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The association between anti-smoking legislation and prevalence of acute respiratory illnesses in Indian children

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ABSTRACT

Objective: Exposure to tobacco smoke causes numerous health problems in children, and create burden on the population in terms of economy, morbidity and mortality. In order to protect the child from exposure to tobacco smoke in the outdoor environment, sufficient legislative enactments are available in Indian legislation. The objective of the present study is to investigate the fact that in absence of any specific laws stating about protection of children from exposure to tobacco smoke in indoor environment, whether outdoor related legislations are sufficient to protect children from exposureand to explore the scope for enforcement of both state and central laws in improving health of children in India.

Study design: The study considered cross-sectional survey data of Demographic and Health Survey Data on India, National Family and Health Survey fourth round (NFHS-4) for the year 2015-16 on Indian children (below age of four).

Methods: Both bivariate and multivariate logistic regression models were used to assess the impact of anti-smoking laws on the prevalence of acute respiratory infection (ARI) based on the place of residence, indoor tobacco smoke exposure and age of the child.

Results: The results have shown an inclination of ARI among children in association with states having single law, rural area resident, exposure to indoor tobacco smoke and age of the child, both as independent or in combination are quite conspicuous, and are found to be underestimated. The logistic regression also revealed the influence of these factors both as independent and even in interaction with other.

Conclusions: Legislative intervention through both at central (or national)and state levels through anti-smoking laws will decrease the indoor tobacco smoke exposure as a result ARI prevalence will also decrease among children in India.

1. Introduction

The World Health Organisation (WHO) has identified smoking as the fifth greatest menace to humanity [1]. Over 7000 compounds have been established to be present in tobacco smoke to date, with more than 50 of these chemicals being identified by International Agency for Research on Cancer (IARC) as carcinogenic [2]. Tobacco smoke chemistry has been the subject of extensive investigation by various scientific research authorities and individual researchers for more than a century [3]. Compounds such carbon monoxide, benzene, formaldehyde, polycyclic

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aromatic hydrocarbons (PAHs), hydrogen cyanide, and nitrosamines are formed when tobacco is burned [4].

Although COPD, emphysema, chronic bronchitis, and asthma are the main non-malignant respiratory diseases caused by cigarette smoking, the risk of acute infectious respiratory diseases also exponentially increases with tobacco smoke [5,6]. Studies [7–9]suggested that cigarette smoking including active, passive, and third-hand smoke exposure is a significant risk factor for upper and lower respiratory tract infections. The smoker who inhales tobacco smoke into his or her lungs is said to be a "first-hand smoke" (FHS) [10]. The term "secondhand smoke" (SHS) refers to a combination of the main stream smoke that the smoker exhales and other chemicals created by side stream smoke from burning cigarettes that enter the air and may be swallowed or taken into the stomach and lungs to be absorbed or digested. The term "third hand smoke" (THS) refers to smoke particles that linger after smoking on items like clothing, walls, furniture, skin, hair, and carpets. These adherent pollutants have the potential to be reemitted into the gas phase or to interact with oxidants and other pollutants that are frequently present in indoor environments to produce secondary pollutants, such as chemicals that are carcinogenic [11].

The relevance of issue of tobacco smoking can be entertained from several perspectives [12] such as it impact on health economy [13,14] by impacting health-related quality of life [15] (López-Nicolás et al., 2018), mortality [16–19] and physical disability [20,21] as it pertains to all types of smokers, i.e., FHS, SHS and THS contrasting the right to smoke with the right to breathe clean air. Exposure to tobacco smoke has been considered as burden [22,23].

In order to protect the general public from the health risks associated with tobacco use, the Ministry of Health and Family Welfare of the Government of India passed a comprehensive piece of legislation in 2003 called the Cigarettes and Other Tobacco Products (Prohibition of Advertisement and Regulation of Trade and Commerce, Production, Supply and Distribution) Act, 2003 (COTPA, 2003). The Food Safety and Standards Authority of India (FSSAI) has issued Regulation 2.3.4 of the Food Safety and Standards (Prohibition and Restrictions on Sales) Regulations, 2011 dated 1st August 2011, which states that tobacco and nicotine may not be used as ingredients in any food products. According to Section 77 of the Juvenile Justice (Care and Protection of Children) Act, 2015, anyone who gives, or causes to be given, to any child any intoxicating liquor, any narcotic drug, tobacco products or psychotropic substance, except on the order of a duly qualified medical practitioner, shall be punishable with rigorous imprisonment for a term that may extend to seven years and shall also be liable to a fine that may extend up to one lakh rupees. The Prohibition of Electronic Cigarettes (Production, Manufacture, Import, Export, Transport, Sale, Distribution, Storage and Advertisement) Act of 2019 and Cigarettes and Other Tobacco Products (Prohibition of Advertisement and Regulation of Trade and Commerce, Production, and Supply) Act are two additional laws that restrict the promotion, production, and consumption of tobacco products.

