 17 18 19 20 21 22	<ul> <li>11. The medications of nasal spray hormone therapy for rhinitis or nebulised hormone therapy for asthmatic assign 0 points for a, 1 point for b, 0 points for c)</li> <li>a. Correct</li> <li>b. Wrong</li> <li>c. Don't know</li> </ul>
23 24 25 26 27 28 29 30 21	12. There is no need to pay attention to removing and avoiding dust mites during desensitization treatments. 0 points for c) a. Correct b. Wrong c. Don't know
31 32 33 34 35 36 37 38	<ul> <li>13. The desensitization of dust mite can treat rhinitis caused by dust mite allergy, but it can't prevent thinks from developing into asthma: (assign 0 points for a, 1 point for b, 0 points for c)</li> <li>a. Correct</li> <li>b. Wrong</li> <li>c. Don't know</li> </ul>
39 40 41 42 43	14. Those adverse reactions in desensitization treatment that require attention are (Multiple choice): (assigned 0.2 points for each option) 44 For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml
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<ul> <li>a. Itching of the palms of the hands and feet. Itchy scalp. Flushed skin all over the body. The appearance of b. Immediate shock (altered mental state. Cold and clammy skin. Decrease in blood pressure)</li> <li>c. Difficulty breathing. Rapid breathing. Hoarseness and other symptoms</li> <li>d. Abdominal pain. Nausea. Vomiting. Urinary incontinence</li> <li>e. Loss of consciousness. Loss of respiration. Loss of carotid artery pulsation</li> </ul>	1-08590Ecaria union 20 December : Enseign
	ated
V. Please choose the appropriate options for the following questions	to t
(the following are the attitude dimension, assign 4 points for a, 3 points for b, 2 points for c, 1 points	
15. Your concerns about dust mite infestation and dust mite allergy	and
15.1 You can't stand dust mites infesting your home:	data
a. Strongly agree	
b. Agree	http://www.solution.com
c. Unsure/Don't know	
d. Strongly disagree	p://bmjopen
15.2 What is your attitude towards the possible health risks of dust mite infestation in children:	n. br
a. Very worried	nj.o
b. Worried	simi
c. Unsure/Don't know	lar t
d. Not worried at all	/bmjopen.bmj.com/ on June 13, Al training, and similar technolo
15.3 Even though you have follow the doctor's advice to reduced your child's exposure to dust mites by worried about the dust mite allergy.:	bouge dust mites removal, you are still
a. Strongly agree	
b. Agree	Agence
c. Unsure/Don't know	φ B
d. Strongly disagree	ibliog
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1 2 3 4 5 6 7	BMJ Open       BMJ Open         16. Your attitude to mite removal and desensitization treatment         16.1 Do you think it is necessary to regularly remove mites from your home:         e. Very necessary         f. Possibly necessary         g. Unsure/Don't know
8 9 10 11 12	h. Unnecessary
13 14 15 16 17 18	<ul> <li>16.2 Do you think that desensitization treatment is an effective option for your child's rhinitis/asthma:</li> <li>a. Yes</li> <li>b. Probably yes</li> <li>c. Don't know /Unsure</li> <li>d. No</li> </ul>
19 20 21 22 23 24	<ul> <li>16.3 Do you think desensitization treatment needs to be carried out strictly according to medical advice (end of the sensitization on time):</li> <li>a. Very needed</li> <li>b. Needed</li> <li>c. Don't know</li> </ul>
25 26 27 28 29 30	<ul> <li>c. Don't know</li> <li>d. Don't need</li> <li>16.4 If your child has a relatively obvious reaction to the treatment, such as severe redness at the injection site of a rash around the body or even anaphylaxis, will you continue with the Desensitization treatment: <ul> <li>a. Persist</li> <li>b. May persist, depending on the situation</li> <li>c. May give up</li> </ul> </li> </ul>
31 32 33 34 35 36	b. May persist, depending on the situation c. May give up d. Definitely give up
37 38 39	VI. Please choose the appropriate options for the following questions (the following are the practice dimension) 17. Targeted practice
40 41 42	46 For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml <b>de</b>
43 44 45	For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

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17.1 Due to your child's dus mites. dust mite allergy and c a. Yes	st mite allergy, have you and your family made a special effort to learn about relevant knowledge (including dust desensitization treatment, etc.) (assign 1 point for Yes, 0 points for No) :	
b. No	for uses	
17.2Does your child use mite for Don't know): a.Yes b. No c. Don't know	e-proof bedding such as mite proof pillowcases and bedclothes (assign 1 and the second	
17.3 Your child is currently v	using a pillow with a content material of (No points for this question):	
a. Latex		
b. Down		
c. Artificial fibre		
d. Buckwheat hulls		
e. Cotton	using a pillow with a content material of (No points for this question): A training, and similar technologies. Using a bedding with a content material of (No points for this question):	
17.4 Your child is currently v	using a bedding with a content material of (No points for this question):	
a. Latex		
b. Down	echn une	
c. Cotton	nolo 13,	
d. Silk	ogies.	
e. Artificial fibre	at a state of the	
17.5 Do you use dust mite co a.Yes	ontroller to remove mites in your home (assign 1 point for Yes, 0 points for No, bound points for Don't know):	
b. No		
c. Don't know	47 For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml <b>de</b>	
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1 2 3 4	BMJ Open 17.6 Do you use instruments such as dehumidifier/air-conditioning, air cleaner, and etc. to remove mites in your home (assign 1 point for Yes, 0
5 6	points for No, 0 points for Don't know):
7	a.Yes
8 9	b. No
9 10 11	c. Don't know
12	17.7 Do you use the decoration which prone to mites such as carpet in your home (assign 0 points for boints for No, 0 points for Don't
13	know):
14 15	a.Yes areio
16	b. No
17	c. Don't know
18 19	
20	ب عق 17.8 Do you or your family weekly wash your pillowcases and bedclothes (assign 1 point for Yes, 0 points for Don't know):
21	a.Yes b.No c.Don't know
22	
23 24	17.9 Do you or your family use vacuum cleaner to clean your house every day (assign 1 point for Yes, 0 points for No, 0 points for Don't know):
25	a.Yes
26	b. No
27 28	
29	17.10 Has your child had a delay in injections for some reason that caused treatment to be restarted (assign 1 point for a, 0 points for b, 0 points for c):
30	17.10 Has your child had a delay in injections for some reason that caused treatment to be restarted or follow-up injections to be cancelled
31 32	(assign 1 points for a 0 points for b 0 points for c).
33	(assign 1 point for a, 0 points for b, 0 points for c): a. Never
34	
35	b. Once or twice before c. Frequently postponed
36 37	c. rrequently postponed
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41 42	48 For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml
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# Parents' knowledge, attitude, and practice toward the prevention and treatment of dust mite allergy: A cross-sectional study in Shenyang (China)

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Parents' knowledge, attitude, and practice toward the prevention and treatment of dust mite allergy: A cross-sectional study in Shenyang (China)

Running title: KAP of dust mite allergy

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### Abstract

**Objective:** This cross-sectional study aimed to evaluate parents' knowledge, attitudes, and practices (KAP) concerning the prevention and treatment of dust mite allergy in children.

**Design:** Conducted between September and December 2022, this cross-sectional study involved multiple healthcare facilities, including primary and secondary care settings, ensuring a comprehensive representation of the target population.

**Participants:** A total of 503 parents of children with dust mite allergies participated, with 253 parents having children undergoing desensitization treatment and 250 parents whose children did not. Selection criteria were carefully defined to include parents directly responsible for the care of children with dust mite allergies.

**Primary and secondary outcome measures:** Two distinct questionnaires were administered to parents, tailored for those with and without children undergoing desensitization treatment. These questionnaires covered demographic information, allergy diagnosis, treatment details, and KAP related to dust mite allergy. Primary outcomes included parents' scores on knowledge, attitudes, and practices regarding dust mite allergy prevention and treatment. Secondary outcomes involved analyzing the interaction between these factors using pathway analysis.

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**Results:** Parents of children undergoing desensitization treatment exhibited higher scores for all items of knowledge, attitude, and overall practice compared to those without desensitization therapy (all P<0.05). The pathway analyses revealed that in the non-desensitization group, knowledge directly affected attitude ( $\beta$ =0.22, P<0.001), and attitude directly affected practice ( $\beta$ =0.16, P<0.001), but the knowledge did not affect practice ( $\beta$ =-0.01, 0.06, P<0.001). In the desensitization group, knowledge directly affected attitude ( $\beta$ =0.13, P=0.028), but the practice was not affected by attitude ( $\beta$ =0.08, P<0.001) or knowledge ( $\beta$ =0.03, 0.12, P<0.001).

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**Conclusions:** The study highlighted differing levels of KAP among parents of children with dust mite allergies. The KAP was influenced by desensitization therapy status. While attitudes tended to be favorable, practices were suboptimal, particularly among parents whose children did not receive desensitization treatment. These findings emphasize the importance of targeted educational interventions to enhance parental awareness and practices regarding dust mite allergy management, especially in cases where desensitization treatment is not pursued. Further research is warranted to explore effective strategies for improving parental engagement and adherence to preventive measures.

**Keywords:** dust mites, house; dust mite allergy; health knowledge, attitudes, practice; desensitization, immunologic; cross-sectional study.

### Strengths and limitations of this study

Based on the provided article, here are the summarized strengths and limitations of the methods section:

### Strengths:

1. Use of a Validated Questionnaire: The study used two versions of a questionnaire that were designed by senior experts and pre-tested for reliability (Cronbach's  $\alpha > 0.7$  for both versions). 2. Cross-Sectional Design: The study was able to capture a snapshot of the parental knowledge, attitudes, and practices (KAP) across a broad sample, making the results relevant for understanding the current state of parental awareness and behavior.

3. Hypothesis-Driven Analysis: The statistical methods included pathway analysis to explore relationships between KAP dimensions, adding depth to the interpretation of the data.

### Limitations:

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1. Single-Center Study: The study was conducted at a single hospital, which limits generalizability to other regions or hospitals.

2. Potential Bias in Self-Reported Data: KAP surveys are prone to social desirability bias, where participants may provide responses they believe are expected rather than their true behaviors.

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### **1 INTRODUCTION**

House dust mites mainly include *Dermatophagoides pteronyssinus*, *Dermatophagoides farinae*, and *Euroglyphus maynei*<sup>1</sup>. They are non-parasitic microscopic bugs that live on desquamated dead skin cells from humans and pets. They prefer warm and moist environments and are found in bedding, linens, carpets, and furniture <sup>2-4</sup>. Although the mite's exoskeleton can contribute to the allergic reaction, the main allergens are found in the mite's fecal pellets <sup>5, 6</sup>. Each mite produces about 20 pellets daily, each the size and weight of a pollen grain <sup>5, 6</sup>. Therefore, they are easily inhaled and can cause sensitization of the respiratory tract mucosa, leading to epithelial permeability and the movement of the mite's antigens to antigen-presenting dendritic cells <sup>5, 6</sup>. The prevalence of dust mite allergy varies from 11.21% in Northeast China to 40.79% in South China <sup>7</sup>. Dust mite allergy contributes to the development of allergic rhinitis and asthma, affecting 800 million people worldwide <sup>1, 5, 8, 9</sup>. The prevalence of asthma in children in the Third National Health Survey in China was 3.02%, showing a 52.8% increase from 2001 to 2013 <sup>10</sup>. Therefore, dust mites represent a serious public health problem.

The most effective management method for dust mite allergy is allergen avoidance (e.g., frequently washing bedding, removing carpets, room air cleaners, and humidity control) <sup>5, 12-14</sup>. Over-the-counter medications (antihistamines, nasal corticosteroids, leukotriene receptor antagonists, cromolyn sodium, and decongestants) and allergen immunotherapy can also help <sup>5, 12</sup>.

Since allergen avoidance involves specific lifestyle habits <sup>5, 12-14</sup>, parents' proper knowledge, attitudes, and practice (KAP) toward dust mites are essential to managing the allergic symptoms in their children. KAP surveys are tools that provide quantitative and qualitative data about a specific subject in a specific population <sup>15, 16</sup>. They can be used to identify gaps and design tailored teaching and training activities <sup>15, 16</sup>. It is known that parents who visited an allergist demonstrated higher dust mite KAP <sup>17</sup>. Generally, parents display very high KAP

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toward food allergies in their children <sup>18-20</sup>, mainly because several of these allergies can be fatal, which is not the case with dust mite allergy. Studies revealed poor parental KAP for allergic rhinitis <sup>21, 22</sup> and poor KAP regarding allergic disorders in general <sup>23</sup>, including in parents of asthmatic children <sup>24</sup>. the KAP toward dust mite allergy in the general population in China is mostly unknown. Therefore, even if the children display symptoms of dust mite allergy, many parents will not consult at all or will consult when the symptoms are exacerbated. Some patients testing positive for dust mite allergy will receive desensitization therapy, but many parents will refuse treatments. All parents receive the same information package when their children test positive for dust mite allergy, and the parents are free to consult all sources of information and to ask questions. Nevertheless, differences can be present between those who decide on desensitization therapy and those who refuse. It was hypothesized that differences in KAP could explain, at least in part, the parents' decision.

Therefore, this study aimed to evaluate the KAP of parents toward preventing and treating dust mite allergy and to examine the differences between the parents of children who were treated with desensitization treatment and the parents of children who were not. Parents are the primary actors in house cleaning and management, and evaluating their KAP toward house mite allergy should help design future teaching activities. Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

### **2 MATERIALS AND METHODS**

### 2.1 Study design and participants

This cross-sectional study survey was conducted from September to December 2022 at Shengjing Hospital, Affiliated with China Medical University. The participants were the parents of children with dust mite allergies. The study was approved by the Medical Ethics Committee of Shengjing Hospital, Affiliated with China Medical University (approval #2022PS935K). Informed consent was obtained from the participants before completing the

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survey. All participants were enrolled at the outpatient clinic of Shengjing Hospital, Affiliated to China Medical University, when their children had an appointment.

The inclusion criteria were 1) parents of children who tested positive for dust mite-specific serum IgE (measured by Phadia ImmunoCAP) and 2) voluntarily completed the questionnaire. The participants were grouped according to whether the children were treated with desensitization treatment or not.

### 2.2 Questionnaires

The questionnaire was designed by two senior experts in allergy with reference to the literature <sup>17, 25, 26</sup>. The final questionnaire had two versions: one for the parents of children who did not undergo desensitization treatment (Questionnaire A) and one for the parents of children who underwent desensitization treatment (Questionnaire B). Thirty parents were randomly selected to complete the questionnaire to test its reliability. Cronbach's  $\alpha$  was 0.726 for Questionnaire A and 0.702 for Questionnaire B.

The questionnaire contained six dimensions: demographic information of the parents, demographic information of the child, diagnosis and treatment information related to dust mite allergy in children, knowledge dimension, attitude dimension, and practice dimension. The specific questions and scoring instructions for both questionnaire versions can be found in the Supplementary Materials. The data were collected by on-site inquiry and questionnaire when the parents visited the hospital.

### 2.3 Statistical analysis

The continuous variables were expressed as means  $\pm$  standard deviations (SD) and analyzed using Student's t-test or ANOVA. The categorical data were expressed as n (%) and analyzed using the chi-square test. All statistical analyses were performed using two-sided tests, and P-values <0.05 were considered statistically significant. Pathway analysis was constructed, and the hypotheses were 1) knowledge has direct effects on attitude, 2) attitude has direct effects

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on practice, and 3) knowledge has direct effects on practice. Good practice was defined as a score ≥70% of the highest possible score for practice. STATA 17.0 (Stata Corporation, College Station, TX, USA) was used for statistical analysis.

### 2.4 Patient and public involvement

No patient involved

### **3 RESULTS**

### **3.1 Characteristics of the participants**

All the patients with dust mite allergy who attended the Pediatric Respiratory Clinic of Shengjing Hospital from September to December 2022 were invited to participate, of whom 189 refused to fill in the questionnaire due to concern about privacy, lack of time, or disinterest. A total of 668 people were surveyed, of which 165 questionnaires were invalid and excluded (135 had missing questions, 27 had contradictory options, and three were filled with all the same options). Therefore, 503 valid questionnaires were included in the analyses: 250 from non-desensitized patients and 253 from desensitized patients.

Most participants were women (81.91%), most participants had a bachelor's degree or higher education, and only a small proportion had a history of dust mite allergy. There were more fathers in the desensitization group (25.69% vs. 9.20%, P<0.001), and the mothers' education was higher in the non-desensitization group (P=0.028) (Table 1). There were no differences between the children of the two groups, except for the residence area (P=0.001) and means of transportation to the hospital (P=0.003) (Supplementary Table S1). Compared with the non-desensitization group, the children in the desensitization group had higher proportions of dust mite allergy diagnosis (P=0.009), less rhinitis (P=0.004), and shorter rhinitis attacks (P<0.001) (Supplementary Table S1).

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## Table 1. Characteristics of the parents, n (%)

	Without	With	Р
	desensitization	desensitization	
Total	250 (49.70)	253 (50.30)	
Parental relationship			< 0.00
Father	23 (9.20)	65 (25.69)	
Mother	223 (89.20)	184 (72.73)	
Other family members	4 (1.60)	4 (1.58)	
Father's education			0.167
Primary school and below	19 (7.60)	13 (5.14)	
Middle school	28 (11.20)	44 (17.39)	
High school/technical secondary school	33 (13.20)	41 (16.21)	
Bachelor's degree/junior college	131 (52.40)	128 (50.59)	
Master's degree	30 (12.00)	20 (7.91)	
Doctorate	9 (3.60)	7 (2.77)	
Mother's education			0.028
Primary school and below	1 (0.40)	3 (1.19)	
Middle school	22 (8.80)	39 (15.42)	
High school/technical secondary school	32 (12.80)	44 (17.39)	
Bachelor's degree/junior college	154 (61.60)	143 (56.52)	
Master's degree	35 (14.00)	21 (8.30)	
Doctorate	6 (2.40)	3 (1.19)	
Annual household income (RMB)			0.379
<30,000	18 (7.20)	24 (9.49)	
30,000-50,000	29 (11.60)	43 (17.00)	
50,000-100,000	76 (30.40)	73 (28.85)	
100,000-200,000	61 (24.40)	61 (24.11)	
200,000-300,000	32 (12.80)	26 (10.28)	
>300,000	34 (13.60)	26 (10.28)	
Are the parents allergic to dust mites?			0.373
None	102 (40.80)	126 (49.80)	
Father only	21 (8.40)	18 (7.11)	
Mother only	24 (9.60)	19 (7.51)	
Both	6 (2.40)	6 (2.37)	
Unclear	97 (38.80)	84 (33.20)	
Ways to learn about allergies			-
[multiple choice]			
Newspaper & Books	49 (19.60)	19 (7.51)	
Radio & TV	36 (14.40)	21 (8.30)	
Web Search	104 (41.60)	82 (32.41)	
Short videos	76 (30.40)	40 (15.81)	
Doctor's guidance during the consultation	164 (65.60)	228 (90.12)	
Never knew about it	26 (10.40)	8 (3.16)	

## 3.2 Knowledge, attitudes, and practice

For the items common to the two questionnaires, compared with the non-desensitization group, the desensitization group showed higher correct response rates about dust mites, the complications of dust mite allergies, the source of dust mites, and how to manage dust mite populations (all P<0.05) (Table 2). Both groups showed relatively poor knowledge regarding the group-specific items (Supplementary Table S2).

	Table 2.	. Knowledge	dimension.	n (	%)	
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	Correct rate		Р
	Without	Desensitization	
	desensitization		
Q1. Which of the following species of dust mite	148 (59.20)	216 (85.38)	< 0.001
can cause an allergic reaction?			
Q2. Only live dust mites can act as allergens that	105 (42.00)	119 (47.04)	0.256
cause allergic reactions.			
Q3. Which of the following diseases can be	153 (61.20)	187 (73.91)	< 0.001
caused by dust mite allergy?			
Q4. Dust mites in the house mainly breed in bed	171 (68.40)	192 (75.89)	0.061
sheets and bedding; carpets and curtains are not			
prone to breeding dust mites.			
Q5. Plush toys are prone to breeding dust mites.	226 (90.40)	245 (96.84)	0.003
Q6. UV light can kill dust mites.	68 (27.20)	54 (21.34)	0.126
Q7. Freezing the plush toys or pillowcases in the	44 (17.60)	68 (26.88)	0.012
refrigerator overnight can kill dust mites.			
Q8. Which temperature of hot water will be the	127 (50.80)	151 (59.68)	0.045
most effective in removing dust mites when			
washing bed sheets?			
Q9. Indoor dust mites can be completely	185 (74.00)	215 (84.98)	0.002
eliminated with a good job of cleaning.	U,		

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About half of the participants cannot stand dust mites in their homes. More participants in the desensitization group were very worried about the possible health risks of dust mites in children (P<0.001). More participants in the desensitization group remained worried after following the doctors' advice to decrease dust mites (P=0.016). Most participants in the two groups agree that it is necessary to remove dust mites regularly (P=0.053) (Table 3). The participants in the non-desensitization group are willing to undergo treatments, but cost appears to be a barrier,

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while most participants in the desensitization group have a favorable attitude toward treatment (Supplementary Table S3).

### Table 3. Attitude dimension, n (%)

	Without	Desensitization	Р
	desensitization		
You can't stand dust mites infesting your			0.481
home.			
Strongly agree	111 (44.40)	122 (48.22)	
Agree	95 (38.00)	98 (38.74)	
Unsure/Don't know	35 (14.00)	28 (11.07)	
Disagree	9 (3.60)	5 (1.98)	
What is your attitude towards the possible			0.001
health risks of dust mite infestation in			
children?			
Very worried	137 (54.80)	177 (69.96)	
Worried	92 (36.80)	70 (27.67)	
Unsure/Don't know	20 (8.00)	5 (1.98)	
Not worried at all	1 (0.40)	1 (0.40)	
Even though you have followed the doctor's			0.016
advice to reduce your child's exposure to dust			
mites by mite removal in the house, you are			
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still worried about the dust mite allergy.			
Strongly agree	101 (40.40)	114 (45.06)	
Agree	105 (42.00)	118 (46.64)	
Unsure/Don't know	39 (15.60)	17 (6.72)	
Strongly disagree	5 (2.00)	4 (1.58)	
Do you think it is necessary to remove mites			0.05
from your home regularly?			
Very necessary	182 (72.80)	188 (74.31)	
Possibly necessary	55 (22.00)	54 (21.34)	
Unsure	13 (5.20)	6 (2.37)	
Unnecessary	0	5 (1.98)	

Compared with the non-desensitization group, subjects in the desensitization group displayed higher rates of positive behavior regarding all practice items (all P $\leq$ 0.001), except for the weekly cleaning of bedding and daily vacuuming (P=0.345 and P=0.142) (Table 4). There were no significant differences between the two groups regarding the pillow and bedding materials (Supplementary Table S4).

