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Prevalence and risk factors for self-reported asthma in an adult Indian population: a cross-sectional survey

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SUMMARY

BACKGROUND AND METHODS: We estimated the prevalence of self-reported asthma in adult Indians and examined several risk factors influencing disease prevalence. Analysis is based on 99 574 women and 56 742 men aged 20–49 years included in India's third National Family Health Survey, 2005–2006. Multiple logistic regression analysis was used to estimate the prevalence odds ratios for asthma, adjusting for various risk factors.

RESULTS: The prevalence of self-reported asthma was 1.8% (95%CI 1.6–2.0) among men and 1.9% (95%CI 1.8–2.0) among women, with higher rates in rural than in urban areas and marked geographic differences. After adjustment for known asthma risk factors, women were 1.2 times more likely to have asthma than men. Daily/weekly consumption of milk/milk products, green leafy vegetables and fruits were associated with a lower asthma risk, whereas consumption of chicken/meat, a lower body mass index (BMI; <16 kg/m², OR 2.08, 95%CI 1.73–2.50) as well as a higher BMI (>30 kg/m², OR 1.67, 95%CI 1.36–2.06), current tobacco smoking (OR 1.30, 95%CI 1.12–1.50) and ever use of alcohol (OR 1.21, 95%CI 1.05–1.39) were associated with an increased asthma risk.

CONCLUSIONS: There are wide regional variations in the prevalence of asthma in India. With the exception of the findings for BMI, however, most of the associations of asthma with the risk factors are relatively weak and account for only a small proportion of cases.

KEY WORDS: asthma; risk factors; men; women; NFHS-3; India

ASTHMA is a substantial global health problem,[1,2] with increasing prevalence rates in many countries.[3,4] According to World Health Organization (WHO) estimates, 300 million people have asthma and 255 000 died of asthma in 2005;[5] over 80% of asthma deaths occur in low- and lower-middle-income countries.[6] It has previously been estimated that the prevalence of asthma in India is about 3% (30 million patients), with a prevalence of 2.4% in adults aged >15 years,[7] and between 4% and 20% in children.[4] In 2004, it was estimated that 57 000 deaths in India were attributed to asthma;[5] it is one of the leading causes of morbidity and mortality in rural India,[8] and is projected to increase in the coming decades.

Several studies have been conducted in India on asthma prevalence in children and adolescents,[9–14] but very few studies have been conducted in adults.[7,15–17] Furthermore, there is little evidence on the prevalence and risk factors for asthma in the adult Indian population at the national level.

India's third National Family Health Survey (NFHS-3, 2005–2006) collected data from 109 041 households and covered regions comprising more than 99% of India's population,[18] which provides a unique opportunity to study the prevalence of asthma and its societal, environmental, lifestyle and dietary determinants. In this article, we report the findings on self-reported asthma and the associated risk factors.

METHODS

Data

India's NFHS-3, 2005–2006 was designed along the lines of the Demographic and Health Surveys (available at www.measuredhs.com), which have been conducted in many developing countries since the 1980s. The NFHS has been conducted in India for three successive rounds, each at an interval of 5 years. NFHS-3 collected demographic, socio-economic and health information from a nationally representative probability sample of 124 385 women aged 15–49 years and 74 369 men aged 15–54 years residing in 109 041 households. This is a multistage cluster sample, with an overall response rate of 98%. All states of India are represented in the sample (except for the small Union Territories), covering more than 99% of the country's population. Full details of the survey have been published elsewhere.[18] The analysis presented

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here focuses on 99 574 women and 56 742 men aged 20–49 years living in the sample households.

Outcome measures

The survey included several questions relating to the current health status of the respondents, including the question, 'Do you currently have asthma?'. The survey was conducted using an interviewer-administered questionnaire in the native language of the respondent using a local, commonly understood term for asthma. A total of 18 languages were used, with back-translation to English to ensure accuracy and comparability.

Risk factors

The variables included in the analysis include the following demographic factors: sex, age (20–29, 30–39, 40–49 years), marital status (currently married, widowed/divorced/separated/deserted, not married), education (illiterate, literate but completed less than middle school, completed middle school, completed high school or more), religion (Hindu, Muslim, Other), caste/tribe (Scheduled Castes, Scheduled Tribes, Other Backward Class and Others; see Appendix),* employment status (not employed, employed), wealth index (measured by an index based on household ownership of assets and graded as lowest, second, middle, fourth and highest, computed using previously described methods; see Appendix), residence (urban, rural) and geographic region (north, north-east, central, east, west, south).

Environmental factors include exposure to cooking fuel (clean fuel, unclean fuel; see Appendix), house type (*pucca, kachha, semi-pucca*), availability of a separate kitchen (yes, no), crowding (number of persons per room: <2, 2–4, >4 persons), lifestyle factors and body mass index (BMI; Indian adult population standard[19] categories of BMI were used: <16 kg/m^2 [moderately thin/severely thin], 16.0–16.9 kg/m^2 [mildly thin], 17.0–18.4 kg/m^2 [underweight], 18.5 to 22.9 kg/m^2 [normal], 23.0 to 24.9 kg/m^2 [overweight], 25.0–29.9 kg/m^2 [obese] and ≥ 30 [clinically obese]), exposure to current tobacco smoke (no, yes; see Appendix), alcohol use (never, ever), frequency of watching TV (not at all, less than once a week, at least once a week, almost every day), and dietary intake (frequency of consumption of milk/milk products, pulses and beans, green leafy vegetables, fruits, eggs, fish and chicken/meat—all categorised into daily, weekly, occasionally and never).

Data analysis

We first examined regional and rural/urban differentials in the prevalence of asthma, and then estimated the prevalence of asthma separately in men and women, and its associations with nine socio-economic and demographic (SED) variables, four environmental factors, four BMI and lifestyle-related factors and seven diet variables. We used multiple logistic regression to estimate the odds ratios (ORs) for each of these risk factors, adjusted for the others. As certain states and certain categories of respondents were oversampled, in all analyses weights were used to restore the representativeness of the sample.[18]

Results are presented as ORs with 95% confidence intervals (CIs). Before carrying out the multivariate model, we assessed the possibility of multicollinearity between the covariates. In the correlation matrix of covariates, all pair-wise Pearson correlation coefficients were <0.5, suggesting that multicollinearity is not a problem. All analyses, including the logistic regression models, were conducted using SPSS Version 19 (IBM SPSS Statistics, Chicago, IL, USA).

Ethical considerations

The NFHS-3 survey received ethical approval from the Ethical Review Board of the International Institute for Population Science. Informed consent was obtained from each respondent prior to the survey. The analysis presented in this study is based on the secondary analysis of existing survey data, with all identifying information removed.

RESULTS

Prevalence of asthma by state and residence

Table 1 shows the findings for self-reported asthma prevalence by sex and region. The prevalence of asthma was 1.8% (95%CI 1.6–2.0) among men and 1.9% (95%CI 1.8–2.0) among women. Marked geographic variations and rural-urban differences in prevalence were observed. Rural rates were higher (2.0%) than urban rates (1.6%). The highest prevalence was among women in the rural north-eastern region (2.8%), particularly in the state of Tripura (6.7%), while the lowest was among men in the central and southern regions (0.9%), particularly in the state of Tamil Nadu (0.4%).

Table 2 shows the characteristics of the study population, and the corresponding asthma prevalence estimates. The Appendix Table shows unadjusted and adjusted ORs for these characteristics.

