

# The effect of the indoor environment on wheeze- and sleep-related symptoms in young Indian children

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## ABSTRACT

**Background:** Environmental exposures have a significant effect on respiratory and sleep symptoms in young children. Although the effect of air pollution on the respiratory symptoms in young children is well-established, less is known about the effect of household environmental characteristics and practices on wheeze and sleep concerns. **Aims:** The aim of this pilot study is to explore the association between household environmental characteristics and practices with the symptoms of wheezing and sleep concerns in the past year in a convenience sample of young Indian children. **Materials and Methods:** A detailed questionnaire about the child's home environment and respiratory and sleep symptoms was administered to the caregivers of 190 outpatients aged between 6 months and 5 years old at a teaching hospital. **Results:** Indoor environmental characteristics and cleaning techniques were analyzed for the association with wheeze and sleep disorders. Half (50%) of the cohort had the symptoms of wheezing and 21% had occasional or frequent sleep concerns. Sleeping with a stuffed toy was significantly associated with both wheezing and sleep concerns ( $P = 0.05$ ). **Conclusions:** Sleeping with a stuffed toy was a risk factor for wheeze and a risk factor for sleep disorders independent of wheeze.

**KEY WORDS:** Childhood respiratory illness, childhood sleep-related problems, indoor environment, sleep, wheeze

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## INTRODUCTION

The prevalence of asthma in India has risen over the past decade. Studies have estimated the prevalence of childhood asthma in India to be 5%–10%.<sup>[1-3]</sup> The prevalence rates are included from both urban and rural setting from the northern and southern regions of the country.<sup>[4-6]</sup> While the cause of rising asthma rates in India

is not known, exposure to many environmental factors can trigger or exacerbate asthma<sup>[7]</sup>

Wheeze in young children is considered to be a significant predictor of later development of asthma.<sup>[8]</sup> A study of young children with asthma observed that almost half

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had at least one episode of wheeze in their 1<sup>st</sup> year of life.<sup>[9]</sup> While the incidence of wheeze is low among school-age children,<sup>[10]</sup> wheeze is a common symptom among preschoolers, and compliance with treatment is often poor.<sup>[11]</sup> In addition, the environment may be a contributing factor to poor control of symptoms. In developed countries, a number of environmental factors are known to initiate wheeze in young children, including allergens, endotoxin, and inhaled particulate matter (PM),<sup>[12-16]</sup> but the effect of household practices on wheeze in young children has not been well-studied in India.

Agarbathis and mosquito coils are known to cause respiratory problems and were included due to their widespread use in India.<sup>[17,18]</sup>

Sleep disorders have been reported to affect 13% of toddlers in India.<sup>[18]</sup> The relationship between snoring/obstructive sleep apnea and wheeze/asthma is well established. Children with lower respiratory illness are more likely to experience sleep problems such as snoring.<sup>[19,20]</sup> Preschoolers with recurrent wheeze have a high prevalence of sleep disordered breathing.<sup>[21,22]</sup> Independent of respiratory conditions, environmental air pollution has been associated with sleep disorders in both adults and children.<sup>[23-25]</sup> A German study of 10-year-old children showed that the presence of dampness and mold in the home adversely affected sleep.<sup>[26]</sup> However, little is known about the effects of indoor environmental characteristics and behaviors on sleep disorders in Indian children independent of wheezing.

### Aims

This pilot study was conducted on young children presenting to a general pediatrics clinic in a tertiary hospital in Western India. The primary aim was to explore the association between the indoor environmental triggers and respiratory illnesses in this cohort. The secondary aim was to determine if indoor environmental characteristics and behaviors were also associated with sleep disorders independent of wheezing.

## MATERIALS AND METHODS

### Sample and data collection

Children between 6 months and 5 years of age who presented to the outpatient general pediatric clinic waiting room at a charitable tertiary hospital in Pune were recruited for the study. Pune, situated in the western part of the country is 93 miles Southeast of Mumbai, has a population of 3.9 million people and is one of India's fastest growing cities. A convenience sample of 190 children (86 girls and 104 boys) was enrolled in the study.