Children's health is significantly impacted by second-hand smoke [24,25]. Exposure to cigarette smoke has been linked to a number of respiratory conditions, including asthma, bronchitis and pneumonia, wheezing, coughing, ear infections, sudden infant death syndrome, and delayed foetal growth and lung development [26]. Children are especially susceptible to a variety of health issues related to exposure to FHS, SHS, and THS. Acute respiratory infection is one of the most serious and sometimes fatal conditions. ARI can be categorised as either lower respiratory infections (LRIs) or upper respiratory infections (URIs). The airways in the upper respiratory system, which also include the middle ear and paranasal sinuses, extend from the nostrils to the voice cords in the larynx. The continuation of the airways from the trachea and bronchi to the bronchioles and alveoli is referred to as the lower respiratory tract [27]. Because of the potential spread of infection or microbial toxins, inflammation, and diminished lung function, ARIs do not just affect the respiratory tract but also have systemic repercussions [28].

Children who are exposed to tobacco smoke have a number of health issues. Indeed, there are enough legislative enactments (both central and many state laws) to support the anti-tobacco smoking and protect children from exposure to tobacco smoke outdoors. Here, we have tried to evaluate the fact that in absence of any specific laws stating about protection of children from exposure to tobacco smoke in indoor environment such as in their house, cars etc, whether outdoor related legislations are sufficient to protect children from exposure. The current study's goal is to investigate the effects of anti-smoking laws for exposure to tobacco smoke in outdoors on acute respiratory infections in children in India according to the child's age, place of residence, and exposure to indoor tobacco smoke.

2. Methodology

Study Design: The present study has considered "Demographic and Health Survey (DHS)" data on Indian children (under the age of four) from the National Family and Health Survey (NFHS-4) for the year 2015–16. The DHS is a collection of nationally representative household surveys that collect data on the population, maternal and child health, and nutrition. The analysis is conducted without taking the weight variable into account because it was considered that children had an equal chance of experiencing the ARI in this case. DHS is basically a cross-sectional survey data, and here we considered fourth round (NFHS-4) for the year 2015-16 on Indian children (N = 259627). The present study uses data of 190,898 children who were alive and below age of four at the time of survey.

Study parameters: Existence of both state and central legislation or only central legislation that are in existence in the state where the child resides, the type of residence, indoor tobacco smoke exposure, and the age of the child are all factors that have been linked to the occurrence of ARI. In any state either both central, defined as single law, there to forbid smoking tobacco and are in effect, or both central along with and state laws, defined as multiple laws, are enacted. If any family member or visitor has smoked inside the home during the past 30 days, it will be considered that the child has been exposed to tobacco smoke indoors. There are two categories of residence: urban and rural. Children are divided into four disjoint groups based on their reported age viz., 0-1 years, 1-2 years, 2-3 years, and 3-4 years.

Our interest lies in finding the prevalence of ARI among Indian children. The NFHS-4 defined ARI as chest-related coughing that is followed by short, fast, or difficult breathing. Mothers were asked if their child had displayed ARI symptoms in the two weeks prior to the study. Children's ARI status was dichotomized in this study's analysis into two categories: yes (coded as 1) and no (coded as 0).

Statistical analyses: Both bivariate and multiple logistic regression models have constructed, separately including the interaction effects to estimate the impact of anti-smoking laws on the prevalence of acute respiratory infection based on the place of residence, indoor tobacco smoke exposure and age of the child. The association has been measured using chi-square test for bivariate analysis, and Cochran-Mantel-Haenszel statistics adjusting for the effects of a stratification variable. The results obtained from the regression analyses have been presented in terms of the odds ratios (ORs) with 95% confidence interval (CI). Statistical analyses were performed using the Statistical Analysis System (SAS) package, (university edition). Corresponding to each of the associated study variable, the associations with the prevalence of ARI have been examined using binary logistic regression analyses, to examine the effect of each of the selected factors and their interactions on the odds of ARI infected and ARI non-infected children.

