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## Inhalant Use Among Schoolchildren in Northeast India: A Preliminary Study

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**Abstract:** Inhalant use by children leads to poor performance in school and has been observed to precede substance use later in life. There is paucity of data on inhalant use among school children in India, particularly in the Northeast region of the country. We determined the prevalence and documented inhalant use characteristics among schoolchildren in the Northeast region of India. This cross sectional study was conducted in six states in the Northeast region of India. Schoolchildren between eighth and eleventh standards from the capital areas of the states were included in the study. Data were collected using a questionnaire. Analysis was done using descriptive statistics and Chi-square test. Of the 4074 enrolled students, data from 3943 students who responded to the inhalant use question were analyzed. Mean age was  $14.8 \pm 1.2$  years and 51.2% of participants were male. The proportion of students who had ever used inhalants (ever user) was 18.8% and adhesive/glue was the inhalant misused by most of the students. A higher proportion of males than females were ever users ( $P \leq 0.001$ ) and the most common place of use was at home (33.1%). Being in the presence of an older person using an inhalant or tobacco was found to be associated with use of inhalants among students. Nearly one-fifth of the students had used inhalants and nearly half used inhalants in the past month. Sensitization of the parents and school authorities to the problem, as well as preventive and curative services, should be considered.

**Keywords:** inhalant use, Northeast India, schoolchildren, epidemiology

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## Introduction

Inhalants include a range of volatile, common household products that produce chemical vapors and can be inhaled to induce a mind-altering effect. Most of these products are easily available and inexpensive, easily concealed, and legal for specific, intended uses. Nevertheless, many people, particularly children, intentionally misuse these substances because they have limited access to alternative substances of abuse.

The northeast region of India consists of eight states and shares 98% of its border with neighboring countries. The region is landlocked and faces developmental challenges because of its geographical and ethnic diversity, poor communication, and poor infrastructure. Thus, the Union Ministry of Development of North Eastern Region was created in 2004 to examine the affairs of the region. The population of the region is approximately 45.6 million. English is one of the official languages in all states. Literacy rates range from 66.9–94.2%.<sup>1</sup>

Inhalant use in the country has been recognized as a problem for the past several decades.<sup>2</sup> Use of inhalants such as volatile petroleum products,<sup>2–4,6</sup> correcting fluids,<sup>4–7</sup> and adhesives<sup>6</sup> have been reported in India. These studies mostly included street children, children from juvenile homes, attendees of de-addiction centers, children from low socioeconomic status and school drop-outs. Inhalant use has also been reported in the northeast region of the country.<sup>8,9</sup> This abuse has acute and long-term health consequences such as sudden sniffing death and brain atrophy. Inhalant use has also been linked to school drop-out.<sup>10</sup> Inhalant use among children was shown to be a predictor for substance use at older ages.<sup>11,12</sup> The region has been facing the problem of substance abuse including injection drug use (IDU) and HIV infection for the past two to three decades.

Studies on inhalant use in India and the region are scarce, and are mostly case reports or series. There has been no study conducted exclusively among schoolchildren in the country. It is also the general perception of public of the region that inhalant use is common among schoolchildren. Confirmation of the existence of the inhalant use problem and documenting use-characteristics are

needed to initiate control measures. Hence, this study was conducted to determine the prevalence and document inhalant use characteristics such as sex, procurement, place of use, and parents' knowledge of the habit among schoolchildren in the northeastern India.

## Materials and Methods

This cross-sectional study was carried out among schoolchildren of eighth to eleventh standards between February and October 2012 in six North-east states of India: Manipur, Nagaland, Meghalaya, Mizoram, Arunachal Pradesh, and Tripura. Purposive selection of the six states and schools located in the capital areas of these states was done. Sample size was calculated based on the prevalence of 16% among schoolchildren<sup>10</sup> with a precision of 1.5% at 5% significance level. Adding a 20% non-response rate, a final sample size of 2754, which was rounded to 3000, was used. However, schools were selected based on geographical spread and popularity of the school (enrollment and reputation) in an attempt to make the findings generalizable to urban areas. Thirteen schools from Manipur, four from Nagaland, four from Meghalaya, seven from Tripura, ten from Arunachal Pradesh, and two from Mizoram were included in the study.

