REVIEW

Immigrants and seasonal respiratory allergies: an observational look at internet search flows – the situation in Italy

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ABSTRACT

Background: Globally, the prevalence of respiratory allergic diseases is on the rise. In Europe, migration is a significant phenomenon, but little is known about its epidemiology in immigrants, normally coming from low-income countries and showing lower prevalence than natives. Over time, seasonal respiratory allergies increase with different patterns among first- and second-generation immigrants. Airborne pollen can be an indicator of exposure to airborne allergens, but traditional monitoring using Hirst-type samplers requires considerable resources, time consuming and delay of data. As a complementary and low-cost alternative, researchers are increasingly analysing internet search behaviour to monitor allergy-related phenomena. This study evaluated Google Trends (GTs) as an indicator for the epidemiological surveillance of seasonal pollen-related allergies among different immigrant populations living in Italy, considering that immigrants represent 8.8% of the Italian population.
Methods: By GTs we analysed flow, searched for terms related to allergy and performed in different languages from 2009 to 2019. The search terms such as "allergy", "rhinitis", "asthma", "antihistamine" and "pollen" were analysed. Descriptive statistics and Mann-Kendall trend test and Pearson's correlation coefficient were performed.
Results: Cross-language GTs analyses showed distinct seasonal peaks mostly in April and May but also in June, August and October with correlations between some languages. Positive correlation between Italian language and English ($R^2 = 0.7215$, $P = 0.038$), Albanian ($R^2 = 0.3621$, $P = 0.001$), French ($R^2 = 0.9434$, $P = 0.001$), and Romanian ($R^2 = 0.1945$, $P = 0.0001$) were observed. Among search trends in other languages, positive

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correlations between Albanian and Romanian (R^2= 0.2175, P = 0.001), as well as Chinese and English (R^2 = 0.1597, P = 0.01) were observed. The total average of Search Volume Index (SVI) queries during the study period was highest for Italian (76.20), followed by French (51.96), Romanian (45.01, Albanian (37.28), English (27.03), Chinese (6.56) and Arabic (6.04).

Discussion: Language-specific research may highlight the distribution of seasonal respiratory allergy patterns among immigrant communities, contributing to a better understanding of the phenomenon, within the limits of the type of approach used and the variables that may interfere with the results.

Key words: google trends, pollen exposures, allergy, immigrants, public health

Introduction

Globally, the prevalence of respiratory allergic diseases is on the rise (1, 2). Pollen grains have been considered the primary cause of pollen allergy (3). It is estimated that 40% of the population in Europe suffers from pollen allergy, including symptoms as asthma and rhinitis (2, 4). Climate change could be one of the possible causes considering that can alter rainfall patterns, frost-free days, temperatures, and carbon dioxide levels, impacting pollen load and the start, end, and length of pollen season, by modifying risk exposure to pollen (2, 5). These observations cannot be generalised, but in our part of the world, the pollination seasons tend to start earlier and, in some cases, end later, resulting in airborne pollen being present for a longer period throughout the year. Moreover, several studies have also indicated that pollen grains are associated with increased respiratory allergic symptoms and worsening of asthma and chronic obstructive pulmonary diseases among at risk individuals (6). Pollen allergies are widespread in Italy, with pollinosis being the most frequent allergic illness. Poaceae are frequent allergenic weeds in Northern and Central Italy, while *Parietaria* spp. is important in Liguria, *Ambrosia* in Lombardy and *Olea europaea* is responsible for severe pollinosis in some areas of Southern Italy (7, 8) . A wealth of information is available on the prevalence of allergies in Italy; however, given the issue of immigration, few studies have been conducted on the prevalence of seasonal respiratory allergic diseases among migrants living in Italy. It is well known that immigrants from low-income countries initially have a lower prevalence of allergies than natives, but over time, seasonal respiratory allergies increase with different patterns among first- and second-generation immigrants, with sub-Saharan populations being more susceptible to asthma (9). In 2021, Italy had 5,193,669 foreign residents (8.8% of the total population). Most of them living in Central-Northern Regions (Lombardy, Lazio and Emilia-Romagna). Romanians, Albanians, Moroccans, Chinese, and Ukrainians immigrants are among the top five communities: Romanians 1.081.836, Albanians 416.829, Moroccans 415.088, Chinese 307.038, Ukrainians 249.613 (10). Pollen allergies are a public health issue, necessitating data-driven initiatives to track disease activity and health-seeking behaviour in response to pollen exposure (11, 12). Pollen data can be considered indicators of exposure to airborne allergens, but traditional monitoring of airborne pollen using Hirst-type samplers requires considerable time resources, continuous supervision by experts and a delay between data recording, data analysis and usefulness. Furthermore, many studies have investigated the internet searching platforms as a risk indicator for seasonal allergy caused by pollen (13, 14). This novel approach has the potential to enhance public health responses by giving low-cost real-time information about allergy-related medical and environmental events (15) . Within a massive amount of data produced by online searches, including Google Trend (GT), trends and patterns could be found. This makes it possible to allocate this data and take appropriate action in a suitable approach and, due to the widespread use of internet search