That wheeze is worse in children with sleep problems, has been previously reported in the literature. In our sample, 72% of children with sleep problems also reported wheeze in contrast to 43% of children without sleep problems.

The present study was adequately powered to detect the higher rates of wheezing among those with sleep issues. Given the difference in the proportion (73% vs. 43%) represents >90% power with an  $\alpha$  of 0.05, using a Pearson Chi-square test for proportional differences.

This pilot study was not powered to detect the differences in other factors.

This clinic serves a resident urban as well as a migrant rural population. Children presenting with a respiratory illness were recruited for this study. As several of the caregivers were illiterate, the consent and questionnaire were administered verbally by the same research assistant to all participants to maintain uniformity. After obtaining a signed consent, the caregiver was administered a 55-item questionnaire [Appendix 1]. Data were collected on the child's demographic information, environmental exposures, respiratory and sleep symptoms, and medication use. Environmental exposure included details on the physical space, material of the floors, ventilation, where the child spends most of the time, type of stove used for cooking, and the practice of burning incense sticks. Questions included cleaning methods both of the floors and the bed linen. The presence of mold, pests including rodents and cockroaches, and the presence of animals in the home was also elucidated. Sleep data were collected using a modified TuCASA questionnaire.<sup>[27]</sup> Health data were collected using a Modified International Study of Asthma and Allergies in Childhood questionnaire. This questionnaire has been validated for the classification of asthma in older children (ages 6–7 years of age) in the Indian setting and was thus used to collect the data on respiratory and allergy symptoms in this younger age group.<sup>[3]</sup> Due to small sample sizes, some response categories were combined.

The IRB at the Smt. Kashibai Navale Medical College and General Hospital, Pune and the Rutgers-Robert Wood Johnson Medical School, New Jersey approved this study.

### Outcomes and exposure variables

The primary analysis was the association between indoor environmental factors and response to the question, "Has your child had wheezing or whistling in the chest in the last 12 months?" The secondary analysis looked at the association of these factors with sleep concerns, defined using several questions from the TuCASA questionnaire.<sup>[27]</sup> [Appendix 1] Six questions were used to determine the presence or absence of sleep concerns:

- Does your child stop breathing at night?
- Does your child struggle to breathe during sleep?
- Do you ever shake your child during sleep to make him/her breathe again?
- Do your child's lips ever turn blue or purple while he/she is sleeping?
- Are you ever concerned about your child's breathing during sleep?
- How often does your child snore loudly?

The answers were coded as “No sleep Concerns (0),” “Rarely (1),” “Occasionally (2),” “Frequently (3),” and “Almost Always (4).” Answers to all 6 questions were totaled. Scores  $\leq 2$  were classified as no or minimal sleep concerns.

### Analysis

The primary analysis explores the relationships of indoor environmental triggers to wheezing through cross-tabulations and Chi-square tests. Ordinal variables utilized Mantel-Haenszel Chi-square statistic to assess an ordinal relationship. Finally, logistic regression with backward selection was conducted to identify the triggers independently associated with wheezing. The model utilized a higher than typical significance criteria of 0.1 to preserve the variables in the selection, due to the exploratory nature of the study.

The secondary analysis explored the relationship of indoor environmental triggers and sleep disorders. A logistic regression was performed to determine if environmental triggers had any independent effect on sleep after accounting for wheeze. This model followed the same methodology as the primary analysis.

Significance was set at  $\alpha = 0.1$ . Analysis was conducted using SAS 9.4. (SAS Institute Inc, Cary, NC, US).

## RESULTS

The sample had 190 completed interviews for children ranging in age from 6 months to 5 years old [Table 1]. About 45% of the sample was female and just under 50% ( $n = 94$ ) reported having symptoms of wheezing in the last 12 months.

About 96% lived in “pucca” homes (built with substantial material such as stone, brick, cement, and concrete) and used gas stoves in the kitchen.

