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Supplementary appendix

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Supplementary Appendix

This appendix has been provided by the authors to give readers additional information about their work

Supplement to: Prevalence, risk factors, and management of asthma in China: a national cross-sectional study

Supplementary Text

Performance of the ECRHS screening questionnaire items in discriminating asthma cases in Chinese adult populations

The European Community Respiratory Health Survey (ECRHS) screening questionnaire has been translated into Chinese and used in several regional asthma surveys in China.[1-3] However, no study has reported the sensitivity and specificity of the ECRHS screening questionnaire items in Chinese population. We, therefore, performed an in-house validation study in two hospitals in Beijing (Beijing Chao-Yang Hospital and Beijing Luhe Hospital).

We recruited 200 adult asthma patients who were ≥20 years old and were diagnosed by a specialist physician within the past 12 months. In addition, 200 controls who were ≥20 years old and had no history of asthma or other chronic respiratory disease were recruited from the health check-up centers in the two hospitals. Pregnant women and those with a hospitalization history for any cardiac condition were excluded. Face-to-face interviews based on a Chinese version of the ECRHS screening questionnaire were conducted by trained interviewers who were blinded to the asthma status of the participants. Because the respiratory complaints, such as wheezing, chest tightness, shortness of breath are often difficult to be distinguished by Chinese people, we requested our interviewers to specifically explain wheezing as "episodes of whistling sound while breathing, especially in exhalation, and often in association with labored breathing" to the participants during the interview (as was done in the CPH study).

As shown in the Table below, we assessed sensitivity and specificity in discriminating asthma and non-asthma in 400 participants for 6 items of asthma-like symptoms. We used the Youden index, defined as (sensitivity + specificity – 1), as a measurement of diagnostic performance. We found that "wheeze in the past 12 months" (Q1) had the highest Youden

index (0.825) among all the questionnaire items, indicating a good balance between sensitivity and specificity. Even considering combinations of the items, the best combination was "Q1 or Q3", which has a Youden index of 0.810, still lower than using Q1 alone. These results were consistent with an early clinical investigation which showed that recent wheeze was specifically linked to asthma among a wide range of Chinese descriptors.[4]

Table. Performance of the Chinese version of the ECRHS screening questionnaire items regarding "physician-diagnosed asthma" in 400 participants

	Sensitivity	Specificity	Youden index
Single item for symptoms			
Q1. Wheeze in past 12 months	0.860	0.965	0.825
Q1.1. Wheeze and breathless	0.705	0.990	0.695
Q1.2. Wheeze without a cold	0.555	0.995	0.550
Q2. Woken up with tightness in the chest	0.305	0.940	0.245
Q3. Woken by shortness of breath	0.270	0.945	0.215
Q4. Woken by cough	0.440	0.785	0.225
Combination of different items			
Answered "yes" to Q1 or Q2 or Q3 or Q4	0.940	0.710	0.650
Answered "yes" to Q1 and answered "yes" to Q1.1 or Q1.2	0.760	0.985	0.745
Answered "yes" to Q1 and answered "yes" to Q1.1 or Q1.2 or Q2 or Q3 or Q4	0.810	0.975	0.785
Answered "yes" to Q1 or Q2	0.890	0.905	0.795
Answered "yes" to Q1 or Q3	0.890	0.920	0.810
Answered "yes" to Q1 or Q4	0.900	0.770	0.670

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Table S1. Age-specific and age-standardized prevalence of asthma in the general Chinese adult population, airflow limitation based on the lower limits of normal (LLN)

Variables	Overall asthma*			Asthma without airflow limitation†			Asthma with airflow limitation†		
	Men	Women	Total	Men	Women	Total	Men	Women	Total
Age, years									
20–29	1.9 (1.1, 3.5)	2.4 (1.4, 4.1)	2.2 (1.5, 3.2)	1.9 (1.1, 3.5)	2.2 (1.3, 3.8)	2.1 (1.4, 3.1)	0.0 (0.0, 0.0)	0.2 (0.0, 0.8)	0.1 (0.0, 0.4)
30–39	2.9 (1.1, 7.3)	3.0 (1.5, 6.0)	2.9 (1.3, 6.5)	2.7 (1.0, 7.1)	2.7 (1.2, 5.8)	2.7 (1.1, 6.3)	0.2 (0.1, 0.9)	0.3 (0.1, 0.8)	0.3 (0.1, 0.6)
40–49	7.4 (3.4,15.3)	3.0 (2.1, 4.3)	5.2 (3.1, 8.7)	6.3 (2.7,14.3)	2.6 (1.7, 3.9)	4.5 (2.4, 8.2)	1.1 (0.5, 2.2)	0.4 (0.2, 0.8)	0.7 (0.5, 1.2)
50–59	4.1 (3.1, 5.4)	4.5 (3.1, 6.6)	4.3 (3.1, 5.9)	2.5 (2.0, 3.1)	3.5 (2.3, 5.4)	3.0 (2.2, 4.1)	1.6 (1.0, 2.8)	1.0 (0.6, 1.6)	1.3 (0.9, 2.0)
60–69	6.4 (5.4, 7.6)	5.6 (4.2, 7.6)	6.0 (5.1, 7.2)	2.2 (1.5, 3.2)	3.1 (1.8, 5.3)	2.7 (2.0, 3.6)	4.2 (3.5, 5.1)	2.5 (1.8, 3.5)	3.4 (2.8, 4.1)
≥70	8.5 (5.7,12.5)	6.5 (3.0,13.3)	7.4 (4.8,11.3)	1.7 (0.7, 3.9)	3.1 (1.9, 5.0)	2.5 (1.6, 3.8)	6.8 (4.3,10.6)	3.4 (1.2, 9.3)	5.0 (3.0, 8.1)
P for trend	0.011	0.020	0.0054	0.64	0.28	0.89	<0.0001	0.00010	<0.0001
Urbanization									
Urban	3.5 (2.7, 4.4)	3.8 (3.1, 4.7)	3.6 (3.0, 4.4)	2.2 (1.6, 2.9)	3.1 (2.4, 4.0)	2.6 (2.1, 3.3)	1.3 (1.0, 1.6)	0.7 (0.5, 1.0)	1.0 (0.8, 1.2)
Rural	6.2 (3.6,10.5)	3.6 (2.2, 5.7)	4.9 (3.1, 7.7)	4.3 (2.0, 9.0)	2.5 (1.2, 5.0)	3.4 (1.7, 6.7)	1.9 (1.4, 2.7)	1.1 (0.6, 2.0)	1.5 (1.1, 2.0)
P for difference	0.10	0.79	0.27	0.20	0.53	0.51	0.094	0.33	0.047
Education level									
Primary school and less	7.1 (4.8,10.3)	4.5 (2.8, 7.1)	5.6 (3.9, 8.0)	5.0 (3.1, 8.1)	3.4 (1.8, 6.3)	4.2 (2.7, 6.6)	2.1 (1.5, 2.9)	1.1 (0.7, 1.7)	1.4 (1.2, 1.8)
Middle and high school	4.5 (2.7, 7.2)	3.2 (2.4, 4.2)	3.9 (2.7, 5.5)	2.9 (1.4, 6.0)	2.3 (1.6, 3.4)	2.6 (1.5, 4.5)	1.6 (1.0, 2.5)	0.9 (0.5, 1.5)	1.3 (0.9, 1.8)
College and higher	3.0 (2.0, 4.5)	3.1 (2.1, 4.5)	3.0 (2.3, 4.0)	1.9 (1.3, 3.0)	2.4 (1.5, 3.8)	2.1 (1.5, 2.9)	1.1 (0.7, 1.8)	0.7 (0.3, 1.3)	1.0 (0.7, 1.4)
P for trend	0.0081	0.33	0.037	0.017	0.46	0.054	0.063	0.25	0.082
Cigarette smoking									
Never smoker	2.9 (2.0, 4.4)	3.8 (3.0, 4.6)	3.5 (2.8, 4.4)	2.1 (1.2, 3.6)	2.8 (2.1, 3.9)	2.6 (1.8, 3.7)	0.9 (0.6, 1.3)	0.9 (0.6, 1.4)	0.9 (0.6, 1.3)
Ever smoker‡	5.9 (3.9, 8.9)	4.1 (2.8, 6.0)	5.8 (3.8, 8.7)	3.9 (2.1, 6.9)	2.2 (1.2, 4.3)	3.8 (2.1, 6.8)	2.1 (1.6, 2.7)	1.9 (1.1, 3.2)	2.0 (1.6, 2.6)
P for difference	0.0066	0.65	0.032	0.057	0.47	0.17	0.00043	0.060	0.0025
No. of ever smokers living in the home¶									