engines by a wide range of demographics, this improves accessibility for real-time data. Overall, utilising online search engines to track pollen counts and allergies offers a viable way to improve surveillance and response strategies for public health. A study indicates a continual increase in search data related to pollen allergies from 2017 to 2020, correlating with pollen concentrations (12). Considering that effective diagnosis and treatment are critical for managing symptoms, increasing quality of life, and lowering socioeconomic costs, this study was carried out to explore the use of Google Trends (GTs) as a proxy of seasonal respiratory allergies in immigrants living in Italy considering that it can be a complement devoted to better understand the epidemiology related to seasonal respiratory allergy. Immigrants, sometimes or often, due to their living conditions, cultural and religious differences, economic conditions and language difficulties, may have more difficulty accessing medical care.

Methods

Google Trends (GT) monthly data from 2009 to 2019 were acquired in May 2024 with focus being placed on search terms "rhinitis", "asthma", "allergy", "antihistamine", and "pollen". The search terms were translated and acquired in eight natives' languages: Italian, Albanian, Arabic, Chinese, English, French, Ukrainian-Cyrillic and Romanian (Table 1). The searches were carried out using the set of five keywords either in combination or simultaneously. The extracted GT data, referred as the Search Volume Index (SVI), is a time series of relative popularity of searches, which was acquired using a standard normalisation based on 100 for a specific geographic region of interest. Descriptive statistics were conducted. The significance levels for Mann-Kendall trend test correlations and Pearson's correlation coefficient were performed by SPSS version 28 and considered significant at p values below 0.05.

Results

The distribution of Google Trends (GTs) average scores for allergy-related queries in Italy, stratified by languages, is shown in Figure 1a. From the boxplots, Italy and France were shown as the top two distributions by central tendency and spread. Albanian and Romanian sit in the mid-range.

No data were found for Ukrainian-Cyrillic searches. Figure 2 shows the Pearson correlation coefficients and the p-values for Kendall's correlation. Regarding the correlation between Italian and other languages, we observed a significant positive correlation with English*, Albanian**, French**, and Romanian**. Among search trends in other languages, positive correlations were observed between Albanian and Romanian*, as well as Chinese and English** (*= $p<0.05$, **= $p<0.01$).

Table 1. Search terms used in Google Trends

	Search terms used in Google Trend				
Queries Language	**Allergy**	**Rhinitis**	**Asthma**	**Pollen**	**Antihistamine**
Albanian	Alergji	Rinit	Astmë	Polen	Antihistaminë
Arabic	الحساسية	التهاب الأنف التحسسي	الربو	حبوب اللقاح	مضاد الحساسية
Chinese	花粉过敏	鼻炎	哮喘	花粉	抗组胺药
English	Allergy	Rhinitis	Asthma	Pollen	Antihistamine
French	Allergie	Rhinite	Asthme	Pollen	Antihistaminique
Italian	Allergia	Rinite	Asma	Polline	Antistaminico
Romanian	Alergie	Rinita	Astm	Polen	Antihistaminic
Ukrainian	Алергія	Риніт	Застуда	Пилок	Антигістамінний засіб