Table 1 shows that several triggers were associated with wheezing, including higher use of agarbathis (incense sticks) and mosquito-repellent coils and higher chance of noticing cockroaches, rodents, and fungus in the home. More frequent dry dusting, sleeping with a stuffed toy, and regular exposure to vehicular traffic were also significantly associated with wheeze.

Overall 21% had occasional or frequent sleep problems in the past 12 months. Wheezing was significantly associated with sleep problems; 73% of those with sleep problems had wheezing in the last 12 months [Table 2]. In terms of indoor environmental triggers, use of a nongas stove, more frequent “pocha” (swabbing), sleeping with a toy, and regular exposure to vehicular traffic were also associated with sleep problems.

The logistic regression models [Table 3] showed that, compared to those who did not have wheezing, those who

had wheezing were more likely to live in household with use of agarbathis (incense sticks) and mosquito-repellent coils several times a month (odds ratio [OR] 2.99 confidence interval [CI]: 1.26–7.34); dry dusting weekly or less compared to daily (OR 0.44 CI: 0.23–0.84) of and sleep with a stuffed toy (OR 4.14 CI: 1.74–10.70).

The models also showed that, compared to those without sleep disorders, those with sleep disorders were more likely to wheeze (OR 3.29 CI: 1.39–8.4), lower odds of being a girl (0.3 CI: 0.1–0.7), lower odds of swabbing weekly or less compared to daily (0.23: CI 0.06–0.97), and higher odds if the child sleep with a stuffed toy (8.78 CI: 3.57–22.9).

## DISCUSSION

The results suggest that household practices impact both wheeze and sleep concerns in this population. The main finding from this analysis is that wheeze in young children attending a general pediatrics clinic in Pune, India, was associated with four of the environmental triggers tested—more frequent use of agarbathis or mosquito coils, existence of fungus in the home, frequent dry dusting and sleeping with a stuffed toy.

Secondarily, the study confirms the previously observed association of wheezing with sleep problems and also reveals that sleeping with a stuffed toy may be associated with sleep problems independent of wheeze. In an earlier study in the US,<sup>[28]</sup> we found that the presence of indoor pets and sleeping with a stuffed toy increased the risk of symptoms, although the increased risk was not statistically significant in the small data set.

In addition, we hypothesize that the surprising finding of more sleep symptoms seen with more frequent pocha was possibly due to the chemicals used were more irritant.

In one study in rural Tamil Nadu, more than 75% of the households used mosquito coils.<sup>[29]</sup> The burning of agarbathis or incense sticks, an important religious and cultural practice in India, and mosquito coils emits PM (PM<sub>10</sub>, PM<sub>2.5</sub>, and PM<sub>1</sub>), which has been associated with exacerbation of asthma and other respiratory illness.<sup>[30]</sup> Other studies have reported associations between increased concentrations of PM (mostly through cigarette smoking) and increased incidence of lower respiratory symptoms<sup>[31]</sup> and toxicity studies have shown detrimental effects for both lower and upper respiratory symptoms in rats and mice.<sup>[32]</sup> The findings from this study add to the growing body of evidence to support the impact of exposure to burning incense and mosquito coils to respiratory health problems. Agarbathis and mosquito coils were combined in the analysis as they both emit particles in the ultrafine range and cause similar respiratory symptoms. A larger study would be needed to look at the effects independently.<sup>[22]</sup>