3. Results

The descriptive summary of laws protecting children under the age of four from exposure to outdoor tobacco smoke is presented in Table 1 along with the child's state of origin, type of residence, and whether or

Table 1
Descriptive and unadjusted odds ratio (OR) and 95% confidence interval (CI) for risk of ARI among Indian children under existence of laws, residence type, indoor tobacco smoke exposure and age of child, and their interaction.

Variable	Total	ARI		p-value	Odds Ratio (95% confidence interval)
		No[n = 190419] (96.09%)	Yes [n = 7741] (3.90%)		
Laws				<.0001[a]	
Single law	134779 (68.02)	129108 (65.15)	5671 (2.86)		1.30 (1.24 - 1.37)
Multiple laws[R]	63381 (31.98)	61311 (30.94)	2070 (1.04)		1.00
Residence				<.0001[a]	
Urban [R]	47110 (23.77)	45469 (22.95)	1641 (0.83)		1.00
Rural	151050 (76.23)	144950 (73.15)	6100 (3.08)		1.17 (1.10 - 1.23)
Indoor Exposure to tobacco smoke				<.0001[a]	
No [R]	85844 (43.32)	82755 (41.76)	3089 (1.56)		1.00
Yes	112316 (56.68)	107664 (54.33)	4652 (2.35)		1.16 (1.11 - 1.21)
Child age-group (in years)				<.0001[a]	
0–1	48295 (24.37)	46207 (23.32)	2088 (1.05)		1.42 (1.33 - 1.52)
1–2	49284 (24.87)	46938 (23.69)	2346 (1.18)		1.57 (1.47 - 1.68)
2–3	49084 (24.77)	47365 (23.9)	1719 (0.87)		1.14 (1.06 - 1.22)
3-4 [R]	51497 (25.99)	49909 (25.19)	1588 (0.8)		1.00
Law X Residence				<.0001[b]	
Single with Urban	32568 (16.44)	31342 (15.82)	1226 (0.62)		1.33 (1.19 - 1.49)
Single with Rural	102211 (51.58)	97766 (49.34)	4445 (2.24)		1.55 (1.40 - 1.71)
Multiple laws with Rural	48839 (24.65)	47184 (23.81)	1655 (0.84)		1.19 (1.07 - 1.33)
Multiple laws with Urban [R]	14542 (7.34)	14127 (7.13)	415 (0.21)		1.00
Law X Indoor Exposure				<.0001[b]	
Single with no-exposure	55975 (28.25)	53710 (27.1)	2265 (1.14)		1.49 (1.37 - 1.61)
Single with exposure	78804 (39.77)	75398 (38.05)	3406 (1.72)		1.59 (1.47 - 1.72)
Multiple laws with exposure	33512 (16.91)	32266 (16.28)	1246 (0.63)		1.36 (1.24 - 1.49)
Multiple laws with no-exposure [R]	29869 (15.07)	29045 (14.66)	824 (0.42)		1.00
Law X Child age				<.0001[b]	
Single law among infants (<1 year)	33132 (16.72)	31573 (15.93)	1559 (0.79)		1.86 (1.67 - 2.08)
Single law among children (1-2 years)	33391 (16.85)	31663 (15.98)	1728 (0.87)		2.06 (1.85 - 2.29)
Single law among children (2-3 years)	33262 (16.79)	32040 (16.17)	1222 (0.62)		1.44 (1.29 - 1.61)
Single law among children (3-4 years)	34994 (17.66)	33832 (17.07)	1162 (0.59)		1.30 (1.16 - 1.45)
Multiple laws among infants (<1 year)	15163 (7.65)	14634 (7.38)	529 (0.27)		1.36 (1.20 - 1.55)
Multiple laws among children (1-2 years)	15893 (8.02)	15275 (7.71)	618 (0.31)		1.53 (1.35 - 1.73)
Multiple laws among children (2-3 years)	15822 (7.98)	15325 (7.73)	497 (0.25)		1.22 (1.07 - 1.40)
Multiple laws among children (3-4 years) [R]	16503 (8.33)	16077 (8.11)	426 (0.21)		1.00
Law X Residence X Indoor Exposure				<.0001[b]	
Single with Urban	14060 (7.1)	13566 (6.85)	494 (0.25)		1.28 (1.09 - 1.51)
Single with Urban and exposed	18508 (9.34)	17776 (8.97)	732 (0.37)		1.45 (1.24 - 1.69)
Single with Rural and unexposed	41915 (21.15)	40144 (20.26)	1771 (0.89)		1.55 (1.35 - 1.79)
Single with Rural and exposed	60296 (30.43)	57622 (29.08)	2674 (1.35)		1.63 (1.42 - 1.88)
Multiple laws with Urban and exposed	6720 (3.39)	6521 (3.29)	199(0.1)		1.07 (0.88 - 1.31)
Multiple laws with rural and unexposed	22047 (11.13)	21439 (10.82)	608 (0.31)		1.00 (0.85 - 1.17)
Multiple laws with rural and exposed	26792 (13.52)	25745 (12.99)	1047 (0.53)		1.43 (1.23 - 1.66)
Multiple laws with Urban and unexposed [R]	7822 (3.95)	7606 (3.84)	216 (0.11)		1.00