0	2.9 (1.7, 5.0)	3.1 (2.5, 3.7)	3.1 (2.3, 4.1)	2.1 (0.9, 4.5)	2.3 (1.7, 3.0)	2.2 (1.4, 3.5)	0.8 (0.5, 1.4)	0.8 (0.4, 1.4)	0.8 (0.5, 1.3)
1	3.1 (1.4, 6.4)	4.1 (3.3, 5.2)	3.9 (3.0, 5.1)	1.8 (0.8, 4.0)	3.1 (2.3, 4.1)	2.9 (2.1, 3.9)	1.2 (0.6, 2.7)	1.1 (0.7, 1.7)	1.1 (0.7, 1.6)
≥2	3.8 (1.8, 8.0)	5.6 (3.2, 9.7)	5.4 (3.2, 9.1)	2.9 (1.3, 6.4)	4.6 (2.3, 8.9)	4.4 (2.3, 8.2)	0.9 (0.2, 4.8)	1.0 (0.6, 1.8)	1.1 (0.6, 1.8)
P for trend	0.60	0.084	0.033	0.60	0.085	0.040	0.95	0.45	0.39
Biomass use									
Yes	7.1 (3.8, 12.8)	5.0 (3.1, 7.9)	6.0 (3.6, 10.1)	4.8 (2.0,11.0)	3.7 (1.9, 7.0)	4.2 (2.0, 8.6)	2.3 (1.7, 3.2)	1.3 (0.9, 2.0)	1.8 (1.4, 2.3)
No	3.9 (2.8, 5.4)	3.2 (2.6, 4.1)	3.6 (3.0, 4.3)	2.7 (1.7, 4.3)	2.5 (1.8, 3.4)	2.6 (2.0, 3.4)	1.2 (1.0, 1.4)	0.7 (0.5, 1.1)	1.0 (0.8, 1.1)
P for difference	0.13	0.17	0.10	0.28	0.33	0.25	0.0089	0.017	0.0014
Annual mean $PM_{2.5}$ exposure, μg/m^3									
<50	8.2 (5.6, 11.8)	3.1 (2.0, 4.7)	6.3 (4.2, 9.3)	6.4 (4.0,10.0)	2.5 (1.6, 3.8)	5.0 (3.1, 7.9)	1.8 (0.8, 4.1)	0.6 (0.3, 1.1)	1.3 (0.6, 2.9)
50–75	3.5 (2.6, 4.6)	2.8 (2.1, 3.7)	3.1 (2.5, 3.9)	1.7 (1.1, 2.5)	2.1 (1.4, 3.2)	1.9 (1.3, 2.7)	1.8 (1.2, 2.6)	0.7 (0.5, 1.0)	1.2 (0.9, 1.5)
≥75	6.0 (2.4, 13.9)	5.4 (4.2, 6.9)	5.6 (3.3, 9.4)	4.4 (1.5,12.2)	4.0 (2.6, 6.2)	4.2 (2.0, 8.3)	1.5 (1.0, 2.2)	1.4 (0.7, 2.9)	1.5 (1.1, 2.0)
P for trend	0.45	0.018	0.71	0.47	0.13	0.64	0.68	0.14	0.78
Occupational exposure[#]									
Yes	5.1 (3.6, 7.4)	6.4 (4.2, 9.5)	5.7 (3.9, 8.2)	3.1 (1.7, 5.4)	5.0 (2.9, 8.5)	3.9 (2.2, 6.7)	2.1 (1.6, 2.8)	1.4 (0.8, 2.3)	1.8 (1.4, 2.3)
No	4.6 (3.0, 6.8)	3.1 (2.5, 3.8)	3.8 (3.0, 4.8)	3.2 (1.8, 5.5)	2.3 (1.7, 3.0)	2.7 (1.9, 3.8)	1.4 (1.0, 2.0)	0.8 (0.6, 1.3)	1.1 (0.9, 1.4)
P for difference	0.53	0.017	0.043	0.89	0.040	0.16	0.098	0.072	0.012
Visible mold spots in the current residence									
Rarely	3.7 (2.2, 6.2)	3.4 (2.9, 4.1)	3.6 (2.7, 4.8)	2.5 (1.1, 5.5)	2.5 (1.9, 3.2)	2.5 (1.5, 4.0)	1.2 (1.0, 1.5)	1.0 (0.6, 1.6)	1.1 (0.8, 1.5)
Sometimes	7.2 (4.8, 10.5)	3.8 (2.7, 5.4)	5.5 (3.9, 7.6)	4.5 (2.2, 8.8)	3.0 (2.0, 4.5)	3.8 (2.3, 6.1)	2.7 (1.6, 4.5)	0.8 (0.6, 1.3)	1.7 (1.1, 2.7)
Often	7.5 (3.7, 14.7)	5.9 (3.4, 10.0)	6.6 (3.6, 12.0)	5.3 (2.2,11.9)	5.0 (2.3,10.6)	5.2 (2.3,11.1)	2.3 (1.2, 4.4)	0.9 (0.3, 2.3)	1.5 (0.9, 2.6)
P for trend	0.061	0.11	0.050	0.075	0.15	0.073	0.18	0.70	0.32
History of pneumonia or bronchitis during childhood									
Yes	9.9 (6.6, 14.6)	12.2 (9.1, 16.2)	10.9 (8.8, 13.3)	6.1 (3.8, 9.8)	8.7 (6.5,11.6)	7.2 (5.7, 8.9)	3.8 (2.2, 6.4)	3.5 (1.9, 6.4)	3.7 (2.4, 5.7)
No	4.5 (3.1, 6.6)	3.3 (2.6, 4.2)	3.9 (2.9, 5.3)	3.0 (1.7, 5.1)	2.5 (1.8, 3.5)	2.8 (1.8, 4.2)	1.5 (1.2, 2.0)	0.8 (0.5, 1.3)	1.2 (0.9, 1.5)

P for difference	0.0024	0.00011	<0.0001	0.0075	0.00010	<0.0001	0.032	0.0091	0.0034
Parental history of respiratory diseases									
Yes	6.9 (5.5, 8.6)	6.9 (5.3, 8.9)	6.9 (5.6, 8.6)	3.7 (2.7, 5.1)	5.1 (3.6, 7.2)	4.4 (3.2, 6.1)	3.2 (2.3, 4.3)	1.8 (1.2, 2.7)	2.5 (1.9, 3.3)
No	4.5 (2.9, 6.8)	3.1 (2.5, 3.8)	3.8 (2.8, 5.0)	3.1 (1.7, 5.5)	2.3 (1.7, 3.1)	2.7 (1.8, 4.1)	1.3 (1.0, 1.8)	0.7 (0.4, 1.3)	1.0 (0.8, 1.3)
P for difference	0.010	0.00013	<0.0001	0.41	0.00035	0.00016	0.00055	0.022	0.00046
Body mass index, kg/m^2									
<18.5	8.1 (4.4, 14.4)	4.5 (2.4, 8.3)	6.0 (3.9, 9.0)	5.7 (2.5,12.2)	2.3 (0.9, 5.6)	3.6 (1.8, 7.1)	2.4 (1.7, 3.5)	2.2 (0.8, 6.0)	2.3 (1.5, 3.6)
18.5–24.9	3.9 (2.4, 6.2)	3.7 (2.8, 4.7)	3.8 (2.7, 5.2)	2.2 (1.0, 4.6)	2.7 (1.8, 4.0)	2.4 (1.4, 4.1)	1.6 (1.3, 2.1)	1.0 (0.6, 1.6)	1.3 (1.0, 1.7)
≥25	5.8 (3.6, 9.3)	3.5 (2.6, 4.8)	4.8 (3.4, 6.8)	4.3 (2.3, 8.1)	2.8 (2.0, 3.9)	3.7 (2.4, 5.8)	1.5 (0.9, 2.4)	0.7 (0.5, 1.1)	1.1 (0.8, 1.5)
P for trend	0.46	0.49	0.49	0.63	0.61	0.94	0.12	0.17	0.011
Allergic rhinitis									
Yes	9.2 (7.0, 11.9)	11.4 (9.1, 14.2)	10.2 (8.4 ,12.4)	6.7 (4.6, 9.6)	9.2 (7.1,11.8)	7.8 (6.1,10.0)	2.5 (1.8, 3.5)	2.3 (1.6, 3.2)	2.4 (1.9, 3.0)
No	4.2 (2.7, 6.3)	2.8 (2.2 , 3.5)	3.5 (2.6, 4.7)	2.6 (1.5, 4.7)	2.0 (1.4, 2.8)	2.3 (1.5, 3.6)	1.5 (1.1, 2.1)	0.8 (0.5, 1.3)	1.2 (0.9, 1.5)
P for difference	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.075	0.00096	0.00056

Values are represented as percentage (%) (95% confidence interval, CI). Abbreviations: $PM_{2.5}$, particulate matter with a diameter less than 2.5 μm. *P* for difference is for the comparison of binary variables. *P* for trend is for the linear trend of polytomous variables. All the calculations of *P* are weighted, taken into account the multistage cluster sampling design and based on $\chi 2$ test.

*Overall asthma was defined as physician-diagnosed asthma and/or wheeze in the past 12 months.

†Airflow limitation was defined as post-bronchodilator $FEV_1/FVC < 70\%$.

‡Ever smoker was defined as having smoked equal to or greater than 100 cigarettes in his/her lifetime.

¶Passive smoking at home were shown with never smokers.

#Occupational exposure was defined as exposed to gas, smoke, chemical vapors or fumes in work above 3 months in his/her lifetime.