Socio-economic and demographic characteristics and asthma prevalence

Strong associations were observed between age and asthma prevalence. Men (5.6%, 95%CI 3.5–8.8) and women (2.9%, 95%CI 2.4–3.5) who were widowed/divorced/separated/deserted were more likely to report asthma than those who were not married or were currently married. Illiterate men (2.6%, 95%CI 2.1–3.1) and women (2.1%, 95%CI 1.9–2.3) had a

*The Appendix is available in the online version of this article at http://www.ingentaconnect.com/content/iuatld/ijtld/2013/00000017/00000002/art00027

Table 1 Prevalence of self-reported asthma among men and women aged 20–49 years by state and residence, India, 2005–2006

	Men			Women		
India/states	Urban *n* (%)	Rural *n* (%)	Total *n* (%)	Urban *n* (%)	Rural *n* (%)	Total *n* (%)
India	21 698 (1.4)	35 100 (1.9)	56 801 (1.8)	34 466 (1.8)	65 701 (2.0)	100 174 (1.9)
Northern region	105 (1.3)	106 (1.5)	211 (1.4)	79 (1.0)	118 (1.1)	197 (1.1)
Delhi	1 010 (1.0)	78 (0.0)	1 088 (0.9)	2 568 (0.7)	199 (0.0)	2 767 (0.7)
Haryana	260 (1.9)	557 (1.4)	81 (1.6)	693 (2.0)	1 540 (1.6)	2 232 (1.7)
Himachal Pradesh	104 (0.0)	655 (0.8)	758 (0.7)	287 (0.7)	2 363 (0.3)	2 649 (0.4)
Jammu and Kashmir	236 (0.0)	526 (1.1)	761 (0.8)	800 (0.8)	1 815 (1.2)	2 616 (1.0)
Punjab	435 (1.1)	551 (0.7)	986 (0.9)	1 146 (0.7)	1 897 (1.2)	3 043 (1.0)
Rajasthan	363 (1.1)	720 (2.8)	1 083 (2.2)	914 (2.2)	2 161 (1.8)	3 075 (1.9)
Uttarkhand	273 (0.7)	461 (1.5)	735 (1.2)	655 (0.8)	1 672 (0.5)	2 327 (0.6)
Central region	51 (0.9)	87 (1.4)	138 (1.2)	93 (1.2)	129 (1.3)	222 (1.3)
Chhattisgarh	255 (1.6)	792 (0.9)	1 048 (1.0)	694 (0.7)	2 275 (0.8)	2 969 (0.8)
Madhya Pradesh	646 (1.7)	1 456 (0.8)	2 103 (1.1)	1 467 (1.4)	3 700 (1.6)	5 167 (1.6)
Uttar Pradesh	2 582 (0.9)	5 800 (1.7)	8 382 (1.4)	2 438 (1.1)	6 746 (1.4)	9 184 (1.3)
Eastern region	43 (0.9)	68 (2.6)	111 (2.2)	171 (2.7)	217 (2.7)	388 (2.7)
Bihar	193 (1.0)	713 (1.3)	906 (1.2)	474 (1.9)	2 396 (2.1)	2 781 (2.1)
Jharkhand	222 (0.5)	541 (0.4)	763 (0.4)	626 (1.6)	1 679 (1.6)	2 306 (1.6)
Orissa	242 (1.2)	1 001 (1.9)	1 243 (1.8)	651 (3.1)	3 001 (2.6)	3 654 (2.7)
West Bengal	708 (3.0)	1 378 (4.9)	2 086 (4.3)	1 761 (2.9)	3 736 (3.6)	5 497 (3.4)
North-eastern region	71 (1.6)	121 (2.2)	192 (1.9)	154 (2.1)	285 (2.8)	439 (2.5)
Arunachal Pradesh	147 (3.4)	367 (1.9)	515 (2.5)	350 (2.9)	899 (1.7)	1 249 (2.0)
Assam	240 (1.2)	855 (1.3)	1 095 (1.3)	603 (1.5)	2 537 (1.5)	3 140 (1.5)
Manipur	1 059 (1.1)	1 995 (1.1)	3 066 (1.1)	1 271 (1.2)	2 476 (1.7)	3 747 (1.5)
Meghalaya	135 (1.5)	373 (0.3)	509 (0.8)	458 (2.6)	1 202 (1.3)	1 660 (1.7)
Mizoram	285 (2.5)	236 (2.5)	521 (2.5)	835 (4.8)	646 (2.8)	1 482 (4.0)
Nagaland	951 (1.6)	2 069 (3.2)	3 020 (2.7)	902 (1.1)	2 237 (1.6)	3 139 (1.4)
Sikkim	142 (0.2)	469 (2.6)	610 (2.1)	355 (2.3)	1 316 (6.9)	1 672 (5.9)
Tripura	91 (4.4)	448 (6.5)	538 (5.9)	274 (4.4)	1 199 (7.3)	1 474 (6.7)
Western region	129 (2.2)	65 (2.1)	194 (2.2)	167 (2.1)	115 (2.1)	282 (2.1)
Goa	508 (1.4)	420 (1.7)	923 (1.5)	1 655 (1.6)	1 301 (2.4)	2 956 (2.0)
Gujarat	473 (1.5)	626 (2.7)	1 100 (2.3)	1 340 (1.4)	1 718 (1.7)	3 058 (1.6)
Maharashtra	3 683 (1.9)	3 149 (2.0)	6 832 (2.0)	3 760 (1.7)	3 587 (2.3)	7 347 (2.0)
Southern region	25 (0.9)	48 (1.4)	73 (1.2)	201 (2.1)	192 (2.0)	393 (2.1)
Andhra Pradesh	1 961 (2.2)	3 587 (2.6)	5 548 (2.5)	1 975 (2.8)	3923 (2.1)	5 898 (2.4)
Karnataka	1 848 (0.6)	2 502 (0.8)	4 350 (0.7)	1 980 (1.8)	2 893 (1.2)	4 873 (1.5)
Kerala	309 (1.6)	535 (3.2)	844 (2.6)	1 073 (4.3)	1 972 (4.4)	3 045 (4.3)
Tamil Nadu	2 325 (0.4)	2 240 (0.9)	4 566 (0.7)	2 461 (1.4)	2 615 (1.1)	5 077 (1.2)

much higher prevalence of asthma than those with middle school or higher education, while Muslim men and women were more likely to report asthma than Hindu or Others. Asthma prevalence was highest among households with the lowest wealth quintile. Those living in the east (2.6%, 95%CI 2.4–2.9) and north-east regions (2.0%, 95%CI 1.7–2.3) of India had the highest prevalence of asthma and those in the central region had the lowest prevalence (1.3%, 95%CI 1.2–1.5).

Environmental factors and asthma prevalence

People living in semi-*pucca* or *kachha* houses (2.0%, 95%CI 1.9–2.1), who cooked using unclean fuels (2.0%, 95%CI 1.9–2.1) and who lived in households with fewer persons (<2) were more likely to report asthma (2.1%, 95%CI 1.9–2.3).

Effect of body mass index and other lifestyle factors on asthma

The prevalence and adjusted ORs for asthma show a U-shaped distribution, with the lowest rates in those with a normal BMI and higher rates in underweight (OR 2.08, 95%CI 1.73–2.50), overweight (OR 1.52, 95%CI 1.33–1.74) and obese groups (OR 1.67, 95%CI 1.36–2.06). Current tobacco smoking (OR 1.30, 95%CI 1.12–1.50) and reported ever alcohol consumption (OR 1.21, 95%CI 1.05–1.39) were both strongly associated with increased asthma prevalence and higher adjusted ORs. However, people who watched TV almost every day (1.6%, 95%CI 1.5–1.8) had a lower prevalence of asthma than those who did not watch TV at all (2.3%, 95%CI 2.1–2.5).