**Table 1: Demographic and environmental characteristics around the home and wheezing in young children**

	Wheezing in past 12 months		Total, n (%)	Significance
	No wheezing, n (%)	Wheezing, n (%)		
Child demographics				
Gender				
Girl	46 (47.9)	40 (42.6)	86 (45.3)	NS
Boy	50 (52.1)	54 (57.4)	104 (54.7)	
Age (months)				
Missing	1 (1.0)	0	1 (0.5)	NS
6-9	10 (10.4)	16 (17.0)	26 (13.7)	
10-12	12 (12.5)	14 (14.9)	26 (13.7)	
13-18	18 (18.8)	15 (16.0)	33 (17.4)	
19-24	5 (5.2)	11 (11.7)	16 (8.4)	
25-36	17 (17.7)	14 (14.9)	31 (16.3)	
37-48	14 (14.6)	11 (11.7)	25 (13.2)	
48-60	19 (19.8)	13 (13.8)	32 (16.8)	
Characteristics of the home				
Type of home				
Pucca (bricks and mortar)	91 (94.8)	92 (97.9)	183 (96.3)	NS
Kucha (not bricks)	5 (5.2)	2 (2.1)	7 (3.7)	
Type of stove				
Gas stove	90 (93.8)	91 (96.8)	181 (95.3)	NS
Nongas stove	6 (6.3)	3 (3.2)	9 (4.7)	
Use of Agarbathis or mosquito repellent coils				
Never	12 (12.5)	6 (6.4)	18 (9.5)	0.06
Less than once a month	21 (21.9)	17 (18.1)	38 (20.0)	
Several times a month	16 (16.7)	31 (33.0)	47 (24.7)	
Daily	45 (46.9)	40 (42.6)	85 (44.7)	
Noticed fungus in the home in the past year	9 (9.4)	19 (20.2)	28 (14.7)	0.04
Noticed rodents in the home in the past year	38 (39.6)	50 (53.2)	88 (46.3)	0.06
Noticed cockroaches in the home in the past year	67 (69.8)	78 (83.0)	145 (76.3)	0.03
Have pets in the home	23 (24.0)	17 (18.1)	40 (21.1)	NS
Type of floor in the home				
Tile floors	79 (82.3)	85 (90.4)	164 (86.3)	0.1
Mud floor	17 (17.7)	9 (9.6)	26 (13.7)	
Cleaning of the home				
Dry dusting				
Daily or more	41 (42.7)	52 (55.3)	93 (48.9)	0.08
Weekly or less	55 (57.3)	42 (44.7)	97 (51.1)	
"Pocha" swabbing				
Daily or more	6 (6.3)	6 (6.4)	12 (6.3)	NS
Weekly or less	90 (93.8)	88 (93.6)	178 (93.7)	
Washing with soap and water				
Weekly or daily	13 (13.5)	18 (19.1)	31 (16.3)	NS
Less frequently than weekly	83 (86.5)	76 (80.9)	159 (83.7)	
Washing of child's bed linens				
Weekly or daily	61 (63.5)	62 (66.0)	123 (64.7)	NS
Less frequently than weekly	35 (36.5)	31 (33.0)	66 (34.7)	
Other characteristics				
Child sleeps with a stuffed toy	10 (10.4)	24 (25.5)	34 (17.9)	0.005
Child regularly exposed to vehicular traffic	7 (7.3)	15 (16.0)	22 (11.6)	0.06
Total			9694190	

NS: Not significant

India is now reported to have ambient air pollution that is among the worst in the world. Major Indian cities are listed among the world's cities with the poorest air quality according to the WHO.<sup>[33]</sup> However, these reports address ambient air pollution, not the indoor environment, which is the focus of this article. In 2018, Junaid *et al.* reported the levels of PM 10 and PM 2.5 in India were 2–28, over 1–40 fold higher than the WHO standards for indoor PM 10 (50 µg/m<sup>3</sup>) and PM 2.5 (25 µg/m<sup>3</sup>), respectively.<sup>[34]</sup> In an attempt to improve the indoor environment and respiratory health of people, the government is promoting several programs that are designed to eliminate modifiable risk

factors such as smoking cessation programs and supplying cleaner cooking mediums such as liquid petroleum gas.<sup>[35]</sup>

The study findings of the impact of stuffed toys on wheeze and sleep concerns are possible through the mechanism of increased exposure to dust mites present in the toys. Despite there being an awareness of dust mites causing wheezing and sleep-related problems,<sup>[36-38]</sup> efforts to reduce exposure to stuffed animals and the dust mite burden in the child's microenvironment have been lacking. Over 80% of children in Western countries have an attachment object, usually a stuffed toy or blanket.