[a] Chi-square test.
[b] Cochran-Mantel-Haenszel statistics adjusting for the effects of a stratification variable.

not they have been exposed to indoor tobacco use. Approximately 4% of children in India were affected by ARI as a result of illiterate legislation. According to research, states with a single (central) anti-smoking law have 2.86% of the nation's total prevalence of ARI (3.91%)cases among children, compared to 1.04% in states having multiple (both central and states) laws anti-smoking laws. Out of all instances, the majority, or 2/3rd(76%) of ARI cases, were reported among children in rural areas. More than half of the children (57%) were exposed to tobacco smoke indoors, and among these exposed kids, 50% of all ARI cases (or 2.35% prevalence), were found. One of the main areas of focus is children's age groups; ARI infections were recorded in roughly comparable numbers among all age groups, such as "0-1" "1-2" "2-3″ and "3-4″ years which was 1%.

In cases where only single(central) anti-smoking law was implemented, the prevalence of ARI among rural children was 4445 (2.24%), which was three times higher than that among urban children 1226 (0.62%). In cases where multiple (both central and state) anti-smoking laws were implemented, the prevalence of ARI among rural children was 1655 (0.84%), which was four times higher than that among urban children 415(0.21%). The interaction between the number of anti-smoking laws and indoor tobacco smoke exposure revealed that exposed children suffered from ARI at a higher rate 1246(0.63%) than non-exposed children 824(0.42%) in the case of multiple anti-smoking law implementing states than in the case of single law implementing states with non-indoor tobacco smoke exposure.

Children of different age groups were found to exhibit an interaction based on the number of laws against smoking and ARI infection. In states with single smoking ban laws, young children are more likely to contact the disease. Infants (less than one year) had an ARI prevalence of 1559 (0.79%), children (1-2 years) of 1728 (0.87%), children (two to three years) of 1222 (0.62%), and children (three to four years) of 1162 (0.59). Similarly, ARI infections among infants (less than one year) were documented under several legislation at 529 (0.27%), 618 (0.31%), 497 (0.25%), and 426 (0.21%), respectively. This infection rate among children under the age of two is higher in states with single laws (1.7%) than in those that are implementing multiple regulations (0.58%).

The relationship between the number of legislations, the type of residence, and exposure to tobacco smoke indoors is depicted. In urban areas, the prevalence of ARI was recorded as 494 (0.25%), while in rural areas, it was 1771 (0.89%), and in exposed areas, it was 2674 (1.35%). Similar to this, ARI with urban and exposed was 199 (0.1%), and unexposed was 608 (0.31%). Additionally, ARI was subject to various regulations with rural and exposed populations of 1047 (0.53%), and 216 (0.11%). The prevalence of ARI was highest in states with a single rule and among children living in rural regions who were exposed to both exposed (1.35%) and unexposed (0.9%) indoor tobacco smoke, accounting for 57% of all ARI cases.

In order to determine the relationship between the predictors and ARI, the chi-square test was used. When combined with the factors listed in Table 1, the ARI results were highly statistically significant. The risk of ARI was also assessed using Cochran-Mantel-Haenszel statistics, which likewise concluded that the interaction among number of law, types of residence and Indoor tobacco smoke exposure were extremely significant.