Effect of diet on asthma

Respondents who never consumed milk/milk products, pulses and beans, green leafy vegetables or fruit were more likely to report asthma than those who consumed them every day. Those who consumed a non-vegetarian diet, daily or even occasionally, were more likely to report asthma than those who were strictly vegetarian.

However, the associations between socio-economic factors (e.g., caste/tribe status, religion, wealth index, rural/urban residence and occupation), environmental factors (e.g., fuel type, house type, availability of a

Table 2 Sample distribution and reported prevalence of asthma among adult men and women by selected characteristics, India, 2005–2006

	Men			Women			Total		
		Asthma prevalence			Asthma prevalence			Asthma prevalence	
Selected characteristic	*n* (%)	Cases *n*	% (95%CI)	*n* (%)	Cases *n*	% (95%CI)	*n* (%)	Cases *n*	% (95%CI)
India	56 742 (100)	1012	1.8 (1.6–2.0)	99 574 (100)	1901	1.9 (1.8–2.0)	157 186 (100)	2913	1.9 (1.8–2.0)
Socio-economic and demographic factors									
Age, years									
20–29	22 842 (40.3)	218	1.0 (0.8–1.2)	43 433 (43.4)	484	1.1 (1.0–1.3)	66 977 (42.6)	752	1.1 (1.0–1.2)
30–39	19 045 (33.6)	337	1.8 (1.5–2.1)	33 970 (33.7)	714	2.1 (1.9–2.3)	52 929 (33.7)	1021	2.0 (1.8–2.2)
40–49	14 855 (26.2)	457	3.1 (2.7–3.5)	22 802 (23.0)	702	3.1 (2.8–3.4)	37 280 (23.7)	1067	3.1 (2.8–3.8)
Marital status									
Currently married	43 133 (76.0)	825	1.9 (1.7–2.1)	86 363 (86.7)	1653	1.9 (1.8–2.0)	123 432 (78.5)	2318	1.9 (1.8–2.0)
Widowed/divorced/ separated/deserted	937 (1.7)	52	5.6 (3.5–8.8)	5 719 (5.7)	165	2.9 (2.4–3.5)	6 549 (4.2)	199	3.3 (2.7–4.0)
Not married	12 672 (22.3)	135	1.1 (0.9–1.3)	7 493 (7.5)	83	1.1 (0.9–1.4)	27 205 (17.3)	323	1.1 (0.9–1.3)
Education*									
Illiterate	11 607 (20.5)	296	2.6 (2.1–3.1)	45 113 (45.3)	939	2.1 (1.9–2.3)	44 996 (28.6)	949	2.2 (2.0–2.4)
Literate, < middle school	10 030 (17.7)	229	2.3 (1.9–2.8)	14 463 (14.5)	305	2.1 (1.8–2.4)	23 423 (14.9)	512	2.2 (1.9–2.5)
Completed middle school	26 783 (47.2)	411	1.5 (1.3–1.8)	31 665 (31.8)	542	1.7 (1.5–1.9)	66 355 (42.2)	1097	1.6 (1.5–1.8)
Completed high school and above	8 311 (14.7)	77	0.9 (0.7–1.3)	8 328 (8.4)	114	1.4 (1.1–1.7)	22 381 (14.2)	282	1.2 (1.0–1.4)
Employment status									
Not employed	3 945 (7.0)	66	1.7 (1.2–2.3)	60 897 (61.2)	1097	1.8 (1.7–1.9)	67 066 (42.7)	1210	1.8 (1.7–1.9)
Employed	52 780 (93.0)	946	1.8 (1.6–2.0)	38 539 (38.8)	799	2.1 (1.9–2.3)	89 908 (57.3)	1625	1.9 (1.8–2.0)
Religion									
Hindu	46 727 (82.4)	804	1.7 (1.6–1.9)	80 648 (81.1)	1493	1.9 (1.7–2.0)	115 231 (73.4)	2012	1.8 (1.7–1.9)
Muslim	6 841 (12.1)	158	2.3 (1.8–3.0)	12 940 (13.0)	289	2.2 (1.9–2.6)	20 054 (12.8)	364	2.3 (2.0–2.6)
Other†	3 166 (5.6)	51	1.6 (1.1–2.3)	5 877 (5.9)	116	2.0 (1.6–2.4)	21 757 (13.9)	462	1.8 (1.6–2.2)
Caste/Tribes‡									
Scheduled Caste	10 726 (19.5)	204	1.9 (1.5–2.4)	18 386 (19.0)	315	1.7 (1.5–2.0)	26 013 (17.3)	456	1.8 (1.6–2.0)
Scheduled Tribe	4 710 (8.6)	110	2.3 (1.8–3.1)	7 935 (8.2)	153	1.9 (1.6–2.4)	19 901 (13.2)	421	2.1 (1.8–2.5)
Other Backward Class	22 047 (40.1)	316	1.4 (1.2–1.7)	39 236 (40.6)	682	1.7 (1.6–1.9)	52 152 (34.6)	861	1.6 (1.5–1.8)
Others	17 495 (31.8)	338	1.9 (1.7–2.3)	31 019 (32.1)	681	2.2 (2.0–2.4)	52 611 (34.9)	9891	2.1 (1.9–2.3)
Wealth index									
Lowest	9 103 (16.0)	246	2.7 (2.2–3.3)	17 286 (17.4)	334	1.9 (1.7–2.2)	16 726 (10.6)	358	2.2 (2.0–2.5)
Second	10 205 (18.0)	193	1.9 (1.5–2.4)	18 546 (18.6)	389	2.1 (1.8–2.4)	21 795 (13.9)	421	2.0 (1.8–2.3)
Middle	11 533 (20.3)	187	1.6 (1.3–2.0)	19 698 (19.8)	368	1.9 (1.6–2.1)	29 922 (19.0)	565	1.8 (1.6–2.0)
Fourth	12 634 (22.3)	218	1.7 (1.4–2.1)	20 925 (21.0)	394	1.9 (1.7–2.1)	39 116 (24.9)	685	1.8 (1.6–2.0)
Highest	13 266 (23.4)	167	1.3 (1.0–1.5)	23 119 (23.2)	416	1.8 (1.6–2.0)	49 627 (31.6)	811	1.6 (1.5–1.8)
Residence									
Urban	20 779 (36.6)	297	1.4 (1.2–1.7)	33 355 (33.5)	608	1.8 (1.7–2.0)	75 868 (48.3)	1289	1.7 (1.5–1.8)
Rural	35 963 (63.4)	715	2.0 (1.8–2.2)	66 219 (66.5)	1293	2.0 (1.8–2.1)	81 318 (51.7)	1551	2.0 (1.9–2.1)
Geographic region									
North	12 603 (22.2)	194	1.5 (1.3–1.8)	13 286 (13.3)	181	1.4 (1.2–1.6)	34 018 (21.6)	408	1.5 (1.3–1.6)
North-east	2 313 (4.1)	42	1.8 (1.4–2.4)	3 978 (4.0)	83	2.1 (1.8–2.5)	27 452 (17.5)	631	2.0 (1.7–2.3)
Central	12 971 (22.9)	169	1.3 (1.1–1.6)	22 250 (22.3)	295	1.3 (1.1–1.5)	29 048 (18.5)	360	1.3 (1.2–1.5)
East	11 810 (20.8)	298	2.5 (2.1–3.1)	21 913 (22.0)	580	2.7 (2.4–3.0)	19 349 (12.3)	499	2.6 (2.4–2.9)
West	9 279 (16.4)	191	2.1 (1.7–2.5)	15 052 (15.1)	279	1.9 (1.6–2.2)	22 240 (14.1)	476	1.9 (1.7–2.2)
South	7 767 (13.7)	117	1.5 (1.2–2.0)	23 096 (23.2)	482	2.1 (1.9–2.3)	25 079 (16.0)	466	1.9 (1.8–2.2)
Environmental factors									
Cooking fuel use§									
Clean	18 020 (31.8)	254	1.4 (1.2–1.7)	29 647 (29.8)	507	1.7 (1.5–1.9)	68 200 (43.4)	1134	1.6 (1.5–1.7)
Unclean	38 711 (68.2)	758	2.0 (1.8–2.2)	69 914 (70.2)	1393	2.0 (1.9–2.1)	88 963 (56.6)	1706	2.0 (1.9–2.1)
House type¶									
Pucca	28 329 (50.2)	435	1.5 (1.4–1.7)	48 178 (48.6)	898	1.9 (1.7–2.0)	86 114 (55.1)	1452	1.7 (1.6–1.9)
Semi-*pucca*/*kachha*	28 111 (49.8)	571	2.0 (1.8–2.3)	50 930 (51.4)	1000	2.0 (1.8–2.1)	70 038 (44.9)	1375	2.0 (1.9–2.1)
Availability of a separate kitchen									
No	17 028 (39.8)	312	1.8 (1.6–2.2)	28 381 (38.3)	484	1.7 (1.5–1.9)	41 094 (32.8)	727	1.8 (1.6–1.9)
Yes	25 708 (60.2)	401	1.6 (1.4–1.8)	45 670 (61.7)	881	1.9 (1.8–2.1)	84 346 (67.2)	1446	1.8 (1.7–1.9)
Crowding, persons/room									
<2	12 762 (22.5)	218	1.7 (1.4–2.1)	21 429 (21.5)	486	2.3 (2.0–2.5)	41 526 (26.4)	803	2.1 (1.9–2.3)
2–4	27 168 (47.9)	487	1.8 (1.6–2.0)	47 881 (48.1)	903	1.9 (1.7–2.1)	75 113 (47.8)	1326	1.9 (1.7–2.0)
⩾4	16 786 (29.6)	307	1.8 (1.6–2.2)	30 191 (30.3)	510	1.7 (1.5–1.9)	40 416 (25.7)	708	1.7 (1.6–1.9)