Table S2. Age-specific and age-standardized prevalence of asthma in the general Chinese adult population by smoking status

Variables	Overall asthma*			Asthma without airflow limitation†			Asthma with airflow limitation‡		
	Ever smokers‡	Never smokers	Total	Ever smokers‡	Never smokers	Total	Ever smokers‡	Never smokers	Total
Gender									
Men	5.9 (3.9, 8.9)	2.9 (2.0, 4.4)	4.8 (3.3, 7.0)	4.0 (2.2, 6.9)	2.1 (1.1, 3.6)	3.2 (1.9, 5.4)	2.0 (1.5, 2.6)	0.9 (0.6, 1.4)	1.6 (1.2, 2.0)
Women	4.1 (2.8, 6.0)	3.8 (3.0, 4.6)	3.7 (3.0, 4.6)	2.3 (1.2, 4.2)	2.9 (2.1, 3.9)	2.9 (2.1, 3.9)	1.9 (1.1, 3.2)	0.9 (0.6, 1.4)	0.9 (0.6, 1.3)
P for difference	0.25	0.11	0.18	0.25	0.046	0.56	0.85	0.92	0.020
Age, years									
20–29	2.3 (0.9, 5.5)	2.1 (1.4, 3.3)	2.2 (1.5, 3.2)	2.3 (0.9, 5.5)	2.1 (1.4, 3.3)	2.2 (1.5, 3.2)	0.0 (., .)	0.0 (., .)	0.0 (., .)
30–39	3.7 (1.1, 11.6)	2.6 (1.4, 4.9)	2.9 (1.3, 6.5)	3.6 (1.1,11.3)	2.5 (1.3, 4.7)	2.8 (1.2, 6.3)	0.1 (0.0, 0.4)	0.1 (0.0, 0.4)	0.1 (0.0, 0.3)
40–49	9.0 (4.2, 18.5)	3.4 (2.0, 5.5)	5.2 (3.1, 8.7)	8.1 (3.5, 17.7)	3.0 (1.7, 5.3)	4.7 (2.6, 8.3)	1.0 (0.4, 2.2)	0.4 (0.2, 0.7)	0.6 (0.4, 0.8)
50–59	5.1 (3.8, 6.8)	3.8 (2.7, 5.5)	4.3 (3.1, 5.9)	3.0 (2.2, 4.2)	3.0 (2.0, 4.4)	3.0 (2.2, 4.1)	2.1 (1.3, 3.5)	0.9 (0.6, 1.3)	1.3 (0.9, 2.0)
60–69	7.2 (5.6, 9.2)	5.4 (4.1, 7.0)	6.0 (5.1, 7.2)	2.3 (1.5, 3.5)	2.7 (1.6, 4.5)	2.6 (1.9, 3.5)	5.0 (3.7, 6.7)	2.7 (1.9, 3.7)	3.5 (2.9, 4.2)
⩾70	10.0 (6.4, 15.2)	6.2 (3.2, 11.8)	7.4 (4.8, 11.3)	1.4 (0.6, 3.2)	2.6 (1.5, 4.3)	2.2 (1.4, 3.5)	8.6 (5.3, 13.7)	3.6 (1.6, 7.9)	5.3 (3.3, 8.3)
P for trend	0.033	0.013	0.0054	0.32	0.57	0.78	0.00010	0.0021	<0.0001
Urbanization									
Urban	4.1 (3.3, 5.1)	3.4 (2.7, 4.4)	3.6 (3.0, 4.4)	2.5 (1.8, 3.5)	2.7 (2.1, 3.6)	2.7 (2.1, 3.3)	1.5 (1.3, 1.8)	0.7 (0.5, 0.9)	1.0 (0.8, 1.2)
Rural	7.6 (4.4, 12.8)	3.5 (2.3, 5.5)	4.9 (3.1, 7.7)	5.4 (2.6, 10.7)	2.5 (1.2, 5.2)	3.5 (1.8, 6.7)	2.2 (1.6, 3.0)	1.0 (0.6, 1.9)	1.4 (1.1, 1.8)
P for difference	0.090	0.89	0.27	0.15	0.84	0.50	0.055	0.35	0.041
Education level									
Primary school and less	8.2 (4.7, 14.1)	4.6 (2.5, 8.3)	5.6 (3.9, 8.0)	5.7 (2.4, 12.8)	3.6 (1.6, 7.8)	4.2 (2.6, 6.6)	2.6 (1.9, 3.5)	1.0 (0.7, 1.4)	1.5 (1.2, 1.8)
Middle and high school	5.6 (3.1, 10.1)	2.9 (2.4, 3.7)	3.9 (2.7, 5.5)	3.8 (1.6, 8.6)	2.0 (1.4, 2.9)	2.6 (1.5, 4.5)	1.8 (1.2, 2.8)	0.9 (0.6, 1.5)	1.3 (0.9, 1.8)
College and higher	3.9 (2.4, 6.2)	2.6 (1.8, 3.6)	3.0 (2.3, 4.0)	2.6 (1.6, 4.5)	2.1 (1.5, 3.0)	2.3 (1.7, 3.1)	1.2 (0.7, 1.9)	0.5 (0.3, 0.8)	0.7 (0.5, 1.0)
P for trend	0.071	0.21	0.037	0.20	0.33	0.085	0.019	0.053	0.0023
No. of ever smokers living in the home¶									

0		5.4 (3.2, 9.1)			4.4 (2.3, 8.2)			1.1 (0.6, 1.8)	
1		3.9 (3.0, 5.1)			3.0 (2.2, 4.0)			1.0 (0.7, 1.5)	
⩾2		3.1 (2.3, 4.1)			2.2 (1.4, 3.5)			0.8 (0.5, 1.3)	
P for trend		<0.0001			<0.0001			<0.0001	
Biomass use									
Yes	8.1 (4.6, 13.8)	5.0 (3.0, 8.1)	6.0 (3.6, 10.1)	5.2 (2.4, 11.1)	3.8 (1.9, 7.5)	4.2 (2.0, 8.6)	2.8 (2.0, 4.0)	1.2 (0.8, 1.8)	1.8 (1.4, 2.3)
No	4.8 (3.1, 7.3)	3.0 (2.5, 3.6)	3.6 (3.0, 4.3)	3.4 (1.9, 6.2)	2.2 (1.7, 2.9)	2.6 (2.0, 3.4)	1.3 (1.1, 1.7)	0.7 (0.5, 1.0)	0.9 (0.8, 1.1)
P for difference	0.13	0.12	0.10	0.34	0.20	0.25	0.013	0.066	0.0020
Annual mean $PM_{2.5}$ exposure, μg/m^3									
<50	12.5 (7.4, 20.4)	2.6 (1.8, 3.8)	6.3 (4.2, 9.3)	10.2 (5.4, 18.6)	2.0 (1.3, 3.1)	5.0 (3.1, 7.8)	2.3 (0.8, 6.0)	0.6 (0.5, 0.8)	1.3 (0.6, 3.1)
50–75	4.0 (3.1, 5.0)	2.7 (2.0, 3.5)	3.1 (2.5, 3.9)	2.0 (1.3, 2.9)	1.9 (1.3, 2.8)	2.0 (1.4, 2.7)	2.0 (1.5, 2.6)	0.7 (0.6, 1.0)	1.1 (0.9, 1.4)
⩾75	7.0 (2.6, 17.2)	5.0 (3.7, 6.7)	5.6 (3.3, 9.4)	5.2 (1.7, 14.6)	3.9 (2.3, 6.4)	4.2 (2.1, 8.3)	1.8 (1.0, 3.2)	1.1 (0.5, 2.4)	1.4 (1.0, 1.9)
P for trend	0.22	0.012	0.71	0.23	0.085	0.68	0.70	0.22	0.92
Occupational exposure[#]									
Yes	5.8 (4.4, 7.6)	5.5 (3.5, 8.7)	5.7 (3.9, 8.2)	3.2 (2.2, 4.7)	4.4 (2.4, 8.2)	4.0 (2.3, 6.7)	2.6 (1.9, 3.5)	1.1 (0.7, 1.7)	1.7 (1.3, 2.2)
No	5.8 (3.4, 9.7)	3.0 (2.4, 3.6)	3.8 (3.0, 4.8)	4.2 (2.0, 8.5)	2.1 (1.6, 2.7)	2.7 (1.9, 3.8)	1.6 (1.2, 2.2)	0.8 (0.6, 1.1)	1.1 (0.9, 1.3)
P for difference	0.97	0.054	0.043	0.45	0.093	0.15	0.041	0.18	0.011
Visible mold spots in the current residence									
Rarely	4.6 (2.4, 8.7)	3.0 (2.5, 3.6)	3.6 (2.7, 4.8)	3.2 (1.2, 8.0)	2.2 (1.7, 2.8)	2.5 (1.6, 4.1)	1.4 (1.1, 1.8)	0.9 (0.5, 1.4)	1.1 (0.8, 1.4)
Sometimes	9.1 (5.8, 14.1)	3.6 (2.8, 4.7)	5.5 (3.9, 7.6)	6.2 (2.9, 12.7)	2.8 (2.0, 3.8)	3.9 (2.4, 6.2)	3.0 (1.8, 4.8)	0.9 (0.6, 1.3)	1.6 (1.0, 2.6)
Often	5.9 (4.0, 8.7)	6.9 (3.4, 13.6)	6.6 (3.6, 12.0)	3.1 (1.7, 5.5)	6.0 (2.5, 14.0)	5.2 (2.3, 11.1)	2.8 (1.6, 5.0)	0.9 (0.4, 2.0)	1.5 (0.9, 2.6)
P for trend	0.51	0.10	0.050	0.95	0.12	0.077	0.11	0.87	0.27
History of pneumonia or bronchitis during childhood									
Yes	11.8 (8.2, 16.6)	10.6 (7.7, 14.4)	10.9 (8.8, 13.3)	7.7 (5.3, 11.1)	7.7 (5.6, 10.6)	7.6 (6.0, 9.5)	4.0 (2.4, 6.7)	2.9 (1.6, 5.1)	3.3 (2.2, 4.9)
No	5.5 (3.6, 8.4)	3.1 (2.5, 4.0)	3.9 (2.9, 5.3)	3.7 (2.0, 6.6)	2.4 (1.6, 3.4)	2.8 (1.8, 4.2)	1.8 (1.4, 2.3)	0.8 (0.5, 1.1)	1.1 (0.9, 1.4)