	Positive behavior		Р
	Without	Desensitization	-
	desensitization		

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P1. Due to your child's dust mite allergy, have	154 (61.60)	216 (85.38)	< 0.001
you and your family made a special effort to			
learn about relevant knowledge (including dust			
mites. dust mite allergy and desensitization			
treatment, etc.)			
P2. Does your child use mite-proof bedding	94 (37.60)	105 (41.50)	< 0.001
such as mite-proof pillowcases and bedclothes			
P3. Do you use a dust mite controller to remove	162 (64.80)	162 (64.03)	< 0.001
mites in your home			
P4. Do you use instruments such as	115 (46.00)	85 (33.60)	< 0.001
dehumidifier/air-conditioning, air cleaner, etc.,			
to remove mites in your home			
P5. Do you use decoration prone to mites, such	20 (8.00)	4 (1.58)	0.001
as carpet in your home			
P6. Do you or your family weekly wash your	161 (64.40)	173 (68.38)	0.345
pillowcases and bedclothes			
P7. Do you or your family use a vacuum cleaner	114 (45.60)	99 (39.13)	0.142
to clean your house every day			

### 3.3 Pathway analysis

The root mean square error of approximation (RMSEA, P<0.001), comparative fit index (CFI, P=1.000), Tucker-Lewis index (TLI, P=1.000), and standardized root mean square residual

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(SRMR, P<0.001) all indicated that the model fit was acceptable. In the non-desensitization group, knowledge directly affected attitude ( $\beta$ =0.22, P<0.001), and attitude directly affected practice ( $\beta$ =0.16, P<0.001) (Table 5), but the knowledge did not affect practice ( $\beta$ =-0.01, 0.06, P<0.001). In the desensitization group, knowledge directly affected attitude ( $\beta$ =0.13, P=0.028), but the practice was not affected by attitude ( $\beta$ =0.08, P<0.001) or knowledge ( $\beta$ =0.03, 0.12, P<0.001) (Figure 1).

O	β (95% CI)	P-value
Without desensitization		
K -> A	0.22 (0.10, 0.35)	< 0.001
A -> P	0.16 (0.09, 0.22)	< 0.001
K -> P	-0.01 (-0.07, 0.06)	0.871
Desensitization		
K -> A	0.13 (0.01, 0.25)	0.028
A -> P	0.08 (-0.01, 0.17)	0.095
K -> P	0.03 (-0.05, 0.12)	0.439

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CI: confidence interval; K: knowledge; A: attitude; P: practice.

# **3.4 Factors influencing practice among parents of children who underwent** desensitization treatment

Among parents of children who underwent desensitization treatment, bachelor's degree or above (OR=3.816, 95%CI: 1.483-9.818, P=0.005), suspected dust allergy based on symptoms (OR=4.299, 95%CI: 1.429-12.929, P=0.009), and children having rhinitis (OR=0.352, 95%CI: 0.170-0.272, P=0.005) were associated with the parents' practice (Table 6).

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**Table 6**. The factors influencing good practices (n=44 parents with good practice) among parents of children who have undergone desensitization treatment (n=253)

	Univari	ate	D	Multivariate	р
Vnowladge	95%CI	(0.016	P	95%CI	Р
Knowledge	0.966 1.102)	(0.846-	0.604		
Attitude		99-1.36)	0.067		
Parental relationship					
Mother	REF				
Father/ Other family members	0.449	(0.19-	0.068		
Tutilet, Stilet fulling memories	1.061)	(0.1)	0.000		
Father's education	,				
Junior college or below	REF				
Bachelor's degree or above	1.44	(0.721-	0.302		
	2.877)				
Mother's education	DEE			DEE	
Junior college or below	REF	(1.500	0.000	REF	0.00
Bachelor's degree or above	3.928	(1.589-	0.003	3.816 (1.483-	0.00
Annual household income (RMB)	9.709)			9.818)	
<100,000	REF				
≥100,000	1.297	(0.676-	0.434		
-100,000	2.487)	(0.070	0.454		
Are the parents allergic to dust	,				
mites?					
None	REF	1			
One of the parents/Both	1.83	(0.814-	0.144		
Unclear	4.112) 0.639	(0.286-	0.275		
Uncical	1.428)	(0.200-	0.275		
Learned about allergies	- )				
No	REF				
Yes	0.621	(0.121-	0.567		
	3.182)				
Pre-visit knowledge of child's dust					
<b>mite allergy</b> Unaware	REF			REF	
Aware	1.81	(0.887-	0 103	1.679 (0.792-	0.17
/ wate	3.694)	(0.007-	0.105	3.561)	0.17
Suspected based on symptoms	3.08	(1.118-	0.03	4.299 (1.429-	0.00
	8.481)			12.929)	
Child's sex					
Male	REF				

1.111	(0.564-	0.761			
2.187)					
0.855	(0.738-	0.039	0.895	(0.764-	0.17
0.992)			1.049)		
0.552	(0.286-	0.076			
1.065)					
REF					
0.432	(0.222-	0.013	0.352	(0.17-	0.005
0.841)			0.727)	<b>`</b>	
0.87	(0.428-	0.699	,		
1.767)					
0.833	(0.362-	0.669			
1.921)					
1.01	(0.521-	0.977			
1.957)	·				
	2.187) 0.855 0.992) 0.552 1.065) REF 0.432 0.841) 0.87 1.767) 0.833 1.921) 1.01	$\begin{array}{c} 2.187)\\ 0.855\\ 0.992) \end{array} (0.738-\\ 0.992) \\ \hline \\ 0.552\\ 1.065)\\ \text{REF} \\ \hline \\ 0.432\\ 0.841)\\ 0.87\\ (0.428-\\ 1.767)\\ 0.833\\ (0.362-\\ 1.921)\\ 1.01\\ (0.521-\\ \end{array}$	$\begin{array}{c} 2.187)\\ 0.855\\ 0.992) \end{array} (0.738- 0.039\\ 0.992) \\ \hline \\ 0.552\\ 1.065)\\ \text{REF} \\ \hline \\ 0.432\\ 0.841)\\ 0.87\\ (0.428- 0.699\\ 1.767)\\ 0.833\\ (0.362- 0.669\\ 1.921)\\ 1.01\\ (0.521- 0.977 \\ \hline \end{array}$	$\begin{array}{c} 2.187)\\ 0.855\\ 0.992) \end{array} (0.738- 0.039 & 0.895\\ 1.049) \\ \hline \\ 0.552\\ 1.065)\\ \text{REF} \\ \hline \\ 0.432\\ 0.841) \\ 0.87\\ (0.428- 0.699\\ 1.767)\\ 0.833\\ (0.362- 0.669\\ 1.921)\\ 1.01\\ (0.521- 0.977 \\ \hline \end{array}$	$\begin{array}{c} 2.187)\\ 0.855\\ 0.992) \end{array} (0.738- \ 0.039 \ 0.895\\ 1.049) \end{array} (0.764-\\ 1.049) \end{array}$ $\begin{array}{c} 0.552\\ 1.065)\\ \text{REF} \end{array} (0.222- \ 0.013 \ 0.352\\ 0.727) \end{array} (0.17-\\ 0.841) \ 0.727) \end{array}$ $\begin{array}{c} 0.432\\ 0.432\\ 0.432\\ 0.428- \ 0.699\\ 1.767)\\ 0.833\\ 0.362- \ 0.669\\ 1.921)\\ 1.01 \ (0.521- \ 0.977 \end{array}$

### **4 DISCUSSION**

This study investigated parents' KAP regarding the prevention and treatment of dust mite allergy and examined the differences between the parents of children who were treated with desensitization treatment and those of children who were not. The results showed that the parents of children with dust mite allergy had relatively good KAP regarding dust mites. The parents of children who did not undergo desensitization therapy had poor knowledge, favorable attitudes, and poor practice regarding dust mites, while the parents of children who underwent desensitization therapy had good knowledge, favorable attitudes, and poor practice.

Although dust mite allergy is bothersome for the patients and can evolve into allergic rhinitis and asthma, the condition is not as dangerous as food allergies, probably explaining why the KAP toward food allergies is very high in parents of food-allergic children <sup>18-20</sup> but lower in parents of children with dust mite allergy, as observed in the present study. Indeed, the relatively low KAP observed here is supported by previous studies on allergic rhinitis <sup>21, 22</sup> and allergies in general <sup>23</sup>. Even parents of children with chronic asthma (in whom allergens can be triggers for asthma attacks) have a poor KAP toward allergies <sup>24</sup>. A study covering 29 Chinese

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cities showed that the KAP of parents toward allergic rhinitis was low <sup>27</sup>. In the present study, the total KAP scores and knowledge scores were higher in the desensitization group than in the non-desensitization group, as supported by Callahan et al. <sup>17</sup>, who reported higher KAP in the parents who met an allergist compared with those who did not (to receive desensitization treatment, all patients must consult an allergist in China). Still, in the present study, the non-desensitization group included parents of children newly diagnosed with dust mite allergy and parents of children with known dust mite allergy who did not receive or did not yet receive desensitization treatment. The attitude scores were relatively high in both groups, but the practice scores were low. These results indicate that although the willingness to take measures against house dust mites to improve their child's health was high, the actual application of these measures was low. Indeed, for example, vacuuming each day is time-consuming, boring, and bothersome. The same goes for changing and laundering sheets more often. Since house dust mite allergy is not a serious condition, many parents do not feel the need to perform all those tasks.

This study showed significantly better scores for several knowledge areas, such as the dust mite species causing allergies, the diseases that can be due to dust mite allergies, the objects in which dust mites are more likely to thrive, methods to eliminate dust mites, and whether cleaning can completely eliminate dust mites. It is probable that the parents who opted for desensitization therapy in their children obtained more information from the physicians or other sources when discussing the treatment options or by themselves to understand better what they were getting into. Indeed, a study showed that the parents of children with life-threatening illnesses were actively seeking information about the illness <sup>28</sup>; although dust mite allergy is far from being life-threatening, a similar protective behavior could be involved. Furthermore, parents of children with allergies are actively seeking information from different sources <sup>29</sup>. Desensitization therapy is relatively expensive, and parents might fear some adverse effects on

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their children, encouraging them to take more information. Compared with the nondesensitization group, the parents in the desensitization group also reported a more worried attitude toward the possible health risks related to dust mites in their children and more worries toward dust mites despite active measures taken to decrease them. These worries could come from a better knowledge of the diseases and complications related to dust mite allergies. Regarding the practice items, compared with the non-sensitization group, the parents in the desensitization group declared more efforts being taken to gain knowledge about dust mites (which could relate to the knowledge scores), as previously suggested <sup>29</sup> and reported a higher use of mite-proof bedding and pillowcase and a lower use of dust mite. Still, both groups reported poor practice regarding washing bedding weekly and vacuuming every day. In the desensitization group and higher education, suspected dust mite allergy based on symptoms (suggesting a higher knowledge of dust allergy) were independently and positively associated with the practice. On the other hand, rhinitis was independently and negatively associated with practice.

The pathway analysis showed different patterns of association among the KAP dimensions between the non-desensitization and desensitization groups. Indeed, in the non-desensitization group, knowledge affected attitude, which in turn affected practice, while in the desensitization group, only knowledge affected attitude. It may be because the parents in the desensitization group had already taken action to address their children's condition. Still, these differences should be investigated more in-depth to tailor future interventions to the specific target populations. In addition, pathway analyses are only statistical surrogates for causality <sup>30, 31</sup>, and the results should be confirmed.

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In the present study, it was hypothesized that differences in KAP could explain, at least in part, the parents' decision for desensitization therapy for children with dust mite allergy. The results

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support the hypothesis and may provide ideas and directions to guide and educate the parents in the clinic. Nevertheless, although the parents of children receiving desensitization treatment had a higher KAP, there were still many gaps in knowledge, suggesting that we should strengthen the education and management of these patients in addition to drug desensitization treatment. The present study provides insights for designing teaching brochures, videos, podcasts, or activities to increase the KAP of parents toward dust mites. In particular, the knowledge about the dust mites themselves and the methods to kill them was poor. The practice of minimizing the living habitats of dust mites and using actual means to get rid of them should be emphasized. An intervention based on the results of the present study is being developed and will be investigated in a future study.

This study had limitations. It was performed at a single center, and the sample size is relatively small. In addition, because the two subpopulations of participants (i.e., with children with or without desensitization treatments) had two different KAP questionnaires, a direct comparison of the KAP scores was not possible between the two groups. Furthermore, as for all KAP surveys, the data represent the situation of a specific population at a specific point in time <sup>15, 16</sup>. In addition, KAP surveys are subject to a social acceptability bias, i.e., the participants can be tempted to answer what they should do instead of what they really do <sup>15, 16</sup>. Nevertheless, the present study might provide a comparator point to evaluate the KAP in a similar population after an intervention to increase health literacy on house dust mites.

### **5 CONCLUSIONS**

In conclusion, the parents who did not decide on desensitization therapy for their children had poor knowledge, favorable attitudes, and poor practices regarding dust mites. On the other hand, the parents of children who underwent desensitization therapy had good knowledge, favorable attitudes, and poor practices. The poor practice scores highlight the need to emphasize the

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importance of dust mite control for the children's health. There is a need to educate the general population about the importance of controlling house dust mites.

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### List of abbreviations

KAP: knowledge, attitudes, and practices

SD: standard deviations

### Declarations

### Ethics approval and consent to participate

The research was carried out in accordance with the Declaration of Helsinki. The study was approved by the Medical Ethics Committee of Shengjing Hospital, Affiliated with China Medical University (approval #2022PS935K). Informed consent by electronic questionnaire was obtained from the participants before completing the survey.

### **Consent for publication**

Not applicable.

### Data Availability Statement

All data generated or analyzed during this study are included in this published article [and its supplementary information files].

### **Conflict of Interest**

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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### Authors' contributions

Conceptualization, Si Liu and Qianlan Zhou; Methodology, Bing Dai; Software, Li Chen;

Validation, Qinzhen Zhang; Formal Analysis, Lina Han; Investigation, Xiaowen Li; Resources,

Wenxin Shen; Data Curation, Si Liu; Writing – Original Draft Preparation, Si Liu; Writing – Review & Editing, Qianlan Zhou; Visualization, Qianlan Zhou; Supervision, Lishen Shan; Project Administration, Lishen Shan; Funding Acquisition, Lishen Shan. Guarantor is Lishen Shan.

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# **Figure Legends**

Figure 1. Pathway analysis. (A) Without desensitization. (B) With desensitization.

to occurrences



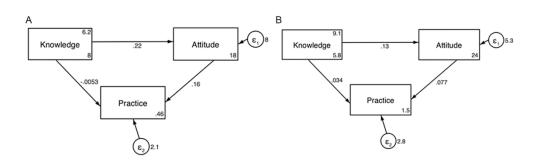


Figure 1. Pathway analysis. (A) Without desensitization. (B) With desensitization.

170x51mm (300 x 300 DPI)

	Without	Desensitization	Р
	desensitization	(n=253)	
	(n=250)		
Gender			0.3
Male	153 (61.20)	166 (65.61)	
Female	97 (38.80)	87 (34.39)	
Age, mean±SD	6.37±3.13	8.80±2.36	-
Ethnicity			0.9
the Han nationality	180 (72.00)	183 (72.33)	
Minorities	70 (28.00)	70 (27.67)	
Yes	147 (58.80)	-	
No	103 (41.20)	-	
Knowing your child's dust mite allergy			0.0
before going to the doctor			
Know	58 (23.20)	79 (31.23)	
Don't know	150 (60.00)	152 (60.08)	
Suspected dust mite allergy in the child	42 (16.80)	22 (8.70)	
based on him/her symptoms			
Season when rhinitis is more likely to			0.0
occur			
Without rhinitis	68 (27.20)	33 (13.04)	
Spring	27 (10.80)	41 (16.21)	
Summer	10 (4.00)	12 (4.74)	
Autumn	66 (26.40)	72 (28.46)	

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	Winter	24 (9.60)	26 (10.28)	
	All year round	55 (22.00)	69 (27.27)	
Ľ	Duration of rhinitis attack			< 0.001
	Without rhinitis	77 (30.80)	40 (15.81)	
	The duration of symptoms <4	89 (35.60)	121 (47.83)	
	days/week, or <4 consecutive weeks			
	The duration of symptoms $\geq 4$	84 (33.60)	92 (36.36)	
	days/week, or $\geq$ 4 consecutive weeks			
F	Frequency of desensitization treatments			-
	First medication	-	16 (6.32)	
	Within 3 months	-	49 (19.37)	
	3 months to 6 months	-	22 (8.70)	
	6 months to 1 year	Ċ,	38 (15.02)	
	More than 1 year	4.	128 (50.59)	
C	<b>Dutcome of desensitization treatment</b>			-
	First medication	- 2	27 (10.67)	
	Significant improvement (no symptoms	- 0	61 (24.11)	
	or close to normal)			
	Improvement (few or occasional mild	-	70 (27.67)	
	symptoms)			
	Remission (fewer symptoms and less	-	55 (21.74)	
	frequent recurrences)			
	Effective (all symptoms still present but	-	34 (13.44)	
	less frequent recurrences)			
	Ineffective (hardly any improvement	-	6 (2.37)	

Time for desensitization to complete		
initial treatment		
Initial treatment has not been completed	-	71 (28.06)
14 weeks	-	95 (37.55)
15-20 weeks	-	45 (17.79)
21-28 weeks	-	10 (3.95)
More than 28 weeks	-	32 (12.65)
Adverse reactions during desensitization		
treatment		
No	-	98 (38.74)
Only redness and swelling at the	-	146 (57.71
injection site		
Large area urticaria throughout the body	4.	6 (2.37)
Severe allergic reaction (difficulty	- 0	3 (1.19)
breathing, shock, etc.)		
Frequency of adverse reactions during		
desensitization		
None	-	105 (41.50
1 - 2 times	-	64 (25.30)
3 - 5 times	-	34 (13.44)
Often	-	35 (13.83)
Every time	-	15 (5.93)

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			5905 on		
Supp	plementary Table S2. The distribution of the remaining problem	s in the knowledge dimension			
Que	estionnaire A Without desensitization treatment	Correct	Wronseige	Don't know	
Q10	0. There is no cure for a child with dust mite allergy, but keep	43 (17.20)	139 (55 169) to nt b	68 (27.20)	
the	house as hygienic as possible to avoid dust mites		ownlo: Super text ar		
Q11	1. Dust mite allergy will heal itself as the child grows up	39 (15.60)	ŭieu deu 119 (4⊉/0 <del>0</del> ) and Berro	92 (36.80)	
		Haven't heard of it	Have Have Have Have Have Have Have Have	Understand	tl
			don't $\frac{2}{3}$ don't $\frac{2}{3}$	process	aı
		· (9)	en.bmj	procedure of it	
Q12	2. Have you heard of or know about desensitization treatment for	91 (36.40)	126 (5).49)	33 (13.20)	
dust	st mites?		June		
Que	estionnaire B Desensitization treatment		0logies.		
Q10	0. The desensitization treatment for dust mite allergy usually	231 (91.30)	4 (1.58) Agence	18 (7.11)	
take	es 3-5 years		nce Bib		
		5	Bibliographique es.xhtml de		
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Q11. The medications of nasal spray hormone therapy for rhinitis	78 (30.83)	ing 5 116 ( <b>Ap</b> .8 <b>2</b> )	59 (23.32)
or nebulized hormone therapy for asthma can be stopped during		cember Enseig uses rei	
desensitization treatment		er 2024. [ ignemen elated to	
Q12. There is no need to pay attention to removing and avoiding	9 (3.56)	231 (945) a e o	13 (5.14)
dust mites during desensitization treatment		aded fro ieur (Al nd data	
Q13. The desensitization of dust mites can treat rhinitis caused by	65 (25.69)		84 (33.20)
dust mite allergy, but it can't prevent rhinitis from developing into		://bmjopen.k , Al training,	
asthma	101	en.bmj ing, ang	
	Itching of the palms of the	Immediate shock	Difficulty breathing.
	hands and feet. Itchy scalp.	(altered state.	Rapid breathing.
	Flushed skin all over the	Cold und slammy skin.	Hoarseness and
	body. The appearance of	۵ ۵	other symptoms
	urticaria	pressure)	
	6	bliograp	
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1 2 3 4	BMJ Open BMJ Open BMJ Open by copyright, includ	
5 6	Q14. Those adverse reactions in desensitization treatment that $212(83.79)$ $146(57.79)$ 195(77.08)	
7 8 9	require attention are (Multiple choice)	
10 11 12 13 14 15 16 17	require attention are (Multiple choice)	
17 18 19 20	BES) - mining	
20 21 22 23 24	Al training,	
25 26 27 28	and similar t	
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		open-2024-085905 on 20 De by copyright, including for $n \begin{pmatrix} \% \end{pmatrix}$		
		5905 on includii		
upplementary Table S3. The distribution of the remaining questions in the a	attitude dimension,			
Questionnaire A Without desensitization treatment	Very necessary	Possibare Possibare	Unsure	Unnecessary
		necessation to		
Q14.2. If there have a therapy to make your child non-allergic to dust mites,	159 (63.60)	71 (28.4 9 0 0	19 (7.60)	1 (0.40)
do you think it is necessary to undergo it		aded fr rieur (A nd data		
· 64	More than 1000	500-10 <b>9</b>	100-500	Less than 100
	CNY/month	CNY/meonen	CNY/month	CNY/month
Q14.3. How much do you think is acceptable to spend for your child on the	47 (18.80)	81 (32:40)	82 (32.80)	40 (16.00)
prevention and treatment of dust mite allergy (RMB)		j.com/ o nd simila		
		on June ar techn		
Questionnaire B Desensitization treatment	Yes	Probabers 2025	Don't	No
		25 at Age s.	know/Unsure	
Q16.2. Do you think that desensitization treatment is an effective option for	211 (83.40)	31 (12.25)	10 (3.95)	1 (0.40)
		bliogra		
8		ğraphique lines.xhtml de		