In addition to the findings in Table 1, logistic regression models were also created with the help of those who did not have ARI. According to the models, single law cases of ARI infection were 30% more common than multiple law cases. Children are 17% more likely to contract ARI in rural regions than in urban ones. There was a 16% greater risk of ARI infection among individuals who had indoor exposure to tobacco smoke than among those who did not. The risk of ARI was 1.57 times higher in the child age group (1-2) than in the child age group (3-4), which has the highest risk among all child age groups. In situations where the number of laws and the type of residence interact, the risk of ARI was higher for single laws in rural areas (55%), single laws in urban areas (33%), and multiple laws in rural areas (19%) than for multiple laws in urban areas. When the number of laws and indoor tobacco exposure were combined, the risk of ARI was 59% greater in single exposure cases than in single exposure cases without laws, and it was 36% more likely in multiple exposure instances than in multiple laws without laws. The Risk of ARI was more likely to be higher among infants (<1 year) [86%], children (1-2 years) [2 times], children (2-3 years) [44%], children (3-4 years) [30%], multiple laws among infants (1 year) [36%], children (1-2 years) [53%], and children (2-3 years) [22%] than multiple laws among children in cases where the number of laws and the age of the children interacted. When number of laws, type of residence, and indoor tobacco exposure interacted, the risk of ARI in children was higher in the following situations: single with urban unexposed [22%], single with urban and exposed [45%], single with rural and unexposed [55%], single with rural and exposed [63%], and multiple laws with rural and exposed [43%] than multiple laws with urban and unexposed, respectively.

Four statistical models with various interactions were shown in Table 2. The independent effects of the number of laws, the type of residence, the exposure to indoor tobacco, and the child's age group were kept in Model 1. The prevalence of ARI was 29% higher in states with a single anti-smoking statute than in those with several. ARI is 16% higher in rural than in urban areas, with 14% more in indoor tobacco smoke exposed children than unexposed. ARI risk was 42% higher among children in the 0–1 year age group, 57% higher among those in the 1-2 year age group, and 14% higher among those in the 2–3 year age group than among those who fall into the 3–4 year age group. Following the adjustment of the other interactions' controlling effects in models 2, 3, and 4, it was determined that the risk of ARI was more likely to be higher than the risk for multiple laws, urban residence, the unexposed group, and the child as group (3–4 years). For each stratum of the variable, an odds ratio and confidence interval were provided in Table 2.

4. Discussion

One of the main risk factors for ARI in India is smoking [29]. India is among the top 15 most afflicted countries in terms of the overall number of pneumonia episodes and related child mortality. In India, ARI-related illnesses claim the lives of almost 0.4 million children under the age of five every year [30]. Data from paediatric hospital admissions show that this number equates to 13–16% of all child fatalities [31,32]. Approximately one-fourth of all annual deaths of children under the age of five worldwide are attributable to ARI, making it a serious public health concern in India [33].

Paediatric age is a significant risk factor for ARI, with the likelihood of development being higher in infants under 12 months of age than in those over 48 months [34,35]. When compared to the child age group (3–4), which has the highest risk of all the child age groups, the risk of ARI in our study was 1.5 times greater in the child age group (1-2).

Studies have shown that ARIs in children under the age of five are closely associated to the environmental, cultural, and socioeconomic factors present in the population [36,37]. Evidently, the rural-urban gap

Table 2
Logistic regression models associating states implementing central and/or state legislation, place of residence, exposure to tobacco exposure and child's age.

Model		Laws (Ref- Multiple laws)	Residence (Ref- Urban)	Exposed (Ref- no-exposure)	Child age (in years) (Ref- Children (3-4 years))		
	Interaction	Single law	Rural	Yes	0-1 years	1-2 years	2-3 years
Model 1		1.294 (1.229,1.362)	1.162 (1.099,1.228)	1.143 (1.091,1.197)	1.419 (1.328,1.517)	1.574 (1.475,1.679)	1.142 (1.065,1.224)
Model 2 = [Model 1 + Interaction]	Law X Residence	1.289 (1.217,1.366)	1.167 (1.095,1.243)	1.143 (1.091,1.197)	1.419 (1.328,1.517)	1.574 (1.475,1.679)	1.142 (1.065,1.224)
	Law X Indoor Exposure	1.175 (1.099,1.255)	1.159 (1.096,1.225)	1.205 (1.144,1.27)	1.42 (1.328,1.517)	1.574 (1.475,1.679)	1.142 (1.066,1.224)
	Law X Child age	1.287 (1.16,1.427)	1.162 (1.099,1.228)	1.143 (1.091,1.197)	1.363 (1.194,1.556)	1.525 (1.336,1.741)	1.222 (1.07,1.395)
Model 3 = [Model 1 + Interaction]	Law X Residence X Indoor Exposure	1.528 (1.339,1.743)	1.327 (1.138,1.549)	1.441 (1.301,1.595)	1.42 (1.328,1.517)	1.574 (1.475,1.679)	1.142 (1.065,1.224)
Model 4 = [Model 1 + Interaction]	Law X Residence X Indoor Exposure X Child age	1.645 (1.089,2.484)	1.466 (1.042,2.061)	1.415 (1.132,1.768)	1.339 (1.116,1.607)	1.547 (1.299,1.843)	1.158 (0.962,1.394)