(*continued*)

Table 2 (*Continued*)

Selected characteristic	Men			Women			Total		
		Asthma prevalence			Asthma prevalence			Asthma prevalence	
	n (%)	Cases *n*	% (95%CI)	*n* (%)	Cases *n*	% (95%CI)	*n* (%)	Cases *n*	% (95%CI)
BMI and lifestyle factors									
BMI, kg/m$^{2\#}$									
<16	1983 (3.5)	105	5.3 (4.0–7.1)	5763 (5.8)	209	3.6 (3.0–4.4)	6111 (3.9)	210	4.1 (3.5–4.8)
16.0–16.9	3491 (6.2)	71	2.0 (1.5–2.8)	7731 (7.8)	139	1.8 (1.4–2.3)	9014 (5.7)	185	1.9 (1.6–2.2)
17.0–18.4	6424 (11.3)	135	2.1 (1.6–2.7)	11497 (11.6)	174	1.5 (1.2–1.9)	14782 (9.4)	247	1.7 (1.5–2.0)
18.5–22.9	30076 (53.0)	486	1.6 (1.4–1.8)	46892 (47.1)	716	1.5 (1.4–1.7)	76894 (48.9)	1204	1.6 (1.4–1.7)
23.0–24.9	5635 (9.9)	89	1.6 (1.2–2.2)	9454 (9.5)	199	2.1 (1.8–2.5)	17629 (11.2)	310	1.9 (1.6–2.2)
25.0–29.9	5080 (9.0)	82	1.6 (1.2–2.2)	10978 (11.0)	295	2.7 (2.3–3.1)	19282 (12.3)	462	2.4 (2.1–2.7)
⩾30	811 (1.4)	18	2.2 (1.1–4.5)	3191 (3.2)	103	3.2 (2.6–4.1)	5003 (3.2)	137	3.0 (2.4–3.8)
Data missing	3242 (5.7)	27	0.8 (0.5–1.4)	4016 (4.0)	62	1.5 (1.1–2.1)	8430 (5.4)	83	1.2 (0.9–1.6)
Tobacco smoking									
Not smoking	35422 (62.4)	512	1.5 (1.3–1.6)	97738 (98.2)	71	1.9 (1.8–2.0)	134542 (85.6)	2337	1.8 (1.7–1.9)
Currently smoking	21321 (37.6)	500	2.4 (2.1–2.7)	1835 (1.8)	1830	3.9 (2.8–5.3)	22644 (14.6)	503	2.5 (2.2–2.8)
Alcohol consumption									
Never	35915 (63.3)	608	1.7 (1.5–1.9)	97101 (97.5)	1834	1.9 (1.8–2.0)	131662 (83.8)	2322	1.8 (1.7–1.9)
Ever	20825 (36.7)	404	1.9 (1.7–2.2)	2473 (2.5)	66	2.7 (2.0–3.7)	25522 (16.2)	518	2.0 (1.8–2.3)
Frequency of watching TV									
Not at all	10517 (18.5)	295	2.8 (2.3–3.4)	35399 (35.6)	754	2.1 (1.9–2.4)	33403 (21.3)	741	2.3 (2.1–2.5)
Less than once a week	11420 (20.1)	191	1.7 (1.4–2.1)	10438 (10.5)	185	1.8 (1.5–2.1)	19641 (12.5)	345	1.7 (1.5–2.0)
At least once a week	9081 (16.0)	170	1.9 (1.5–2.3)	10952 (11.0)	195	1.8 (1.5–2.1)	21060 (13.4)	378	1.8 (1.6–2.1)
Almost every day	25717 (45.3)	357	1.4 (1.2–1.6)	42763 (43.0)	767	1.8 (1.7–2.0)	83055 (52.8)	1376	1.6 (1.5–1.8)
Dietary intake									
Milk or milk products									
Daily	26307 (46.4)	343	1.3 (1.1–1.5)	40366 (40.5)	667	1.7 (1.5–1.8)	66128 (42.1)	968	1.5 (1.4–1.6)
Weekly	11554 (20.4)	241	2.1 (1.7–2.5)	15071 (15.1)	253	1.7 (1.4–2.0)	26575 (16.9)	467	1.9 (1.6–2.1)
Occasionally	14757 (26.0)	296	2.0 (1.7–2.4)	32918 (33.1)	664	2.0 (1.8–2.2)	46541 (29.6)	925	2.0 (1.9–2.2)
Never	4114 (7.3)	132	3.2 (2.4–4.3)	11202 (11.3)	316	2.8 (2.5–3.2)	17911 (11.4)	480	2.9 (2.6–3.3)
Pulses and beans									
Daily	29863 (52.6)	511	1.7 (1.5–1.9)	52440 (52.7)	954	1.8 (1.7–2.0)	78898 (50.2)	1389	1.8 (1.7–1.9)
Weekly	21705 (38.3)	388	1.8 (1.5–2.1)	36597 (36.8)	715	2.0 (1.8–2.2)	59040 (37.6)	1045	1.9 (1.8–2.1)
Occasionally	4660 (8.2)	99	2.1 (1.6–2.9)	9663 (9.7)	200	2.1 (1.8–2.5)	17500 (11.1)	362	2.1 (1.8–2.4)
Never	505 (0.9)	14	2.8 (1.3–6.1)	852 (0.9)	30	3.5 (2.3–5.6)	1716 (1.1)	44	3.3 (2.2–4.5)
Green leafy vegetables									
Daily	33982 (59.9)	595	1.8 (1.6–2.0)	64095 (64.4)	1178	1.8 (1.7–2.0)	99070 (63.0)	1736	1.8 (1.7–1.9)
Weekly	19270 (34.0)	343	1.8 (1.5–2.1)	28606 (28.7)	581	2.0 (1.8–2.3)	47171 (30.0)	880	1.9 (1.8–2.1)
Never/Occasionally	3480 (6.1)	73	2.1 (1.5–2.9)	6840 (6.9)	142	2.1 (1.7–2.5)	10896 (6.9)	224	2.1 (1.8–2.5)
Fruits									
Daily	7320 (12.9)	104	1.4 (1.1–1.8)	12789 (12.9)	191	1.5 (1.3–1.8)	27557 (17.5)	382	1.5 (1.3–1.7)
Weekly	19368 (34.1)	261	1.3 (1.1–1.6)	26731 (26.9)	474	1.8 (1.6–2.0)	51389 (32.7)	802	1.6 (1.5–1.8)
Occasionally	28484 (50.2)	561	2.0 (1.7–2.2)	56336 (56.6)	1127	2.0 (1.9–2.2)	74118 (47.2)	1534	2.0 (1.9–2.1)
Never	1546 (2.7)	86	5.6 (3.9–7.9)	3631 (3.6)	108	3.0 (2.3–3.8)	4024 (2.6)	122	3.8 (3.0–4.6)
Eggs									
Daily	2931 (5.2)	39	1.3 (0.9–2.1)	3475 (3.5)	81	2.3 (1.8–3.1)	8217 (5.2)	174	1.9 (1.5–2.4)
Weekly	20682 (36.5)	392	1.9 (1.7–2.2)	28778 (28.9)	584	2.0 (1.8–2.3)	52531 (33.4)	990	2.0 (1.8–2.1)
Occasionally	19786 (34.9)	385	1.9 (1.7–2.3)	32635 (32.8)	643	2.0 (1.8–2.2)	54375 (34.6)	999	0.4 (0.1–1.3)
Never	13330 (23.5)	196	1.5 (1.2–1.8)	34647 (34.8)	591	1.7 (1.5–1.9)	41996 (26.7)	674	1.6 (1.5–1.8)
Fish									
Daily	3706 (6.5)	78	2.1 (1.5–2.9)	6505 (6.5)	194	3.0 (2.5–3.5)	12877 (8.2)	339	2.7 (2.3–3.1)
Weekly	14414 (25.4)	298	2.1 (1.7–2.5)	22070 (22.2)	497	2.3 (2.0–2.5)	40159 (25.6)	794	2.2 (2.0–2.4)
Occasionally	21818 (38.5)	388	1.8 (1.5–2.1)	34242 (34.4)	655	1.9 (1.7–2.1)	56280 (35.8)	1012	1.9 (1.7–2.0)
Never	16782 (29.6)	248	1.5 (1.3–1.8)	36724 (36.9)	554	1.5 (1.4–1.7)	47804 (30.4)	695	1.5 (1.4–1.6)
Chicken or meat									
Daily	706 (1.2)	16	2.3 (1.3–3.9)	839 (0.8)	10	1.2 (0.6–2.4)	3133 (2.0)	48	1.6 (1.1–2.5)
Weekly	15609 (27.5)	271	1.7 (1.5–2.0)	21938 (22.0)	453	2.1 (1.8–2.3)	44620 (28.4)	841	1.9 (1.8–2.1)
Occasionally	26135 (46.1)	534	2.0 (1.8–2.3)	42222 (42.0)	886	2.1 (1.9–2.3)	66233 (42.2)	1321	2.1 (1.9–2.2)
Never	14272 (25.2)	191	1.3 (1.1–1.6)	34537 (34.7)	552	1.6 (1.4–1.8)	43131 (27.5)	629	1.5 (1.4–1.7)