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	your child's rhinitis/asthma		n 20 De ling for		
		Very needed	US US	Don't know	Don't need
	Q16.3. Do you think desensitization treatment needs to be carried out strictly	217 (85.77)	36 (14.d to t	0	0
	according to medical advice (e.g., Follow up consultation on time)		Super ext an		
		Persist	d deug deug May person AE	May give up	Definitely give
					up
			AI trainir		
			situation b		
	Q16.4. If your child has a relatively obvious reaction to the treatment, such	108 (2.69)		18 (7.11)	4 (1.58)
	as severe redness at the injection site or a rash around the body, or even		r techn		
	anaphylaxis, will you continue with the Desensitization treatment		d sięj2) 123 (8. juliar technologies		
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Supplementary Table S4. Material of the bedding items, n (%)	IJ Open J Open	jopen-2024-085905 on 20 De	
		Desensitization	Р
	desensitization		
Your child is currently using a pillow with the content material of	text an		0.700
Latex	123 (49.20)	122 (48.22)	
Down	1 (0.40)	2 <b>1</b> (0.40)	
Latex Down Artificial fiber Buckwheat hulls	24 (9.60) Al train	30 (11.86)	
Buckwheat hulls	75 (30.00)	82 (32.41)	
Cotton	17 (6.80) d similar	10 (3.95)	
Other	10 (4.00)	8 (3.16)	
Your child is currently using bedding with the content material of	ologies	122 (48.22) 1 (0.40) 30 (11.86) 82 (32.41) 10 (3.95) 8 (3.16) 13, 2025	0.830
Latex	5 (2.00)	5 at Agence 10 (3.95)	
Down	9 (3.60)	ence 10 (3.95)	
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Page 41 of 68			BMJ Open	и ву сору	jopen-20	
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5 6 7	Artificial fiber		39 (	(15.60)	1 20 Je	8 (15.02)
8 9	Silk		138	(55.20)	cember Enseig	35 (53.36)
10 11 12	Cotton		50 (2	20.00)	2024. E	0 (23.72)
13 14	Other	Or	9 (3	.60)	bownlos	(1.98)
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Questionnaire A		ng for	
Dear Parents: Hello!		Enseig Uses re	
We are researchers at Shengjing Hospital of China Medical University and we thank y conducted to collect information to understand the knowledge, attitudes and practice of			
mite allergy, and aims to provide a basis for the development of scientific interventior in the future and improve their condition. Your participation in this study is voluntary	n strategies f	or the design	e, which may help more people
Approval Committee. If you agree to participate in this study, please refer to the follor patiently by <b>circling the corresponding symbol</b> .		0	a
1. There are no certain correct or wrong answers, you just need to fill in the questionn during the answering process can be asked to us, after finishing, please submit it in tir		ng to your	tual situation, any questions
2. This study is only a simple questionnaire and will not harm your physical or psycho	ological cond		
questions, such as your gender, age, etc. We will keep your information strictly confid will be derived from the overall statistical analysis of the data and will not involve any	y personal pr	rivacy, <b>E</b> lea	e feel free to fill in.
3. As a participant, you can be kept informed of information and research progress rel study, please let us know and your data will not be included in the results of this study Finally, we sincerely thank you for taking time out of your busy schedule to support o	у.	d si	3
□I have been informed of and agree to the use of the data collected for scientific	c research.	researchar technologies.	
Participation date:	Year	Mouth	
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5	Questionnai
6	
7	I. Please fill
8 9	1. Your relati
9 10	a. Father
11	
12	b. Mother
13	c. Other fam
14	
15	2. Father's ec
16	
17	a. Primary so
18	b. Middle sc
19	c. High scho
20 21	d. Bachelor's
22	e. Master's d
23	f. Doctorate
24	1. Dootoiute
25	
26	3. Mother's e
27	a. Primary so
28	b. Middle sc
29	c. High scho
30	d. Bachelor's
31 32	
32 33	e. Master's d
34	f. Doctorate
35	
36	4. Annual ho
37	
38	a. <30,000
39	
40	
41	
42	
43	
44	

45 46 4. Annual household income (CNY): 13

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b. 30,000-50,000	
c. 50,000-100,000	
d. 100,000-200,000	
e. 200,000-300,000	
f. >300,000	
2	
5. Are the parents allergic to dust mite	es?
a. None	
b. Father only	
c. Mother only	t
d. Both allergic to dust mites	
e. Haven't followed it, don't know yet	t
6. You learn about allergies through:	
a. Newspaper & Books	
b. Radio & TV	
c. Web Search	
d. Short videos (Tiktok)	
e. Doctor's guidance during consultat	ion
f. Never knew about it	
II. Please fill in your child's basic in	nformation:
1. Name:	
2. Age:	
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#### II. Please fill in your child's basic information:

### **BMJ** Open 3. Gender: 4. Ethnicity: 5. Whether your child is the only-child? a. Yes ...pte choice): b. No 6. The exercises your children usually enjoy to do (Multiple choice): a. Outdoor running and walking b. Playing basketball c. Swimming d. Taekwondo e. Indoor dancing f. Cycling g. Other 7. The floor your child live on: a. Single-storey house b. First floor c. Floor 2-10 d. Floor 10-20 e. Floor 21 and above f. Top Floor

**BMJ** Open

8. Your child's residence is:

- a. Within Shenyang City
- b. Rural areas of Shenyang
- c. Towns of Shenyang
- d. City of Liaoning Province (except Shenyang)
- e. Rural areas within Liaoning Province (except Shenyang)
- f. Towns within Liaoning Province (except Shenyang)
- g. Outside Liaoning Province

9. The transportation to visit a doctor:

a. On foot

- b. Bus
- c. Metro
- d. High-speed Rail
  - e. Long distance bus
- f. Private Car
  - g. Other

### III. Please fill in your child's medical information:

- · Deer review or -1. The doctor has diagnosed your child with (multiple choice):
- a. Rhinitis
- b. Bronchial asthma
- c. Cough variant asthma
- d. Allergic cough

Page	47	of	68
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6. Does your child's rhinitis affect his/her study, cultural & sports activities, and sleep?

a. Without rhinitis

b. Without significant effect

c. Have significant or severe effects

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 2. Has your child visits to a paediatric allergist in the past?
 Energineer to Superior 2024. Downloaded from the paediatric allergy to see related to the paediatric allergy and similar technologies.

 3. Were you aware of your child's rhinitis is more likely to occur?
 a. Nor rhinitis

 b. Don't know
 support

 c. Suspected dust mite allergy in child based on him/her symptoms
 a. Nor rhinitis

 b. Spring
 summer

 c. Autumn
 summer

 f. All year round
 summer

 f. All year round
 summer

 f. All year round
 summer

 b. Nor rhinitis
 b. The duration of symptoms <4 days/week, or <4 consecutive weeks</td>

 c. The duration of symptoms ≥4 days/week, or ≥4 consecutive weeks
 c. The duration of symptoms ≥4 days/week, or <4 consecutive weeks</td>

 c. Does your child's rhinitis affect his/her study, cultural & sports activities, and sleep?
 a. Without rhininitis

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	on 20 I ding f
<ul><li>7. Which season your child's asthma is more likely to occur?</li><li>a. No asthma</li></ul>	or u:
b. Spring	es i
c. Summer	imber 2024 inseigneme
d. Autumn	024. ted t
e. Winter	
f. All year round	wnk bupe
	loade and c
8. The times of your child's asthma attack in the last six months is:	ata Jata
a. No asthma	min
b. No acute asthma	http ing
c. 1-2 times	Alt
d. 3-5 times	rain
e. ≥6 times	ing,
	anc
	d sin
<ul> <li>b. No acute asthma</li> <li>c. 1-2 times</li> <li>d. 3-5 times</li> <li>e. ≥6 times</li> </ul>	nilar
	n را ال
	http://bmjopen.bmj.com/ on June 13, ) . ing, Al training, and similar technolo
IV. Please choose the appropriate options for the following questions (the following are the know	0 -
1. Which of the following species of dust mite can cause an allergic reaction: (assign 0 points for ab, 1	
a. House dust mite only	
b. Dermatophagoides farinae only	gen
c. Both house dust mite and dermatophagoides farinae	Ce E
e. Don nouse dust nine and dermatophagerdes farmae	Siblio
18	grap
10	hiqu
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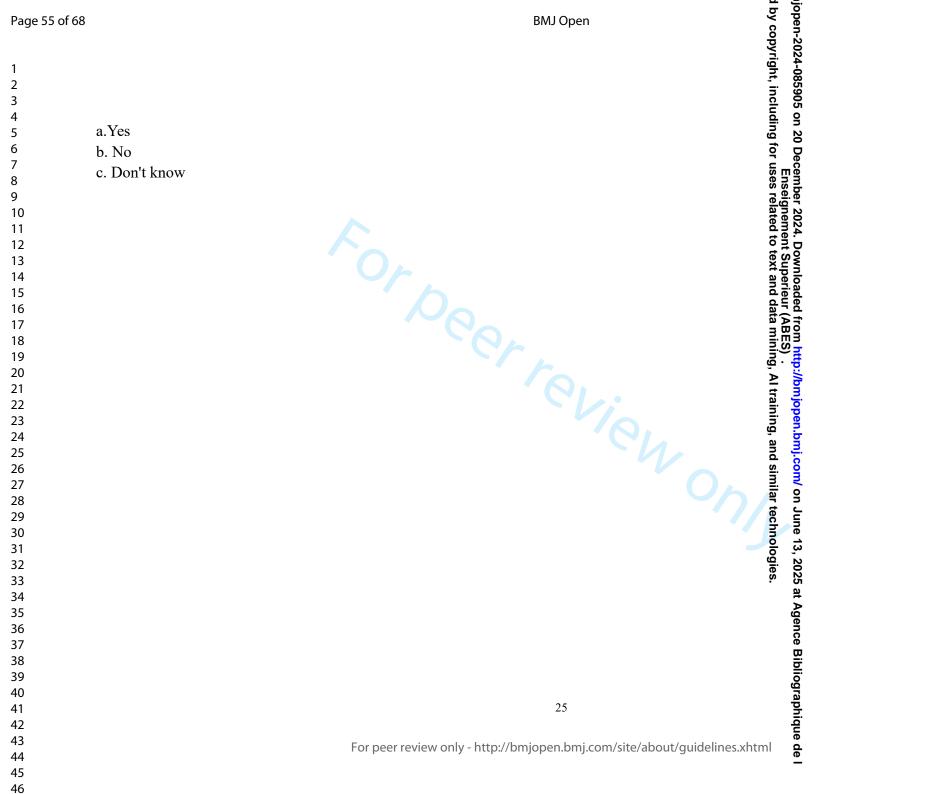
Page 49 of 68	BMJ Open BMJ Open BMJ Open BMJ Open
	opy: 202
1	
2	, 5 85 in 99
3 4	d. Don't know
5	d. Don't know
6	for De
7	2. Only live dust mites can act as allergens to causing allergic reactions: (assign 0 points for a, 1 point for bar bar bar bar bar bar bar bar bar ba
8 9	a. Correct
10	b. Wrong
11	c. Don't know
12 13	
14	3. Which of the following diseases can be caused by dust mite allergy: (assign 0.5 points for abcd, 1 points for e, 0 points for f)
15	a. Eczema
16	b. Allergic conjunctivitis
17 18	c. Rhinitis d. Asthma
19	d. All of them
20	e. Don't know
21 22	
23	4. Dust mites in the house mainly breed in bed sheets and bedding, carpets and curtains are not prone to been given by the dust mites: (assign 0 points for
24	a, 1 point for b, 0 points for c)
25	
26 27	b. Wrong
28	c. Don't know
29	
30 31	<ul> <li>a. Correct</li> <li>b. Wrong</li> <li>c. Don't know</li> <li>5. Plush toys are prone to breeding dust mites: (assign 1 point for a, 0 points for b, 0 points for c)</li> <li>a.Correct b.Wrong c.Don't know</li> </ul>
32	a.Correct b.Wrong c.Don't know
33	
34 35	6. UV light can kill dust mites: (assign 0 points for a, 1 point for b, 0 points for c)
36	a. Correct
37	b. Wrong
38	
39 40	Öğ
41	۱۹ <b>گ</b>
42	6. UV light can kill dust mites: (assign 0 points for a, 1 point for b, 0 points for c) a. Correct b. Wrong 19 For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml
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44 45	<u> </u>

	BMJ Open c. Don't know	Page 50 of 68
	-2024-085905 opyright, inclu	
1	ght,	
2 3	inc 590	
4	di or	
5	c. Don't know	
6 7		
7 8	7. Freezing the plush toys or pillowcases in the refrigerator overnight can kill dust mites: (assign 1 points for b, 0 points for c)	
9	a. Correct	
10	b. Wrong	
11 12	c. Don't know	
12 13		
14	8. How many degrees hot water for washing bed sheets will be most effective in removing dust mites: gas ggn 0 points for abc, 1 point for d, 0	
15	points for e)	
16 17	a. 25°C	
17	b. 35°C	
19	c. 45°C	
20		
21 22	e. Don't know	
22		
24	<ul> <li>d. 55°C</li> <li>e. Don't know</li> <li>9. Indoor dust mites can be completely eliminated with a good job cleaning: (assign 0 points for a, 1 point for b, 0 points for c)</li> </ul>	
25	a. Correct	
26 27	b. Wrong	
28	c. Don't know	
29		
30	10. There is no sure for a shild with dust mits allows but to keep the house as hypispie as possible to we d dust mits. (assign 0 points for $a_{1}$	
31 32	10. There is no cure for a child with dust mite allergy but to keep the house as hygienic as possible to avoid dust mites: (assign 0 points for a, 1 point for b, 0 points for c)	
33	point for b, 0 points for c)	
34	a. Correct	
35	b. Wrong c. Don't know	
36 37		
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1 2 3 4 5 6 7 8 9 10 11 12 13 14	BMJ Open 11. Dust mite allergy will heal itself as the child grows up: (assign 0 points for a, 1 point for b, 0 points a. Correct b. Wrong c. Don't know 12. Have you heard of or know about desensitization treatment for dust mites?: (assign 0 points for a, 0 a. Haven't heard of it b. Have heard of it but don't know the details	lecember 202
14 15 16	c. Understand the process and procedure of it	and de d
17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38	<ul> <li>V. Please choose the appropriate options for the following questions</li> <li>(the following are the attitude dimension, assign 4 points for a, 3 points for b, 2 points for c, 1 por 13. Your concerns about dust mite infestation and dust mite allergy</li> <li>13.1 You can't stand dust mites infesting your home: <ul> <li>a. Strongly agree</li> <li>b. Agree</li> <li>c. Unsure/Don't know</li> <li>d. Strongly disagree</li> </ul> </li> <li>13.2 What is your attitude towards the possible health risks of dust mite infestation in children?: <ul> <li>a. Very worried</li> <li>b. Worried</li> <li>c. Unsure/Don't know</li> <li>d. Not worried at all</li> </ul> </li> </ul>	U
39 40 41	21	ographi
42 43 44 45	For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml	ique de l

BMJ Open 13.3 Even though you have follow the doctor's advice to reduced your child's exposure to dust	njopen- d by co	Page 52 of 68
	2024 pyri	
	1-085 ght,	
	inclu	
13.3 Even though you have follow the doctor's advice to reduced your child's exposure to dust	t mites by thits removal in th	e house, vou are still
worried about the dust mite allergy.:	of D	
a. Strongly agree	December Enseig for uses re	
b. Agree	nber Isei( Is rei	
c. Unsure/Don't know	· 202 Jner late	
d. Strongly disagree	24. D d to	
	te Sul	
14. Your attitude to mite removal and desensitization treatment	perio	
14.1 Do you think it is necessary to regularly remove mites from your home:	ded 9 dat	
a.Very necessary b.Possibly necessary c.Unsure d.Unnecessary	from (ABE	
14.2 If there have a therapy to make your child non-allergic to dust mites, do you think it is nec	essary to undergo it:	
a. Very necessary		
b. Possibly necessary	//bmjop Al trair	
c. Unsure/Don't know	ving.	
d. Unnecessary	, and si	
14.3 How much do you think is acceptable to spend for your child on prevention and treatment		)
a. More than 1000 CNY/month;	ar is	
b. 500-1000 CNY/month;	June techn	
c. 100-500 CNY/month;	13, 1	
d. Less than 100 CNY/month;	June 13, 2025 technologies.	
VI. Please choose the appropriate options for the following questions (the following are the	e practice dimension)	
15. Targeted practice	<u>o</u>	
	e Bi	
	blio	
	grap	
22	hiq	
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15.5 Do you use Dust Mite Controller to remove mites in you	BMJ Open	open by cc	Page 54
		-202	
		1-08; ght,	
		incl	
15.5 Do you use Dust Mite Controller to remove mites in you	r home (assign 1 point for Yes. 0.)	5 points for intend to purcha	ase 0 points for a not
intend to purchase):	i nome (usoign i pometor res, s		
a.Yes		r us	
b. Previously test showed dust mite allergy but not used		mbe es r	
c. Recent test show dust mite allergy and intend to purchase		elate	
d. Recent test show dust mite allergy but not intend to purchas	e	ed to	
		ont So	
15.6 Do you use instruments such as dehumidifier/air-conditio	ning, air cleaner, and etc. to remove	e mites in worthome (assig	gn 1 point for Yes, 0.5
points for intend to purchase, 0 points for a.not intend to purch		rieu nd d	
a.Yes		d fr ata	
b. Previously test showed dust mite allergy but not used		om BES	
c. Recent test show dust mite allergy and intend to purchase		http ing	
d. Recent test show dust mite allergy but not intend to purchas	le la		
		njor trair	
<ul><li>d. Recent test show dust mite allergy but not intend to purchas</li><li>15.7 Do you use the decoration which prone to mites such as</li></ul>	s carpet in your home (assign 0 p	oints for Yes, 1 point for N	o, 0 points for Don't
know):			
a.Yes		d si	
b. No		mila	
c. Don't know		mj.com/ on June and similar techr	
		une	
15.8 Do you or your family weekly wash your pillowcases and a.Yes	d bedclothes (assign 1 point for Ye	es, 0 poines for No, 0 points	for Don't know):
a.Yes		2025 gies.	
b. No		at	
c. Don't know		Ager	
15.9 Do you or your family use vacuum cleaner to clean your h	ouse every day (assign 1 point for	Ves 0 pointer for No. 0 poin	ts for Don't know).
13.9 Do you of your failing use vacuum cleaner to clean your h	louse every day (assign 1 point for		is for Don't know /:
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	24	aphiq	
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Dear Parents: Hello!	cember Enseig	
We are researchers at Shengjing Hospital of China Medical University and we thank you for participation conducted to collect information to understand the knowledge, attitudes and practice of parents toward the	2 2 2	
mite allergy, and aims to provide a basis for the development of scientific intervention strategies for scient		e, which may help more people
Approval Committee. If you agree to participate in this study, please refer to the following instructions and patiently by <b>circling the corresponding symbol</b> .	2.0	· · · ·
1. There are no certain correct or wrong answers, you just need to fill in the questionnaire according	onehttp: BES) . mining.	pur actual situation, any
2. This study is only a simple questionnaire and will not harm your physical or psychological conditing questions, such as your gender, age, etc. We will keep your information strictly confidential and will not	<u> </u>	• • • •
will be derived from the overall statistical analysis of the data and will not involve any personal privacy,		e feel free to fill in.
3. As a participant, you can be kept informed of information and research progress related to this study the study, please let us know and your data will not be included in the results of this study.	aly.	you decide to withdraw from
Finally, we sincerely thank you for taking time out of your busy schedule to support our scientific re	ar n	
$\Box$ I have been informed of and agree to the use of the data collected for scientific research.	June 13, 2025 ; technologies.	
Participation date: Year Mouth	at Agence	Day

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	Questionnaire B on the prevention and	I treatment of dust mite allergy (for patients treated with	ght, inced hypedi	s for the sensitization of the
	I. Please fill in your basic information:		ng fo	20 D
	1. Your relationship with your child is?		r us n	
	a. Father		es r	mbe
)	b. Mother		elat	Pr 20
,	c. Other family member		ed to	)24. Г
	2 Father's education.		t sup	Down
·	a. Primary school and below		and	lo ad
,	b. Middle school		ur (/ data	ed f
,	c. High school/Technical secondary school	ol	a mi	
)	d. Bachelor's degree/Junior college		s).	htt
)	e. Master's degree		g, ≥	p://b
2	f. Doctorate		train	mjop
;	3. Mother's education:		ing, a	en.b
;	a. Primary school and below		and	<u>, ,</u>
) ,	b. Middle school		simi	om/
}	c. High school/Technical secondary school	ol	ilar t	on
)	d. Bachelor's degree/Junior college		tech	Jun
	e. Master's degree		nolo	e 13
-	f. Doctorate		ogies	, 202:
•	4. Annual household income (CNY):		•	5 at A
	a. <30,000			gen
	b. 30,000-50,000			ce E
	c. 50,000-100,000			Bibli
)	d. 100,000-200,000			ogr
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e. 200,000-300,000 f. >300,000

5. Are the parents allergic to dust mites?

a. None

b. Father only

c. Mother only

d. Both allergic to dust mites

e. Haven't followed it, don't know yet

6. You learn about allergies through:

a. Newspaper & Books

b. Radio & TV

c. Web Search

d. Short videos (Tiktok)

e. Doctor's guidance during consultation

f. Never knew about it

II. Please fill in your child's basic information:

1. Name:

2. Age:

3. Gender:

4. Ethnicity:

6. Whether your child is the only-child?

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46	

6. The exercises your children usually enjoy to do (Multiple choice):

- a. Outdoor running and walking
- b. Playing basketball
  - c. Swimming

c. Yes d. No

- d. Taekwondo
- e. Indoor dancing
- f. Cycling
- g. Other
  - 7. The floor your child live on:
  - a. Single-storey house
  - b. First floor
- c. Floor 2-10
- d. Floor 10-20
  - e. Floor 21 and above
  - f. Top Floor
  - 8. Your child's residence is:
  - a. Within Shenyang City
  - b. Rural areas of Shenyang
  - c. Towns of Shenyang
  - d. City of Liaoning Province (except Shenyang)
  - e. Rural areas within Liaoning Province (except Shenyang)
  - f. Towns within Liaoning Province (except Shenyang)
  - g. Outside Liaoning Province