**Table 2: Demographic and environmental characteristics around the home and sleeping in young children**

	Sleeping in past 12 months		Total, <i>n</i> (%)	Significance
	No or minimal sleep concerns, <i>n</i> (%)	Occasional or frequent sleep concerns, <i>n</i> (%)		
Wheezing in last 12 months				
Yes	65 (43.3)	29 (72.5)		0.001
Child demographics				
Gender				
Girl	74 (49.3)	12 (30.0)	86 (45.3)	0.03
Boy	76 (50.7)	28 (70.0)	104 (54.7)	
Age (months)				
Missing	0	0	0	
6-12	42 (28.0)	10 (25.0)	52 (27.4)	
13-24	38 (25.3)	11 (27.5)	49 (25.8)	
25-36	24 (16.0)	7 (17.5)	31 (16.3)	
37 and over	45 (30.0)	12 (30.0)	57 (30.0)	
Characteristics of the home				
Type of home				
Pucca (bricks and mortar)	146 (97.3)	37 (92.5)	183 (96.3)	0.08
Kucha (not bricks)	4 (2.7)	3 (7.5)	7 (3.7)	
Type of stove				
Gas stove	145 (96.7)	36 (90.0)	181 (95.3)	
Nongas stove	5 (3.3)	4 (10.0)	9 (4.7)	
Use of Agarbathis or mosquito repellent coils				
Never	16 (10.7)	2 (5.0)	18 (9.5)	
Less than once a month	32 (21.3)	6 (15.0)	38 (20.0)	
Several times a month	35 (23.3)	12 (30.0)	47 (24.7)	
Daily	66 (44.0)	19 (47.5)	85 (44.7)	
Noticed fungus in the home in the past year	22 (14.7)	6 (15.0)	28 (14.7)	
Noticed rodents in the home in the past year	69 (46.0)	19 (47.5)	88 (46.3)	
Noticed cockroaches in the home in the past year	114 (76.0)	31 (77.5)	145 (76.3)	
Have pets in the home	34 (22.7)	6 (15.0)	40 (21.1)	
Type of floor in the home				
Tile floors	130 (86.7)	34 (85.0)	164 (86.3)	
Mud floor	20 (13.3)	6 (15.0)	26 (13.7)	
Cleaning of the home				
Dry dusting				
Daily or more	73 (48.7)	20 (50.0)	93 (48.9)	0.07
Weekly or less	77 (51.3)	20 (50.0)	97 (51.1)	
“Pocha” swabbings				
Daily or more	7 (4.7)	5 (12.5)	12 (6.3)	
Weekly or less	143 (95.3)	35 (87.5)	178 (93.7)	
Washing with soap and water				
Weekly or daily	24 (16.0)	7 (17.5)	31 (16.3)	
Less frequently than weekly	126 (84.0)	33 (82.5)	159 (83.7)	
Washing of child’s bed linens				
Weekly or daily	96 (64.0)	27 (67.5)	123 (64.0)	
Less frequently than weekly	53 (35.3)	13 (32.5)	66 (34.7)	
Other characteristics				
Child sleeps with a stuffed toy	15 (10.0)	19 (47.5)	34 (17.9)	<0.0001
Child regularly exposed to vehicular traffic	14 (9.3)	8 (20.0)	22 (11.6)	0.06
Total	150	40	190	

Although less frequent in resource-poor countries, we were surprised that 18% of children in our study slept with a stuffed toy. Having a stuffed toy may be important for the emotional development of children everywhere; however, recommendations regarding washing the stuffed toys are varied. The most common recommendation is to wash with soap and water and air or machine dry. We did not collect the data specifically on cleaning of stuffed toys.

The limitations of this pilot study include the small convenience sample from a general pediatrics clinic practice, which may not represent the general population

of young children. Due to the cross-sectional study design, causality cannot be inferred from the observed associations. Both household practice and health outcome data were collected by questionnaire and may be subject to recall bias. In this study of prevalent wheezing and sleep disordered breathing, behaviors may have changed in response to illness, presenting the possibility of reverse causation. Socio-economic status indicators which could have impacted the results such as income and maternal education were not collected. In addition, we did not collect the details on the duration of stuffed toy use or indoor properties of the home.