We used a semi-structured questionnaire to collect data (Appendix 1). The questionnaire had two parts, including background characteristics (Part A) and inhalant use characteristics (Part B). The questionnaire was prepared for the study through discussion and consultation and was not validated. Only an English version was used, as the schools selected were English medium schools and different dialects were present in the region. Many of the dialects spoken in the region used English script. We used local personnel to brief the students in English and the local language. Before students completed the questionnaire, the questions and how to fill in the questionnaire were explained. The importance of giving honest answers was emphasized. The students were also told that they can opt not to answer questions with which they felt uncomfortable. Confidentiality was emphasized. All students, who were present on that day, were seated sparsely. The research team and class teacher



were present in the room until questionnaires were completed. On average, filling in the questionnaire in the classroom took 25 minutes. Next, interactive sessions regarding inhalant use were held with teachers and students.

In this study, inhalants were defined as volatile substances that produce chemical vapors, which can be inhaled to induce a psychoactive or mind altering effect. An “ever user” of inhalant was defined as a student who had used inhalants at least once in his or her lifetime. “Current user” was defined as a person who had used inhalants in the previous one month.

Data were checked for completeness and consistency before entry. Double data entry by two separate persons was done using SPSS version 16. Part B of the questionnaire contained two open-ended questions on reasons for initiation of inhalant use and how students purchased inhalants. The answers were entered in string for the first 200 cases and later clubbed into similar domains and coded. The remaining cases were entered as coded values for the two variables. Proportion was used to summarize the data and Chi-square test was used to test significance of association between variables. A *P*-value of <0.05 was considered significant.

Ethical clearance was obtained from the Institute Ethics Committee. Permission from the school authorities and verbal consent/assent from the participants were obtained before collecting data. Identifiers such as school name, name of the participants, name of the parents, residential address, community, etc., were not collected from the participants in order to maintain confidentiality. Students who were absent on the day of data collection and who expressed their unwillingness to participate were excluded from the study.

## Results

A total of 4074 students participated in the study and 131 did not respond to the question asking whether they had ever used inhalants. Analysis was carried out based on the remaining 3943 participants, though incomplete responses led to different denominators. The age of the children ranged from 12–18 years with a mean of  $14.8 \pm 1.2$  years. Table 1 shows the background characteristics of the participants. Approximately one-third of the respondents did

**Table 1.** Background characteristics of the respondents.\*

Background characteristics	Number/base	Percentage
Sex		
Male	1968/3847	51.2
Female	1879/3847	48.8
Residence (at the time of survey)		
Arunachal Pradesh	710/3943	18.0
Manipur	1048/3943	26.6
Meghalaya	610/3943	15.4
Mizoram	145/3943	3.7
Nagaland	958/3943	24.3
Tripura	472/3943	12.0
Number of friends		
≤3 (few)	834/3563	23.4
>3 (many)	2729/3563	76.6
Fathers' education		
Up to 12 years	1670/3909	42.7
More than 12 years	942/3909	24.1
Don't know	1297/3909	33.2
Mothers' education		
Up to 12 years	1913/3888	49.2
More than 12 years	579/3888	14.9
Don't know	1396/3888	35.9

**Note:** \*Bases are different because of incomplete responses.

not know the education status of their parents. Most participants did not write the occupation of their parents.

Table 2 shows inhalant use characteristics. Nearly one-fifth of the respondents had used an inhalant at least once in their lifetime. The highest proportion of ever users was from Arunachal Pradesh and the lowest proportion was in Tripura. Nearly half of the ever users had used inhalants in the past 1 month (current users) and 2.8% used them every day (data not shown). One-third of the current users did it alone. An individual's own home or friend's homes were the places where most students used inhalants. One-third of the current users bought inhalants. Approximately half of the current users responded that their parents did not know of their habits. Two-thirds of the current users used their own money to buy inhalants (Table 2).

Inhalant use appeared to increase with age, from 7.6% at an age of 12 years to 25% at an age of 18 years. The main reasons for initiating use of inhalants included curiosity (34.4%), to forget problems at home and schools (23.7%), being in fashion of the present day (19.3%), and to get high/kick (15.9%).

