

# A Global Analysis Of Associations Between Climate And Vegetation With Intermittent And Persistent Rhinitis Prevalence

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## Background/Objective

- Potential impacts of changes in climate and vegetation on rhinitis and associated health are uncertain.
- Classifying rhinitis symptoms as either intermittent or persistent is applicable worldwide and better suits a patient's needs.

**OBJECTIVE:** To examine between- and within-country associations of climate measures and the normalized difference vegetation index (NDVI) with intermittent and persistent rhinitis symptoms in a global context.

## Methods

**Data:** ISAAC Phase 3: 222 centres for the 13-14 age group (Figure 1, Table 1) and 132 centres for the 6-7 age group.

**Outcomes:** Country and centre prevalences of

- persistent rhinitis: symptoms in  $\geq 2$  consecutive months.
- intermittent rhinitis: symptoms in  $\geq 1$  month but not for two consecutive months.

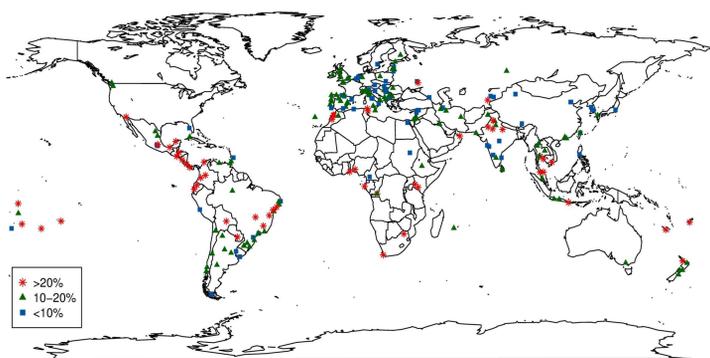
**Exposures:** Mean and standard deviation of monthly temperature ( $^{\circ}\text{C}$ ), precipitation (mm), vapour pressure (hPa) and normalized difference vegetation index (NDVI units) measurements.

**Analysis:** Linear mixed-effects regression models, adjusted for gross national income per capita and population density.

Results presented as average change in

- country-level prevalence per 100 children per one interquartile range increase in country-level exposure (between-country associations; Figure 2).
- centre-level prevalence per 100 children per one interquartile range increase in centre-level exposure (within-country associations; Figure 3).

## Results

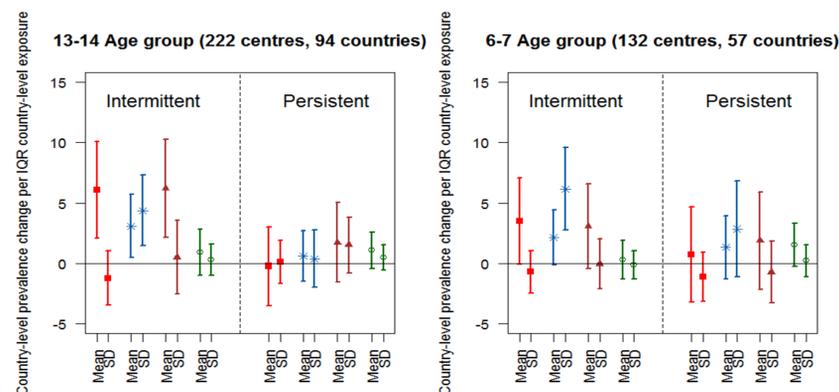


**Figure 1:** Global variation in centre prevalence of intermittent rhinitis symptoms for the 13-14 age group centres

**Table 1:** Intermittent and persistent rhinitis prevalence by climate type<sup>1</sup> for the 13-14 age group centres. Intermittent ( $p < 0.001$ ) but not persistent ( $p = 0.06$ ) prevalence varied by climate type:

Climate type	No. centres	Intermittent symptoms		Persistent symptoms	
		Mean (SD)	Range	Mean (SD)	Range
Snow/polar	13	8.9 (8.0)	0.4, 22.4	14.0 (9.3)	3.4, 28.3
Arid	23	12.6 (7.7)	0.1, 30.9	12.3 (6.3)	1.4, 25.6
Equatorial	64	20.0 (11.0)	0.0, 49.5	12.9 (8.5)	0.0, 33.8
Warm temperate, dry winter	21	9.5 (4.0)	3.5, 18.6	14.6 (7.0)	3.1, 26.8
Warm temperate, fully humid	101	15.4 (7.8)	0.0, 44.9	16.1 (7.1)	1.1, 32.1

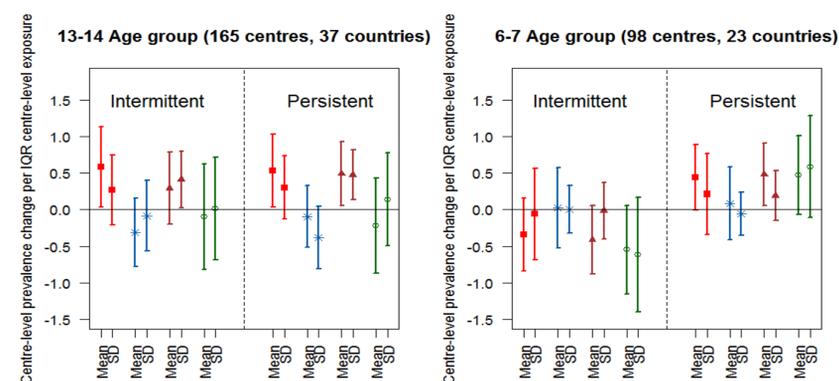
<sup>1</sup>Classified according to the Köppen climate classification system



**Figure 2:** Between-country associations for intermittent and persistent rhinitis prevalence with environmental factors (temperature, precipitation, vapour pressure, vegetation)

### Between-country associations

- Intermittent symptom prevalence was positively associated with country-level changes in mean temperature and vapour pressure, and the mean and standard deviation of precipitation measurements.
- No associations found with persistent symptoms.



**Figure 3:** Within-country associations for intermittent and persistent rhinitis prevalence with environmental factors (temperature, precipitation, vapour pressure, vegetation)

### Within-country associations

- Persistent symptom prevalence was positively associated with mean temperature and the mean and standard deviation of monthly vapour pressure measurements (not significant for younger age group).
- Associations with intermittent symptoms were inconsistent.

## Interpretation

- Intermittent symptoms are associated with climatic factors, possibly via climate related allergens (e.g. pollen and molds or perennial allergens related to indoor environments).
- Persistent symptoms may be more strongly affected by lifestyle factors. Associations with climatic factors were only detected in within-country analyses, which are less likely to be influenced by unmeasured confounding.
- This ecological study design may not be ideal for assessing associations with vegetation, which may vary more over small areas than those with climatic factors.

## Conclusions

**Given the several significant associations between indicators of climate and rhinitis symptoms observed in this global study, future changes in climate may affect the prevalence of rhinitis independently, via changes in aeroallergens or through other mechanisms.**

## Acknowledgements

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