**Table 3: Logistic regression showing the significant associations of demographic and environmental characteristics around the home with wheezing and sleeping in young children**

	Wheezing in past 12 months*			Sleeping in past 12 months*		
	OR estimate	LCL	UCL	OR estimate	LCL	UCL
Wheezing in last 12 months				3.291	1.386	8.404
Yes						
Child demographics Gender				0.296	0.113	0.71
Girl						
Boy				Reference		
Use of Agarbathis or mosquito repellent coils						
Never or less than once a month	Reference					
Several times a month	2.987	1.258	7.34			
Daily	1.428	0.674	3.071			
Noticed fungus in the home in the past year	3.709	1.469	10.604			
Cleaning of the home						
Dry dusting						
Daily or more	Reference					
Weekly or less	0.441	0.227	0.838			
“Pocha” swabbing						
Daily or more				Reference		
Weekly or less				0.236	0.06	0.974
Washing with soap and water						
Weekly or daily	Reference					
Less frequently than weekly	0.461	0.194	1.061			
Other characteristics	4.134	1.74	10.7	8.776	3.57	22.893
Child sleeps with a stuffed toy						

\*Significance at the 0.1 level. UCL: Upper control limit, LCL: Lower control limit, OR: Odds ratio

## CONCLUSIONS

The use of agarbathis or mosquito coils, existence of fungus in the home, and regular dry dusting were associated with wheeze in our small, cross-sectional sample of young children attending a general pediatrics clinic in Pune, India. Sleeping with a stuffed toy was a risk factor for sleep disorders, independent of wheeze. The results suggest the need for further investigation of the potential causal associations between these environmental factors and wheeze and sleep disorders in young children.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

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**Appendix 1:** The TuCASA questionnaire (Goodwin JL *et al.*, 2003)<sup>[23]</sup>

**The effect of the indoor environment on wheeze and sleep-related symptoms in young Indian children**

P a t i e n t I D : ... ..  
Date: -----

**We have some questions about your child and your home.**

1. Is your child a boy or a girl?

Girl	0
Boy	1

2. How old is your child (in months)? \_\_\_\_\_

**We have some questions about your child's health.**

3. Has your child ever had wheezing or whistling in the chest at any time in the past?

Yes	1
No	0

IF YOU ANSWERED "NO" PLEASE SKIP TO QUESTION 8

4. Has your child had wheezing or whistling in the chest in the last 12 months?

Yes	1
No	0

IF YOU ANSWERED "NO" PLEASE SKIP TO QUESTION 8

5. How many attacks of wheezing has your child had in the last 12 months?

None	0
1-3	1
4-12	2
>12	3

6. In the last 12 months, how often, on average, has your child's sleep been disturbed due to wheezing?

Never woken with wheezing	0
Less than one night per week	1
One or more nights per week	2

7. In the last 12 months, has wheezing ever been severe enough to limit your child's speech to only one or two words at a time between breaths?

Yes	1
No	0

8. Has your child ever had asthma?

Yes	1
No	0

9. In the last 12 months, has your child's chest sounded wheezy during or after exercise?

Yes	1
No	0

10. In the last 12 months, has your child had a dry cough at night, apart from a cough associated with a cold or a chest infection?

Yes	1
No	0

11. Has your child ever had a problem with sneezing, or a runny, or a blocked nose when he/she DID NOT have a cold or the flu?

Yes	1
No	0

IF YOU ANSWERED "NO" PLEASE SKIP TO QUESTION 16

12. In the past 12 months, has your child had a problem with sneezing, or a runny, or a blocked nose when he/she DID NOT have a cold or the flu?