*Illiterate = 0 years of education; literate but completed < middle school = 1–5 years of education; completed middle school = 6–8 years of education; completed high school or more = ⩾9 years of education.
†Sikh, Buddhist, Christian, Jain, Jewish, Zoroastrian.
‡Scheduled Castes and Scheduled Tribes are identified by the Government of India as socially and economically backward and needing protection from social injustice and exploitation; 'Other Backward Class' is a diverse collection of intermediate castes that were considered low in the traditional caste hierarchy but are clearly above Scheduled Caste; 'Others' is a default residual group that enjoys higher status in the caste hierarchy (see Appendix).
§Clean fuels = kerosene, liquefied petroleum gas/natural gas, biogas or electricity; unclean fuels = biomass fuels such as wood, straw/shrubs/grass, agricultural crop waste, dung cakes, others; and solid fuels such as coal/lignite or charcoal.
¶*Pucca* houses are made from high-quality materials such as bricks, tiles, cement and concrete throughout, including roof, walls and floor; *kachha* houses are made from mud, thatch or other low-quality materials; semi-*pucca* houses are made from a combination of the above.
#In NFHS-3, all respondents were weighed using a solar-powered scale with an accuracy of ±100 g. Their height was measured using an adjustable wooden measuring board, specifically designed to provide accurate measurements (to the nearest 0.1 cm). Women who were pregnant at the time of the survey or who had given birth during the 2 months preceding the survey, were excluded from these anthropometric measurements.
CI = confidence interval; BMI = body mass index; NFHS-3 = National Family Health Survey 3.

separate kitchen and crowding) and dietary intake (e.g., pulses and beans, eggs and fish) and risk of reported asthma were attenuated in the adjusted logistic analyses.

Sex differences

To examine the sex differences in the adjusted effect of asthma prevalence, we also carried out separate analyses for men and women (data not shown). Women who used unclean fuels for cooking were 1.3 times (95%CI 1.05–1.55, $P = 0.014$) more likely to report asthma than women who used clean fuels for cooking. We also observed a higher risk of asthma (OR 1.14, 95%CI 1.00–1.30, $P = 0.051$) among women in households that had a separate kitchen. Not surprisingly, these effects were not observed among men (Appendix Table).

DISCUSSION

In this large-scale nationwide cross-sectional study, we identified three main sets of findings relating to 1) overall self-reported asthma prevalence; 2) geographical differences in prevalence; and 3) risk factors for prevalence.

First, we found that the prevalence of self-reported asthma in this large, nationally representative survey was low (1.9%, 95%CI 1.8–2.0) compared to earlier studies.[16,17] Second, we found striking geographical differences and differences between specific states in asthma prevalence. Prevalence ratios varied, and were as high as three fold in women in Sikkim, a north-eastern state (5.9% compared to a national average of 1.9%). These substantial differences (15 fold between Tripura and Tamil Nadu, and about three fold between the north-eastern region overall and the central region) clearly warrant further investigation. State-specific analysis using multilevel methods could be conducted to explore the substantial differences in asthma prevalence in Indian states. Some potential explanations for these differences are that the north-eastern states have a very high prevalence of smoking and drinking, along with a high Scheduled Tribe population and poorer access to health care services compared to the rest of India. In Tripura, a study reported very high incidence rates of acute respiratory infection in children,[20] with a high number of cases of malnutrition, which could also be the cause of high rates of respiratory problems in the adult population, as Tripura has a relatively high proportion of malnourished adults (the proportion of adults with BMI < 18.5 kg/m^2 is 36.9% among women and 41.7% among men).[18]