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10. The transportation to visit a doctor:		35905
h. On foot		on
i. Bus	0 0	200
j. Metro		б
k. High-speed Rail	eg -	20 December Enseig
l. Long distance bus	e e e e e e e e e e e e e e e e e e e	igne
m. Private Car	eo a	2024.
n. Other	O Te	
		ownload Superie
III. Please fill in your child's medical inform	mation:	pade
1. The diagnose of your child (multiple choice	e):	h t t t t t
a. Rhinitis		BE
b. Bronchial asthma		S)
c. Cough variant asthma		
d. Allergic cough		mjop
2. Were you aware of your child's dust mite all	llergy before you brought him/her to the paediatric allergy und on him/her symptoms likely to occur?	tp://bmjopen.bmj.com/ on June 13, 2025
a. Know		
b. Don't know		on/
c. Suspected dust mite allergy in child based o	on him/her symptoms	9 N
1 00		Jun
3. Which season your child's rhinitis is more l	likely to occur?	e 13
a. No rhinitis		, 20
b. Spring	ů.	, 25 a
c. Summer		t Ag
d. Autumn		Jenc
e. Winter		ë B
f. All year round		iblio
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4. What is the duration of your child's rhinitis attack?
a No rhinitis

- b. The duration of symptoms <4 days/week, or <4 consecutive weeks
- c. The duration of symptoms  $\geq$ 4 days/week, or  $\geq$ 4 consecutive weeks
- 5. Does your child's rhinitis affect his/her study, cultural & sports activities, and sleep?
- a. No rhinitis
- b. No significant effect
- c. Have significant or severe effects
- 6. Which season your child's asthma is more likely to occur?
- a. No asthma
- b. Spring
- c. Summer
- d. Autumn
- e. Winter
- f. All year round
- r review 7. The times of your child's asthma attack in the last six months is:
  - a. No asthma
  - b. No acute asthma
- c. 1-2 times
- d. 3-5 times
- e.  $\geq 6$  times
  - 8. The time your child has been receiving desensitization treatment is:
  - a. First medication
- b. Within 3 months
- c. 3 months to 6 months

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jopen-2024-085905 on 20 December 2024. Download Enseignement Superie d by copyright, including for uses related to text and **BMJ** Open http://bmjopen.bmj.com/ on June 13, 2025 at Agence Bibliographique de I S) . 12.Has your child had any adverse reactions during desensitization treatment? a. No b. Yes, but not serious (only redness and swelling at injection site) c. Experienced a large area urticaria throughout the body For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

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	opyric
1 2	d Experienced a severe allergic reaction (Difficulty breathing Shock and etc.)
3 4	BMJ Open       by cpp/1024-08590       open         d. Experienced a severe allergic reaction (Difficulty breathing, Shock, and etc.)       on 20 pen       on 20 pen         13. Frequency of adverse reactions:       on 20 pen       on 20 pen
5 6	
7 8	a. None
9	b. 1 - 2 times
10	c. 3 - 5 times
11 12	d. Often
13	e. Every time
14	
15 16	IV. Please choose the appropriate options for the following questions (the following are the knowled a mension)
17	1. Which of the following species of dust mite can cause an allergic reaction: (assign 0 points for ab, 1 points for d):
18	a. House dust mite only
19 20	b. Dermatophagoides farinae only
21	c. Both house dust mite and dermatophagoides farinae d. Don't know
22 23	
24	2. Only live dust mites can act as allergens to causing allergic reactions: (assign 0 points for a, 1 point for b 0 points for c)
25	a. Correct
26 27	b. Wrong
28	c. Don't know
29 30	<ul> <li>c. Don't know</li> <li>3. Which of the following diseases can be caused by dust mite allergy: (assign 0.5 points for abcd, 1 point for e, 0 points for f)</li> <li>a. Eczema</li> <li>b. Allergic conjunctivitie</li> </ul>
31	3. Which of the following diseases can be caused by dust mite allergy: (assign 0.5 points for abcd, 1 point for e, 0 points for f)
32	a. Eczema
33	
34 35	c. Rhinitis d. Asthma
36	d. All of them
37	e. Don't know
38 39	
40	ogra
41	c. Rhinitis d. Asthma d. All of them e. Don't know 33 For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml
42 43	
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<ul> <li>BMJ Open</li> <li>4. Dust mites in the house mainly breed in bed sheets and bedding, carpets and curtains are not profa, 1 point for b, 0 points for c)</li> <li>a. Correct</li> <li>b. Wrong</li> <li>c. Don't know</li> <li>5. Plush toys are prone to breeding dust mites: (assign 1 point for a, 0 points for b, 0 points for c</li> <li>a. Correct</li> <li>b. Wrong</li> <li>c. Don't know</li> </ul>	ijopen∹ 1 by co		Page 64 of 68
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4. Dust mites in the house mainly breed in bed sheets and bedding, carpets and curtains are not pro	one to breeding of <u>e</u> . S	lust mites: (assign 0 points for	
a, I point for b, U points for c)	- 20 ng f		
a. Correct	Ör u		
b. Wrong	;eml Ises		
c. Don't know	seig relig		
5 Pluch toxe are property hereding dust mites. (agging 1 point for a 0 points for b 0 points for a	202 ated		
a. Correct	1 to t		
h. Wrong	own Sup		
c. Don't know	lload berie and		
	l daf		
6. UV light can kill dust mites: (assign 0 points for a, 1 point for b, 0 points for c)	ABE		
a. Correct	ining		
b. Wrong	9, A		
c. Don't know	/bmjope Al trainin		
7. Freezing the plush toys or pillowcases in the refrigerator overnight can kill dust mites: (assign	. <u>e</u> <u>-</u> .	points for b. 0 points for $c$ )	
a. Correct			
b. Wrong	sim		
c. Don't know	ilar		
	Jun		
<ul> <li>7. Freezing the plush toys or pillowcases in the refrigerator overnight can kill dust mites: (assign a. Correct</li> <li>b. Wrong</li> <li>c. Don't know</li> <li>8. How many degrees hot water for washing bed sheets will be most effective in removing dust r points for e)</li> <li>a. 25°C</li> <li>b. 35°C</li> <li>c. 45°C</li> <li>d. 55°C</li> </ul>	mites: Zassign (	) points for abc, 1 point for d, 0	
points for e)	, 20; ogie		
a. 25°C	s. 25 a		
b. 35°C	ıt Aç		
c. 45°C	yend		
d. 55°C	се В		
e. Don't know	iblic		
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1 2 3	BMJ Open 9. Indoor dust mites can be completely eliminated with a good job cleaning: (assign 0 points for a, 1 points for c)
5	a. Correct
	b. Wrong c. Don't know השפר ג שני או
8 9	
10 11 12 13 14	10. The desensitization treatment for dust mite allergy usually takes 3-5 years: (assign 1 point for a, 0 points for b, 0 points for c) a. Correct b. Wrong c. Don't know
10	11. The medications of nasal spray hormone therapy for rhinitis or nebulised hormone therapy for asthur treatment: (assign 0 points for a, 1 point for b, 0 points for c)
	a. Correct
21 22	c. Don't know
25 26	12. There is no need to pay attention to removing and avoiding dust mites during desensitization treatments is a points for a, 1 point for b, 0 points for c)
27	a. Correct b. Wrong
29 30	c. Don't know
32	13. The desensitization of dust mite can treat rhinitis caused by dust mite allergy, but it can't prevent rhiniting from developing into asthma: (assign
34	o points for a, 1 point for b, 0 points for c
30	a. Correct B. Wrong Construction Constructio
	c. Don't know
39 40 41 42	14. Those adverse reactions in desensitization treatment that require attention are (Multiple choice): (assign $0.2$ points for each option) 35
43 44	For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

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<ul> <li>a. Itching of the palms of the hands and feet. Itch</li> <li>b. Immediate shock (altered mental state. Cold a</li> <li>c. Difficulty breathing. Rapid breathing. Hoarse</li> <li>d. Abdominal pain. Nausea. Vomiting. Urinary i</li> <li>e. Loss of consciousness. Loss of respiration. Loss</li> <li>V. Please choose the appropriate options for t</li> <li>(the following are the attitude dimension, a</li> <li>15. Your concerns about dust mite infestation an</li> <li>15.1 You can't stand dust mites infesting your hose.</li> <li>a. Strongly agree</li> <li>b. Agree</li> <li>c. Unsure/Don't know</li> <li>d. Strongly disagree</li> </ul>	hy scalp. Flushed skin all over the body. Th and clammy skin. Decrease in blood pressur eness and other symptoms incontinence oss of carotid artery pulsation	jopen-2024-08590 by copyright, inction 20 December 2 Enseign re)	
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v. Please choose the appropriate options for t	the following questions	for s 1 moder d)	
15 Your concerns about dust mite infestation an	addust mite allergy		
15.1 You can't stand dust mites infesting your he	ome	I dat	
a Strongly agree	sinc.	a ABE	
h. Agree		inin IS)	
c. Unsure/Don't know		9, A	
<ul> <li>b. Agree</li> <li>c. Unsure/Don't know</li> <li>d. Strongly disagree</li> <li>15.2 What is your attitude towards the possible I</li> <li>a. Very worried</li> <li>b. Worried</li> <li>c. Unsure/Don't know</li> <li>d. Not worried at all</li> <li>15.3 Even though you have follow the doctor's worried about the dust mite allergy.:</li> <li>a. Strongly agree</li> </ul>		http://bmjopen.bmj.com/ on June 3) . ing, Al training, and similar techn ren :	
15.2 What is your attitude towards the possible	hoalth risks of dust mits infostation in shild	ing,	
a Very worried	nearth fisks of dust linte intestation in clind		
h Worried		sin ğ	
c. Unsure/Don't know		ilar on	
d. Not worried at all		June	
		13,	
15.3 Even though you have follow the doctor's	advice to reduced your child's exposure to	o dust mites by hopse dust mite	s removal, you are still
worried about the dust mite allergy.:		s 5 at	
a. Strongry agree		Age	
b. Agree		ince	
c. Unsure/Don't know		Bib	
d. Strongly disagree		sliog	
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Page 67 of 68  1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23	BKU Open     by opproved.besold       16. Your attitude to mite removal and desensitization treatment     16.1 Do you think it is necessary to regularly remove mites from your home:     0       16. Your attitude to mite removal and desensitization treatment     16.1 Do you think it is necessary to regularly remove mites from your home:     0       16. Your attitude to mite removal and desensitization treatment     16.2 Do you think that desensitization treatment is an effective option for your child's rhinitis/asthma:     a. Yes       16.2 Do you think that desensitization treatment is an effective option for your child's rhinitis/asthma:     a. Yes       b. Probably yes     c. Don't know /Unsure     a. No       16.3 Do you think desensitization treatment needs to be carried out strictly according to medical advice (action on time):     a. Very needed       b. Needed     a. Don't know     a. Support the desensitization treatment needs to be carried out strictly according to medical advice (action on time):     a. Wery needed
24 25 26	d. Don't need
27 28 29 30 31 32 33 34 35 26	<ul> <li>16.4 If your child has a relatively obvious reaction to the treatment, such as severe redness at the injection of the injection of the body or even anaphylaxis, will you continue with the Desensitization treatment:</li> <li>a. Persist</li> <li>b. May persist, depending on the situation</li> <li>c. May give up</li> <li>d. Definitely give up</li> </ul>
36 37 38	VI. Please choose the appropriate options for the following questions (the following are the practice dingension)
39 40	17. Targeted practice
41 42	37 For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml
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	yright,	
	BMJ Open ite allergy, have you and your family made a special effort to learn about received the knowledge (including dust mites. zation treatment, etc.) (assign 1 point for Yes, 0 points for No) :	
a. Yes	for	
b. No	g for uses references of points for risk of g for uses references	
17.2Does your child use mite-p Don't know):	proof bedding such as mite proof pillowcases and bedclothes (assign 1 paints for Yes, 0 points for No, 0 points for	
a.Yes		
b. No		
c. Don't know	nd da	
17.3 Your child is currently usi	ing a pillow with a content material of (No points for this question):	
a. Latex	ning	
b. Down		
c. Artificial fibre		
d. Buckwheat hulls		
e. Cotton	ing a pillow with a content material of (No points for this question): a mining, Al training, and similar technologies. a bedding with a content material of (No points for this question): a bedding with a content material of (No points for this question):	
17.4 Your child is currently usi	ing a bedding with a content material of (No points for this question):	
a. Latex		
b. Down		
c. Cotton	nol	
d. Silk	ologies.	
e. Artificial fibre	ੇ ਹੈ। ਬ	
17.5 Do vou use dust mite cont	troller to remove mites in your home (assign 1 point for Yes, 0 points for No, g points for Don't know):	
a.Yes	Ö.	
b. No		
c. Don't know	Og Z	
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4 5	17.6 Do you use instruments such as dehumidifier/air-conditioning, air cleaner, and etc. to remove mites in your home (assign 1 point for Yes, 0
6	points for No. 0 points for Don't know). $\overrightarrow{}$
7	a.Yes
8 9	b. No
9 10	a.Yes b. No c. Don't know
11	
12	17.7 Do you use the decoration which prone to mites such as carpet in your home (assign 0 points for boilts for No, 0 points for Don't
13 14	know):
15	a.Yes
16	b. No
17	c. Don't know
18 19	
20	17.8 Do you or your family weekly wash your pillowcases and bedclothes (assign 1 point for Yes, 0 points for Don't know):
21	a. Yes b.No c.Don't know
22 23	
23	17.9 Do you or your family use vacuum cleaner to clean your house every day (assign 1 point for Yes, 0 points for No, 0 points for Don't know):
25	a.Yes
26	b. No
27 28	c. Don't know
29	
30	17.10 Has your child had a delay in injections for some reason that caused treatment to be restarted or folley - a injections to be cancelled (assign
31 32	
33	1 point for a, 0 points for b, 0 points for c): a. Never
34	
35	b. Once of twice before
36 37	c. Frequently postponed
38	
39	
40	b. Once or twice before c. Frequently postponed Bibliographique 39 For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml
41 42	39 <b>P</b> .
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# Parents' knowledge, attitude, and practice toward the prevention and treatment of dust mite allergy: A cross-sectional study in Shenyang (China)

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# Parents' knowledge, attitude, and practice toward the prevention and treatment of dust mite allergy: A cross-sectional study in Shenyang (China)

Running title: KAP of dust mite allergy

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#### Abstract

**Objective:** This cross-sectional study aimed to evaluate parents' knowledge, attitudes, and practices (KAP) concerning the prevention and treatment of dust mite allergy in children.

**Design:** This cross-sectional study survey was conducted from September to December 2022 at Shengjing Hospital, Affiliated with China Medical University.

**Participants:** A total of 503 parents of children with dust mite allergies participated, with 253 parents having children undergoing desensitization treatment and 250 parents whose children did not. Selection criteria were carefully defined to include parents directly responsible for caring for children with dust mite allergies.

**Primary and secondary outcome measures:** Two distinct questionnaires were administered to parents, tailored for those with and without children undergoing desensitization treatment. These questionnaires covered demographic information, allergy diagnosis, treatment details, and KAP related to dust mite allergy. Primary outcomes included parents' scores on knowledge, attitudes, and practices regarding dust mite allergy prevention and treatment. Secondary outcomes involved analyzing the interaction between these factors using pathway analysis.

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**Results:** Parents of children undergoing desensitization treatment exhibited higher scores for all items of knowledge, attitude, and overall practice than those without desensitization therapy (all P<0.05). The pathway analyses revealed that in the non-desensitization group, knowledge directly affected attitude ( $\beta$ =0.22, P<0.001), and attitude directly affected practice ( $\beta$ =0.16, P<0.001), but the knowledge did not affect practice ( $\beta$ =-0.01, 0.06, P<0.001). In the desensitization group, knowledge directly affected attitude ( $\beta$ =0.13, P=0.028), but the practice was not affected by attitude ( $\beta$ =0.08, P<0.001) or knowledge ( $\beta$ =0.03, 0.12, P<0.001).

**Conclusions:** The study highlighted differing levels of KAP among parents of children with dust mite allergies. The KAP was influenced by desensitization therapy status. While attitudes tended to be favorable, practices were suboptimal, particularly among parents whose children

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> did not receive desensitization treatment. These findings emphasize the importance of targeted educational interventions to enhance parental awareness and practices regarding dust mite allergy management, especially in cases where desensitization treatment is not pursued. Further research is warranted to explore effective strategies for improving parental engagement and adherence to preventive measures.

> **Keywords:** dust mites, house; dust mite allergy; health knowledge, attitudes, practice; desensitization, immunologic; cross-sectional study.

# Strengths and limitations of this study

Based on the provided article, here are the summarized strengths and limitations of the methods section:

#### Strengths:

1. Use of a Validated Questionnaire: The study used two versions of a questionnaire designed by senior experts and pre-tested for reliability (Cronbach's  $\alpha > 0.7$  for both versions).

2. Hypothesis-Driven Analysis: The statistical methods included pathway analysis to explore relationships between KAP dimensions, adding depth to the interpretation of the data.

#### Limitations:

1. Single-Center Study: The study was conducted at a single hospital, which limits generalizability to other regions or hospitals.

2. Potential Bias in Self-Reported Data: knowledge, attitudes, and practices (KAP) surveys are prone to social desirability bias, where participants may provide responses they believe are expected rather than their true behaviors.

3. Cross-Sectional Design: Although the study captured a snapshot of the parental KAP across a broad sample, the temporal relationship is unknown.

### **1 INTRODUCTION**

House dust mites mainly include *Dermatophagoides pteronyssinus*, *Dermatophagoides farinae*, and *Euroglyphus maynei* [1]. They are non-parasitic microscopic bugs that live on desquamated dead skin cells from humans and pets. They prefer warm and moist environments and are found in bedding, linens, carpets, and furniture [2-4]. Although the mite's exoskeleton can contribute to the allergic reaction, the main allergens are found in the mite's fecal pellets [5, 6]. Each mite produces about 20 pellets daily, each the size and weight of a pollen grain [5, 6]. Therefore, they are easily inhaled and can cause sensitization of the respiratory tract mucosa, leading to epithelial permeability and the movement of the mite's antigens to antigen-presenting dendritic cells [5, 6]. The prevalence of dust mite allergy varies from 11.21% in Northeast China to 40.79% in South China [7]. Dust mite allergy contributes to the development of allergic rhinitis and asthma, affecting 800 million people worldwide [1, 5, 8, 9]. The prevalence of asthma in children in the Third National Health Survey in China was 3.02%, showing a 52.8% increase from 2001 to 2013 [10]. Therefore, dust mites represent a serious public health problem. The most effective management method for dust mite allergy is allergen avoidance (e.g., frequently washing bedding, removing carpets, room air cleaners, and humidity control) [5, 11-13]. Over-the-counter medications (antihistamines, nasal corticosteroids, leukotriene receptor antagonists, cromolyn sodium, and decongestants) and allergen immunotherapy can also help [5, 11].

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Since allergen avoidance involves specific lifestyle habits [5, 11-13], parents' proper knowledge, attitudes, and practice (KAP) toward dust mites are essential to managing the allergic symptoms in their children. KAP surveys provide quantitative and qualitative data about a specific subject in a specific population [14, 15]. They can identify gaps and design tailored teaching and training activities [14, 15]. It is known that parents who visited an allergist demonstrated higher dust mite KAP [16]. Generally, parents display very high KAP toward

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food allergies in their children [17-19], mainly because several of these allergies can be fatal, which is not the case with dust mite allergy. Studies revealed poor parental KAP for allergic rhinitis [20, 21] and poor KAP regarding allergic disorders in general [22], including in parents of asthmatic children [23]. The KAP toward dust mite allergy remains unknown in the general population of China. Therefore, many parents do not consult when their children display dust mite allergy symptoms or delay consultation when the symptoms exacerbate. Some patients testing positive for dust mite allergy will receive desensitization therapy, but many parents refuse treatments. All parents receive the same information package when their children test positive for dust mite allergy, and the parents are free to consult all sources of information and to ask questions. Nevertheless, differences can be present between those who decide on desensitization therapy and those who refuse. It was hypothesized that differences in KAP could explain, at least in part, the parents' decision.

Therefore, this study aimed to evaluate the KAP of parents toward preventing and treating dust mite allergy and to examine the differences between the parents of children who were treated with desensitization treatment and those of children who were not. Parents are the primary actors in house cleaning and management, and evaluating their KAP toward house mite allergy should help design future teaching activities.

#### 2 MATERIALS AND METHODS

#### 2.1 Study design and participants

This cross-sectional study survey was conducted from September to December 2022 at Shengjing Hospital, Affiliated with China Medical University. The participants were the parents of children with dust mite allergies. The study was approved by the Medical Ethics Committee of Shengjing Hospital, Affiliated with China Medical University (approval #2022PS935K). Informed consent was obtained from the participants before completing the

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survey. All participants were enrolled at the outpatient clinic of Shengjing Hospital, Affiliated to China Medical University when their children had an appointment.

The inclusion criteria were 1) parents of children who tested positive for dust mite-specific serum IgE (measured by Phadia ImmunoCAP) and 2) voluntarily completed the questionnaire. The participants were grouped according to whether the children were treated with desensitization treatment or not.

# 2.2 Questionnaires

Two senior experts in allergy designed the questionnaire with reference to the literature [16, 24, 25]. The final questionnaire had two versions: one for the parents of children who did not undergo desensitization treatment (Questionnaire A) and one for the parents of children who underwent desensitization treatment (Questionnaire B). Thirty parents were randomly selected to complete the questionnaire to test its reliability. Cronbach's  $\alpha$  was 0.726 for Questionnaire A and 0.702 for Questionnaire B.

The questionnaire contained six dimensions: demographic information of the parents, demographic information of the child, diagnosis and treatment information related to dust mite allergy in children, knowledge dimension, attitude dimension, and practice dimension. The specific questions and scoring instructions for both questionnaire versions can be found in the Supplementary Materials. The data were collected by on-site inquiry and questionnaire when the parents visited the hospital.