P for difference	0.0011	0.00027	<0.0001	0.00071	0.00025	<0.0001	0.036	0.0094	0.0024
Parental history of respiratory diseases									
Yes	6.5 (5.4, 7.9)	7.0 (5.1, 9.6)	6.9 (5.6, 8.6)	3.4 (2.3, 5.0)	5.3 (3.4, 7.9)	4.6 (3.5, 6.2)	3.2 (2.4, 4.2)	1.8 (1.1, 2.8)	2.3 (1.7, 3.0)
No	5.8 (3.4, 9.6)	2.8 (2.2, 3.4)	3.8 (2.8, 5.0)	4.1 (2.1, 8.1)	2.1 (1.6, 2.8)	2.8 (1.9, 4.1)	1.7 (1.3, 2.2)	0.7 (0.4, 1.2)	1.0 (0.8, 1.3)
P for difference	0.65	0.00084	<0.0001	0.67	0.0030	<0.0001	0.00062	0.022	0.00062
Body mass index, kg/m^2									
<18.5	8.6 (4.0, 17.6)	4.6 (2.3, 8.7)	6.0 (3.9, 9.0)	5.7 (1.9, 15.8)	2.8 (1.2, 6.1)	3.7 (1.9, 7.1)	2.9 (2.1, 3.9)	1.8 (0.6, 5.6)	2.3 (1.5, 3.6)
18.5–24.9	4.9 (2.6, 9.2)	3.3 (2.7, 3.9)	3.8 (2.7, 5.2)	3.0 (1.2, 7.5)	2.3 (1.6, 3.3)	2.5 (1.5, 4.2)	1.9 (1.4, 2.5)	0.9 (0.6, 1.5)	1.3 (1.0, 1.6)
⩾25	6.6 (3.9, 10.8)	3.8 (2.7, 5.4)	4.8 (3.4, 6.8)	4.8 (2.3, 9.4)	3.2 (2.1, 4.8)	3.8 (2.4, 5.8)	1.8 (1.2, 2.7)	0.7 (0.5, 0.9)	1.0 (0.8, 1.3)
P for trend	0.60	0.60	0.49	0.79	0.65	0.94	0.064	0.26	0.0083
Allergic rhinitis									
Yes	11.5 (7.2, 17.8)	9.5 (7.7, 11.8)	10.2 (8.4, 12.4)	9.0 (5.1, 15.4)	7.5 (6.1, 9.3)	8.1 (6.4, 10.2)	2.5 (1.8, 3.4)	2.0 (1.5, 2.7)	2.1 (1.7, 2.6)
No	5.1 (3.4, 7.7)	2.7 (2.1, 3.5)	3.5 (2.6, 4.7)	3.3 (1.8, 5.9)	1.9 (1.3, 3.0)	2.3 (1.5, 3.6)	1.9 (1.5, 2.4)	0.7 (0.5, 1.2)	1.1 (0.9, 1.4)
P for difference	0.0016	<0.0001	<0.0001	0.0035	<0.0001	<0.0001	0.16	0.00068	0.00058

Values are represented as percentage (%) (95% confidence interval, CI). Abbreviations: $PM_{2.5}$, particulate matter with a diameter less than 2.5 μm. *P* for difference is for the comparison of binary variables. *P* for trend is for the linear trend of polytomous variables. All the calculations of *P* are weighted, taken into account the multistage cluster sampling design and based on χ^2 test.

*Overall asthma was defined as physician-diagnosed asthma and/or wheeze in the past 12 months.

†Airflow limitation was defined as post-bronchodilator $FEV_1/FVC < 70\%$.

‡Ever smoker was defined as having smoked equal to or greater than 100 cigarettes in his/her lifetime.

¶Passive smoking at home were shown with never smokers.

#Occupational exposure was defined as exposed to gas, smoke, chemical vapors or fumes in work above 3 months in his/her lifetime.

Table S3. Age and gender-adjusted odds ratios of asthma in the general Chinese adult population

Variables	Entire population						Never smokers					
	Overall asthma*		Asthma without airflow limitation†		Asthma with airflow limitation†		Overall asthma*		Asthma without airflow limitation†		Asthma with airflow limitation†	
	OR (95% CI)	*P*	OR (95% CI)	*P*	OR (95% CI)	*P*	OR (95% CI)	*P*	OR (95% CI)	*P*	OR (95% CI)	*P*
Male	1.30 (0.89, 1.91)	0.17	1.17 (0.74, 1.85)	0.49	1.79 (1.04, 3.09)	0.037	0.78 (0.55, 1.09)	0.13	0.71 (0.48, 1.05)	0.086	0.96 (0.52, 1.78)	0.90
Age (by 10 years)	1.26 (1.09, 1.46)	0.0035	1.03 (0.94, 1.12)	0.53	2.35 (1.98, 2.79)	<0.0001	1.26 (1.07, 1.48)	0.0083	1.07 (0.96, 1.18)	0.21	2.28 (1.85, 2.82)	<0.0001
Rural resident	1.39 (0.79, 2.44)	0.24	1.34 (0.61, 2.93)	0.45	1.57 (1.04, 2.37)	0.034	1.00 (0.55, 1.82)	0.99	0.91 (0.40, 2.08)	0.82	1.47 (0.65, 3.34)	0.34
Ever smoker‡	1.88 (1.26, 2.81)	0.0040	1.84 (1.11, 3.05)	0.020	2.14 (1.33, 3.44)	0.0036						
No. of ever smokers living in the home¶												
0							1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
1							1.26 (0.86, 1.84)	0.011	1.26 (0.79, 2.01)	0.0088	1.30 (0.84, 2.02)	0.35
≥2							1.75 (1.15, 2.65)		1.84 (1.19, 2.84)		1.33 (0.72, 2.45)	
Biomass use	1.75 (1.03, 2.98)	0.041	1.65 (0.83, 3.31)	0.14	2.05 (1.44, 2.90)	0.00042	1.67 (0.97,2.90)	0.065	1.70 (0.87, 3.30)	0.11	1.65 (1.09, 2.51)	0.021
Annual mean $PM_{2.5}$, μg/m^3												
<50	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)		1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
50-75	0.42 (0.18, 1.02)	0.63	0.34 (0.12, 0.94)	0.60	0.99 (0.37, 2.67)	0.81	1.02 (0.62, 1.69)	0.020	0.97 (0.54, 1.74)	0.061	1.26 (0.74, 2.16)	0.16
≥75	0.80 (0.31, 2.08)		0.75 (0.24, 2.35)		1.12 (0.40, 3.14)		1.99 (1.13, 3.51)		1.98 (0.96, 4.08)		1.93 (0.75, 4.95)	
Education level												
Primary school and lower	1.00 (Reference)	0.081	1.00 (Reference)	0.063	1.00 (Reference)	0.0020	1.00 (Reference)	0.57	1.00 (Reference)	0.48	1.00 (Reference)	0.16

Middle and high school	0.58 (0.38, 0.89)		0.52 (0.29, 0.96)		0.81 (0.52, 1.24)		0.58 (0.34, 1.01)		0.51 (0.27, 0.98)		0.93 (0.69, 1.25)	
College and higher	0.49 (0.22, 1.10)		0.44 (0.18, 1.05)		0.37 (0.21, 0.66)		0.73 (0.23, 2.29)		0.65 (0.18, 2.31)		0.55 (0.23, 1.29)	
Occupational exposure[#]	1.49 (1.01, 2.18)	0.043	1.52 (0.92, 2.52)	0.095	1.47 (1.02, 2.10)	0.039	1.92 (1.08, 3.41)	0.029	2.19 (1.09, 4.41)	0.030	1.23 (0.88, 1.72)	0.20
Visible mold spots in the current residence												
Rarely	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)		1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Sometimes	1.57 (0.94, 2.63)	0.0011	1.54 (0.69, 3.45)	0.00081	1.66 (0.84, 3.31)	0.18	1.18 (0.89, 1.56)	0.015	1.22 (0.85, 1.76)	0.0073	1.06 (0.49, 2.32)	0.65
Often	1.97 (1.37, 2.85)		2.19 (1.45, 3.30)		1.48 (0.83, 2.64)		2.48 (1.22, 5.03)		2.98 (1.39, 6.36)		1.13 (0.64, 2.02)	
History of pneumonia or bronchitis during childhood	3.22 (2.21, 4.70)	<0.0001	3.15 (2.07, 4.80)	<0.0001	3.45 (2.11, 5.63)	<0.0001	4.08 (2.51, 6.63)	<0.0001	4.00 (2.39, 6.67)	<0.0001	4.55 (2.69, 7.68)	<0.0001
Parental history of respiratory diseases	1.90 (1.58, 2.28)	<0.0001	1.81 (1.51, 2.18)	<0.0001	2.44 (1.73, 3.44)	<0.0001	2.73 (1.75, 4.23)	0.00015	2.74 (1.73, 4.35)	0.00022	2.97 (1.46, 6.06)	0.0049
Body mass index, kg/m^2												
<18.5	1.45 (0.86, 2.43)		1.18 (0.58, 2.43)		1.76 (0.92, 3.36)		1.34 (0.77, 2.31)		1.13 (0.66, 1.93)		1.96 (0.50, 7.60)	
18.5-24.9	1.00 (Reference)	0.80	1.00 (Reference)	0.45	1.00 (Reference)	0.0039	1.00 (Reference)	0.75	1.00 (Reference)	0.37	1.00 (Reference)	0.13
≥25	1.33 (0.85, 2.10)		1.62 (0.90, 2.93)		0.89 (0.63, 1.26)		1.22 (0.95, 1.57)		1.43 (1.07, 1.91)		0.81 (0.57, 1.14)	
Allergic rhinitis	3.13 (2.44, 4.03)	<0.0001	3.54 (2.56, 4.89)	<0.0001	1.87 (1.33, 2.64)	0.0012	4.10 (2.99, 5.61)	<0.0001	4.36 (2.80, 6.79)	<0.0001	2.98 (1.77, 5.03)	0.00036

Risk factors were estimated by multivariable-adjusted analyses for age and gender. *P* values for categorical variables with multiple levels were based on linear trend tests. Abbreviations: OR, odds ratio; 95% CI: 95% confidence interval. $PM_{2.5}$, particulate matter with a diameter less than 2.5 μm.