We also found a high prevalence of asthma in rural India, contrary to findings in industrialised countries, where a lower prevalence of asthma is found in individuals brought up in rural farming environments.[21] Several earlier studies in India have also found a significant burden of asthma-associated symptoms in children and adults in rural India.[9,17,22] A study of the respiratory disease burden in rural India found that bronchitis and asthma were the leading causes of death.[23] Major causative agents that may be implicated in this difference between industrialised countries and India include poor housing conditions, pollen, grains, fungal spores, insect debris, animal epithelia and bed dust allergies.[24] Insects commonly seen in rural households in India, such as flies, cockroaches, mosquitoes and moths, also significantly influence bronchial asthma. Furthermore, indoor air pollution due to use of biomass fuels is high in rural India.[25]

Third, we identified a number of specific risk factors for asthma prevalence. The finding that people with a higher BMI ($\geqslant$25 kg/m^2) have a substantially higher risk of asthma is consistent with other evidence, some from prospective cohort studies in the West[26] and cross-sectional studies from developing countries.[27] Underweight ($\leqslant$17 kg/m^2) persons also have a significantly higher risk of asthma than those with a normal BMI in our study, consistent with greater vulnerability of undernourished populations in developing countries to a host of other diseases.[28]

The finding that current tobacco smoking is associated with a significantly increased risk of asthma is also consistent with previous research.[27] A positive significant effect of biomass fuel use on asthma among women (but not men) is also consistent with previous research linking cooking smoke to asthma.[27,29]

We found that widowed/divorced/separated/deserted persons were more likely to report asthma than those who were married. As with divorce, separation is often viewed as stressful, and there is growing evidence highlighting the potential role of emotional stress in asthma development; recent evidence from prospective studies has found associations between stress and new-onset asthma in adults,[30] potentially mediated through physiological pathways.

With regard to dietary factors, positive associations of asthma with meat consumption were observed. These associations have also been observed in several studies in Western countries, where increased consumption of meat and fast food have been suggested to be risk factors for asthma.[31] A study among Indian schoolchildren also identified consumption of meat or fast food once or more per week as a risk factor for current wheeze or asthma.[16] Our study shows that high fish consumption was associated with higher prevalence of asthma, which may be correlated with the state-level findings of asthma prevalence. We found a high prevalence of asthma in the coastal states of West Bengal and Kerala, which have high fish consumption rates. Increased consumption of fruit and vegetables has been suggested to be associated with reduced asthma prevalence, and lower intakes of milk, vegetables, fibre, vitamin E, magnesium, calcium, sodium and potassium were significantly related to asthma,[32] consistent with our study.

The strengths of our study include the large nationally representative study sample, which allows comparisons to be made between states and urban vs. rural settings, and the ability to examine socioeconomic and lifestyle patterns of asthma risk. However, due to the general challenges of measuring asthma in population-based studies,[33] the measurement of asthma in the NFHS also has apparent limitations. The NFHS measure of asthma prevalence was based on a single question, in contrast to a hierarchy of asthma/wheeze outcomes based on responses to standardised respiratory questionnaires. No effort was made to clinically test for asthma nor to inquire whether the response was based on a physician's diagnosis. Given the marked variation in recognition and presentation to a physician by an individual with recurrent wheezing or asthma episodes, considerable differences in diagnostic labelling and treatment by doctors between populations[34] and suboptimal levels of access to health care, physician-diagnosed asthma prevalence or use of asthma medication is equally problematic in the Indian context.[35] Furthermore, neither asthma severity nor the frequency of asthma attacks were ascertained. Overall, the NFHS data appear to underestimate asthma prevalence compared with other studies in India,[16,17] including those from the International Study of Asthma and Allergies in Childhood (ISAAC),[4] although prevalence is similar to those of other countries in the subcontinent, such as Bangladesh and Nepal.[36,37] These limitations affect the usefulness of the NFHS for estimating the burden of asthma prevalence. However, in collecting wide-ranging social, demographic, environmental, lifestyle and diet data, and as it is nationally representative, the NFHS provides a unique opportunity to draw descriptive conclusions about the social distribution and patterning of asthma risk in India. Furthermore, it seems unlikely that such under-reporting would explain the differences in prevalence observed between subgroups of people who took part in the NFHS survey.

Other possible sources of bias should be considered when interpreting the findings of this study. First, asthma prevalence was based on self-reports of asthma itself rather than asthma symptoms, and respondents were more likely to report some disease conditions such as chronic bronchitis or chronic obstructive pulmonary disease with similar symptoms to asthma due to their lack of awareness, low educational status and hesitation to disclose diseases. However, rigorous efforts were made in the NFHS-3 to obtain reliable self-reported data: the survey used local terminology and commonly understood terms to describe the disease, rigorously trained interviewers, supervisors and standard quality checks. Furthermore, the problem of misclassification of asthma and other respiratory conditions could affect prevalence estimates, but are unlikely to have biased regional comparisons or the analyses of associations with risk factors. Second, information on environmental exposures was obtained retrospectively and could be subject to recall bias. However, this would only occur if the recall of particular exposures was different in adults with asthma symptoms than in adults without asthma symptoms. This is generally unlikely to be the case for those risk factors that we have identified. Third, 24 potential risk factors were investigated. Thus, for each symptom, one would expect one or two findings to be statistically significant by chance alone. However, one would expect less than one finding per analysis to be significantly positive by chance alone, and all of the analyses had more than one finding that was statistically significant.

CONCLUSIONS

The latest NFHS-3 data provide a unique opportunity to study the associations between different modifiable risk factors and asthma in India. Risk factors for self-reported asthma identified in this survey include meat consumption, above/below average BMI, tobacco smoking and alcohol consumption. Protective factors include regular consumption of milk/milk products, vegetables and fruit. With the exception of the findings for BMI, most of these associations, however, are relatively weak and account for only a small proportion of cases. There are also wide regional variations in the prevalence of asthma in India, as well as urban-rural differences; the reasons for these are unclear and require further investigation.

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APPENDIX

CASTES AND TRIBES IN INDIA

In NFHS-3, the information on caste/tribe status was based on head of household's self-identification as belonging to a Scheduled Caste, Scheduled Tribe, Other Backward Class or other caste. Although there is a substantial degree of heterogeneity within each category, these categories are routinely used for population-based monitoring.[1]

'Scheduled Castes' are castes that the Government of India identifies as socially and economically backward and in need of special protection from social injustice and exploitation. They are explicitly recognised by the Constitution of India, were previously called the 'depressed classes' by the British and are otherwise known as 'untouchables' or 'dalits'.[2] Scheduled Castes comprise over 16% of India's total population. Scheduled Castes are the lowest castes in the traditional Hindu caste hierarchy, and as a consequence they experience intense social and economic segregation and disadvantages.[3,4] Occupationally, most Scheduled Castes are landless agricultural labourers or are engaged in what were traditionally considered to be ritually polluting occupations.[5]

The Constitution of India has recognised certain ethnic groups as 'Scheduled Tribes'. The Government of India identifies communities as Scheduled Tribes based on a community's 'primitive traits, distinctive culture, shyness with the public at large, geographical isolation and social and economic backwardness', with substantial variations in each of these dimensions with respect to different Scheduled Tribe communities.[6] Through a constitutional mandate formulated in 1950, Scheduled Tribes have been formally recognised as a distinct community in India.[7] There are clear government policies for affirmative action targeted at Scheduled Tribes,[2] and their members are routinely enumerated in national surveys[8] and censuses.[9] Scheduled Tribes consist of approximately 700 tribes that tend to be geographically isolated and have limited economic and social interaction with the rest of the population.[4] Although they are ethnically distinct, their physical isolation has been the main criterion used to identify communities as Scheduled Tribes and to treat them as beneficiaries of affirmative action.[4]

'Other Backward Class' comprises a diverse collection of 'intermediate' castes that were considered low in the traditional caste hierarchy but clearly above the Scheduled Castes.[10] Other Backward Classes are described as 'socially and educationally backward classes', and the government is enjoined to ensure their social and educational development. Under Article 340 of the Indian Constitution, it is obligatory for the government to promote the welfare of the Other Backward Classes.