Model 1: Fixed and independent effect of number of laws, residence type, indoor tobacco exposure and age-group of child.

influences the prevalence of children ARI [38]. In rural areas of single (central) laws implementing states without any indoor tobacco smoke exposure, the prevalence of ARI was 1771 (0.89%), compared to 494 (0.25%) in urban areas. Similarly, in rural areas of multiple (central and states) laws implementing states without any indoor tobacco smoke exposure, the prevalence of ARI was 608 (0.31%), compared to 199 (0.10%) in urban areas. Parental smoking, insufficient ventilation, and overcrowding could all be factors in rural locations where ARI is more common.

Many countries including India have realized the awareness of anti-smoking laws and the positive health impact availed by it, for example, US government had Children's Health Insurance Plan and Reauthorization Act (CHIPRA) of 2009, the Family Smoking Prevention and Tobacco Control Act of 2009, and the Affordable Care Act of 2010. As mentioned above, in India COTPA (2003), FSSAI regulation, Section-77 of the Juvenile Justice (Care and Protection of Children) Act, 2015, the Prohibition of Electronic Cigarettes (Production, Manufacture, Import, Export, Transport, Sale, Distribution, Storage and Advertisement) Act, 2019, Cigarettes and other Tobacco Products (Prohibition of Advertisement and Regulation of Trade and Commerce, Production, Supply and Distribution) Amendment Rules, 2023. Along with these laws, in some states such as Delhi, Sikkim, Goa, Himachal Pradesh, Meghalaya, Assam, Rajasthan, West Bengal, Karnataka, Andhra Pradesh, Jharkhand (Appendix-S1) have also made state wise anti-smoking laws, which further strengthen the fight against tobacco.

In our study, we compared the impact of single (central) anti-smoking legislation to the combined effects of state and central anti-smoking legislation on prevalence of ARI. In Indian states having only central declared anti-smoking law in place, the prevalence of ARI among rural children was 4445 (2.24%), while it was 1655 (0.84%) in states with multiple (both state and central) anti-smoking laws. The prevalence of ARI in rural children is reported to be 4445(2.24) in states having a single anti-smoking law, which reduces in multiple laws implementing states to 1655(0.84). Similar pattern has been observed whereas in urban children also. Thus, compared to single with multiple anti-smoking laws, the prevalence of ARI was 29% greater in states with only central(single) anti-smoking laws.

A child will be regarded as being exposed to indoor tobacco smoke if any member of the family or visitor smoked inside the house within the last 30 days. Children who endured exposure to tobacco smoke had a 4652 (2.35%) greater likelihood of developing ARI than those who were not (which was 3089 (1.56%)). Despite the fact that India does not have any specific legislation prohibiting indoor smoking, our analysis found that the states with only central anti-smoking regulations had a higher prevalence of ARIs 3406(1.72%) than states with both central and state anti-smoking laws 1246(0.63%).

5. Conclusion

Children's acute respiratory infections have decreased after anti-smoking legislation was implemented in public places of India. The existing national or central legislations have assisted in reducing outdoor second-hand smoking exposure, which is a substantial cause of respiratory ailments. The present study has been demonstrated that there are significant and substantial reduction in prevalence of ARI and exposure to indoor tobacco smoke, among children residing in states having both central and state legislation on anti-tobacco smoking. The enforcement of anti-smoking regulations at state level in addition to central laws has been shown a significant step in improving the health of children in India. States without anti-smoking laws may think about forming policies and legislation surrounding the issue because it has been demonstrated that they have a positive effect on reducing the prevalence of ARI at the state level.

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Declaration of competing interest

Authors have no conflicts of interest with respect to the contents of this paper.

Appendix A. Supplementary data

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