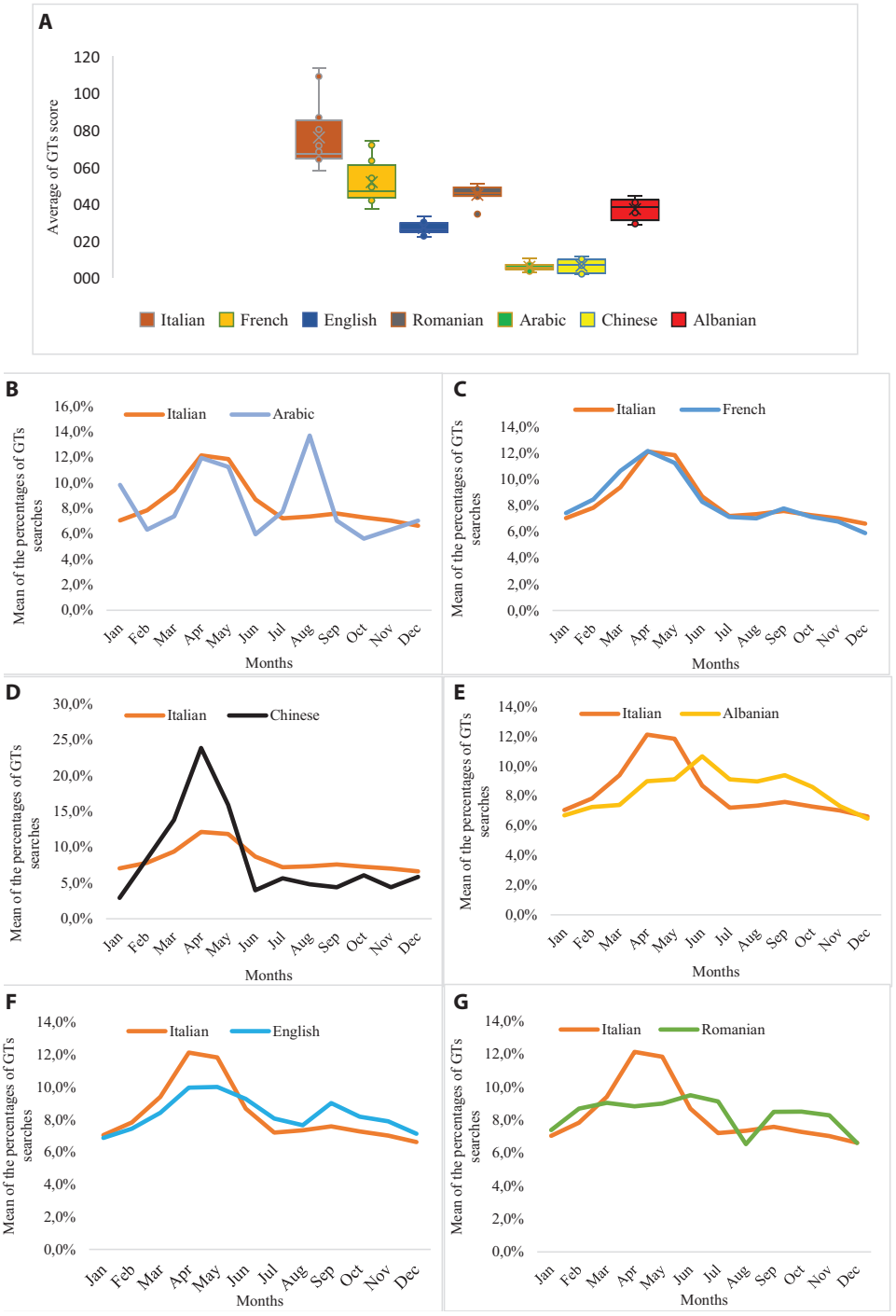

Figure 1. Comparison of average Google Trend score, from 2009 to 2019, across languages (a) and cross-linguistic analysis of pollen allergy searches in Italy using Google Trends – Language-specific seasonal patterns in pollen-related allergy searches (b – g).