'Other caste' is thus a default residual group (i.e., persons who do not belong to a Scheduled Caste, Scheduled Tribe or Other Backward Class) that enjoys higher status in the caste hierarchy.

Scheduled Tribes and Scheduled Castes are the most socially disadvantaged groups and have traditionally been identified by the Indian government as needing affirmative action.[8] According to the central government policy, Scheduled Tribe, Scheduled Caste and Other Backward Class are the three categories entitled to positive discrimination. Sometimes these three categories are together defined as 'backward classes'. On the other hand, the general population in India are known as 'forward classes', which generally denote peoples, communities and castes from any religion who do not currently qualify for Government of India Reservation benefits (i.e., set quotas for political representation) for Scheduled Castes, Scheduled Tribes and Other Backward Classes. The list presented by the commission for Scheduled Castes, Scheduled Tribes and Other Backward Classes is dynamic (classes and communities can be added or removed) and will change from time to time depending on social, educational and economic factors.

THE CONSTRUCTION OF THE WEALTH INDEX

One of the background characteristics used in this study is an index of the economic status of households, called the wealth index. The wealth index has been developed and tested in a large number of countries in relation to inequalities in household income, use of health services and health outcomes (Rutstein S, Johnson K, Gwatkin D. Poverty, health inequality, and its health and demographic effects. Paper presented at the 2000 Annual Meeting of the Population Association of America, Los Angeles, CA, USA, 2000). It is an indicator of the level of wealth that is consistent with expenditure and income measures.[11] The economic index was constructed using household asset data and housing characteristics such as electrification, type of windows, drinking water source, type of toilet facility, type of flooring, material of exterior walls, type of roofing, cooking fuel, house ownership, number of household members per sleeping room, ownership of a bank or post-office account, and ownership of a mattress, a pressure cooker, a chair, a cot/bed, a table, an electric fan, a radio/transistor, a black and white television, a colour television, a sewing machine, a mobile telephone, any other telephone, a computer, a refrigerator, a watch or clock, a bicycle, a motorcycle or scooter, an animal-drawn cart, a car, a water pump, a thresher and a tractor.

Each household asset is assigned a weight (factor score) generated through principal components analysis, and the resulting asset scores are standardised in relation to a normal distribution, with a mean of zero and standard deviation of one.[12] Each household is then assigned a score for each asset, and the scores

were summed for each household; individuals are ranked according to the score of the household in which they reside. The sample is then divided into quintiles, i.e., five groups with an equal number of individuals in each. In NFHS-3, one wealth index has been developed for the whole sample and for the country as a whole. Thus, at the national level, 20% of the household population is in each wealth quintile, although this is not necessarily true at the state level.

QUESTION ON COOKING FUELS

NFSH-3 used a 10-item classification of cooking fuel: electricity, liquefied petroleum gas (LPG)/natural gas, biogas, kerosene, coal/lignite, charcoal, wood, straw/shrubs/grass, agricultural crop waste, dung cakes and a residual category of other fuels (unknown). The question asked was 'What type of fuel does your household mainly use for cooking?', followed by the above list of fuels. We used information from the above questions to group households into two categories representing the extent of exposure to cooking smoke: unclean fuels, which cause high and medium exposure (households using either biomass fuels: wood, straw/shrubs/grass, agricultural crop waste, dung cakes, others; or solid fuels: coal/lignite and charcoal), and cleaner fuels, which cause low exposure (households using only cleaner fuels: kerosene, liquefied petroleum gas/natural gas, biogas or electricity). This two category classification of cooking fuels, i.e., unclean and clean fuels, is used in this study.

QUESTION ON TOBACCO SMOKING

The survey also collected information on the use of tobacco directly by asking respondents to report on their own tobacco use. All eligible men and women who were interviewed were asked four specific questions on current use of tobacco (smoke and non-smoke variants): 'Do you currently smoke cigarettes or *bidis*?', 'In the last 24 hours, how many cigarettes or *bidis* have you smoked?', 'Do you currently smoke or use tobacco in another form?', and 'In what other form do you currently smoke or use tobacco?'. The information from these four questions was used to ascertain exposure to tobacco smoke: yes, active smoker (person currently smokes) and non smoker (the person has never smoked). However, past smoking was not ascertained.

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Table A Demographic, environmental, lifestyle and dietary covariates of asthma risk; multivariate analysis unadjusted and adjusted ORs and 95%CIs, India, 2005–2006

