

# Association between allergic conditions and school absenteeism among Indian adolescents

To the Editor,

Allergic rhinitis and asthma are among the most prevalent conditions in childhood.<sup>1</sup> Prevalence has increased significantly in some countries, but national trends are inconsistent.<sup>2</sup> With nearly 20% of the world population, India contributes significantly to the global burden of allergic conditions. Approximately, 22% of Indian children and adolescents have allergic rhinitis while the prevalence of asthma varies between 2% and 23% (median 8%) among school children.<sup>3–5</sup> Children with asthma have increased rates of school absenteeism.<sup>6</sup> Associations between other allergic conditions and school absenteeism are lacking. In India, the social consequences of allergic conditions and asthma have not been well characterized.

We analysed data from the Prevalence and Risk Factors of Asthma and Allergy-Related Diseases among Adolescents (PERFORMANCE) study, a multicentre, cross-sectional study of 13–14-year olds in West Bengal, India. Study methods have been described previously.<sup>3,7</sup> We used International Study on Allergy and Asthma in Childhood (ISAAC) questionnaires to obtain self-reported information about rhinitis, rhinoconjunctivitis, asthma and allergic skin rashes and calculated rates of any allergic symptom and allergic multimorbidity (>1 condition). We asked participants how frequently they missed school due to their allergic conditions in the past 3 months (never, rarely [ $\leq 4$  days/month], and often [ $> 4$  days/month]). The total number of students enrolled in selected schools was 2973; 2801 (94%) were present on the interview days and 2716 (97%) of these answered the questionnaires.

We used modified Poisson regression models to assess associations between allergic conditions and absenteeism. Models were adjusted for sex, domicile, parental education, number of siblings, symptoms in siblings, parental symptoms, family type, domestic smoke exposure, pets and food allergies and the data were presented as rate ratios (RRs) with 95% confidence intervals (CIs). We also used multinomial logistic regression to estimate associations between allergic conditions and absenteeism categorized as never missed (reference category), rarely missed ( $\leq 4$  days/month) and often missed ( $> 4$  days/month) and data

were presented as relative rate ratios (RRRs) and 95% CIs. We stratified analyses by sex and domicile (rural, suburban and urban).

Of 2716 participants, 57% were boys, 51% were from rural and 22% from urban areas. A total of 18% reported current rhinitis, 13% rhinoconjunctivitis. The prevalence of asthma and allergic skin rashes were 12% and 22%, respectively. A total of 19% reported >1 allergic condition and 37% reported missing school in the previous 3 months due to allergic conditions.

We found asthma, any allergic symptom and allergic multimorbidity were associated with absenteeism (RR: 1.37; 95% CI: 1.17–1.60 asthma; RR: 1.14; 95% CI: 1.01–1.28 any symptom; RR: 1.24; 95% CI: 1.07–1.43 allergic multimorbidity). There were no relevant differences by sex. Associations between asthma, any symptom, multimorbidity and absenteeism were higher among rural and urban than suburban participants. The reverse was seen for rhinitis and rhinoconjunctivitis, which were associated with absenteeism in urban and rural, but not in suburban participants. Skin rashes were only associated with absenteeism in rural areas.

In multinomial logistic regression, all allergic conditions were associated with rare but not often absenteeism, except for asthma, where there was higher absenteeism (RRR: 1.67; 95% CI: 1.10–2.54 for rare absenteeism and RRR: 1.99; 95% CI: 1.36–2.91 for often absenteeism) (Figure 1A). In rural participants, we observed a dose–response relationship between allergic conditions and school absenteeism, while the trend was mixed for suburban and absent for urban participants.

Our observation of significant associations between asthma and absenteeism is consistent with previous reports from other countries.<sup>8</sup> However, allergic multimorbidity was also associated with higher absenteeism. This is consistent with another study showing schoolchildren sensitized to  $\geq 1$  allergen miss school more than non-sensitized children.<sup>9</sup>

We cannot confirm why higher absenteeism occurred among rural and urban adolescents due to asthma and allergic multimorbidity than those of suburban regions. It is possible that adolescents

**FIGURE 1** Associations between allergic conditions and school absenteeism among Indian adolescents (A) among all participants and by sex, and (B) by domicile (rural, suburban and urban) to compare between never, rarely ( $\leq 4$  days/month) and often ( $> 4$  days/month) absent. Data are shown as relative rate ratios (RRR) and 95% confidence interval (CI) obtained from modified multinomial logistic regression models (one per allergic condition) adjusted for confounders mentioned above. Each allergic condition was tested in a single model. Sex and domicile were excluded from the models when stratified for these factors respectively. Markers: ● never (reference category), ■ rarely ( $\leq 4$  days/month) and ◆ often ( $> 4$  days/month) absent.