**Table 2.** Characteristics of inhalant use among the respondents.\*

Use characteristics	Number/base	Percentage
Ever used inhalant(s)		
Yes	740/3943	18.8
No	3203/3943	81.2
Ever user by residence (at the time of survey)		
Arunachal Pradesh	195/710	27.5
Manipur	187/1048	17.8
Meghalaya	70/610	11.5
Mizoram	24/145	16.6
Nagaland	219/958	22.9
Tripura	45/472	9.5
Inhalant use in the past one month		
Yes	359/740	48.5
No	381/740	51.5
With whom you use inhalant?		
Alone	106/304	34.9
With friend(s)	198/304	65.1
Usual places for use		
Own home	105/312	33.6
Friends' home	62/312	19.9
School premises	43/312	13.8
Permanent public places	52/312	16.7
Temporary public places (eg, social events)	50/312	16.0
Procurement of inhalants		
Bought	103/299	34.4
From friends	136/299	45.5
Available at home or office	49/299	16.4
Others (stealing, stranger, etc.)	11/299	3.7
Parents' knowledge about inhalant use habit		
Parents know	59/309	19.1
Parents don't know	145/309	46.9
I don't know	105/309	34.0
Source of money for buying inhalants		
Pocket money	108/170	63.5
From parents with some pretext	24/170	14.2
From friends	12/170	7.1
Stealing	13/170	7.6
Readily available; didn't buy	13/170	7.6

**Note:** \*Bases are different because of incomplete responses.

Common inhalants misused by the students included adhesives (28.4%), adhesive with correcting fluids (15.4%), and adhesives with others inhalants (11.5%). Other inhalants misused were nail polish and nail polish remover, fuels (petrol, kerosene and diesel), shoe polish, marker pen, paints and thinner, perfumes, and deodorants.

Nearly 75% of the inhalant users wanted to stop the habit or had tried to stop in the past (79.1%). Important suggested actions to help quit the habit included accepting help from family and friends (26.2%) or doctors (25.1%), being sent to rehabilitation centers (24.1%), leaving them alone (11.8%), or obtaining help from school counsellors/teachers (7.7%). Compared to girls, boys were more aware of inhalants (30.5% vs. 22.3%) and had better knowledge regarding dangers of using inhalants (21.3% vs. 16%) (data not shown).

Use of inhalants was significantly higher among boys than girls ( $P \leq 0.001$ ). There was no significant difference in inhalant use between participants who had few friends and those who had many friends ( $P = 0.28$ ). No significant associations were observed between inhalant use and parents' education, having talks on inhalant use at school, or at home. Participants were more likely to be inhalant users when they knew an older person was also using it. Inhalant users were found to be more likely tobacco users (Table 3). When the analysis was performed on a subset of current users, having an older person using inhalant was

**Table 3.** Association between inhalant use and selected background variables.

Variable	Inhalant ever user		P-value
	Yes	No	
Sex			
Male	461	1507	0.000
Female	250	1629	
Close friends			
Few	145	689	0.29
Many (>3)	521	2208	
Fathers education			
Up to 12 years	293	1377	0.68
More than 12 years	172	770	
Mothers' education			
Up to 12 years	334	1579	0.98
More than 12 years	102	477	
Having talks on inhalants in school			
Yes	386	1667	0.85
No	305	1292	
Having discussion on inhalants at home			
Yes	402	1632	0.11
No	318	1479	
Knowing an older person using inhalants			
Yes	191	348	0.000
No	378	1609	
Using tobacco			
Yes	300	723	0.000
No	407	2336	





the only variable significantly associated with current use.

## Discussion

The overall prevalence of ever users of inhalants in this study was 18.8% and this study confirmed the general belief of people in the region that inhalant use among schoolchildren is prevalent. This study specifically examined inhalant use among schoolchildren. The prevalence of inhalant use reported in various studies in India<sup>7,8,13-16</sup> could not be compared with the results of the present study. Most other studies involved street children, were case reports, or were institution-based. The prevalence reported in this study may be an underestimate of the actual problem as many students opted not to answer the question on ever use of inhalant, potentially because saying that they did not use inhalants is a socially desirable answer. There were differences among the states regarding inhalant use rate. This may be due to differences in sample sizes and response rates. Socio-economic and demographic characteristics of the states may not fully explain the difference, as the variations were expected to be minimal. However, further studies are warranted to understand the epidemiology and dynamics of this problem. Less priority given to the problem and, lack of counselling and support services for those children using inhalants in the region could be the explanation for increase rate of inhalant use by age. Further study is needed to understand this phenomenon.