Characteristic	Unadjusted OR (95%CI)	Adjusted* OR (95%CI)
Socio-economic and demographic factors		
Sex		
Male†	1.00	1.00
Female	1.19 (1.10–1.28)	1.24 (1.08–1.43)
Age, years		
20–29†	1.00	1.00
30–39	1.73 (1.58–1.90)	1.60 (1.42–1.81)
40–49	2.59 (2.36–2.85)	2.30 (2.02–2.61)
Marital status		
Currently married†	1.00	1.00
Widowed/divorced/ separated/deserted	1.64 (1.41–1.90)	1.22 (1.02–1.46)
Not married	0.63 (0.56–0.71)	1.09 (0.93–1.27)
Education		
Illiterate†	1.00	1.00
Literate, <middle school	1.04 (0.93–1.16)	1.07 (0.93–1.23)
Completed middle school	0.78 (0.72–0.85)	0.95 (0.83–1.09)
Completed high school and above	0.59 (0.52–0.68)	0.80 (0.66–0.98)
Employment status		
Not employed†	1.00	1.00
Employed	1.00 (0.93–1.08)	0.99 (0.89–1.10)
Religion		
Hindu†	1.00	1.00
Muslim	1.04 (0.93–1.16)	0.96 (0.82–1.13)
Other	1.22 (1.10–1.35)	1.15 (0.99–1.34)
Caste/Tribes		
Scheduled Caste†	1.00	1.00
Scheduled Tribes	1.21 (1.06–1.38)	1.02 (0.85–1.22)
Other Backward Class	0.94 (0.84–1.06)	0.98 (0.85–1.13)
Others	1.07 (0.95–1.19)	1.10 (0.96–1.27)
Wealth index		
Lowest†	1.00	1.00
Second	0.90 (0.78–1.04)	0.97 (0.80–1.17)
Middle	0.88 (0.77–1.01)	0.95 (0.78–1.16)
Fourth	0.82 (0.72–0.93)	0.90 (0.71–1.14)
Highest	0.76 (0.67–0.86)	0.93 (0.70–1.23)
Residence		
Urban†	1.00	1.00
Rural	1.13 (1.04–1.21)	1.01 (0.89–1.14)
Geographic region		
North	0.64 (0.56–0.73)	0.64 (0.55–0.75)
North-east	1.24 (1.10–1.40)	1.07 (0.89–1.28)
Central	0.66 (0.58–0.76)	0.64 (0.54–0.76)
East	1.40 (1.23–1.59)	1.11 (0.93–1.31)
West	1.16 (1.02–1.31)	1.17 (1.01–1.37)
South†	1.00	1.00
Environmental factors		
Cooking fuel use		
Clean†	1.00	1.00
Unclean	1.16 (1.07–1.25)	0.99 (0.85–1.15)
House type		
Pucca†	1.00	1.00
Semi-*pucca*/*kachha*	1.17 (1.08–1.26)	0.93 (0.81–1.07)
Availability of separate kitchen		
Yes†	1.00	1.00
No	0.97 (0.89–1.06)	1.01 (0.91–1.12)
Crowding, persons/room		
<2†	1.00	1.00
2–4	0.91 (0.83–1.00)	0.94 (0.84–1.04)
⩾4	0.90 (0.82–1.00)	0.89 (0.78–1.02)
BMI and lifestyle factors		
BMI, kg/m^2		
<16	3.58 (2.77–4.62)	2.08 (1.73–2.50)
16–17	2.11 (1.62–2.73)	1.36 (1.13–1.64)
17–18.5	1.71 (1.33–2.19)	1.12 (0.97–1.34)
18.5–23†	1.00	1.00
23–25	1.60 (1.28–2.00)	1.06 (0.91–1.24)
25–30	1.80 (1.41–2.30)	1.52 (1.33–1.74)
⩾30	2.47 (1.95–3.12)	1.67 (1.36–2.06)
Data missing	2.83 (2.15–3.73)	0.57 (0.43–0.76)
Tobacco smoking		
Non-smoker†	1.00	1.00
Current smoker	1.29 (1.17–1.42)	1.30 (1.12–1.50)
Alcohol consumption		
Never†	1.00	1.00
Ever	1.15 (1.05–1.27)	1.21 (1.05–1.39)
Frequency of watching television		
Not at all†	1.00	1.00
Less than once a week	1.35 (1.23–1.47)	0.82 (0.69–0.97)
At least once a week	1.06 (0.94–1.20)	0.93 (0.79–1.10)
Almost every day	1.09 (0.97–1.22)	0.95 (0.82–1.10)
Dietary intake		
Milk or milk products		
Daily	1.36 (1.22–1.52)	0.75 (0.64–0.87)
Weekly	0.73 (0.67–0.80)	0.78 (0.67–0.92)
Occasionally	0.88 (0.79–0.99)	0.88 (0.77–1.02)
Never†	1.00	1.00
Pulses and beans		
Daily	1.25 (0.91–1.71)	0.98 (0.66–1.46)
Weekly	0.85 (0.76–0.95)	0.87 (0.59–1.29)
Occasionally	0.85 (0.76–0.96)	0.91 (0.61–1.37)
Never†	1.00	1.00
Green leafy vegetables		
Daily	1.10 (0.95–1.28)	0.79 (0.66–0.93)
Weekly	0.94 (0.86–1.02)	0.91 (0.76–1.09)
Never/occasionally†	1.00	1.00
Fruit		
Daily	1.48 (1.23–1.78)	0.59 (0.45–0.77)
Weekly	0.67 (0.59–0.75)	0.63 (0.49–0.81)
Occasionally	0.75 (0.69–0.82)	0.84 (0.66–1.06)
Never†	1.00	1.00
Eggs		
Daily	0.87 (0.79–0.96)	1.22 (0.95–1.56)
Weekly	1.16 (0.98–1.36)	0.99 (0.83–1.19)
Occasionally	1.03 (0.94–1.12)	0.94 (0.79–1.11)
Never†	1.00	1.00
Fish		
Daily	0.81 (0.73–0.89)	1.07 (0.86–1.34)
Weekly	1.48 (1.30–1.67)	0.87 (0.72–1.06)
Occasionally	1.10 (1.00–1.21)	0.86 (0.72–1.03)
Never†	1.00	1.00
Chicken or meat		
Daily	0.73 (0.66–0.80)	0.84 (0.55–1.27)
Weekly	0.76 (0.57–1.02)	1.31 (1.06–1.63)
Occasionally	0.94 (0.86–1.03)	1.26 (1.03–1.54)
Never†	1.00	1.00

*Adjusted for all other variables in the table.
†Reference category.
OR = odds ratio; CI = confidence interval; BMI = body mass index.

RÉSUMÉ

CONTEXTE ET MÉTHODES : Nous avons estimé la prévalence auto-rapportée de l'asthme chez les Indiens adultes et examiné plusieurs facteurs de risque influençant la prévalence de la maladie. L'analyse repose sur 99 574 femmes et 56 742 hommes âgés de 20 à 49 ans et inclus dans la troisième Enquête Nationale des Familles en Inde, 2005–2006. On a utilisé l'analyse de régression logistique multiple pour estimer les odds ratio de prévalence pour l'asthme, après ajustement pour divers facteurs de risque.

RÉSULTATS : La prévalence auto-rapportée de l'asthme est de 1,8% (IC95% 1,6–2,0) parmi les hommes et de 1,9% (IC95% 1,8–2,0) parmi les femmes, les taux étant plus élevés dans les zones rurales que dans les zones urbaines, et les différences géographiques étant marquées. Après ajustement pour les facteurs de risque d'asthme connus, les femmes sont 1,2 fois plus susceptibles de souffrir de l'asthme que les hommes. La consommation quotidienne ou hebdomadaire de lait/produits laitiers, de légumes à feuilles vertes et de fruits est en association avec un risque plus faible d'asthme alors que la consommation de poulet ou de viande, un index de masse corporelle (BMI) plus bas (<16 kg/m², OR 2,08 ; IC95% 1,73–2,50) ainsi qu'un BMI plus élevé (>30 kg/m², OR 1,67 ; IC95% 1,36–2,06), le fait de fumer du tabac actuellement (OR 1,30 ; IC95% 1,12–1,50) et l'utilisation de l'alcool à un moment quelconque (OR 1,21 ; IC95% 1,05–1,39) sont en association avec un risque accru d'asthme.

CONCLUSIONS : La prévalence de l'asthme en Inde varie largement selon les régions. Toutefois, à l'exception des observations sur le BMI, l'association de l'asthme avec les facteurs de risque est relativement faible et ne rend compte que d'une petite proportion des cas seulement.

RESUMEN

MARCO DE REFERENCIA Y MÉTODOS: Se calculó la prevalencia de asma autorreferida en los adultos en la India y se evaluaron varios factores de riesgo que influyen sobre la prevalencia de la enfermedad. El estudio se basó en las 99 574 mujeres y los 56 742 hombres de 20 a 49 años de edad que participaron en la tercera Encuesta Nacional sobre la Salud de la Familia en la India entre el 2005 y el 2006. Mediante un análisis de regresión logística multifactorial se calculó la prevalencia de asma y el cociente de posibilidades de padecerla, al corregir diversos factores de riesgo.

RESULTADOS: La prevalencia de asma autorreferida fue 1,8% en los hombres (intervalo de confianza [IC] del 95% 1,6 a 2,0) y 1,9% en las mujeres (IC95% 1,8 a 2,0); se observaron tasas más altas en las zonas rurales que en las zonas urbanas y se presentaron diferencias geográficas considerables. Tras corregir en función de algunos factores de riesgo de padecer asma conocidos, las mujeres presentaron una probabilidad 1,2 veces superior a los hombres de sufrir la enfermedad. El consumo diario o semanal de leche o productos lácteos, hortalizas de hojas verdes y frutas se asoció con un menor riesgo de asma y el consumo de carne de pollo o de res, un bajo índice de masa corporal (<16 kg/m²; OR 2,08; IC95% 1,73 a 2,50) igual que un alto índice de masa corporal (>30 kg/m²; OR 1,67; IC95% 1,36 a 2,06), el tabaquismo actual (OR 1,30; IC95% 1,12 a 1,50) y el consumo de alcohol en algún momento de la vida (OR 1,21; IC95% 1,05 a 1,39) se asociaron con un mayor riesgo de padecer la enfermedad.

CONCLUSIÓN: Existen amplias variaciones geográficas en la prevalencia de asma en la India. Sin embargo, con la excepción del índice de masa corporal, la mayor parte de las asociaciones del asma con los factores de riesgo fueron débiles y explican solo una pequeña proporción de los casos.