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### 2.3 Statistical analysis

The continuous variables were expressed as means  $\pm$  standard deviations (SD) and analyzed using Student's t-test or ANOVA. The categorical data were expressed as n (%) and analyzed using the chi-square test. All statistical analyses were performed using two-sided tests, and P-values <0.05 were considered statistically significant. Pathway analysis was constructed, and the hypotheses were 1) knowledge has direct effects on attitude, 2) attitude has direct effects

on practice, and 3) knowledge has direct effects on practice. Good practice was defined as a score  $\geq$ 70% of the highest possible score for practice. STATA 17.0 (Stata Corporation, College Station, TX, USA) was used for statistical analysis.

# 2.4 Patient and public involvement

No patient involved

# **3 RESULTS**

# **3.1 Characteristics of the participants**

All the patients with dust mite allergy who attended the Pediatric Respiratory Clinic of Shengjing Hospital from September to December 2022 were invited to participate, of whom 189 refused to fill in the questionnaire due to concern about privacy, lack of time, or disinterest. A total of 668 people were surveyed, of which 165 questionnaires were invalid and excluded (135 had missing questions, 27 had contradictory options, and three were filled with all the same options). Therefore, 503 valid questionnaires were included in the analyses: 250 from non-desensitized patients and 253 from desensitized patients.

The majority of the participants were women (81.91%) and had a bachelor's degree or higher education, but only a small proportion had a history of dust mite allergy. There were more fathers in the desensitization group (25.69% vs. 9.20%, P<0.001), and the mothers' education was higher in the non-desensitization group (P=0.028) (Table 1). There were no differences between the children of the two groups, except for the residence area (P=0.001) and means of transportation to the hospital (P=0.003) (Supplementary Table S1). Compared with the nondesensitization group, the children in the desensitization group had higher proportions of dust mite allergy diagnosis (P=0.009), less rhinitis (P=0.004), and shorter rhinitis attacks (P<0.001) (Supplementary Table S1).

	Without	With	Р
	desensitization	desensitization	
Total	250 (49.70)	253 (50.30)	
Parental relationship			< 0.00
Father	23 (9.20)	65 (25.69)	
Mother	223 (89.20)	184 (72.73)	
Other family members	4 (1.60)	4 (1.58)	
Father's education			0.167
Primary school and below	19 (7.60)	13 (5.14)	
Middle school	28 (11.20)	44 (17.39)	
High school/technical secondary school	33 (13.20)	41 (16.21)	
Bachelor's degree/junior college	131 (52.40)	128 (50.59)	
Master's degree	30 (12.00)	20 (7.91)	
Doctorate	9 (3.60)	7 (2.77)	
Mother's education			0.028
Primary school and below	1 (0.40)	3 (1.19)	
Middle school	22 (8.80)	39 (15.42)	
High school/technical secondary school	32 (12.80)	44 (17.39)	
Bachelor's degree/junior college	154 (61.60)	143 (56.52)	
Master's degree	35 (14.00)	21 (8.30)	
Doctorate	6 (2.40)	3 (1.19)	
Annual household income (RMB)			0.379
<30,000	18 (7.20)	24 (9.49)	
30,000-50,000	29 (11.60)	43 (17.00)	
50,000-100,000	76 (30.40)	73 (28.85)	
100,000-200,000	61 (24.40)	61 (24.11)	
200,000-300,000	32 (12.80)	26 (10.28)	
>300,000	34 (13.60)	26 (10.28)	
Are the parents allergic to dust mites?		× ,	0.373
None	102 (40.80)	126 (49.80)	
Father only	21 (8.40)	18 (7.11)	
Mother only	24 (9.60)	19 (7.51)	
Both	6 (2.40)	6 (2.37)	
Unclear	97 (38.80)	84 (33.20)	
Ways to learn about allergies	× /		-
[multiple choice]			
Newspaper & Books	49 (19.60)	19 (7.51)	
Radio & TV	36 (14.40)	21 (8.30)	
Web Search	104 (41.60)	82 (32.41)	
Short videos	76 (30.40)	40 (15.81)	
	· · · · · · · · · · · · · · · · · · ·	· · · ·	
Doctor's guidance during the consultation	164 (65.60)	228 (90.12)	

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# 3.2 Knowledge, attitudes, and practice

For the items common to the two questionnaires, compared with the non-desensitization group,

the desensitization group showed higher correct response rates about dust mites, the

complications of dust mite allergies, the source of dust mites, and how to manage dust mite populations (all P<0.05) (Table 2). Both groups showed relatively poor knowledge regarding the group-specific items (Supplementary Table S2).

 Table 2. Knowledge dimension, n (%)

	Correct rate		Р
	Without	Desensitization	
	desensitization		
Q1. Which of the following species of dust mite can cause an allergic reaction?	148 (59.20)	216 (85.38)	< 0.001
Q2. Only live dust mites can act as allergens that cause allergic reactions.	105 (42.00)	119 (47.04)	0.256
Q3. Which of the following diseases can be caused by dust mite allergy?	153 (61.20)	187 (73.91)	< 0.001
Q4. Dust mites in the house mainly breed in bed sheets and bedding; carpets and curtains are not prone to breeding dust mites.	171 (68.40)	192 (75.89)	0.061
Q5. Plush toys are prone to breeding dust mites.	226 (90.40)	245 (96.84)	0.003
Q6. UV light can kill dust mites.	68 (27.20)	54 (21.34)	0.126
Q7. Freezing the plush toys or pillowcases in the refrigerator overnight can kill dust mites.	44 (17.60)	68 (26.88)	0.012
Q8. Which hot water temperature will most effectively remove dust mites when washing bed sheets?	127 (50.80)	151 (59.68)	0.045
Q9. Indoor dust mites can be completely eliminated with a good job of cleaning.	185 (74.00)	215 (84.98)	0.002

About half of the participants cannot stand dust mites in their homes. More participants in the desensitization group were very worried about the possible health risks of dust mites in children (P<0.001). More participants in the desensitization group remained worried after following the doctors' advice to decrease dust mites (P=0.016). Most participants in the two groups agree that it is necessary to remove dust mites regularly (P=0.053) (Table 3). The participants in the non-desensitization group are willing to undergo treatments, but cost appears to be a barrier, while most participants in the desensitization group have a favorable attitude toward treatment (Supplementary Table S3).

 Table 3. Attitude dimension, n (%)

Without	Desensitization	Р

		desensitization	1	
You can't stand o	lust mites infesting your			0.481
home.				
Strongly agree		111 (44.40)	122 (48.22)	
Agree		95 (38.00)	98 (38.74)	
Unsure/Don't know		35 (14.00)	28 (11.07)	
Disagree		9 (3.60)	5 (1.98)	
0	ude towards the possible	· · · ·	· · · ·	0.001
	lust mite infestation in			
children?				
Very worried		137 (54.80)	177 (69.96)	
Worried		92 (36.80)	70 (27.67)	
Unsure/Don't know		20 (8.00)	5 (1.98)	
Not worried at all		1 (0.40)	1 (0.40)	
	ave followed the doctor's		1 (0.10)	0.016
	ur child's exposure to dust			0.010
•	oval in the house, you are			
e e	the dust mite allergy.			
Strongly agree	ine dust inte aneigj.	101 (40.40)	114 (45.06)	
Agree		101 (40.40)	118 (46.64)	
Unsure/Don't know		39 (15.60)	17 (6.72)	
			· · · ·	
Strongly disagree		5 (2.00)	4 (1.58)	0.052
	necessary to remove mites			0.053
from your home reg	gularly?	100 (70.00)	100 (74 21)	
Very necessary		182 (72.80)	188 (74.31)	
Possibly necessary		55 (22.00)	54 (21.34)	
Unsure		13 (5.20)	6 (2.37)	
Unnecessary		0	5 (1.98)	

Compared with the non-desensitization group, subjects in the desensitization group displayed higher rates of positive behavior regarding all practice items (all P<0.001), except for the weekly cleaning of bedding and daily vacuuming (P=0.345 and P=0.142) (Table 4). There were no significant differences between the two groups regarding the pillow and bedding materials (Supplementary Table S4).

# Table 4. Practice dimension, n (%)

	Positive behavior		Р
	Without	Desensitization	
	desensitization		
P1. Due to your child's dust mite allergy, have you and your family made a special effort to learn about relevant knowledge (including dust mites. dust mite allergy and desensitization treatment, etc.)	154 (61.60)	216 (85.38)	<0.001

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P2. Does your child use mite-proof bedding such as mite-proof pillowcases and bedclothes	94 (37.60)	105 (41.50)	< 0.001
P3. Do you use a dust mite controller to remove mites in your home	162 (64.80)	162 (64.03)	< 0.001
P4. Do you use instruments such as dehumidifier/air-conditioning, air cleaner, etc., to remove mites in your home	115 (46.00)	85 (33.60)	<0.001
P5. Do you use decoration prone to mites, such as carpet in your home	20 (8.00)	4 (1.58)	0.001
P6. Do you or your family weekly wash your pillowcases and bedclothes	161 (64.40)	173 (68.38)	0.345
P7. Do you or your family use a vacuum cleaner to clean your house every day	114 (45.60)	99 (39.13)	0.142

# 3.3 Pathway analysis

The root mean square error of approximation (RMSEA, P<0.001), comparative fit index (CFI, P=1.000), Tucker-Lewis index (TLI, P=1.000), and standardized root mean square residual (SRMR, P<0.001) all indicated that the model fit was acceptable. In the non-desensitization group, knowledge directly affected attitude ( $\beta$ =0.22, P<0.001), and attitude directly affected practice ( $\beta$ =0.16, P<0.001) (Table 5), but the knowledge did not affect practice ( $\beta$ =0.01, 0.06, P<0.001). In the desensitization group, knowledge directly affected attitude ( $\beta$ =0.08, P<0.001) or knowledge ( $\beta$ =0.03, 0.12, P<0.001) (Figure 1).

Table 5. Estimates of	of hypothesis	paths of KAP
-----------------------	---------------	--------------

	β (95% CI)	P-value
Without desensitization		
K -> A	0.22 (0.10, 0.35)	< 0.001
A -> P	0.16 (0.09, 0.22)	< 0.001
K -> P	-0.01 (-0.07, 0.06)	0.871
Desensitization		
K -> A	0.13 (0.01, 0.25)	0.028
A -> P	0.08 (-0.01, 0.17)	0.095
K -> P	0.03 (-0.05, 0.12)	0.439

CI: confidence interval; K: knowledge; A: attitude; P: practice.

# 3.4 Factors influencing practice among parents of children who underwent desensitization treatment

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Among parents of children who underwent desensitization treatment, bachelor's degree or above (OR=3.816, 95%CI: 1.483-9.818, P=0.005), suspected dust allergy based on symptoms (OR=4.299, 95%CI: 1.429-12.929, P=0.009), and children having rhinitis (OR=0.352, 95%CI: 0.170-0.272, P=0.005) were associated with the parents' practice (Table 6).

**Table 6**. The factors influencing good practices (n=44 parents with good practice) among parents of children who have undergone desensitization treatment (n=253)

	Univariate		Ð	Multivariate	P
	95%CI	(0.046	P	95%CI	Р
Knowledge	0.966 1.102)	(0.846-	0.604		
Attitude	1.16 (0.	99-1.36)	0.067		
Parental relationship					
Mother	REF				
Father/ Other family members	0.449 1.061)	(0.19-	0.068		
Father's education					
Junior college or below	REF				
Bachelor's degree or above	1.44 2.877)	(0.721-	0.302		
Mother's education					
Junior college or below	REF			REF	
Bachelor's degree or above	3.928 9.709)	(1.589-	0.003	3.816 (1.483- 9.818)	0.00
Annual household income (RMB)	,			)	
<100,000	REF				
≥100,000	1.297 2.487)	(0.676-	0.434		
Are the parents allergic to dust mites?	,				
None	REF				
One of the parents/Both	1.83 4.112)	(0.814-	0.144		
Unclear	0.639 1.428)	(0.286-	0.275		
Learned about allergies					
No	REF				
Yes	0.621 3.182)	(0.121-	0.567		
Pre-visit knowledge of child's dust mite allergy	,				
Unaware	REF			REF	
Aware	1.81 3.694)	(0.887-	0.103	1.679 (0.792- 3.561)	0.17

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Suspected based on symptoms	3.08	(1.118-	0.03	4.299	(1.429-	0.009
r i i i i i i i i i i i i i i i i i i i	8.481)			12.929		
Child's sex	,				, ,	
Male	REF					
Female	1.111	(0.564-	0.761			
	2.187)					
Child's age	0.855	(0.738-	0.039	0.895	(0.764-	0.17
	0.992)			1.049)		
Only child						
Yes	0.552	(0.286-	0.076			
	1.065)					
No	REF					
Child's Diagnosed Conditions:						
Rhinitis	0.432	(0.222-	0.013	0.352	(0.17-	0.005
	0.841)			0.727)		
Bronchial Asthma	0.87	(0.428-	0.699	,		
	1.767)					
Cough-Variant Asthma	0.833	(0.362-	0.669			
	1.921)					
Allergic Cough	1.01	(0.521-	0.977			
	1.957)					

# **4 DISCUSSION**

This study investigated parents' KAP regarding the prevention and treatment of dust mite allergy and examined the differences between the parents of children treated with desensitization and those of children who were not. The results showed that the parents of children with dust mite allergy had relatively good KAP regarding dust mites. The parents of children who did not undergo desensitization therapy had poor knowledge, favorable attitudes, and poor practice regarding dust mites, while the parents of children who underwent desensitization therapy had good knowledge, favorable attitudes, and poor practice.

Although dust mite allergy is bothersome for the patients and can evolve into allergic rhinitis and asthma, the condition is not as dangerous as food allergies, probably explaining why the KAP toward food allergies is very high in parents of food-allergic children [17-19] but lower in parents of children with dust mite allergy, as observed in the present study. Indeed, the relatively low KAP observed here is supported by previous studies on allergic rhinitis [20, 21] and allergies in general [22]. Even parents of children with chronic asthma (in whom allergens

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can be triggers for asthma attacks) have a poor KAP toward allergies [23]. A study covering 29 Chinese cities showed that the KAP of parents toward allergic rhinitis was low [26]. In the present study, the total KAP scores and knowledge scores were higher in the desensitization group than in the non-desensitization group, as supported by Callahan et al. [16], who reported higher KAP in the parents who met an allergist compared with those who did not (to receive desensitization treatment, all patients must consult an allergist in China). Still, in the present study, the non-desensitization group included parents of children newly diagnosed with dust mite allergy and parents of children with known dust mite allergy who did not receive or did not yet receive desensitization treatment. The attitude scores were relatively high in both groups, but the practice scores were low. These results indicate that although the willingness to take measures against house dust mites to improve their child's health was high, the actual application of these measures was low. Indeed, for example, vacuuming each day is time-consuming, boring, and bothersome. The same goes for changing and laundering sheets more often. Since house dust mite allergy is not a serious condition, many parents do not feel the need to perform all those tasks.

This study showed significantly better scores for several knowledge areas, such as the dust mite species causing allergies, the diseases that can be due to dust mite allergies, the objects in which dust mites are more likely to thrive, methods to eliminate dust mites, and whether cleaning can completely eliminate dust mites. The parents who opted for desensitization therapy in their children probably obtained more information from the physicians or other sources when discussing the treatment options or by themselves to understand better what they were getting into. Indeed, a study showed that the parents of children with life-threatening illnesses actively sought information about the illness [27]; although dust mite allergy is far from life-threatening, a similar protective behavior could be involved. Furthermore, parents of children with allergies actively seek information from different sources [28]. Desensitization therapy is relatively

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expensive, and parents might fear some adverse effects on their children, encouraging them to take more information. Compared with the non-desensitization group, the parents in the desensitization group also reported a more worried attitude toward the possible health risks related to dust mites in their children and more worries toward dust mites despite active measures taken to decrease them. These worries could come from a better knowledge of the diseases and complications related to dust mite allergies. Regarding the practice items, compared with the non-sensitization group, the parents in the desensitization group declared more efforts being taken to gain knowledge about dust mites (which could relate to the knowledge scores), as previously suggested [28] and reported a higher use of mite-proof bedding and pillowcase and a lower use of dust mites. Still, both groups reported poor practice regarding washing bedding weekly and vacuuming daily. In the desensitization group and higher education, suspected dust mite allergy based on symptoms (suggesting a higher knowledge of dust allergy) were independently and positively associated with the practice.

The pathway analysis showed different patterns of association among the KAP dimensions between the non-desensitization and desensitization groups. Indeed, in the non-desensitization group, knowledge affected attitude, which in turn affected practice, while in the desensitization group, only knowledge affected attitude. It may be because the parents in the desensitization group had already taken action to address their children's condition. Still, these differences should be investigated more in-depth to tailor future interventions to the specific target populations. In addition, pathway analyses are only statistical surrogates for causality [29, 30], and the results should be confirmed.

In the present study, it was hypothesized that differences in KAP could explain, at least in part, the parents' decision for desensitization therapy for children with dust mite allergy. The results

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support the hypothesis and may provide ideas and directions to guide and educate the parents in the clinic. Nevertheless, although the parents of children receiving desensitization treatment had a higher KAP, there were still many gaps in knowledge, suggesting that we should strengthen the education and management of these patients in addition to drug desensitization treatment. The present study provides insights for designing teaching brochures, videos, podcasts, or activities to increase the KAP of parents toward dust mites. In particular, the knowledge about the dust mites themselves and the methods to kill them was poor. The practice of minimizing the living habitats of dust mites and using actual means to get rid of them should be emphasized. An intervention based on the results of the present study is being developed and will be investigated in a future study.

This study had limitations. It was performed at a single center, and the sample size is relatively small. In addition, because the two subpopulations of participants (i.e., with children with or without desensitization treatments) had two different KAP questionnaires, a direct comparison of the KAP scores was impossible between the two groups. Furthermore, as for all KAP surveys, the data represent the situation of a specific population at a specific point in time [14, 15]. In addition, KAP surveys are subject to a social acceptability bias, i.e., the participants can be tempted to answer what they should do instead of what they really do [14, 15]. Nevertheless, the present study might provide a comparator point to evaluate the KAP in a similar population after an intervention to increase health literacy on house dust mites.

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# **5 CONCLUSIONS**

In conclusion, the parents who did not decide on desensitization therapy for their children had poor knowledge, favorable attitudes, and poor practices regarding dust mites. On the other hand, the parents of children who underwent desensitization therapy had good knowledge, favorable attitudes, and poor practices. The poor practice scores highlight the need to emphasize the

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importance of dust mite control for the children's health. There is a need to educate the general population about the importance of controlling house dust mites.

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# List of abbreviations

KAP: knowledge, attitudes, and practices

SD: standard deviations

#### Declarations

#### Ethics approval and consent to participate

The research was carried out in accordance with the Declaration of Helsinki. The study was approved by the Medical Ethics Committee of Shengjing Hospital, Affiliated with China Medical University (approval #2022PS935K). Informed consent by electronic questionnaire was obtained from the participants before completing the survey.

# **Consent for publication**

Not applicable.

# **Data Availability Statement**

All data generated or analyzed during this study are included in this published article [and its supplementary information files].

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#### **Conflict of Interest**

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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# Authors' contributions

Conceptualization, Si Liu and Qianlan Zhou; Methodology, Bing Dai; Software, Li Chen; Validation, Qinzhen Zhang; Formal Analysis, Lina Han; Investigation, Xiaowen Li; Resources,

> Wenxin Shen; Data Curation, Si Liu; Writing – Original Draft Preparation, Si Liu; Writing – Review & Editing, Qianlan Zhou; Visualization, Qianlan Zhou; Supervision, Lishen Shan; Project Administration, Lishen Shan; Funding Acquisition, Lishen Shan. The guarantor is Lishen Shan.

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Not applicable.

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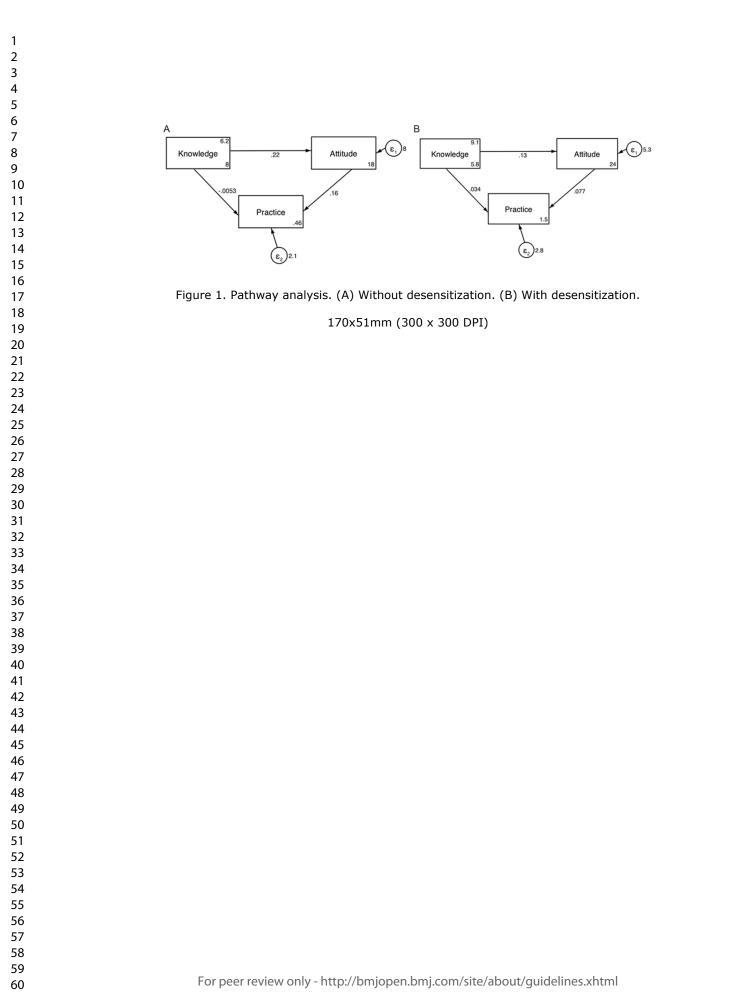
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# **Figure Legends**

Figure 1. Pathway analysis. (A) Without desensitization. (B) With desensitization.