In this study, adhesive alone and adhesive with correcting fluid were the most commonly used inhalants (43.8%). Though adhesive use has been reported earlier,<sup>6</sup> this study is the first to report adhesive as the commonest misused inhalant. Adhesive and correcting fluid are available in many households and offices. Moreover, these inhalants can be easily purchased from stationery shops. These features are true for the other inhalants such as nail polish remover, fuels, marker pen, and shoe polish. Use of these inhalants has been reported in other studies as well.<sup>4,6,17-21</sup> Concern regarding the sale of these inhalants to young children has been expressed by many parents in Manipur in the recent past.

Their own or friends' homes and school premises were where two-thirds of the schoolchildren used inhalants. This finding highlights the importance of parents and teachers in recognizing and fighting this problem. The finding is also in agreement with the

observation that students use inhalants either alone or with friends. 'Curiosity', 'to forget the problems at home and schools', 'it's a fashion', and 'to get a kick or high' were the four common reasons cited by the inhalant users. Curiosity and peer pressure were also found to be important reasons for initiating inhalant use in other studies.<sup>6,7,13,19,22</sup> Peer pressure was not an important reason for inhalant use in this study. However, peer pressure may be the main driving factor behind the above reasons for using inhalants, as "I saw friends doing it, so I tried" was a major response.

Boys used inhalants significantly more than girls, though boys had better knowledge of inhalants than girls. This may be due to socio-political factors in which males typically engage in risky behaviors more than girls. The same reason may explain the observation that inhalant users were more significantly associated with tobacco users. Other studies<sup>7,10</sup> also reported a higher proportion of males using inhalants. Inhalant users were more likely to know an older inhalant user. Previous studies<sup>2,7</sup> also reported the influence of senior persons in initiating inhalant use. This finding and increase inhalant use rate in older children may warrant considering intervention measures in adults. Education of the parents was not found to be associated with inhalant use in this study. Exclusion of the 'don't know' category from the analysis may have affected the relationship statistics.

The findings of this study may not be extrapolated to the adolescent population in the region as the sample size region-wise was inadequate; only schoolchildren were included and purposive sampling was employed. We did not possess accurate information on the schools and the proportion of enrollment in the studied age groups. The problem of street children in the region is nearly non-existent. The proportion of absent schoolchildren during survey was approximately 7%, which may not have influenced the results. No student denied participation on the day of the survey. We could not ascertain how the missing responses of many questions in the study and exclusion of the remaining schools influenced the findings. Since the schools were selected across city areas, we assumed that the findings may be representative of urban areas. This is the first study specifically examining inhalant use among schoolchildren in the region. The findings of this study clearly indicate that a detailed study on inhalant use among schoolchildren should be conducted and that control activities should be initiated.



## Conclusions

Inhalant use among schoolchildren in the region is a reality, as nearly one-fifth of students surveyed had used inhalants. Nearly one in ten schoolchildren used inhalants in the past month. Immediate actions in terms of preventive and curative services need to be considered. Further studies are warranted to fully understand the epidemiology and consequences of inhalant use in the region to inform future intervention services.

## Author Contributions

Conceived and designed the experiments: BSA, MNJ. Analyzed the data: BSA, MNJ, EP, GSS. Wrote the first draft of the manuscript: MNJ, EP. Contributed to the writing of the manuscript: BSA, MNJ, EP, GSS. Agree with manuscript results and conclusions: BSA, MNJ, EP, GSS. Jointly developed the structure and arguments for the paper: BSA, MNJ. Made critical revisions and approved final version: BSA, MNJ, EP, GSS. All authors reviewed and approved of the final manuscript.

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## Competing Interests

Author(s) disclose no potential conflicts of interest.

## Disclosures and Ethics

As a requirement of publication the authors have provided signed confirmation of their compliance with ethical and legal obligations including but not limited to compliance with ICMJE authorship and competing interests guidelines, that the article is neither under consideration for publication nor published elsewhere, of their compliance with legal and ethical guidelines concerning human and animal research participants (if applicable), and that permission has been obtained for reproduction of any copyrighted material. This article was subject to blind, independent, expert peer review. The reviewers reported no competing interests.

## Supplementary Files

Appendix I contains the full text of the survey used in this study.

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