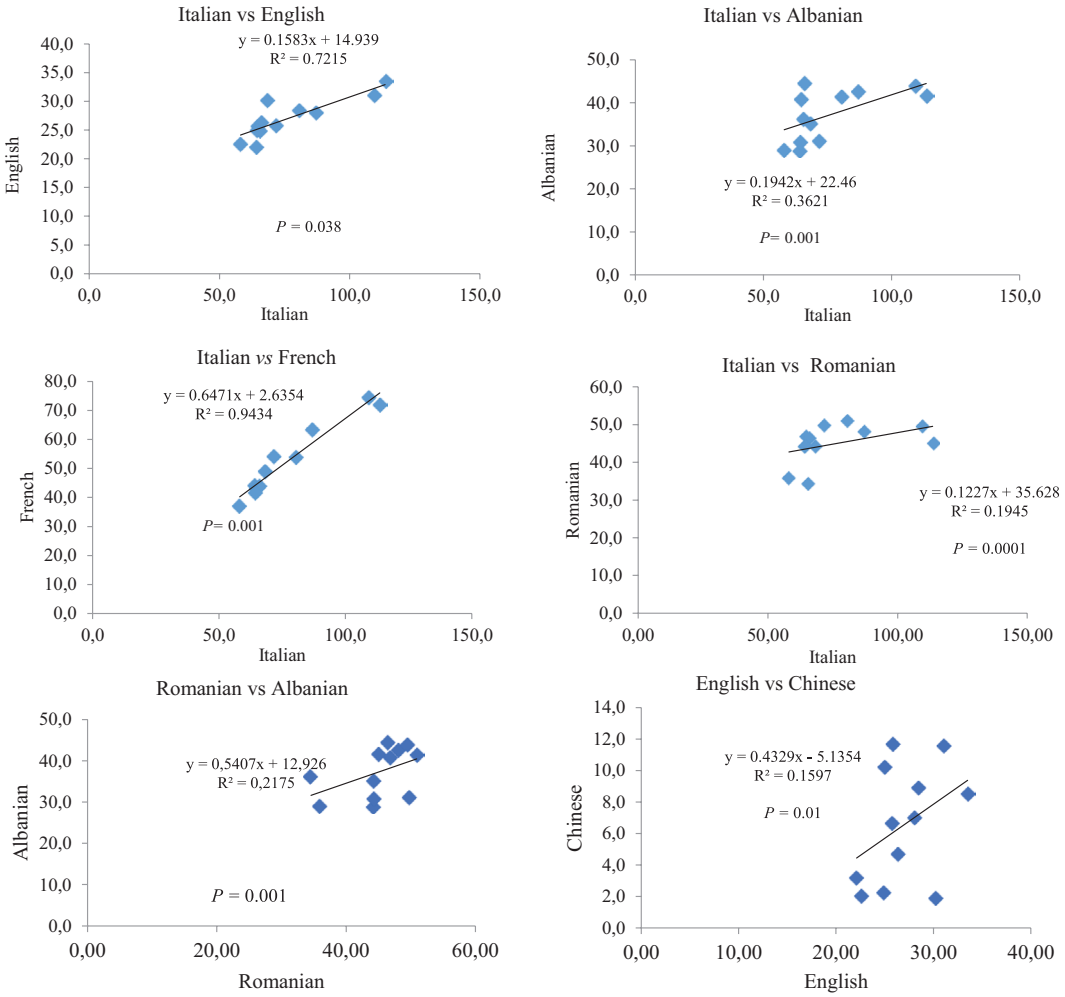

Figure 2. Linear regression of the Search Volume Index (SVI) against linguistic trends (2009–2019) using Pearson's correlation. The p-values from the Mann–Kendall analysis have been included.

Discussion

Immigration in Italy is a broad topic that involves demographic, economic, social, political and regulatory aspects, as well as public health issues. Immigration is not in itself a risk factor; in fact, many studies point to the so-called "healthy migrant effect or migrant paradox" (16), a phenomenon where recent immigrants tend to have better health than the native-born population in the host country, despite often having lower socioeconomic status and less access to healthcare. This effect is attributed to "positive selection"; individuals who migrate are often healthier and more resilient, a temporary health advantage that diminishes over time as immigrant health habits change and the risk exposure in the new environment changes. Over time, critical issues arise due to living and working conditions and the various social dynamics to which they are exposed, which are not so much dependent on their countries of origin as on precarious housing conditions, strenuous or undeclared work, limited access to health services, linguistic, cultural and religious related topics, bureaucratic difficulties, low income and illegal status. It is the so-called

