

Geo-climatic heterogeneity in self-reported asthma, allergic rhinitis and chronic bronchitis in Italy



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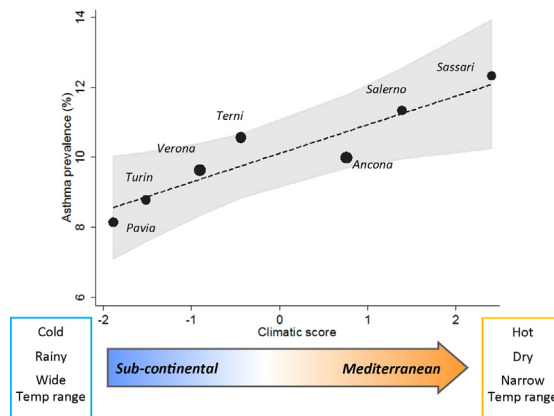
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HIGHLIGHTS

- Asthma and chronic bronchitis prevalence rates are heterogeneous across Italy
- A climatic and a topographic component explain most geo-climatic variability in Italy
- Greater asthma prevalence is found in cities with warmer and drier climate

GRAPHICAL ABSTRACT



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ABSTRACT

Background: Several studies highlighted a great variability, both between and within countries, in the prevalence of asthma and chronic airways diseases.

Aim: To evaluate if geo-climatic variations can explain the heterogeneity in the prevalence of asthma and respiratory diseases in Italy.

Methods: Between 2006 and 2010, a postal screening questionnaire on respiratory health was administered to 18,357 randomly selected subjects, aged 20–44, living in 7 centers in northern, central, and southern Italy. A random-effects meta-analysis was fitted to evaluate the between-centers heterogeneity in the prevalence of asthma, asthma-like symptoms, allergic rhinitis, and chronic bronchitis (CB). A principal component analysis (PCA) was performed to synthesize the geo-climatic information (annual mean temperature, range of temperature, annual rainfalls, global solar radiations, altitude, distance from the sea) of all the 110 Italian province capital

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towns. The associations between these geo-climatic components obtained with PCA and the prevalence of respiratory diseases were analyzed through meta-regression models.

Results: 10,464 (57%) subjects responded to the questionnaire. There was a significant between-centers heterogeneity in the prevalence of asthma ($I^2 = 59.5\%$, $p = 0.022$) and CB ($I^2 = 60.5\%$, $p = 0.019$), but not in that of asthma-like symptoms or allergic rhinitis. Two independent geo-climatic components explaining together about 80% of the overall geo-climatic variability were identified: the first principally summarized the climatic variables; the second the topographic ones. Variations in the prevalence of asthma across centers were significantly associated with differences in the climatic component ($p = 0.017$), but not with differences in the topographic one.

Conclusions: Our findings suggest that climate play a role in determining the between-center heterogeneity in the prevalence of asthma in Italy, with higher prevalence in dry-hot Mediterranean climates, and lower in rainy-cold northern climates.

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1. Introduction

Asthma, chronic bronchitis and allergic rhinitis are common health problems worldwide, with a high social and economic impact (Accordini et al., 2008). The European Community Respiratory Health Survey (ECRHS) and the International Study of Asthma and Allergies in Childhood (ISAAC) highlighted a great variability of asthma prevalence all over the world (Burney et al., 1996; Asher et al., 1998; Weiland et al., 2004). Although to a lesser extent, an important geographical variability has been observed even at national level in Italy both in children (Renzoni et al., 1997; de Sario et al., 2005) and adult population (de Marco et al., 2002; Zanolin et al., 2004; Bugiani et al., 2005).

A potential role of climatic conditions in the etiology of asthma and allergies has long been suspected. Several studies analyzed the short-term effects of meteorological factors in the exacerbations of respiratory symptoms, but there is still controversy about the potential long-term effects of climate on the regional variability in the prevalence of chronic respiratory diseases.

The aim of this study is to evaluate whether there is a variability in asthma, asthma-like symptoms, allergic rhinitis, and chronic bronchitis prevalence among different Italian cities, and whether this variability can be explained by geo-climatic differences. To achieve this, data from the population-based Gene–Environment Interaction in Respiratory Disease (GEIRD) survey were analyzed.

2. Methods

2.1. Study population and design

The GEIRD is an ongoing two-stage multicenter study, aiming at investigating allergic and respiratory conditions in the Italian adult population (de Marco et al., 2010).

Seven centers took part to the GEIRD study (Fig. 1): three of them – Turin, Pavia, and Verona – are sited in the Po River Valley in 3 different Regions of the northern part of Italy (Piedmont, Lombardy, and Veneto, respectively); the other four centers are located in 4 different Regions of central (Ancona and Terni), southern (Salerno), and insular part (Sassari) of Italy. Ancona, Salerno, and Sassari lie along the sea coast. The centers in northern Italy are characterized by a Sub-continental climate (Köppen climate classification: CFA), with relatively hot summers and cool winters and a temperature range between the coldest month and the hottest month that is of over 20 °C. Conversely, centers of central and southern Italy are characterized by a typical Mediterranean climate (Köppen climate classification: CSA), with hot summers, sea-mitigated winters and smaller temperature ranges between the cold and the hot season. The Mediterranean climate is accentuated in Salerno and Sassari, which lie in southern latitudes compared to Ancona and Terni.

As part of GEIRD stage-1, a cross-sectional screening questionnaire was administered between 2006 and 2010 to 18,357 subjects from the general population aged 20–44, living in one of the seven GEIRD centers.

The GEIRD screening questionnaire (www.geird.org) is a modified version of the European Community Respiratory Health Survey (ECRHS) questionnaire, and included items on the occurrence of allergic diseases, socio-demographic characteristics and environmental exposures (de Marco et al., 1999). The questionnaire was mailed up to 3 times in the case of non-response, and a final phone interview was carried out to reach the remaining non responders. Participants were informed about all the research aspects and consented to complete and return the questionnaire. Approval to conduct the study was granted from the local ethical committee in each participating center.

2.2. Respiratory outcomes

A subject was classified as having:

- ‘lifetime diagnosed asthma’ (asthma) in case of affirmative answer to the question ‘Have you ever had asthma?’ and ‘Was this confirmed by a doctor?’;
- ‘asthma-like symptoms’ in case of positive answers to at least one of the following questions: ‘Have you had wheezing or whistling in your chest



Fig. 1. Geographical distribution of GEIRD centers in Italy.

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