Yes	1
No	0

IF YOU ANSWERED "NO" PLEASE SKIP TO QUESTION 16

13. In the past 12 months, has this nose problem been accompanied by itchy-watery eyes?

Yes	1
No	0

14. In which of the past 12 months did this nose problem apply? (Please circle any which apply).

January	1
February	2
March	3
April	4
May	5
June	6
July	7
August	8
September	9
October	10
November	11
December	12

15. In the past 12 months, how much did this nose problem interfere with your child's daily activities?



Not at all	0
A little	1
A moderate amount	2
A lot	3

16. Has your child ever had an itchy rash which was coming and going for at least 6 months?

Yes	1
No	0

IF YOU ANSWERED “NO” PLEASE SKIP TO QUESTION 22

17. Has your child had this itchy rash at any time in the last 12 months?

Yes	1
No	0

IF YOU ANSWERED “NO” PLEASE SKIP TO QUESTION 23

18. Has this itchy rash at any time affected any of the following places: the folds of the elbows, behind the knees, in front of the ankles, under the buttocks, or around the neck, ears or eyes?

Yes	1
No	0

19. At what age did this itchy rash first occur?

Under 2 years	1
Age 2-4	2

20. Has this rash cleared completely at any time during the last 12 months?

Yes	1
No	0

21. In the last 12 months, how often, on average, has your child been kept awake at night by this itchy rash?

Never in the last 12 months	0
Less than one night per week	1
One or more nights per week	2

22. Has your child ever had eczema?

Yes	1
No	0

23. Has your child had medication for breathing problems prescribed by the doctor in the last 12 months? This includes any oral (pill or liquid) medications as well

as those used in a nebulizer.

Yes	1
No	0

IF YOU ANSWERED “NO” PLEASE SKIP TO QUESTION 25

24. Which medications were prescribed? Does your child take this regularly or only when he/she is having breathing problems? PLACE A CHECK MARK NEXT TO PRESCRIBED MEDICATIONS.

Medication	Prescribed in last 12 months	Take regularly	Take when having a problem
Salbutamol			
Terbutaline			
Salmeterol			
Prednisolone			
Montelukast			
Other (specify)			

25. In the past 12 months, how many visits has your child made to any of the following health professionals for wheezing or asthma?

Health visits	None	1-3 visits	4-12 visits	>12 visits
Clinic				
Hospital (emergency)				

26. In the past 12 months, how many times has your child been admitted to hospital because of wheezing or asthma?

Never	0
1	1
2	2
>2	3

Now we have some questions about your child’s sleep habits. For each question, please answer never, rarely, occasionally, frequently or almost always.

27. Does your child stop breathing at night?

Don’t know	99
Never	0
Rarely	1
Occasionally	2
Frequently	3
Almost always	4

28. Does your child struggle to breathe during sleep?

Don’t know	99
Never	0
Rarely	1
Occasionally	2
Frequently	3

Almost always 4

29. Do you ever shake your child during sleep to make him/her breathe again?

Don't know 99  
Never 0  
Rarely 1  
Occasionally 2  
Frequently 3  
Almost always 4

30. Do your child's lips ever turn blue or purple while he/she is sleeping?

Don't know 99  
Never 0  
Rarely 1  
Occasionally 2  
Frequently 3  
Almost always 4

31. Are you ever concerned about your child's breathing during sleep?

Don't know 99  
Never 0  
Rarely 1  
Occasionally 2  
Frequently 3  
Almost always 4

32. How often does your child snore loudly?

Don't know 99  
Never 0  
Rarely 1  
Occasionally 2  
Frequently 3  
Almost always 4

33. How often does your child have a sore throat?

Don't know 99  
Never 0  
Rarely 1  
Occasionally 2  
Frequently 3  
Almost always 4

34. Is your child a daytime mouth breather?

Don't know 99  
Never 0  
Rarely 1  
Occasionally 2  
Frequently 3  
Almost always 4