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	Without	Desensitization	Р
	desensitization	(n=253)	
	(n=250)		
Gender			0.304
Male	153 (61.20)	166 (65.61)	
Female	97 (38.80)	87 (34.39)	
Age, mean±SD	6.37±3.13	8.80±2.36	-
Ethnicity			0.934
the Han nationality	180 (72.00)	183 (72.33)	
Minorities	70 (28.00)	70 (27.67)	
Yes	147 (58.80)	-	
No	103 (41.20)	-	
Knowing your child's dust mite allergy			0.009
before going to the doctor			
Know	58 (23.20)	79 (31.23)	
Don't know	150 (60.00)	152 (60.08)	
Suspected dust mite allergy in the child	42 (16.80)	22 (8.70)	
based on him/her symptoms			
Season when rhinitis is more likely to			0.004
occur			
Without rhinitis	68 (27.20)	33 (13.04)	
Spring	27 (10.80)	41 (16.21)	
Summer	10 (4.00)	12 (4.74)	
Autumn	66 (26.40)	72 (28.46)	

Supplementary Table S1. Medical characteristics of the children, n (%)

Winter	24 (9.60)	26 (10.28)	
All year round	55 (22.00)	69 (27.27)	
Duration of rhinitis attack			< 0.001
Without rhinitis	77 (30.80)	40 (15.81)	
The duration of symptoms <4 days/week, or	89 (35.60)	121 (47.83)	
<4 consecutive weeks			
The duration of symptoms $\geq$ 4 days/week, or	84 (33.60)	92 (36.36)	
≥4 consecutive weeks			
Frequency of desensitization treatments			-
First medication	-	16 (6.32)	
Within 3 months	-	49 (19.37)	
3 months to 6 months	-	22 (8.70)	
6 months to 1 year	9	38 (15.02)	
More than 1 year	<u>.</u>	128 (50.59)	
Outcome of desensitization treatment			-
First medication	- 2	27 (10.67)	
Significant improvement (no symptoms or	- 0	61 (24.11)	
close to normal)			
Improvement (few or occasional mild	-	70 (27.67)	
symptoms)			
Remission (fewer symptoms and less	-	55 (21.74)	
frequent recurrences)			
Effective (all symptoms still present but	-	34 (13.44)	
less frequent recurrences)			
Ineffective (hardly any improvement and	-	6 (2.37)	

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worse symptoms)		
Time for desensitization to complete		
initial treatment		
Initial treatment has not been completed	-	71 (28.06)
14 weeks	-	95 (37.55)
15-20 weeks	-	45 (17.79)
21-28 weeks	-	10 (3.95)
More than 28 weeks	-	32 (12.65)
Adverse reactions during desensitization		
treatment		
No	-	98 (38.74)
Only redness and swelling at the injection	-	146 (57.71)
site		
Large area urticaria throughout the body	4.	6 (2.37)
Severe allergic reaction (difficulty	- 0	3 (1.19)
breathing, shock, etc.)		
Frequency of adverse reactions during		
desensitization		
None	-	105 (41.50)
1 - 2 times	-	64 (25.30)
3 - 5 times	-	34 (13.44)
Often	-	35 (13.83)
Every time	-	15 (5.93)

3		3MJ Open	jopen-2024-085905 1 by copyright, incl		
Suppleme	ntary Table S2. The distribution of the remaining problem	ns in the knowledge dime	nsion, n (%) fo		
Question	naire A Without desensitization treatment	Correct	Wrong ng n	Don't know	
Q10. The	re is no cure for a child with dust mite allergy, but keep	43 (17.20)		68 (27.20)	
the house	as hygienic as possible to avoid dust mites		24. Dov ad to te		
Q11. Dus	t mite allergy will heal itself as the child grows up	39 (15.60)	<u>× ت کیم</u> 119 (42/1000) م د ان م	92 (36.80)	
	PR	Haven't heard of it	Have angeard of it but	Understand	th
			don't another the details	process	an
			://bmjo Al trai	procedure of it	
Q12. Hav	e you heard of or know about desensitization treatment for	91 (36.40)	126 ( <b>a</b> ).49)	33 (13.20)	
dust mite	s?		and simil		
Question	naire B Desensitization treatment		on Jur		
Q10. The	e desensitization treatment for dust mite allergy usually	231 (91.30)	4 (1.50 gies.	18 (7.11)	
takes 3-5	years		•		
Q11. The	medications of nasal spray hormone therapy for rhinitis	78 (30.83)	116 (45.8g)	59 (23.32)	
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		includ	5905 o			
or nebulized hormone therapy for asthma can be stopped during		ing fo	n 20 C			
desensitization treatment			Decemb			
Q12. There is no need to pay attention to removing and avoiding	9 (3.56)		30) 2		13 (5.14)	_
dust mites during desensitization treatment		231 (Area to tex	<			
Q13. The desensitization of dust mites can treat rhinitis caused by	65 (25.69)		nto load		84 (33.20)	_
dust mite allergy, but it can't prevent rhinitis from developing into		ur (Ab data r	led fro			
asthma		aES) . nining, /	http:/			
•	Itching of the palms of the	Imme		shock	Difficulty breathing.	,-
	hands and feet. Itchy scalp.	alter ها م	mental	state.	Rapid breathing.	, <b>-</b>
	Flushed skin all over the	Cold and	ع. الإي المسلح	/ skin.	Hoarseness and	ł
	body. The appearance of	Decrease	on in	blood	other symptoms	
	urticaria	pressure)	ine 13, :			
Q14. Those adverse reactions in desensitization treatment that	212 (83.79)	146 (\$7.7	2022) 7253		195 (77.08)	
require attention are (Multiple choice)			at Agence			
			e Biblic			
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33	BMJ Open		ijopen-20 1 by cop		
S	unnlamentary Table S2. The distribution of the remaining questions in the	attituda dimangian	open-2024-085905 on 20 by copyright, including n (%)		
_	Supplementary Table S3. The distribution of the remaining questions in the           Questionnaire A Without desensitization treatment	Very necessary	Possibly me		Unnecessary
			nber 203 necessate		
	Q14.2. If there have a therapy to make your child non-allergic to dust mites, do you think it is necessary to undergo it	159 (63.60)	71 (28.55 Superior 71 (28.55 Superior 71 (28.55 Superior 10.55 Sup	19 (7.60)	1 (0.40)
		More than 1000	500-100 GAT	100-500	Less than 10
		CNY/month	CNY/neon	i CNY/month	CNY/month
(	Q14.3. How much do you think is acceptable to spend for your child on the	47 (18.80)	81 (32.40)	82 (32.80)	40 (16.00)
]	prevention and treatment of dust mite allergy (RMB)	101	ining, and		
			and simil		
	Questionnaire B Desensitization treatment	Yes	Probability Probability Probability Probability	Don't	No
			Probable Pro	know/Unsure	
(	Q16.2. Do you think that desensitization treatment is an effective option for	211 (83.40)	31 (12.25)	10 (3.95)	1 (0.40)
	your child's rhinitis/asthma		ıt Agenc		
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	Very needed	Needer	Don't know	Don't need	
Q16.3. Do you think desensitization treatment needs to be carried out strictly	217 (85.77)	36 (14.53) c	0	0	
according to medical advice (e.g., Follow up consultation on time)		iber 2024 seignem s related			
	Persist	May per sist	May give up	Definitely give	
		dependering of		up	
		on data			
		situation			
Q16.4. If your child has a relatively obvious reaction to the treatment, such	108 (2.69)	123 (8.42) inin	18 (7.11)	4 (1.58)	
as severe redness at the injection site or a rash around the body, or even		Ģ, <mark>P</mark>			
anaphylaxis, will you continue with the Desensitization treatment		mj.com/ on June 13, 2025 and similar technologies.			
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Page 33 of 83		BMJ Open	ijopen-202		
1 2 3 4 5 6	Supplementary Table S4. Material of the bedding items, n (%)	BMJ Open	ijopen-2024-085905 on 20 D		
7 8 9 10			Enseignem	Desensitization	Р
11 12	Your child is currently using a pillow with the content material of	<u>ت</u> 5	.0.		0.700
13 14 15	Latex	123 (49.20)	Downloaded from http://bmjopen.bmj.com/ on June 13, 2029 nt Superieur (ABES) . A taxt and data mining Al training and similar tochoologies	122 (48.22)	
15 16 17	Down Artificial fiber Buckwheat hulls Cotton	1 (0.40)	ded fro eur (AE	1 (0.40)	
18 19	Artificial fiber	24 (9.60)	BES) .	30 (11.86)	
20 21 22	Buckwheat hulls	75 (30.00)	://bmjc	82 (32.41)	
22 23 24	Cotton	17 (6.80)	open.b	10 (3.95)	
25 26	Other	10 (4.00)	mj.com	8 (3.16)	
27 28 29	Your child is currently using bedding with the content material of		v on Ju		0.830
30 31	Latex	5 (2.00)	une 13,	5 (1.98)	
32 33	Down	9 (3.60)			
34 35	Artificial fiber	39 (15.60)	at Age	38 (15.02)	
36 37 38	Silk	138 (55.20)	<u></u>	150 (05.50)	
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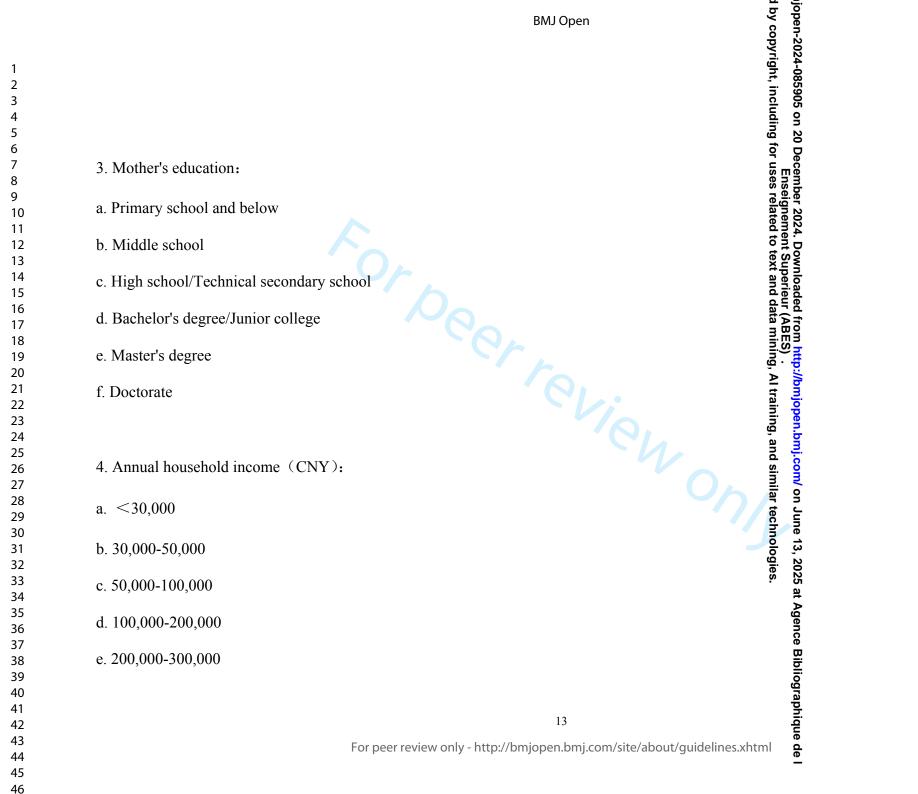
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1 2 3 4 5 6 7 8	Cotton Other	50 (20.00) 9 (3.60) 50 (20.00) 50 (20.00) 50 (23.72) 5 (1.98)	
9 10 11 12 13 14 15 16 17		BMU Open 50 (20.00) 50 (23.72) 9 (3.60) 5 (1.98) 50 (20.01) 10 Une 13, 2025 5 (1.98)	
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26 27 28 29 30 31 32 33		d similar technologies.	
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Page 35 of 83	BMJ Open Spen -2
1 2	024-0859 yright, i
3 4 5	BMJ Open by copyright, including for 20 b Questionnaire A
6 7	
8 9 10	Dear Parents: Hello!
11 12	لاقع کے We are researchers at Shengjing Hospital of China Medical University and we thank you for participating ibour research! This study is
13 14 15	conducted to collect information to understand the knowledge, attitudes and practice of parents toward the prevention and treatment of dust
16 17	mite allergy, and aims to provide a basis for the development of scientific intervention strategies for the $\frac{5}{3}$ be $\frac{5}{2}$ , which may help more people
18 19 20	in the future and improve their condition. Your participation in this study is voluntary and this study has approved by the Ethics
20 21 22	Approval Committee. If you agree to participate in this study, please refer to the following instructions and complete the questionnaire
23 24	patiently by circling the corresponding symbol.
25 26	1. There are no certain correct or wrong answers, you just need to fill in the questionnaire according to your interval situation, any questions
27 28 29	during the answering process can be asked to us, after finishing, please submit it in time.
30 31	2. This study is only a simple questionnaire and will not harm your physical or psychological condition, and will not harm your physical or psychological condition, and will not harm your physical or psychological condition, and will not harm your physical or psychological condition, and will not harm your physical or psychological condition, and will not harm your physical or psychological condition, and will not harm your physical or psychological condition, and will not harm your physical or psychological condition, and will not harm your physical or psychological condition, and will not harm your physical or psychological condition, and will not harm your physical or psychological condition, and the psychological condition of the
32 33	questions, such as your gender, age, etc. We will keep your information strictly confidential and will no give your information, the results
34 35 36	will be derived from the overall statistical analysis of the data and will not involve any personal privacy, plass feel free to fill in.
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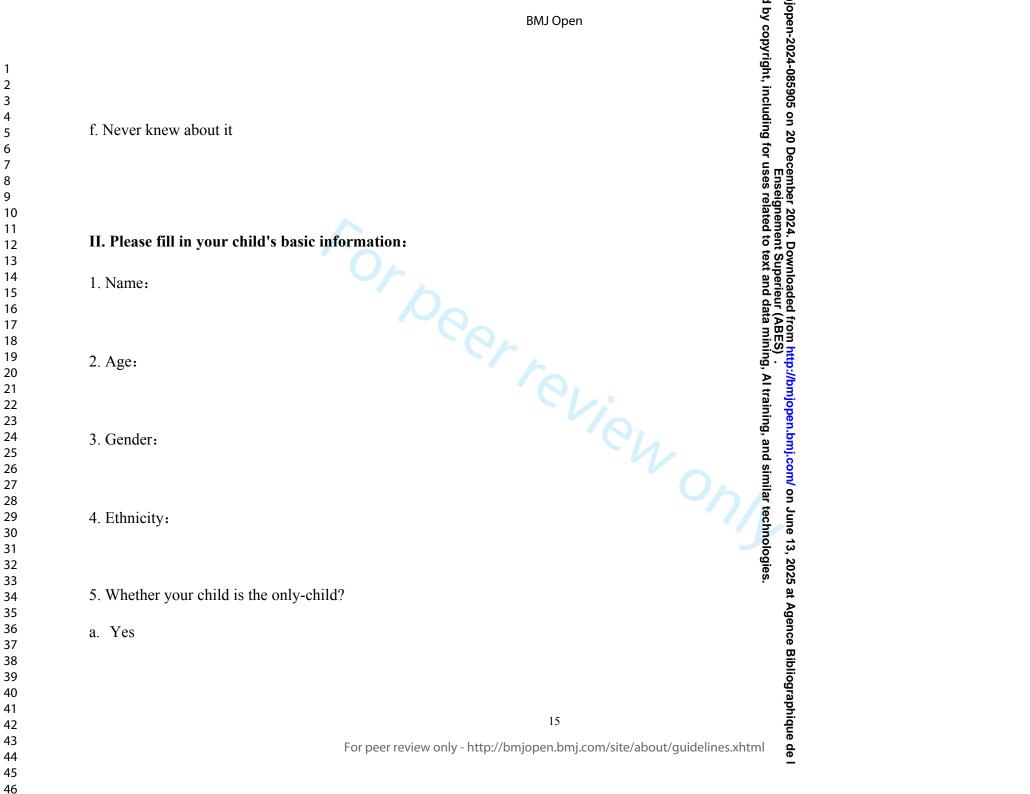
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BMJ Open 3. As a participant, you can be kept informed of information and research progress related to this study. If you	2024-0
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3. As a participant, you can be kept informed of information and research progress related to this study.	we decide to withdraw from the
study, please let us know and your data will not be included in the results of this study.	ecemt
Finally, we sincerely thank you for taking time out of your busy schedule to support our scientific researed	December 2024
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1 2 3	BMJ Open BMJ Open Questionnaire A on the prevention and treatment of dust mite allergy (for patients without desensitizzation treatment)
4 5 6 7 8	
9 10 11	I. Please fill in your basic information:
11 12 13	1. Your relationship with your child is?
14 15 16	a. Father
17 18	b. Mother
19 20 21 22	I. Please fill in your basic information:     Image: State of the stat
23 24 25	2. Father's education:
26 27	a. Primary school and below
28 29 30	b. Middle school
31 32	c. High school/Technical secondary school
33 34	d Bachelor's degree/Junior college
35 36	e. Master's degree ge
37 38 39 40	f. Doctorate Bijographique 12 For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml
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9 10	5. Are the parents allergic to dust mites?	nber 20 ıseigne ıs relate
11 12 13	a. None	24. Dov ment S ad to te:
14 15	b. Father only	vnloade uperieu xt and (
16 17 18	c. Mother only	ed from ur (ABE data mi
19	d. Both allergic to dust mites	ining,
20 21 22 23 24	<ul> <li>5. Are the parents allergic to dust mites?</li> <li>a. None</li> <li>b. Father only</li> <li>c. Mother only</li> <li>d. Both allergic to dust mites</li> <li>e. Haven't followed it, don't know yet</li> <li>6. You learn about allergies through:</li> <li>a. Newspaper &amp; Books</li> <li>b. Radio &amp; TV</li> </ul>	.//bmjopen.br Al training, a
25 26 27	6. You learn about allergies through:	nj.com/ nd simil
28 29	a. Newspaper & Books	on Jun lar tech
30 31 32	b. Radio & TV	nologi
33 34	c. Web Search	
35 36	d. Short videos (Tiktok)	Agenc
37 38 39	e. Doctor's guidance during consultation	at Agence Bibliographique de l
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**BMJ** Open b. No , vultiple choice): ...utg 6. The exercises your children usually enjoy to do (Multiple choice): a. Outdoor running and walking b. Playing basketball c. Swimming d. Taekwondo e. Indoor dancing f. Cycling g. Other 7. The floor your child live on: a. Single-storey house b. First floor c. Floor 2-10 For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

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- e. Floor 21 and above
- f. Top Floor
- 8. Your child's residence is:
- a. Within Shenyang City
- b. Rural areas of Shenyang
- c. Towns of Shenyang
- d. City of Liaoning Province (except Shenyang)
- tronut T e. Rural areas within Liaoning Province (except Shenyang)
- f. Towns within Liaoning Province (except Shenyang)
- g. Outside Liaoning Province
- 9. The transportation to visit a doctor:
- a. On foot

**BMJ** Open

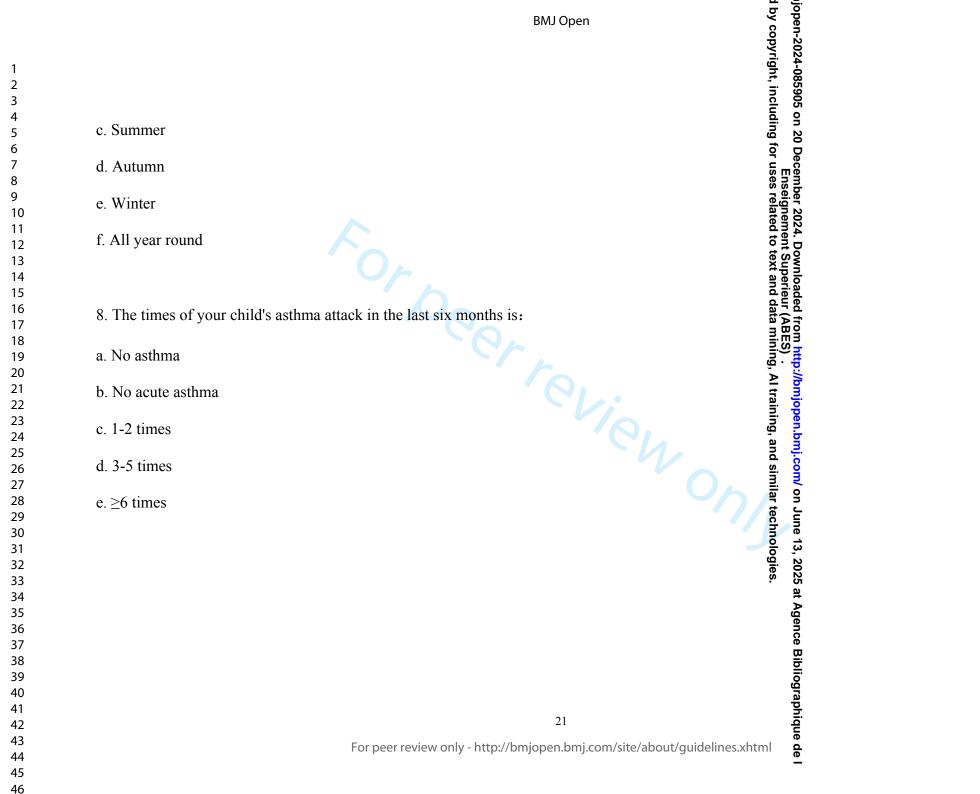
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b. Bus c. Metro d. High-speed Rail		open-2024-085905 on 20 December 2024. Downloaded from http://bmjopen.bmj.com/ on June 13, 2025 at Enseignement Superieur (ABES) . by copyright, including for uses related to text and data mining, Al training, and similar technologies.
e. Long distance bus		24. Dow nent Su d to tex
f. Private Car		nloade uperieu t and c
<ul><li>III. Please fill in your child's medical information:</li><li>1. The doctor has diagnosed your child with (multiple choice):</li></ul>		ttp://bmjopen.bmj.cc ng, Al training, and s
a. Rhinitis		m/ on , imilar t
b. Bronchial asthma		June 13 technolo
c. Cough variant asthma		, 2025 <i>a</i> ogies.
d. Allergic cough		ıt Agence
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2. Has your child visits to a paediatric a. Yes o. No	BMJ Open
3. Were you aware of your child's dus a. Know	t mite allergy before you brought him/her to the paediatric allergy u
o. Don't know	eer to
<ul> <li>c. Suspected dust mite allergy in child</li> <li>4. Which season your child's rhinitis i</li> </ul>	en
a. No rhinitis 5. Spring	
c. Summer	
d. Autumn	
e. Winter	
	19
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## **BMJ** Open f. All year round 5. What is the duration of your child's rhinitis attack? a. No rhinitis b. The duration of symptoms <4 days/week, or <4 consecutive weeks c. The duration of symptoms $\geq$ 4 days/week, or $\geq$ 4 consecutive weeks 6. Does your child's rhinitis affect his/her study, cultural & sports activities, and sleep? ien o a. Without rhinitis b. Without significant effect c. Have significant or severe effects 7. Which season your child's asthma is more likely to occur? a. No asthma b. Spring