[*]Overall asthma was defined as physician-diagnosed asthma and/or wheeze in the past 12 months.

[†]Airflow limitation was defined as post-bronchodilator $FEV_1/FVC < 70\%$.

[‡]Ever smoker was defined as having smoked equal to or greater than 100 cigarettes in his/her lifetime.

[¶]Passive smoking at home were shown with never smokers.

[#]Occupational exposure was defined as exposed to gas, smoke, chemical vapors or fumes in work above 3 months in his/her lifetime.

Table S4. Physiologic characteristics and the use of healthcare resources in asthmatics

Variables	Asthma without physician-diagnosis (N=1518)	Asthma diagnosed by physician (N=514)	*P*
Lung function			
Post-BD FEV_1/FVC, %	75.6(1.7)	75.7(4.0)	1.00
Post-BD FEV_1, L	2.5(0.1)	2.8(0.4)	0.36
Short form (SF)-12 scores			
PCS scores	46.0(0.7)	46.1(0.4)	0.88
MCS scores	49.8(1.1)	54.3(0.8)	0.0022
Ever-taken PFT	227(22.8%)	154(25.0%)	0.77
Medication use			
Inhaled corticosteroid	64(3.9%)	87(10.2%)	0.11
Inhaled bronchodilator	81(4.7%)	140(16.8%)	0.078
Aminophylline	129(5.4%)	102(30.0%)	0.00010
Systemic corticosteroid	57(3.2%)	72(17.2%)	0.0013
Antibiotics	354(16.6%)	120(37.2%)	0.0044
Exacerbation of respiratory symptoms in the last 12 months			
Emergency, %	213(13.8%)	152(19.8%)	0.47
Hospital admission, %	87(5.1%)	76(12.5%)	0.20

Values are weighted and shown as number (%) or mean (SE). Abbreviations: BD, bronchodilator; FEV_1, forced expiratory volume in one second; FVC, forced vital capacity; PCS, physical component summary; MCS, mental component summary; PFT, pulmonary function test. All the calculations of *P* are weighted, taken into account the multistage cluster sampling design and based t-test.

Table S5. Comparison of clinical characteristics and the use of healthcare resources between asthmatics and non-asthmatics in the elderly adults (aged 40 years or older) with airflow limitation (i.e., spirometry-defined COPD)

Variables	Never smoker			Ever smoker			Total		
	With asthma	Without asthma	*P*	With asthma	Without asthma	*P*	With asthma	Without asthma	*P*
Male	78 (28.9%)	676 (42.5%)	0.045	301 (94.1%)	1900 (93.8%)	0.84	379 (64.2%)	2576 (69.9%)	0.37
Age, years	63.6 (1.4)	63.2 (1.1)	0.81	63.7 (1.0)	62.0 (1.1)	0.25	63.7 (1.0)	62.6 (1.1)	0.46
Body mass index, kg/m^2	23.4 (0.4)	23.8 (0.1)	0.40	23.7 (0.5)	23.3 (0.2)	0.44	23.5 (0.3)	23.5 (0.1)	0.94
Allergic rhinitis	84 (23.5%)	168 (10.1%)	0.021	58 (10.6%)	153 (6.3%)	0.069	142 (16.5%)	321 (8.0%)	0.0043
Peripheral Blood									
Eosinophil percentage (%)	3.4 (0.5)	3.5 (0.7)	0.81	3.5 (0.5)	3.2 (0.1)	0.59	3.4 (0.5)	3.3 (0.3)	0.72
Eosinophil (%) >5%, %	27 (17.5%)	99 (15.0%)	0.68	27 (20.3%)	120 (20.0%)	0.97	54 (18.9%)	219 (17.7%)	0.84
Lung function									
Post-BD FEV_1/FVC, %	55.5 (1.2)	62.3 (0.2)	<0.0001	53.1 (1.7)	60.8 (0.7)	0.00090	54.2 (0.9)	61.5 (0.4)	<0.0001
Post-BD FEV_1, L	1.5 (0.1)	2.0 (0.1)	<0.0001	1.8 (0.1)	2.3 (0.1)	<0.0001	1.6 (0.1)	2.1 (0.1)	<0.0001
Positive bronchodilator reversibility*, %	93 (32.5%)	281 (13.3%)	0.0042	108 (26.9%)	313 (16.9%)	0.087	201 (29.5%)	594 (15.2%)	0.0071
Short form (SF)-12 scores									
PCS scores	42.9 (1.0)	49.6 (1.3)	<0.0001	43.9 (0.8)	51.0 (0.3)	<0.0001	43.4 (0.7)	50.4 (0.7)	<0.0001
MCS scores	52.8 (1.1)	54.1 (0.6)	0.20	50.0 (1.2)	54.6 (0.3)	0.0017	51.3 (1.0)	54.4 (0.4)	0.0011
Medication use									

Inhaled corticosteroid	41 (7.0%)	18 (1.4%)	0.0082	24 (9.2%)	8 (0.4%)	0.040	65 (8.2%)	26 (0.8%)	0.016
Inhaled bronchodilator	64 (13.7%)	10 (1.0%)	0.0088	50 (13.7%)	17 (2.0%)	0.0075	114 (13.7%)	27 (1.6%)	0.027
Aminophylline	67 (19.3%)	13 (5.6%)	0.023	65 (21.1%)	11 (5.7%)	0.0025	132 (20.3%)	24 (5.7%)	0.0078
Systemic corticosteroid	39 (9.3%)	9 (8.3%)	0.72	28 (9.2%)	6 (2.8%)	0.037	67 (9.3%)	15 (6.0%)	0.094
Antibiotics	94 (18.0%)	29 (34.3%)	0.20	84 (25.4%)	24 (18.4%)	0.53	178 (22.0%)	53 (27.6%)	0.53
Exacerbation of respiratory symptoms in the last 12 months									
Emergency, %	94 (24.8%)	46 (3.1%)	<0.0001	75 (20.7%)	45 (2.0%)	0.00017	169 (22.6%)	91 (2.5%)	<0.0001
Hospital admission, %	53 (16.9%)	28 (2.8%)	0.0033	45 (14.1%)	18 (1.0%)	0.00025	98 (15.4%)	46 (1.8%)	<0.0001

Values are weighted and shown as number (%) or mean (SE). Abbreviations: BD, bronchodilator; FEV_1, forced expiratory volume in one second; FVC, forced vital capacity; PCS, physical component summary; MCS, mental component summary. All the calculations of *P* are weighted, taken into account the multistage cluster sampling design and based t-test.

*Positive bronchodilator reversibility test was defined as an increase in FEV_1 of >12% and >200 ml from baseline, 20 minutes after bronchodilator inhalation (salbutamol 400 μg).

Figure S1. Geographic distribution of 10 selected provinces/municipalities in the China Pulmonary Health study. Numbers in the parentheses indicate sample size from each site.

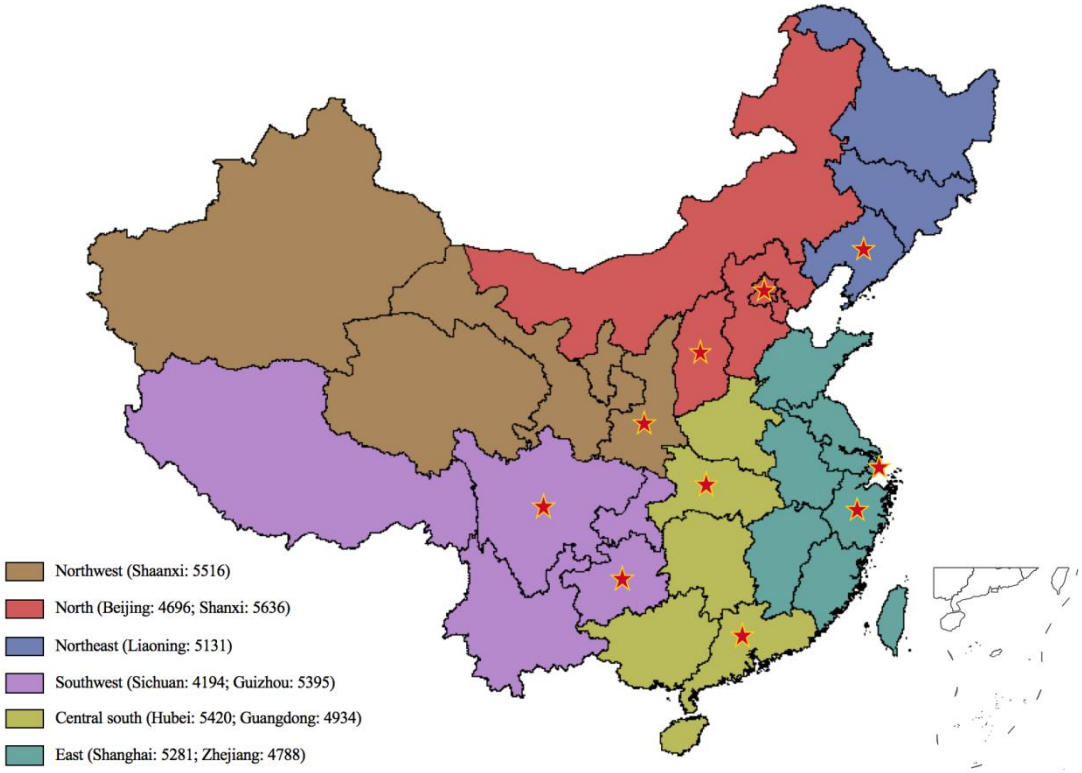


Figure S2. Flowchart of quality controls on the CPH study participants.