35. Does your child usually (more than 1/2 the nights) sleep with a stuffed toy?

Yes 1  
No 0  
N/A 2

**Our next questions are about your home.**

36. How many adults and children live in this home?

Number of adults \_\_\_\_\_  
Number of children \_\_\_\_\_

37. Is your home?

Pucca 1  
Kaccha (material) 2

38. What type of stove do you have? (Circle all that apply).

Gas 1  
Kerosene 2  
Chulha (closed) 3  
Chulha (open) 4

39. How often do you burn *agarbatties/dhoop*/mosquito coil in your home?

Never 0  
Occasionally (less than once a month) 1  
Frequently (several times a month) 2  
Daily/almost daily 3

40. Have you noticed fungus (*burshi*) in your home in the past 12 months?

Yes 1  
No 0

41. Which rooms had fungus (circle all that apply)?

Bathroom 1  
Bedroom 2/NA  
Living room 3/NA  
Kitchen 4/NA  
Other (specify \_\_\_\_\_) 5

42. Have you noticed any rodents in your home in the past 12 months?

Yes 1  
No 0

43. Have you noticed any cockroaches in your home in the past 12 months?

Yes 1  
No 0

44. We'd like to know how often people leave a window(s)/

door open for more than 4 hours in each season. For each season, can you tell me approximately how many days you leave at least one window/door open for more than 4 hours? (For each season, enter frequency code.)

Season	Almost never (enter 0)	1-3 times a month (enter 1)	1-3 times a week (enter 2)	Almost daily (enter 3)	Don't know (enter 99)
Summer					
Monsoon					
Winter					

45. Do you have a cat or a dog that your child plays with indoors?

Yes	1
No	0

46. Which one room does your child usually play in?

Living room/family room	1
Bedroom	2/NA
Kitchen	3/NA
Other: _____	4

47. Does this room have a TV?

Yes	1
No	0

48. What type of floor covering is in this room (if more than one, please choose the one that covers most of the floor)?

Bare floor (tile, stone)	1
Mud, cow dung	2

49. Approximately how often do you change the mud/cow dung?/NA

<1 year	1
1-2 years	2
>2 years	3
Don't know	99

50. How do you clean this floor?

Cleaning	Never	Within the last week	Within the last month	Within the last year	Over 1 year ago
Dry dusting (sweeping)					
Pocha (swabbing)					
Washing with water					
Washing with soap and water					

51. How often do you wash the child's bed linen?

Cleaning	Never	Within the last week	Within the last month	Within the last year	Over 1 year ago
----------	-------	----------------------	-----------------------	----------------------	-----------------

Bed sheet  
Bed cover  
Quilt

Now I have some questions about your child and the type of activities your child usually does in this room.

Does your child usually sleep overnight in this room?

Yes	1
No	0

These questions refer to daytime activities in the room. For each activity, your child does in this room, does he/she sometimes do it while sitting, crawling, or lying on the floor? If there are other activities that your child usually does in this room, please add them to this list.

Activity	Does in this room	Does so sitting, crawling, or lying on the floor
----------	-------------------	--

Watch TV  
Read a book/color  
Play with toys  
Eat snacks  
Eat meals  
Run around  
Do gymnastics (rolls/cartwheels)  
Play with a pet  
Sleeps or naps

52. Which of the activities listed above does your child do most frequently when he/she is in this room?

Most frequent activity: \_\_\_\_\_

53. We would like to know about how your child moves around in this room. For this question, think of the time your child spends in this room as 100%.

When your child is in this room can you tell us what percent of the time your child is:

Standing, walking or running	_____ %
Sitting or lying on a sofa or chair	_____ %
Sitting, crawling, or lying on the floor	_____ %

We would also like to know where children usually spend their time. Please think about the last typical week day you had.

For each hour listed below, please mark an "X" under your child's location. If your child was in more than one location during that hour, please mark the one where they spent the most time.

<b>Hour</b>	<b>Inside at home</b>	<b>At school</b>	<b>Outside at home</b>	<b>On a cycle/2- wheeler/auto</b>	<b>Other (specify)</b>
Morning					
8-9					
9-10					
10-11					
11-noon					
Afternoon					
Noon-1					
1-2					
2-3					
3-4					
4-5					
5-6					
Evening					
6-7					
7-8					
8-9					