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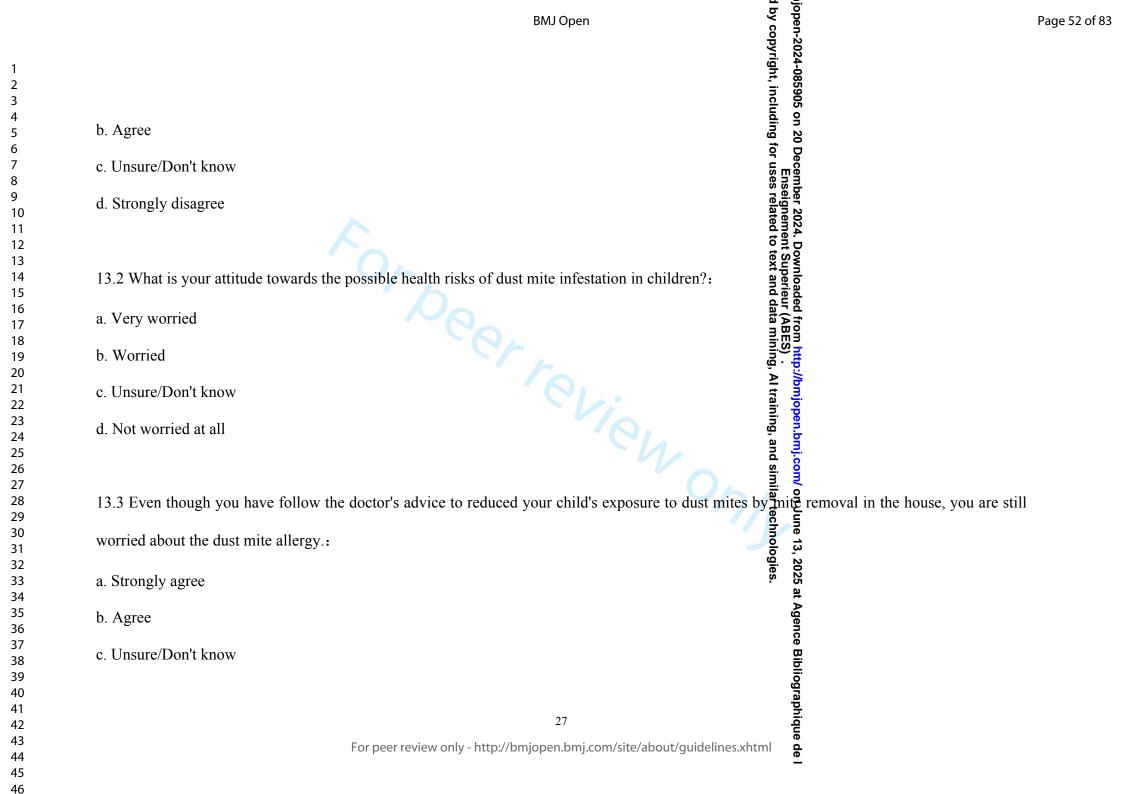
Page 47 of 83	BMJ Open	jopen
1 2 3 4 5 6 7 8	BMJ Open <b>IV. Please choose the appropriate options for the following questions (the following are the knowledge)</b> 1. Which of the following species of dust mite can cause an allergic reaction: (assign 0 points for ab, 1 points) a. House dust mite only b. Dermatophagoides farinae only	.024-085905 on 20 Decemt
9 10	IV. Please choose the appropriate options for the following questions (the following are the knowled	<b>G</b> dimension)
11 12	1. Which of the following species of dust mite can cause an allergic reaction: (assign 0 points for ab, 1 po	$\mathbf{L} \in \mathbf{N}$ the for c, 0 points for d):
13 14 15	a. House dust mite only	Superio
16 17	b. Dermatophagoides farinae only	and fro
10		
20 21 22 23 24	<ul> <li>c. Both house dust mite and dermatophagoides farinae</li> <li>d. Don't know</li> <li>2. Only live dust mites can act as allergens to causing allergic reactions: (assign 0 points for a, 1 point for a)</li> </ul>	://bmjopen.bn
25 26 27	2. Only live dust mites can act as allergens to causing allergic reactions: (assign 0 points for a, 1 point for	$r b_{0}^{2}$ points for c)
28 29	a. Correct b. Wrong c. Don't know	m/ on June 13, 2025
30 31	b. Wrong	ne 13, 2
32 33 34 35 36	<ul> <li>c. Don't know</li> <li>3. Which of the following diseases can be caused by dust mite allergy: (assign 0.5 points for abcd, 1 points)</li> </ul>	a
37 38 39 40	3. Which of the following diseases can be caused by dust mite allergy: (assign 0.5 points for abcd, 1 points)	<u>D</u>
41 42	22	liographique de l
43 44 45	For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml	e d e

	BMJ Open BMJ Open 2024-085905 on 20 December a. Eczema b. Allergic conjunctivitis	Page 48 of 83
1	yright	
2 3	;; 85905 incl 905	
4 5 6	a. Eczema ding for a be	
7 8	b. Allergic conjunctivitis	
9 10	c. Rhinitis d. Asthma	
11 12	d. All of them	
13 14 15 16	e. Don't know	
17 18 19 20	4. Dust mites in the house mainly breed in bed sheets and bedding, carpets and curtains are not prone to be dust mites: (assign 0 points for	
21 22	a, 1 point for b, 0 points for c)	
23 24 25	a. Correct	
26 27	b. Wrong	
28 29 30 31	<ul> <li>a, 1 point for b, 0 points for c)</li> <li>a. Correct</li> <li>b. Wrong</li> <li>c. Don't know</li> <li>5. Plush toys are prone to breeding dust mites: (assign 1 point for a, 0 points for b, 0 points for c)</li> </ul>	
32 33 34	5. I fush toys are profic to breeding dust fintes: Cassign 1 point for a, o points for b, o points for c 7	
35 36 37	a.Correct b.Wrong c.Don't know	
38 39 40	23 For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml	
41 42	23	
43 44 45	For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml	

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1 2 3 4 5 6	6. UV light can kill dust mites: (assign 0 points for a, 1 point for b, 0 points for c)	jopen-2024-085905 on 20 Decemt Ens
7 8	a. Correct	becemt Ens
9 10 11	b. Wrong	ber 202 related
11 12 13 14 15	c. Don't know	4. Downloade nent Superieu d to text and c
16 17 18	7. Freezing the plush toys or pillowcases in the refrigerator overnight can kill dust mites: (assign 1 poin	a f a b far a, 0 points for b, 0 points for c)
19 20	a. Correct	http://
21 22	b. Wrong	omjope I traini
23 24 25 26 27	b. Wrong c. Don't know	g, Al training, and similar technologies.
28 29 30	8. How many degrees hot water for washing bed sheets will be most effective in removing dust mites:	assign 0 points for abc, 1 point for d, 0
31 32	points for e)	ologies
33 34 35	a. 25°C	H H
36 37 38 39 40	b. 35°C	Agence Bibliographique de
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43 44 45 46	For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtm	

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7	d. 55°C		usé	cer	
8 9			š r	nbe	
9 10	e. Don't know		ela	эг 2	
11			ted em	024	
12			to to		
13			tex su	OW	
14	9. Indoor dust mites can be completely	y eliminated with a good job cleaning:	(assign 0 points for a. 1 pome	$\mathbf{\overline{b}}$ b. 0 points for c)	
15		gi ang	d c		
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17	a. Concer		a n BE		
18 19	h Wrong		inirS)		
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20	Devilt las eres		Alt		
22	c. Don't know			<u></u>	
23			nin	per	
24			, the second sec	b	
25			nd		
26	10. There is no cure for a child with d	ust mite allergy but to keep the house a	s hygienic as possible to aveid	gust mites: (assign 0 points for a, 1	
27	<ul> <li>9. Indoor dust mites can be completely</li> <li>a. Correct</li> <li>b. Wrong</li> <li>c. Don't know</li> <li>10. There is no cure for a child with depoint for b, 0 points for c)</li> <li>a. Correct</li> <li>b. Wrong</li> <li>c. Don't know</li> </ul>			0	
28 29	point for b, 0 points for c)		r te		
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1		•2024-
2		1t, inc
4 5 6	BMJ Open 11. Dust mite allergy will heal itself as the child grows up: (assign 0 points for a, 1 point for b, 0 points	5 on 20 I
7 8	a. Correct	) Decemt
9 10	b. Wrong	ber 202 reignen
11 12 13 14 15	c. Don't know	4. Download hent Superie to text and
16 17	12. Have you heard of or know about desensitization treatment for dust mites?: (assign 0 points for a, 0	a for b, 1 point for c)
18 19 20	a. Haven't heard of it	http://
21 22	b. Have heard of it but don't know the details	l trainii
23 24 25 26 27	<ul> <li>a. Haven't heard of it</li> <li>b. Have heard of it but don't know the details</li> <li>c. Understand the process and procedure of it</li> <li>V. Please choose the appropriate options for the following questions <ul> <li>(the following are the attitude dimension, assign 4 points for a, 3 points for b, 2 points for c, 1 points.</li> </ul> </li> <li>13. Your concerns about dust mite infestation and dust mite allergy <ul> <li>13.1 You can't stand dust mites infesting your home:</li> <li>a. Strongly agree</li> </ul> </li> </ul>	m http://bmjopen.bmj.com/ on June ES) . nining, Al training, and similar techr
28 29	V. Please choose the appropriate options for the following questions	on June
30 31 32	(the following are the attitude dimension, assign 4 points for a, 3 points for b, 2 points for c, 1 po	antförd) ≝
32 33 34	13. Your concerns about dust mite infestation and dust mite allergy	ies.
35 36 37	13.1 You can't stand dust mites infesting your home:	lgence
38 39 40	a. Strongly agree	Agence Bibliographique de
41 42	26	aphiqu
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1 2 3 4		by copyright, including for uses rel	2024-085905 0	
5 6 7 8	d. Strongly disagree	Ens ling for uses	n 20 Decemb	
9 10 11	14. Your attitude to mite removal and desensitization treatment	eignem relatec	er 2024.	
12 13	14.1 Do you think it is necessary to regularly remove mites from your home:	ient Su I to tex		
14 15 16 17 18	a.Very necessary b.Possibly necessary c.Unsure d.Unnecessary	perieur (ABE t and data mi	nloaded from	
10	14.2 If there have a therapy to make your child non-allergic to dust mites, do you think it is necessary to	o pinde A	go it:	
21 22 23	a. Very necessary	l traini	hmiope	
23 24 25	b. Possibly necessary	ng, and	n hmi.	
26 27	c. Unsure/Don't know	l simila		
28 29 30 31 32	<ul> <li>a. Very necessary</li> <li>b. Possibly necessary</li> <li>c. Unsure/Don't know</li> <li>d. Unnecessary</li> <li>14.3 How much do you think is acceptable to spend for your child on prevention and treatment of dust</li> </ul>	ır technologi	n June 13. 2(	
33 34	14.3 How much do you think is acceptable to spend for your child on prevention and treatment of dust	mite a	Hergy:	(CNY)
35 36 37 38 39 40	a. More than 1000 CNY/month;		Agence Bibliographique de	
41 42	28	1	nhiau	
43 44 45	For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xh	tml	o de l	

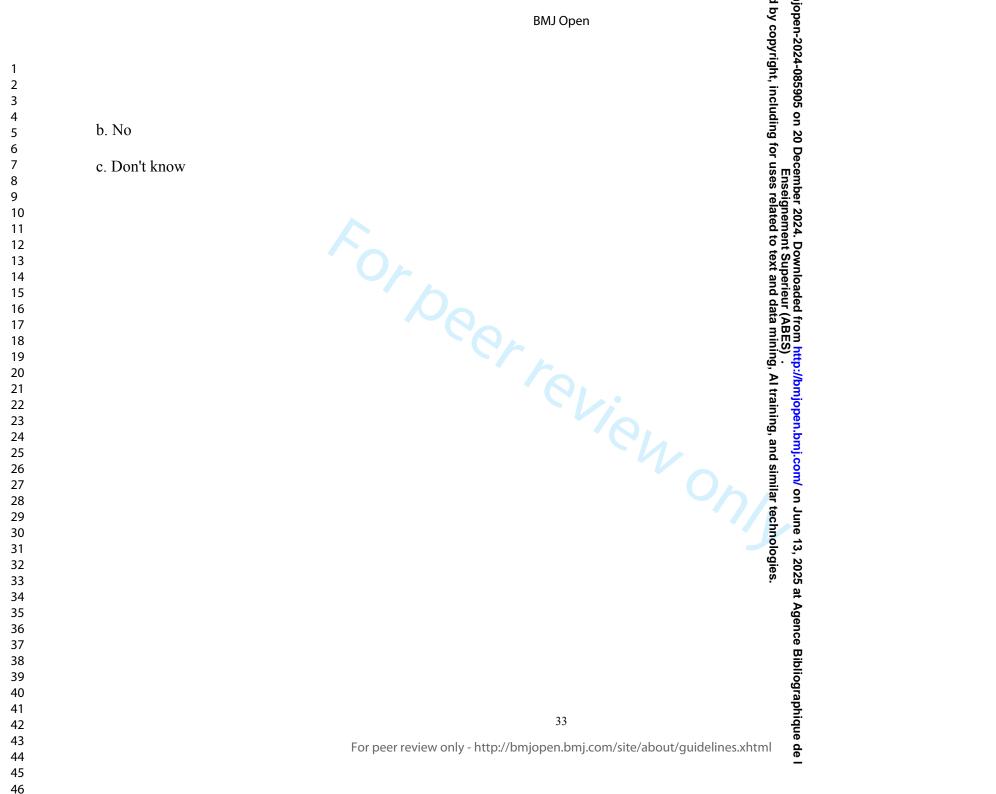
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b. 500-1000 CNY/month;		on 20 Dec uding for u	
c. 100-500 CNY/month;		or uses	
d. Less than 100 CNY/month;		ber 2024. I seignemer s related to	
		Downl o text a	
VI. Please choose the appropriate options for	the following questions (the follo	wing are the practice difference of the practice of the practi	
15. Targeted practice		ata mi	
15.1Due to your child's dust mite allergy, have y	ou and your family made a special	effort to learn about redevant knowle	edge (including dust mites.
dust mite allergy and desensitization treatment, e	etc.) (assign 1 point for Yes, 0 point	nts for No):	
a. Yes		ning, a	
b. No		nts for No) : bedclothes (assign of point for Ye	
15.2 Does your child use mite-proof bedding su	ch as mite proof pillowcases and	bedclothes (assign <b>g</b> point for Ye	es, 0.5 points for intend to
purchase, 0 points for a.not intend to purchase):			
a. Yes		Agence B	
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	29	aphiqu	
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	b. Previously test showed dust mite allergy but not used
	c. Recent test show dust mite allergy and intend to purchase
	d. Recent test show dust mite allergy but not intend to purchase
	15.3 Your child is currently using a pillow with a content material of (No points for this question):
	<ul> <li>a. Latex</li> <li>b. Down</li> <li>c. Artificial fibre</li> <li>d. Buckwheat hulls</li> <li>e. Cotton</li> </ul>
	b. Down
	c. Artificial fibre
	d. Buckwheat hulls
	e. Cotton
	5/
	15.4 Your child is currently using a bedding with a content material of (No points for this question):
	a. Latex
	b. Down
	c. Cotton
	20
	30 For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

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1	yrigt	
2	nt, in 59	
3 4		
5	d. Silk	
6 7	e. Artificial fibre	
8		
9 10	relation of the second s	
11	15.5 Do you use Dust Mite Controller to remove mites in your home (assign 1 point for Yes, 0.5 points to gut the descent of the purchase, 0 points for a not	
12 13	13.5 Do you use Dust whe Controller to remove lintes in your nome Cassign 1 point for 1 es, 0.5 points and the purchase, 0 points for a not	
14	intend to purchase):	
15 16	d day de	
17	a. Yes	
18 19	b. Previously test showed dust mite allergy but not used	
20		
21 22	c. Recent test show dust mite allergy and intend to purchase	
23 24	<ul> <li>d. Recent test show dust mite allergy but not intend to purchase</li> <li>15.6 Do you use instruments such as dehumidifier/air-conditioning, air cleaner, and etc. to remove mitestin une to purchase, 0 points for a.not intend to purchase):</li> <li>a.Yes</li> <li>b. Previously test showed dust mite allergy but not used</li> </ul>	
25	an a	
26 27	je inizial de la companya	
28	15.6 Do you use instruments such as dehumidifier/air-conditioning air cleaner and etc. to remove mitegein your home (assign 1 point for Yes)	
29 30		
31	0.5 points for intend to purchase, 0 points for a not intend to purchase):	
32 33	pies. 2025	
34	a.Yes	
35 36	b. Previously test showed dust mite allergy but not used	
37		
38 39	c. Recent test show dust mite allergy and intend to purchase	
40		
41 42	c. Recent test show dust mite allergy and intend to purchase 31 For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml	
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44 45		

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1 2 3 4 5 6 7 8	3 BMJ Open BMJ Open d. Recent test show dust mite allergy but not intend to purchase d. Recent test show dust mite allergy but not intend to purchase BMJ Open definition of the purchase base of the	
9 10	15.7 Do you use the decoration which prone to mites such as carpet in your home (assign 0 points for	No, 0 points for Don't
11 12 13	know):	
14 15	a.Yes	
16 17 18	b. No at a Been miles	
19 20 21 22	a.Yes b. No c. Don't know 15.8 Do you or your family weekly wash your pillowcases and bedclothes (assign 1 point for Yes, 0 points for No, 0 points	
23 24 25		s for Don't know):
23 26 27	a.Yes	
28 29 30	b. No	
30 31 32 33 34	a.Yes b. No c. Don't know	
35 36	15.9 Do you or your family use vacuum cleaner to clean your house every day (assign 1 point for Yes, 0 points for No, 0 point	its for Don't know):
37 38 39 40	a.Yes 32 For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml	
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43 44 45 46	For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml	

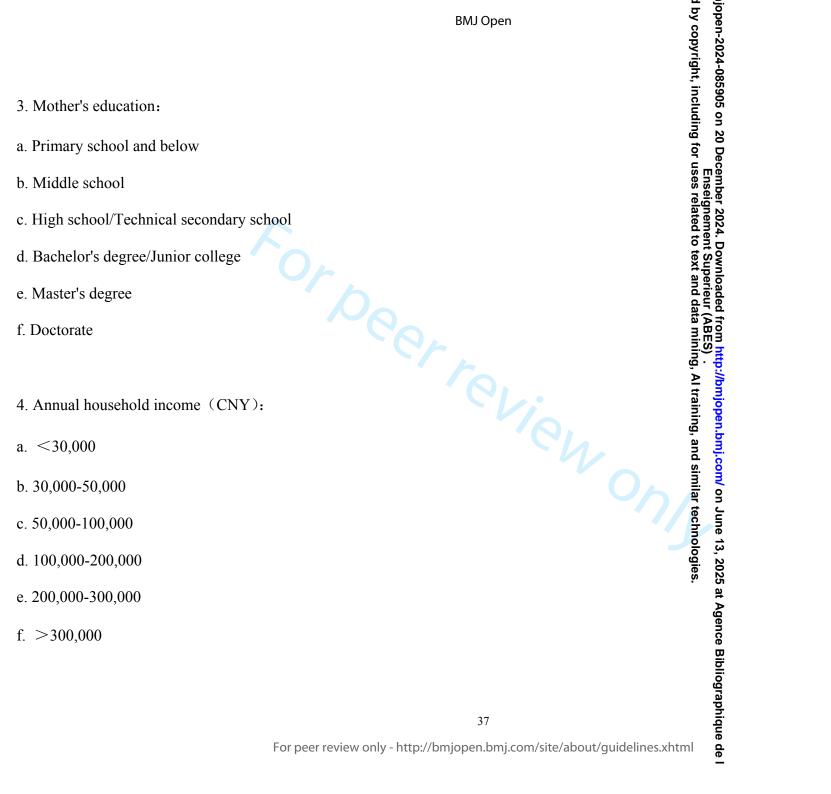


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3 4 5	BMJ Open BMJ
6 7	
8 9 10	Dear Parents: Hello!
11 12	We are researchers at Shengjing Hospital of China Medical University and we thank you for participating in our research! This study is
13 14 15	conducted to collect information to understand the knowledge, attitudes and practice of parents toward the prevention and treatment of dust
16 17	mite allergy, and aims to provide a basis for the development of scientific intervention strategies for the
18 19	in the future and improve their condition. Your participation in this study is voluntary and this study has approved by the Ethics
20 21 22	Approval Committee. If you agree to participate in this study, please refer to the following instructions and complete the questionnaire
23 24	patiently by circling the corresponding symbol.
25 26	1. There are no certain correct or wrong answers, you just need to fill in the questionnaire according to your actual situation, any questions
27 28 29	during the answering process can be asked to us, after finishing, please submit it in time.
30 31	2. This study is only a simple questionnaire and will not harm your physical or psychological condition, and will not harm your physical or psychological condition, and will not harm your physical or psychological condition, and will not harm your physical or psychological condition, and will not harm your physical or psychological condition, and will not harm your physical or psychological condition, and will not harm your physical or psychological condition, and will not harm your physical or psychological condition, and will not harm your physical or psychological condition, and will not harm your physical or psychological condition, and will not harm your physical or psychological condition, and a simple question of the psychological condition of the psychologi
32 33	questions, such as your gender, age, etc. We will keep your information strictly confidential and will no go by the results
34 35 36	will be derived from the overall statistical analysis of the data and will not involve any personal privacy, plass feel free to fill in.
37 38	Bi Bi
39 40 41	
41 42 43	34 For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml
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BMJ Open 3. As a participant, you can be kept informed of information and research progress related to this study. If y	
	u decide to withdraw from the
3. As a participant, you can be kept informed of information and research progress related to this study. If you can be kept informed of information and research progress related to this study.	u decide to withdraw from the
Finally, we sincerely thank you for taking time out of your busy schedule to support our scientific researed to the support out scientific researed to the support out scienti	
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5. Are the parents allergic to dust mites? a. None vet b. Father only c. Mother only d. Both allergic to dust mites e. Haven't followed it, don't know yet 6. You learn about allergies through: a. Newspaper & Books b. Radio & TV c. Web Search d. Short videos (Tiktok) e. Doctor's guidance during consultation f. Never knew about it