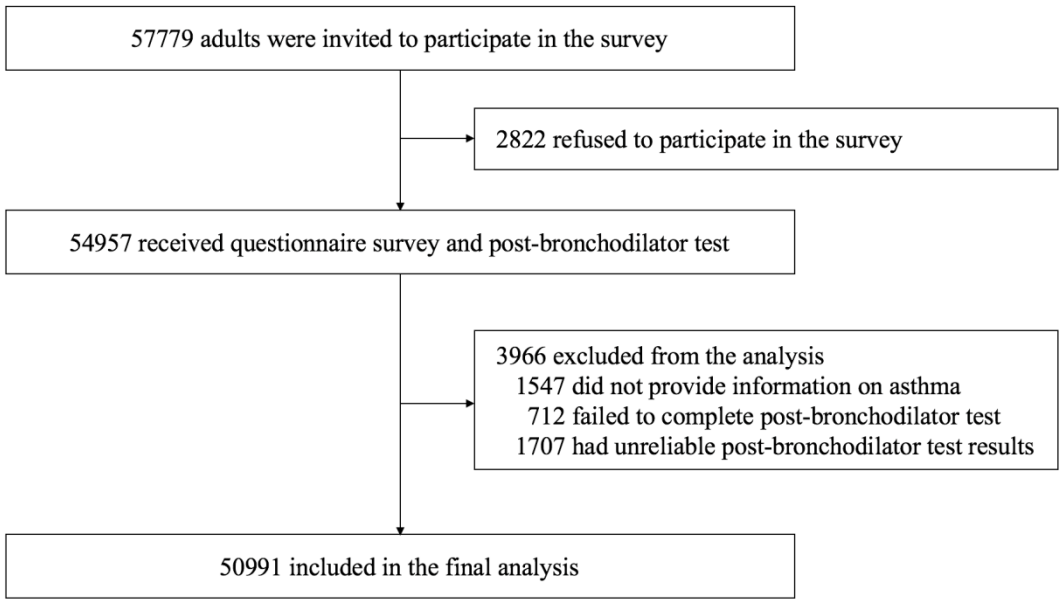
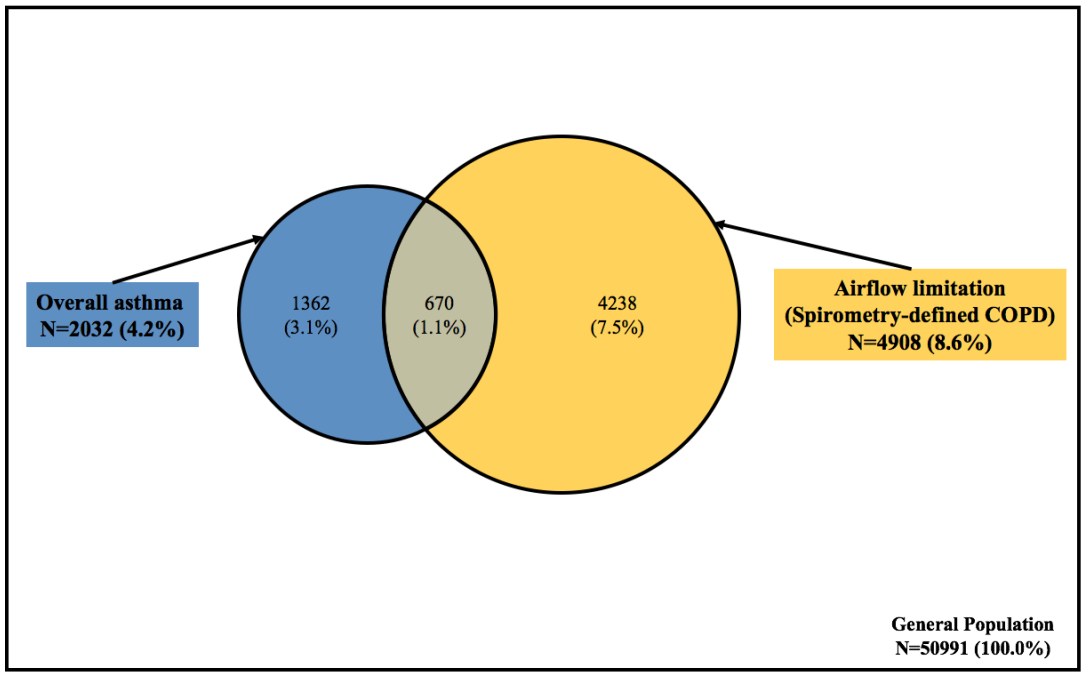


Figure S3. Distribution of study subjects. (A) Venn diagram of people with asthma and/or airflow limitation in the general population. (B) Distribution of asthmatics based on physician diagnosis and/or self-reported wheezing in the past 12 months.

A



B

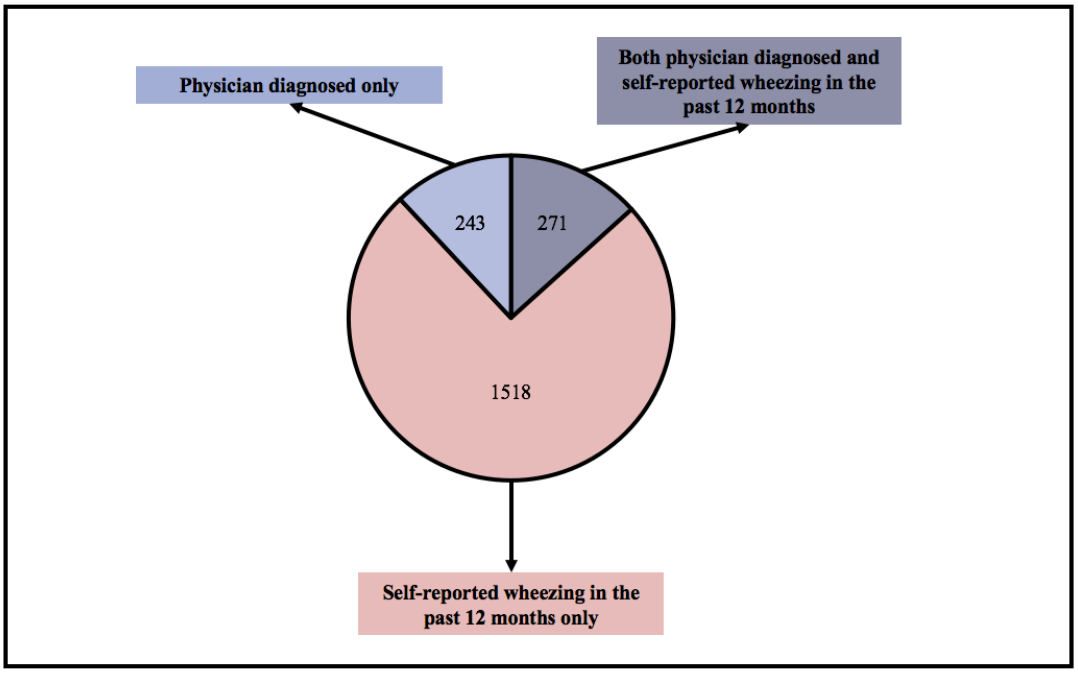


Figure S4. The proportion of airflow limitation in the general Chinese adult population by smoking status and asthma. Bars represent proportion and whiskers indicate 95% CI. * P<0.05 for ever-smoking asthmatics vs. ever smokers without asthma (P=0.016 for men, P<0.0001 for women, P=0.013 for total); # P<0.05 for ever-smoking asthmatics vs. never-smoking asthmatics (P=0.0043 for women). All calculations are weighted, taking into account the multistage cluster sampling design. P values are based on t-tests.