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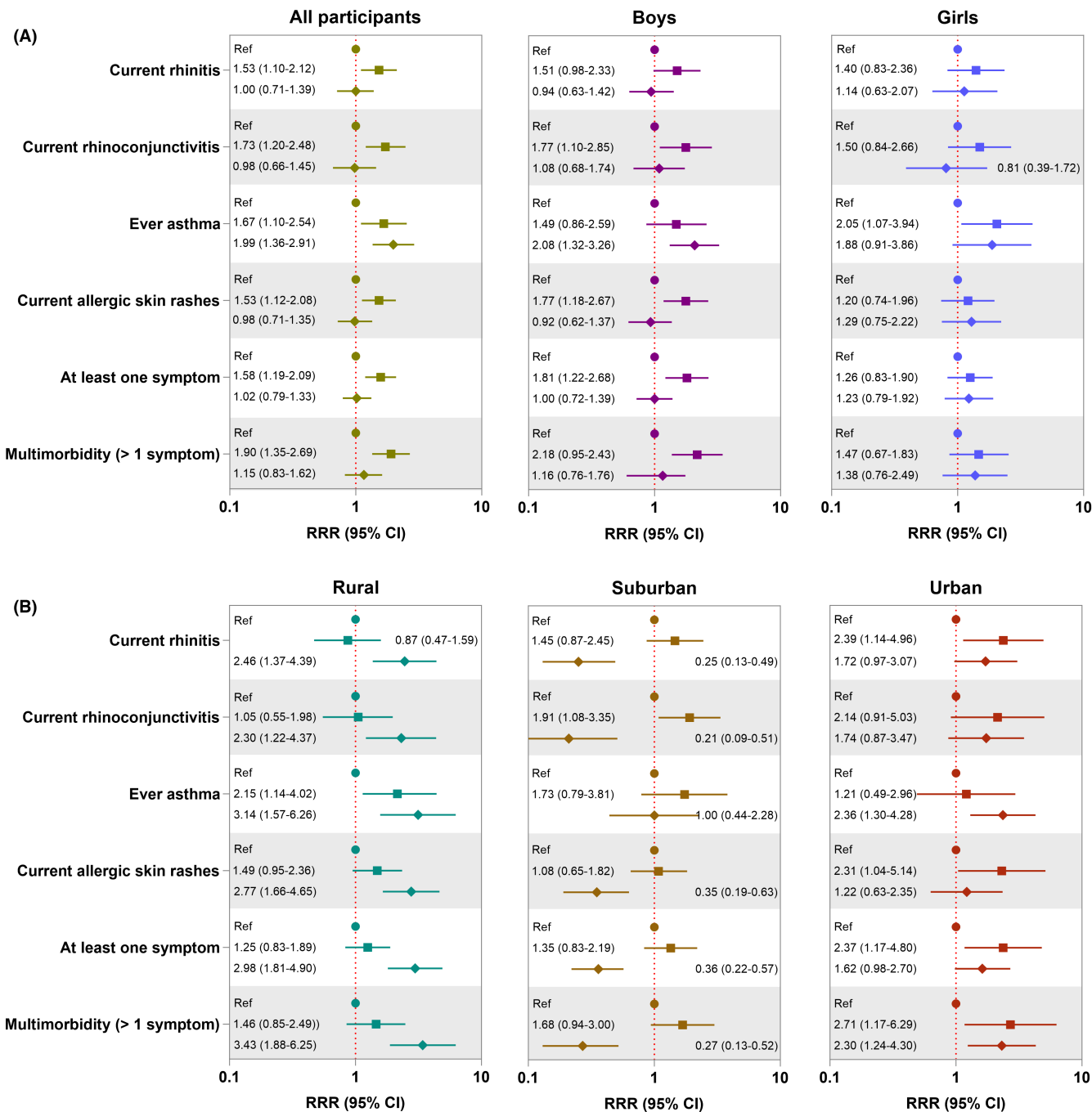
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in rural areas may experience more severe allergic conditions, and absenteeism among urban adolescents may reflect increased parental concern. However, we cannot rule out the possibility of other relevant factors. Previous Indian reports of allergic disease prevalence in adolescents mostly represent urban populations, and little is known about the prevalence and determinants of allergic conditions in suburban or rural populations.

This is the first study to report on the association between allergic conditions and school absenteeism among Indian adolescents. Despite concordant findings from other countries, there are some

**Summary Box**

- Previous studies on allergic conditions and school absenteeism are limited and have only focused on asthma.
- Our research relating allergic conditions with school absenteeism highlight the much-undermined social burdens of allergic conditions.



limitations to consider. Responses were self-reported and could not be verified with a clinical assessment. We could not verify absenteeism with the school register, and thus, there is a possibility of recall bias. We could not perform any clinical measurements and could not obtain other information such as disease severity or medication use. Lastly, we considered only 'ever asthma' in this study which could have been substantiated by more detailed information such as whether asthma was physician-diagnosed and whether it was current. These limitations did not allow us to further investigate whether absenteeism was due to allergic disease severity. Finally, as this is a cross-sectional study, we cannot draw any causal inference between allergic conditions and absenteeism.

In conclusion, asthma and allergic multimorbidity are associated with higher school absenteeism among Indian adolescents and these associations significantly differ across settings (domiciles). Our findings demonstrate that asthma and allergic conditions impose a significant burden on children and their families.

### AUTHOR CONTRIBUTIONS

Subhabrata Moitra, P. Haldar, J. Garcia-Aymerich, I. Annesi-Maesano and Saibal Moitra conceptualized and designed the study. Subhabrata Moitra, P. Haldar, S. Debnath and D. Chattopadhyay acquired the data. T. Qian and Subhabrata Moitra analysed and interpreted the data. T. Qian, A. Deprato and N. Patel prepared the draft of the article. All authors critically revised the article for important intellectual content. Subhabrata Moitra and P. Haldar were the guarantors. All authors approved the final article.

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### CONFLICT OF INTEREST STATEMENT

Subhabrata Moitra reports personal fees from Synergy Respiratory & Cardiac Care (Canada), Permanyer Inc. (Spain), Elsevier Inc. (USA) and Apollo Multispeciality Hospital (India) outside the submitted work. Judith Garcia-Aymerich reports speaker fees from Esteve, Chiesi and AstraZeneca, not related to this work, and grants from AstraZeneca, not related to this work. Paige Lacy reports grants from AstraZeneca not related to this work, grants from the Natural Science and Engineering

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### DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

### ETHICS STATEMENT

This study was approved by the Clinical Research Ethics Committee of the Allergy & Asthma Research Centre, Kolkata (CREC-AARC-04-2016). Informed consent was obtained from the principals of the attending schools.

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