social determinants of health that have multiple impacts on immigrants. As far as allergies are concerned, much depends on the length of the stay in Italy. Studies show that new immigrants have fewer respiratory allergies (rhinitis and/or allergic asthma) and less atopic dermatitis than the Italian population (17). This is due to less early exposure to "European" allergens (e.g. greater exposure to local pollen of grasses, pellitory, olive trees, or cypresses), exposure to dust mites and urban air pollutants, more rural lifestyles in their countries of origin and changes in lifestyle (diet, indoor living). Immigrants often receive a late diagnosis, make limited use of allergy clinics, and take few preventive measures. The immigration related topics are language and communication, poor knowledge of the healthcare system, limited access to specialists and precarious employment, which makes it difficult to keep appointments (18). After a few years in Italy, immigrants develop allergies at the same level or even higher than Italians, especially second-generation minors, with Sub-Saharan populations more susceptible to asthma. Children who are the offspring of immigrants born or raised in Italy show allergy rates like or higher than those of their Italian peers (19). Google Trends is a free tool from Google that shows how search interest in a word or topic changes over time and across geographical areas. The data are relative (on a scale from 0 to 100); they do not show the absolute number of searches but indicate how frequently a term is searched compared to its historical peak in a specific period and location. GTs allow filtering by country or region, so you can see how much interest there is for the topic of interest. For these reasons, GTs can be useful in pollen research as indicator of public awareness, support for health research, geographical and temporal analysis. To address these challenges, researchers have begun exploring the potential of GTs as a surrogate for epidemiological surveillance of pollen respiratory allergies. GTs interest in internet searches can be used as an indicator of the attitude towards the health risk of allergy seasons in the population. Google Trends data investigated show that the seasonality of online search traffic data is linked to the real cases of the diseases being searched for. This innovative approach harnesses the wealth of data generated by multilingual search queries related to allergy symptoms and pollen counts and could be useful to understand health awareness, especially for populations with heterogeneous healthcare access, which is the immigrant population made up of a diverse mix of nationalities, cultures and religions. GTs data present several advantages, including accessibility and real-time data availability, but caution is warranted due to potential biases in search behaviour, data interpretation (20) and the use of social media. Not all search queries related to allergy symptoms may accurately reflect actual disease prevalence, as individuals may search for reasons unrelated to personal health status or immigrant effective condition. Moreover, fluctuations in internet usage patterns and media coverage can influence GTs data trends (21). However, despite these limitations, GT data hold promises for enhancing public health surveillance and response strategies by providing additional useful information (15, 14). The integration of GT data with traditional monitoring methods could offer a comprehensive approach with additional information that could improve understanding of the epidemiology of allergic respiratory diseases. This synergy enables the timely detection of changes in allergy prevalence and pollen concentrations, facilitating targeted public health interventions. Continued research and refinement of methodologies will further enhance the utility of GT as a tool for epidemiological surveillance of pollen respiratory allergies, contributing to improved public health outcomes (22). In our study, GTs data revealed some distinct seasonal and linguistic patterns in pollen-related allergy searches across Italy. Searches in Arabic show dual-peak pattern, suggesting possible differences in population sensitivity or regional exposure periods among Arabic-speaking communities in Italy. Correlation analyses highlight similarities and differences. In particular, while Italian and Albanian search trends are significantly correlated despite the shift in the peak of Albanian-language searches to the following month, there is no correlation with Romanian search behaviour, which is apparently similar to that of Albania. Due to differences in peak values and timing, searches in Chinese and Arabic, respectively, show no correlation with those in Italian. While acknowledging that the choice of language in web searches does not uniquely identify migration status

or the presence of a specific medical condition, the results obtained show that in some cases there are differences depending on the languages used. The variation in search patterns across languages could suggest different dynamics of awareness and concerns related to pollen-related allergies in different linguistic communities of immigrants. The tourism population movement could also have some influence, considering that in Italy, e.g., in 2019, there were 65 million arrivals (ISTAT data), of which 71.7% came from European Union countries and 18.3% from non-European Union areas, especially from the United Kingdom (10). The results of the study could also suggest different levels of computer literacy depending on the language used to conduct the searches, which could interfere with online search capabilities. Health literacy may also have interfered with awareness, desire and need for research; to obtain information through Internet searches, an appropriate term is required. It is also important to consider the digital divide across immigrant communities, as differential access to digital technologies may result in the systematic under-representation of certain linguistic groups in GTdata, thus representing a direct limitation of the study design (23). However, the study considered generic terms commonly employed by the population, not medical terms, which require a minimum level of competence in applying keywords in Internet searches. In any case, analysing Internet search terms related to allergies in Italy in some of the languages used by different ethnic groups could provide useful information, considering the significant number of immigrants who, for various reasons, may have a different attitude towards the disease and limited access to treatment. In conclusion, we are aware of the limitations of the proposed approach for our study, and also of its potential considering the possible absolute or partial lack of observational data on immigrant seasonal respiratory allergy. Policymakers and health authorities, by analysing GT data, could acquire more quickly useful information to better discuss on the prevalence and distribution of allergic respiratory diseases in populations of different origins in the absence of other sources of information. This would enable the use of a more accessible and cost-effective surveillance tool than others, with a view to developing more targeted public health measures. In the future, with improved ability to analyse the origin, characteristic and composition of data, this approach could improve forecasts in a system that includes, in addition to what is used today, data relating to Internet search flows, also envisaging the use of artificial intelligence.

Ethic approval: Not applicable for studies not involving humans or animals.

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