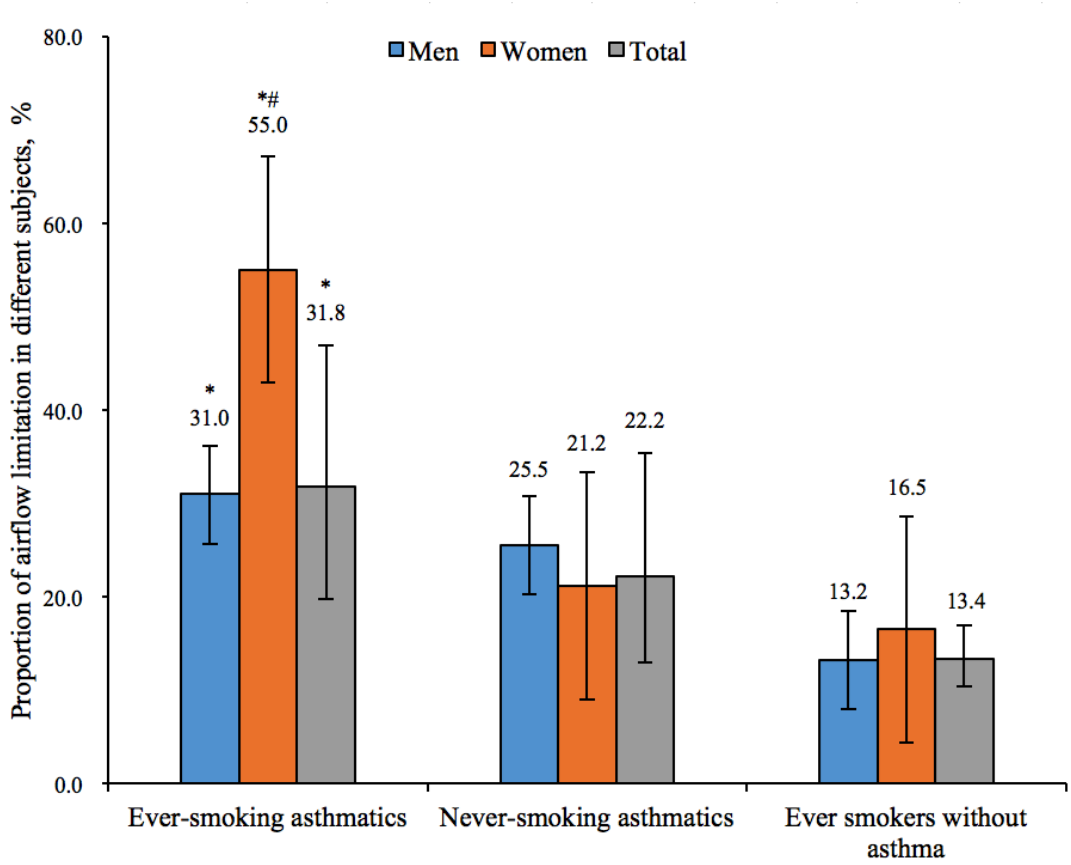
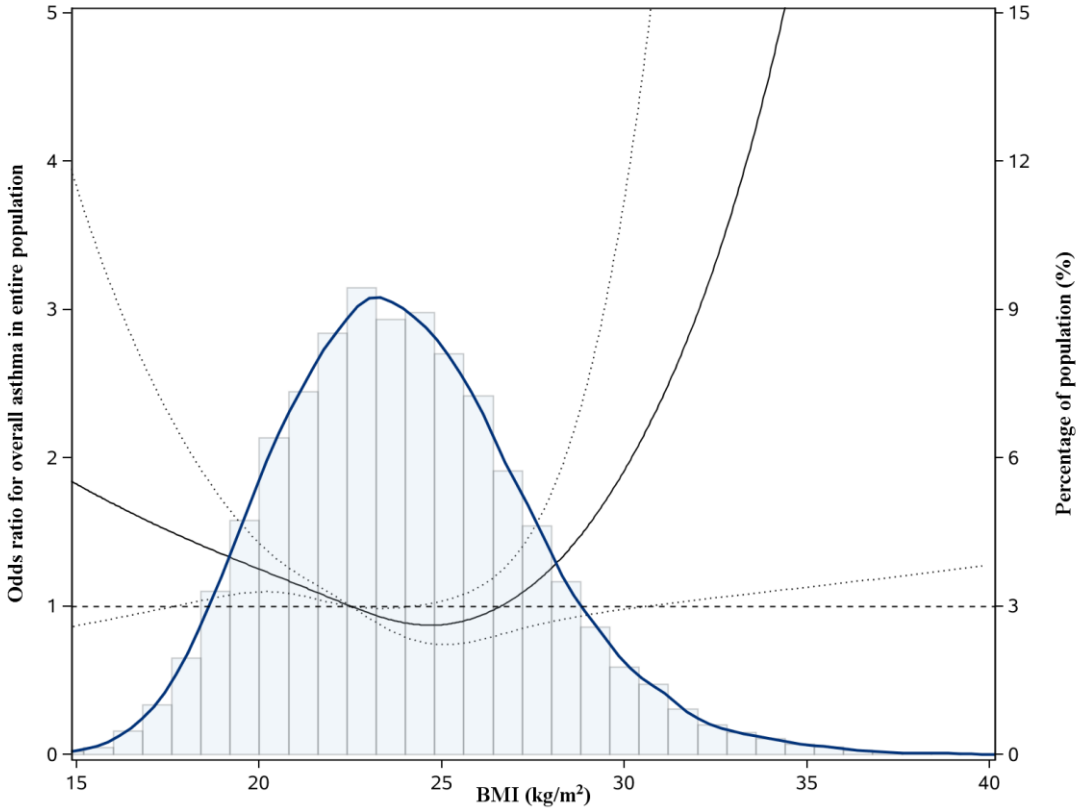
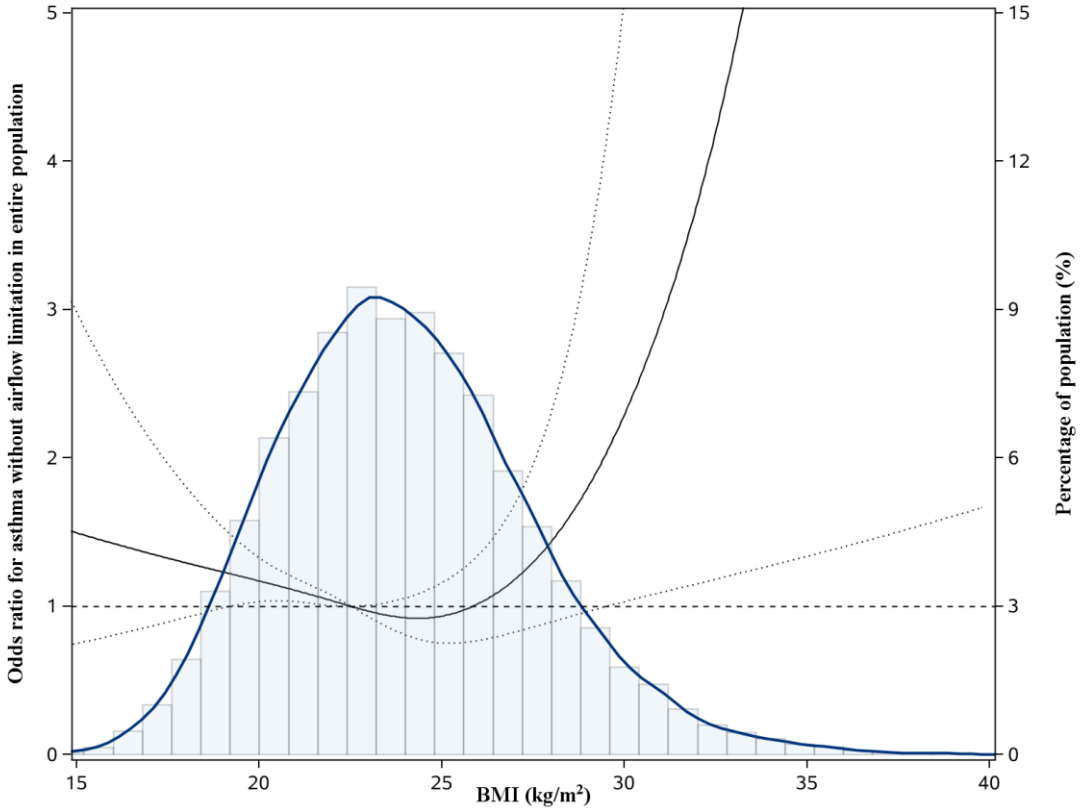


Figure S5. The restricted cubic spline for the association between BMI and asthma in entire population. The lines represent adjusted odds ratios based on restricted cubic splines for the BMI in the multivariable-adjusted regression model with all variables. Spline regression analysis indicated significant non-linear associations between BMI and phenotype of asthma. (A) Overall asthma, $P<0.0001$; (B) Asthma without airflow limitation, $P<0.0001$; (C) Asthma with airflow limitation, $P=0.041$.

A



B


Odds ratio for asthma without airflow limitation in entire population
Percentage of population (%)
BMI (kg/m²)
0
1
2
3
4
5
0
3
6
9
12
15
15
20
25
30
35
40