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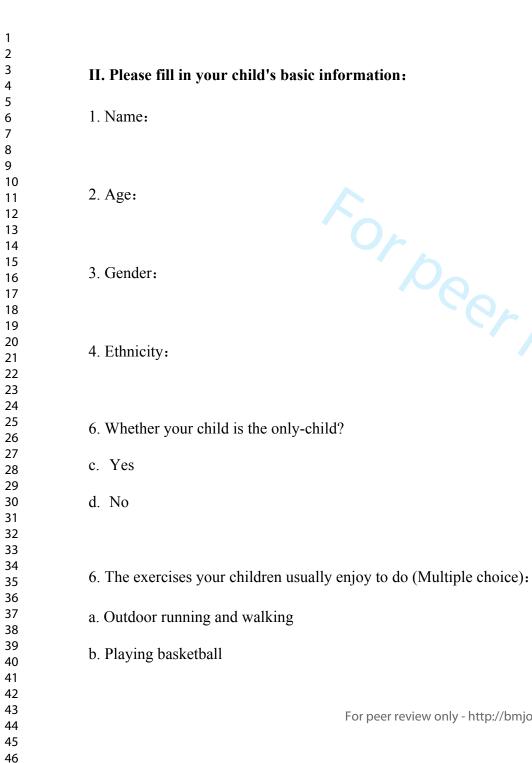
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1 2		BMJ Open	2027-0820
3 4	c. Swimming		22.2
5 6	d. Taekwondo	ng for the	י קריי
7 8	e. Indoor dancing		hund
9 10 11	f. Cycling	relatec	~r 202
12 13 14	g. Other	seignement Superieur (ABES) . s related to text and data mining, Al training, and similar technologies	1 Down
15 16		and da	haher
17 18	7. The floor your child live on:		from
19 20 21	a. Single-storey house	s) s) ng, Al	http://hr
22 23	b. First floor		Ninne
24 25	c. Floor 2-10	ig, and	5 5mi
26 27	d. Floor 10-20	l simili	~~m( r
28 29	e. Floor 21 and above	ar tech	ś
30 31	f. Top Floor	inolog	222
32 33 34			
35 36	8. Your child's residence is:	40 For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml	
37 38 39	a. Within Shenyang City		, הוייוי
39 40 41			מפזחי
41 42 43		40	
43 44 45		For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml	ע רע ר

- b. Rural areas of Shenyang
- c. Towns of Shenyang
- d. City of Liaoning Province (except Shenyang)
- , milar tech e. Rural areas within Liaoning Province (except Shenyang)
- f. Towns within Liaoning Province (except Shenyang)
- g. Outside Liaoning Province
- 10. The transportation to visit a doctor:
- h. On foot
- i. Bus
  - j. Metro
  - k. High-speed Rail
  - 1. Long distance bus
- m. Private Car
- n. Other

BMJ Open	hy popyri
BMJ Open <b>III. Please fill in your child's medical information:</b> 1. The diagnose of your child (multiple choice): a. Rhinitis	Ensei
1. The diagnose of your child (multiple choice):	₂ for =
a. Rhinitis	Enseic
b. Bronchial asthma	nemer
c. Cough variant asthma	nt Supe
d. Allergic cough	Prieur (.
99×	ABES)
2. Were you aware of your child's dust mite allergy before you brought him/her to the paediatric allergy u	3. pit'
a. Know	raining
b. Don't know	חמני חמני
<ul> <li>2. Were you aware of your child's dust mite allergy before you brought him/her to the paediatric allergy use.</li> <li>a. Know</li> <li>b. Don't know</li> <li>c. Suspected dust mite allergy in child based on him/her symptoms</li> <li>3. Which season your child's rhinitis is more likely to occur?</li> <li>a. No rhinitis</li> </ul>	the second secon
	.torhn
3. Which season your child's rhinitis is more likely to occur?	alania
a. No rhinitis	
b. Spring	
c. Summer	
42	
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4. What is the duration of your child's rhinitis attack?

a. No rhinitis

b. The duration of symptoms <4 days/week, or <4 consecutive weeks

c. The duration of symptoms  $\geq$ 4 days/week, or  $\geq$ 4 consecutive weeks

5. Does your child's rhinitis affect his/her study, cultural & sports activities, and sleep?

a. No rhinitis

b. No significant effect

c. Have significant or severe effects

6. Which season your child's asthma is more likely to occur?

a. No asthma

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$     \begin{array}{r}       1 \\       2 \\       3 \\       4 \\       5 \\       6 \\       7 \\       8 \\       9 \\       10 \\       11 \\       12 \\       13 \\       14 \\       15 \\       16 \\       17 \\       18 \\       19 \\       20 \\       21 \\       22 \\       23 \\       24 \\       25 \\       26 \\       27 \\       28 \\       29 \\       30 \\       31 \\       32 \\       33 \\       34 \\       35 \\       36 \\       37 \\       \end{array} $	<ul> <li>b. Spring</li> <li>c. Summer</li> <li>d. Autumn</li> <li>e. Winter</li> <li>f. All year round</li> <li>7. The times of your child's asthma attack in the last six months is:</li> <li>a. No asthma</li> <li>b. No acute asthma</li> <li>c. 1-2 times</li> <li>d. 3-5 times</li> <li>e. ≥6 times</li> <li>8. The time your child has been receiving desensitization treatment is:</li> <li>a. First medication</li> </ul>
38 39	b. Within 3 months
40 41 42	44
42 43	For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml
44 45	

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c. 3 months to 6 months

d. 6 months to 1 year

e. More than 1 year

9. Your current evaluation for the outcome of desensitization treatment on your child is:

a. First medication

b. Significant improvement (no symptoms or close to normal)

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 d. 6 months to 1 year

e. More than 1 year

11. How many weeks desensitization take your child to complete initial treatment?

a. Initial treatment has not been completed

b. 14 weeks

c. 15-20 weeks

d. 21-28 weeks

e. More than 28 weeks

12.Has your child had any adverse reactions during desensitization treatment?

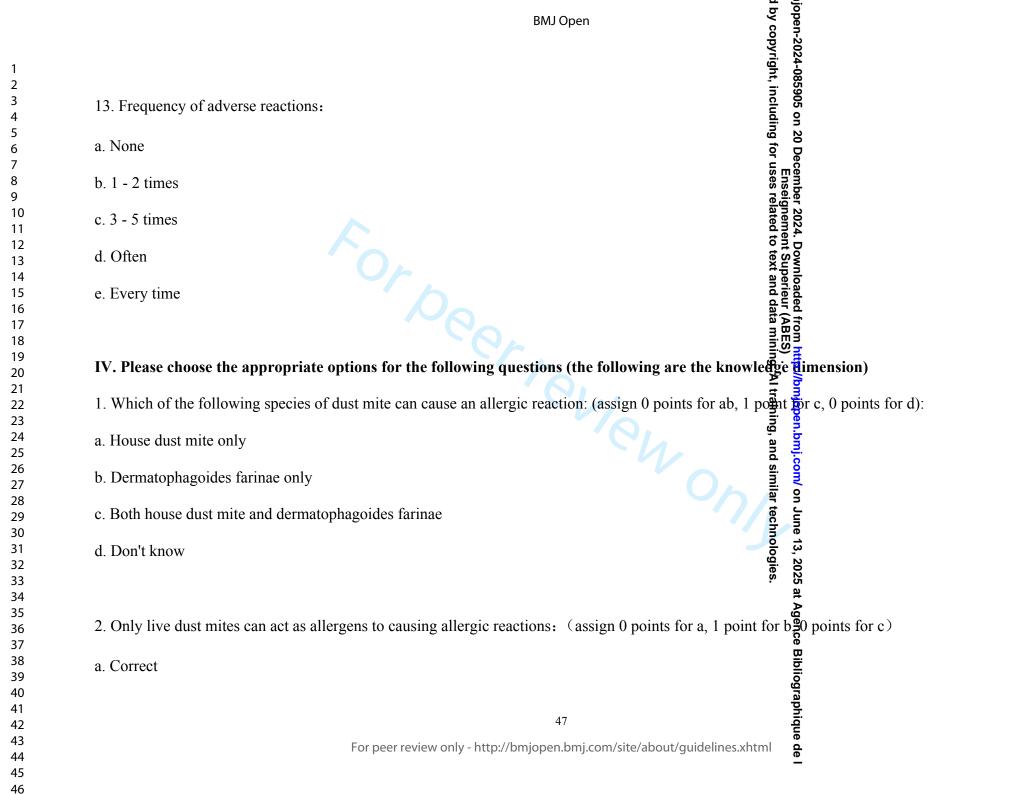
a. No

b. Yes, but not serious (only redness and swelling at injection site)

c. Experienced a large area urticaria throughout the body

d. Experienced a severe allergic reaction (Difficulty breathing, Shock, and etc.)

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4 5 6	c. Don't know		on 20 D Juling fo
7 8 9			ecembe Ensei
10 11 12	3. Which of the following diseases can be caused	d by dust mite allergy: (assign 0.5 points for abcd, 1	point for f)
13 14	a. Eczema		) text and
15 16 17	<ul><li>b. Allergic conjunctivitis</li><li>c. Rhinitis d. Asthma</li></ul>		aded fro ieur (AE
18 19 20	d. All of them		nining,
21 22 23 24	e. Don't know	heets and bedding, carpets and curtains are not prone	/bmjopen.bm Al training, ar
25 26 27 28	4. Dust mites in the house mainly breed in bed s	heets and bedding, carpets and curtains are not prone	to baseding dust mites: (assign 0 points for
29 30 31	a, 1 point for b, 0 points for c)		June 13 technol
32 33	a. Correct		, 2025 a ogies.
34 35 36	b. Wrong		at Ageno
37 38 39	C. Don't know		Agence Bibliographique de
40 41		48	ographic
42 43 44	For peer r	review only - http://bmjopen.bmj.com/site/about/guidelines.x	thtml de
45 46			

	BMJ Open	open-2 by cop	Page 74
5. Plush toys are prone to breeding dust mites: (a	assign 1 point for a 0 points for b 0 points f	jopen-2024-085905 on 20 Decembe Ensei by copyright, including for uses re	
a. Correct		on 20 D Iding fo	
b. Wrong		ecembo Ense r uses r	
c. Don't know		ar 2024. D ignement elated to	
( UN light our bill dust mites (assign 0 mints f	for 1 maint for h 0 maints for a)	oownload t Superic text anc	
6. UV light can kill dust mites: (assign 0 points f	for a, 1 point for b, 0 points for c)	ded frc eur (AE	
a. Correct		from http ABES) - ta mining	
b. Wrong		o://bmj	
<ul> <li>b. Wrong</li> <li>c. Don't know</li> <li>7. Freezing the plush toys or pillowcases in the ref</li> <li>a. Correct</li> </ul>		open.bmj. iining, and	
7. Freezing the plush toys or pillowcases in the ref	frigerator overnight can kill dust mites: (as	sign 1 points for b	, 0 points for c)
a. Correct		June	
b. Wrong		June 13, 2025 technologies.	
c. Don't know		at	
		lence E	
		Agence Bibliographique idelines.xhtml de	
	49	raphic	
	49	ž	

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1 2 3 4 5	8. How many degrees hot water for washing bed sheets will be most effective in removing dust mites:	assign 0 points for abc, 1 point for d, 0
6 7	points for e)	20 December 2
8 9 10	<u>-</u>	
11 12	b. 35°C	ement:
13 14 15	c. 45°C	Superio
16 17	d. 55°C	eur (AB
18 19 20 21	e. Don't know	ies) - http://bm
22 23 24	9. Indoor dust mites can be completely eliminated with a good job cleaning: (assign 0 points for a, 1 points	t for b, 0 points for c)
25 26	a. Correct	
27 28 29	b. Wrong	. Von Ju
30 31 32 33	<ul> <li>b. 35°C</li> <li>c. 45°C</li> <li>d. 55°C</li> <li>e. Don't know</li> <li>9. Indoor dust mites can be completely eliminated with a good job cleaning: (assign 0 points for a, 1 point a. Correct</li> <li>b. Wrong</li> <li>c. Don't know</li> <li>10. The desensitization treatment for dust mite allergy usually takes 3-5 years: (assign 1 point for a, 0 point fo</li></ul>	ne 13, 2025
34 35 36	10. The desensitization treatment for dust mite allergy usually takes 3-5 years: (assign 1 point for a, 0 point for a) (assign 1 point for a) (assign 1 point for a) (assign 1 point for a) (b) (b) (b) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c	ge
37 38	a. Correct	nce Bibl
39 40 41	b. Wrong	Bibliographique de
42 43 44 45 46	50 For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml	que de l

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c. Don't know	BMJ Open BMJ	
11. The medications of nasal	l spray hormone therapy for rhinitis or nebulised hormone therapy for asthness be stopped during desensitization	
treatment: (assign 0 points)	for a, 1 point for b, 0 points for c)	
a. Correct	to text	
b. Wrong	and d	
c. Don't know	ata mining,	
12. There is no need to pay a	ttention to removing and avoiding dust mites during desensitization treatments for a, 1 point for b, 0	
points for c)	n.bmj.o	
a. Correct	d similar t	
b. Wrong	techn	
c. Don't know	en.bmj.com/ on June 13, 2025 ing, and similar technologies.	
	24 24	
13. The desensitization of d	lust mite can treat rhinitis caused by dust mite allergy, but it can't prevent rhights from developing into asthma:	
(assign 0 points for a, 1 poi	int for b, 0 points for c) 51 For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml	
	51 <b>B</b>	
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1	2024-C
2	nt, 1859
3 4	a. Correct
5	BMJ Open a. Correct b. Wrong c. Don't know
7 8 9	c. Don't know
10 11	ated t
12 13 14	14. Those adverse reactions in desensitization treatment that require attention are (Multiple choice): (as is 0.2 points for each option)
15 16	a. Itching of the palms of the hands and feet. Itchy scalp. Flushed skin all over the body. The appearance
17 18	b. Immediate shock (altered mental state. Cold and clammy skin. Decrease in blood pressure)
19 20	c. Difficulty breathing. Rapid breathing. Hoarseness and other symptoms
21 22 23	d. Abdominal pain. Nausea. Vomiting. Urinary incontinence
23 24 25	e. Loss of consciousness. Loss of respiration. Loss of carotid artery pulsation
26 27 28 29 30	a. Correct b. Wrong c. Don't know 14. Those adverse reactions in desensitization treatment that require attention are (Multiple choice): (astranguenous equations) 14. Those adverse reactions in desensitization treatment that require attention are (Multiple choice): (astranguenous equation) a. Itehing of the palms of the hands and feet. Itehy scalp. Flushed skin all over the body. The appearance b. Immediate shock (altered mental state. Cold and elammy skin. Decrease in blood pressure) c. Difficulty breathing. Rapid breathing. Hoarseness and other symptoms d. Abdominal pain. Nausea. Vomiting. Urinary incontinence e. Loss of consciousness. Loss of respiration. Loss of carotid artery pulsation <b>V. Please choose the appropriate options for the following questions</b> (the following are the attitude dimension, assign 4 points for a, 3 points for b, 2 points for e, 1 points for e, 2 points
31 32	V. Please choose the appropriate options for the following questions
33 34 25	(the following are the attitude dimension, assign 4 points for a, 3 points for b, 2 points for c, 1 point for d)
35 36 37	15. Your concerns about dust mite infestation and dust mite allergy
38 39	15. Your concerns about dust mite infestation and dust mite allergy       Billiographic billiographicobilliographic billiographic billiographic
40 41 42	52 52 <b>3</b>
43	For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml 요
44 45	
46	

ueuth risks of dust mice infestation in children: d supported by our proportion of the proportion of

8 9

13 14

44 45

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	d. Strongly disagree	right, including t	jopen-2024-085905 on 20 December Enseig
	16. Your attitude to mite removal and desensitization treatment	or uses r	Decembe
	16.1 Do you think it is necessary to regularly remove mites from your home:	related	er 2024
	e. Very necessary	to text	
	f. Possibly necessary	and da	ownloaded Superieur
	g. Unsure/Don't know	ata min	l from l
	<ul><li>c. vory necessary</li><li>f. Possibly necessary</li><li>g. Unsure/Don't know</li><li>h. Unnecessary</li></ul>	/asthma:	http://bmjopen.bmj.com/ on June 13,
	16.2 Do you think that desensitization treatment is an effective option for your child's rhinitis,	asthma: and	en.bmj.
	a. Yes		com/ o
	b. Probably yes	r techn	n June
	c. Don't know /Unsure		13, 2025
	d. No	ŵ	25 at Agence
	16.3 Do you think desensitization treatment needs to be carried out strictly according to media	cal advice (e.	g. Eollow up consultation on time):
	54		graphique de
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	BMJ Open a. Very needed b. Needed c. Don't know	Page 80 of 83
1 2	yright,	
2 3 4	a. Very needed	
5 6	b. Needed 20 De	
7 8 9	c. Don't know	
10 11	d. Don't need	
12 13 14	o text a	
15 16	16.4 If your child has a relatively obvious reaction to the treatment, such as severe redness at the injection areas areas around the body or even	
17 18	anaphylaxis, will you continue with the Desensitization treatment:	
19 20 21	a. Persist	
22 23	b. May persist, depending on the situation	
24 25	c. May give up	
26 27 28	<ul> <li>a. Persist</li> <li>b. May persist, depending on the situation</li> <li>c. May give up</li> <li>d. Definitely give up</li> </ul>	
29 30	June	
31 32	VI. Please choose the appropriate options for the following questions (the following are the practicediffension)	
33 34	17. Targeted practice	
35 36 37	17.1 Due to your child's dust mite allergy, have you and your family made a special effort to learn about relevent knowledge (including dust mites.	
38 39	a. Persist b. May persist, depending on the situation c. May give up d. Definitely give up VI. Please choose the appropriate options for the following questions (the following are the practice 17. Targeted practice 17.1 Due to your child's dust mite allergy, have you and your family made a special effort to learn about relevant knowledge (including dust mites. dust mite allergy and desensitization treatment, etc.) (assign 1 point for Yes, 0 points for No.) : 52 For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml	
40 41 42	dust mite allergy and desensitization treatment, etc.) (assign 1 point for Yes, 0 points for No) :       Sign 1         55       55         For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml       Ge	
43 44 45	For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml	

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1	BMJ Open by copyright, incl a. Yes
2 3 4	BMJ Open a. Yes a. Yes
5 6 7	b. No for c co
8 9	ses reign
10 11	17.2Does your child use mite-proof bedding such as mite proof pillowcases and bedclothes assign 1 por Yes, 0 points for No, 0 points for
12 13 14	Don't know):
15 16	a.Yes deided da Garded da
17 18	b. No
19 20 21 22	Don't know ): a.Yes b. No c. Don't know
23 24 25 26	
27 28	<ul> <li>17.3 Your child is currently using a pillow with a content material of (No points for this question):</li> <li>a. Latex</li> <li>b. Down</li> </ul>
29 30	b. Down
31 32 33	c. Artificial fibre
34 35	d. Buckwheat hulls
36 37	e. Cotton 56 For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml
38 39 40	
41 42	56 Sector
43 44	For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml
45 46	

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17.4 Your child is currentl	y using a bedding with a content material of (No points for this question):	jopen-2024-085905 on 20 Deceml Ens J by copyright, including for uses	
a. Latex		20 Dec g for u	
b. Down		2embe Ensei Ises r	
c. Cotton		r 2024. Igneme elated t	
d. Silk		Down the Sup	
e. Artificial fibre		loaded from berieur (ABE and data mi	
17.5 Do you use dust mite	controller to remove mites in your home (assign 1 point for Yes, 0 points f	for No, Points for	Don't know):
a.Yes		mjope trainin	
b. No		n.bmj.c ig, and	
c. Don't know	controller to remove mites in your home (assign 1 point for Yes, 0 points for the for Yes, 0 points for the for the formula of	com/ on June similar techn	
17.6 Do you use instrumer	nts such as dehumidifier/air-conditioning, air cleaner, and etc. to remove min	tes an your home (	assign 1 point for Yes, 0
points for No, 0 points for	Don't know):		
a.Yes		ence E	
b. No		3ibliog	
	57	Agence Bibliographique de I	
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7 8 9	17.7 Do you use the decoration which prone to mites such as carpet in your home (assign 0 points for generation of the second se
10 11 12	know):
13 14	a.Yes text ar
15 16 17	b. No dated data a A fr
17 18 19 20	c. Don't know
21 22 23 24	17.8 Do you or your family weekly wash your pillowcases and bedclothes (assign 1 point for Yes, 0 points for No, 0 points for Don't know):
25 26 27	a.Yes b.No c.Don't know 17.9 Do you or your family use vacuum cleaner to clean your house every day (assign 1 point for Yes, 0 points for No, 0 points for Don't know): a.Yes b. No c. Don't know
28 29 30	17.9 Do you or your family use vacuum cleaner to clean your house every day (assign 1 point for Yes, 0 points for No, 0 points for Don't know):
31 32 33	a.Yes
34 35 26	b. No
36 37 38 39	c. Don't know 58 For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml
40 41	graph.
42 43 44	58 58 For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml 6
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