C

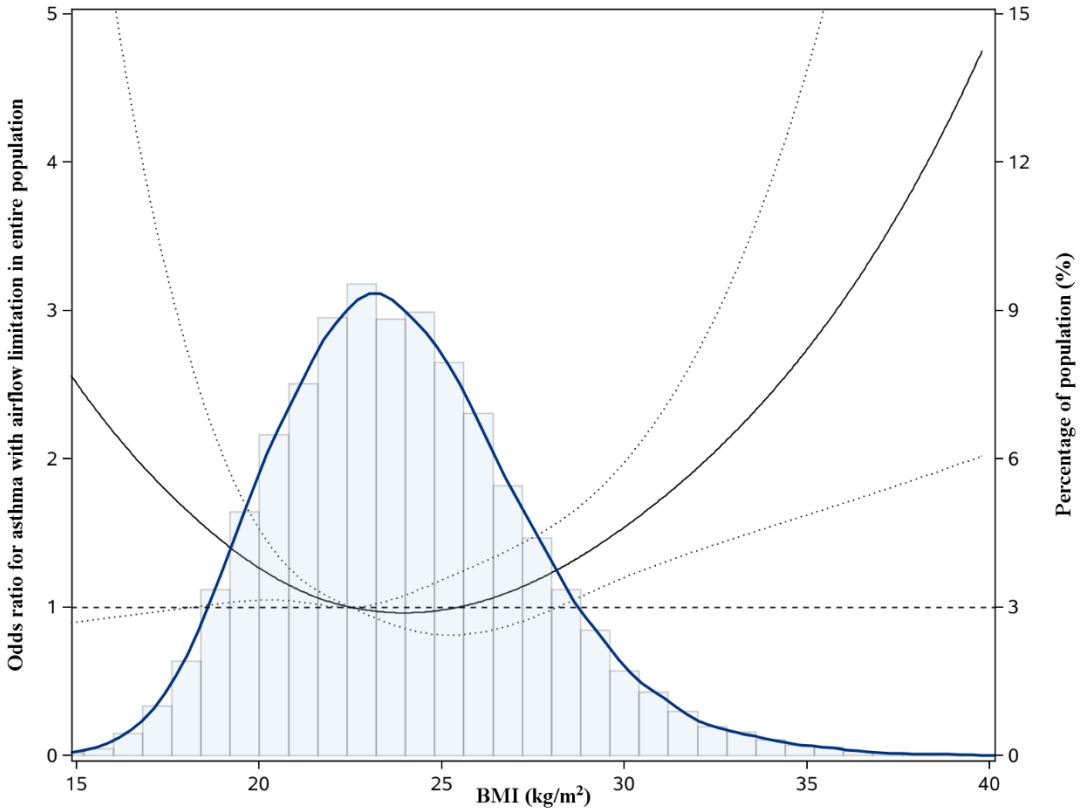
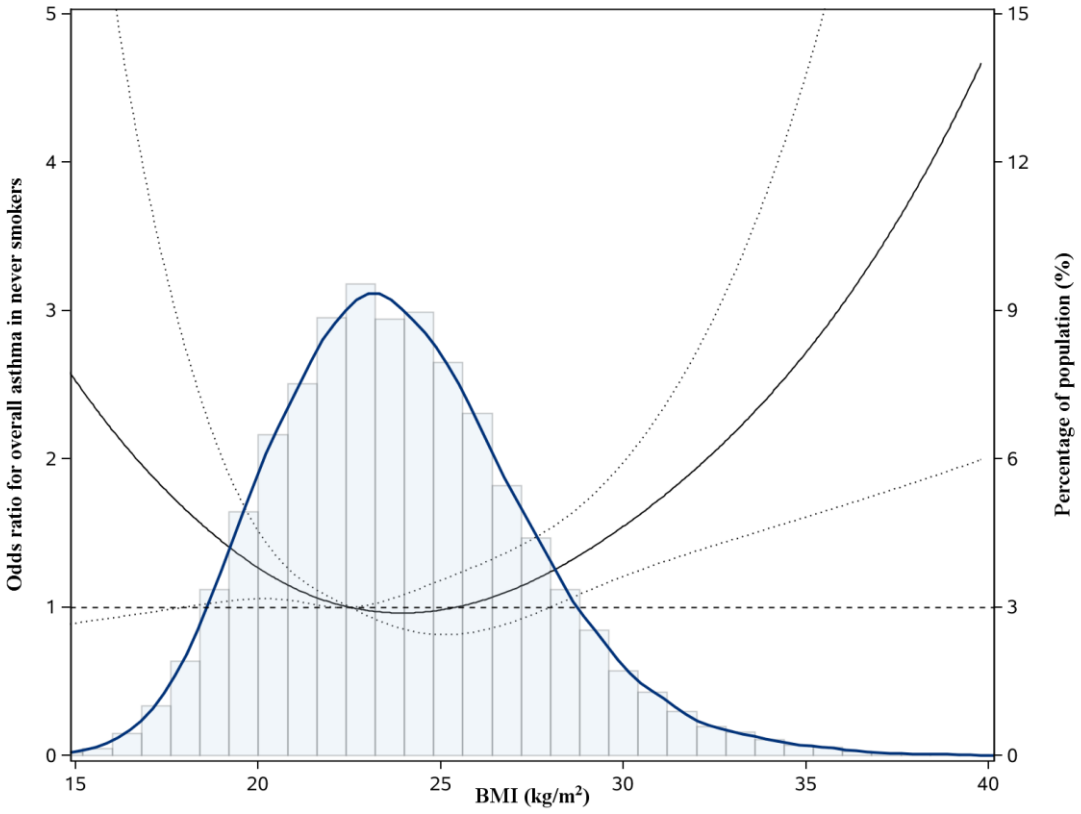
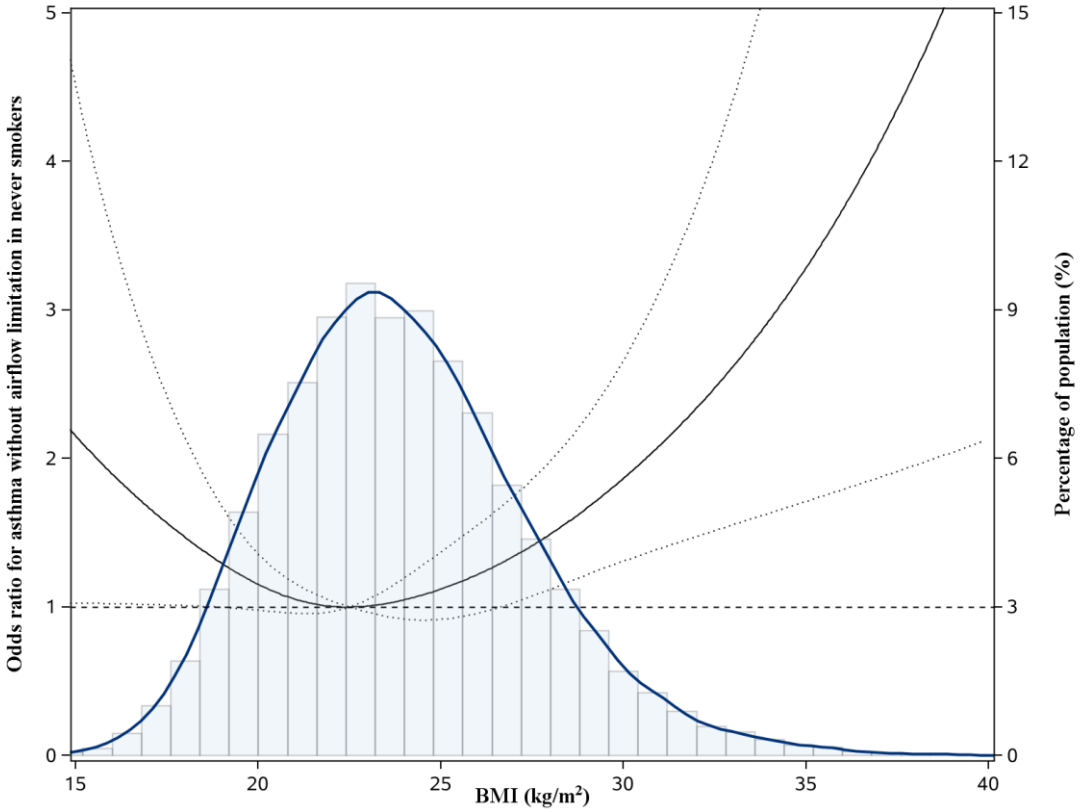

Odds ratio for asthma with airflow limitation in entire population
Percentage of population (%)
BMI (kg/m²)
0
1
2
3
4
5
0
3
6
9
12
15
15
20
25
30
35
40

Figure S6. The restricted cubic spline for the association between BMI and asthma in never smokers. The lines represent adjusted odds ratios based on restricted cubic splines for the BMI in the multivariable-adjusted regression model with all variables. Spline regression analysis indicated significant non-linear associations between BMI and phenotype of asthma. (A) Overall asthma, *P*<0.0001; (B) Asthma without airflow limitation, *P*<0.0001; (C) Asthma with airflow limitation, *P*<0.0001.

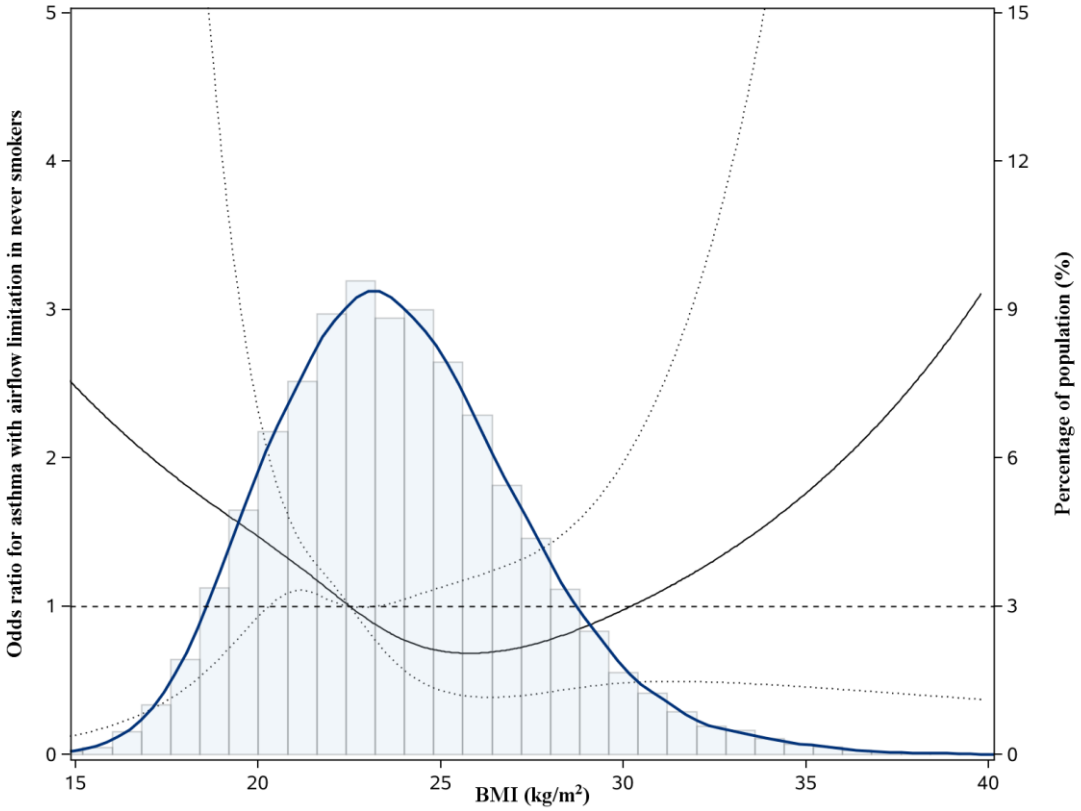
A



B


Odds ratio for asthma without airflow limitation in never smokers
Percentage of population (%)
BMI (kg/m²)
0
1
2
3
4
5
0
3
6
9
12
15
15
20
25
30
35
40

C


Odds ratio for asthma with airflow limitation in never smokers
Percentage of population (%)
BMI (kg/m²)
0
1
2
3
4
5
0
3
6
9
12
15
15
20
25
30
35
40