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Respiratory symptoms/diseases prevalence is still increasing: a 25-yr population study

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ABSTRACT

Background: Few epidemiological surveys on general population samples estimated changes in prevalence of respiratory symptoms/diseases over a long time interval; our study aims to quantify the temporal changes in the prevalence rates of asthma, allergic rhinitis and Chronic Obstructive Pulmonary Disease (COPD) after 25 years from baseline.

Methods: A general population sample participated in 3 cross-sectional surveys carried out in Central Italy (Pisa) in 1985–88 (n = 3865), 1991–93 (n = 2841), 2009–11 (n = 1620). 2276 (47%) subjects participated in at least 1 survey, 1723 (35.5%) in at least 2 surveys and 849 (17.5%) in all the 3 surveys. All subjects filled in a standardized questionnaire about health status and risk factors; a sub-sample performed spirometry.

Chi-square test was used to compare adjusted prevalence rates of respiratory symptoms/diseases and descriptive characteristics among the surveys. Generalised estimating equations (GEE) were used to analyze the association between respiratory symptoms/diseases and risk factors.

Results: There was an increasing trend in prevalence rates of all respiratory symptoms/diseases throughout the surveys: current asthma attacks (1st–3rd survey prevalence: 3.4–7.2%), allergic rhinitis (16.2–37.4%), usual phlegm (8.7–19.5%) and COPD (2.1–6.8%) more than doubled. The GEE model confirmed these increasing trends, indicating higher risk of having respiratory symptoms/diseases in the second and third surveys.

Conclusions: While asthma and allergic rhinitis increasing trends were confirmed, with respect to other international studies, also a COPD increasing prevalence rates was shown.

1. Introduction

Few studies assessed the temporal changes in prevalence of respiratory symptoms/diseases from cross-sectional studies repeated at interval of some years, but covering only certain age ranges (e.g., children and young adults up to 44 years of age) [1,2].

The prevalence of asthma increased worldwide after the second world war until the 1990s, without a clear temporal pattern thereafter [3]. Swedish studies showed an increase up to about 10% of asthma prevalence from 1996 to 2006 in general population samples (age range 20–69 yrs) [4,5]. Also the Italian phase of the European Community Respiratory Health Survey (ECRHS) (20–44 yrs) found increasing asthma prevalence up to 6.6% in 2010 [2].

The frequency of allergic rhinitis (AR) has also been increasing worldwide. The Italian and Swedish ECRHS samples estimated an AR increase up to 25.8% (in 2010) [2] and 31% (in 2008) [6], respectively.

Chronic Obstructive Pulmonary Disease (COPD), according to the World Health Organization, will rank 3rd among the death causes by 2030 worldwide [7]. A Canadian study showed that COPD

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Abbreviations list

AO	airway obstruction
AR	allergic rhinitis
ATS	American Thoracic Society
COPD	Chronic Obstructive Pulmonary Disease
95% CI	95% Confidence Interval
ECRHS	European Community Respiratory Health Survey
ERS	European Respiratory Society
FEV_1	forced expiratory volume in the first second
FVC	forced vital capacity
GEE	Generalised estimating equations
IMCA2	Indicators for Monitoring COPD and Asthma in the EU project
LLN	Lower Limit of Normal
OR	odds ratio
PI1	Pisa 1 survey
PI2	Pisa 2 survey
PI3	Pisa 3 survey

standardized prevalence increased from 7.8% to 9.5%, since 1991 to 2007, in adult subjects with age ≥ 35 yrs [1]. In Norway, an increasing adjusted prevalence of GOLD-defined COPD from 7% to 14% in nine years was shown (subjects with age ≥ 35 yrs) [8]. On the contrary, the Italian ECRHS study showed a stable prevalence of chronic bronchitis during the past decade (12.5%) [9].

We aim to quantify 25-yr temporal changes in the prevalence of asthma, AR and COPD symptoms/diagnoses in an Italian general population sample, by analyzing three subsequent cross-sectional surveys which include both cross-sectional (investigated only once) and longitudinal subjects (investigated at least two times).

2. Materials and methods

2.1. Study population and methods

Detailed information on population characteristics and methods were previously published [10,11].

A flow chart of the investigated population is presented in Fig. 1.

In 1985–1988, a general population sample of 3865 subjects (84% of the invited subjects) living in the urban and suburban area of Pisa, Central Italy, was investigated within the first Pisa survey (**PI1**) with the aim to assess the COPD natural history and the related risk factors. The sample was enrolled through a randomized, stratified, family cluster design, similar to the one previously used in the Po Delta Survey [12].

A second cross-sectional survey (**PI2**) was carried out in 1991–1993. Beside those participating in PI1, new subjects were recruited: newborns, new spouses and subjects not available in PI1. There were 433 subjects lost to follow-up (dead or moved). Overall, 2841 subjects (69% of the invited subjects) were investigated. 2257 subjects participated in both PI1 and PI2 surveys, corresponding to a longitudinal participation rate of 58% (66% if those lost to follow-up were excluded from the computation) with a mean follow-up of 6 years.

A third cross-sectional survey (**PI3**) was carried out in 2009–2011 within the European IMCA2 (Indicators for Monitoring COPD and Asthma in the EU) project. Beside those participating in PI1 and/or PI2, new subjects were recruited: newborns, new spouses and subjects not available in PI1 and/or PI2. There were 1201 subjects lost to follow-up (dead or moved). Overall, 1620 subjects (69% of invited) were investigated. 1107 subjects participated in both PI2 and PI3 surveys, corresponding to a longitudinal participation rate of 39% (68% excluding lost to follow-up) with a mean follow-up of 18 years.

The same study protocol was used in PI1 and PI2. Information on respiratory symptoms/diseases and risk factors were obtained through a standardized interviewer-administered questionnaire developed by the National Research Council [13].

In PI2, a subsample (n = 1890) of subjects with age ≤ 75 years performed spirometry (forced vital capacity maneuver) according to the American Thoracic Society (ATS) protocol [14], thorough a water-sealed spirometer (Baires, Biomedin) [11].

As regards PI3, an interviewer-administered questionnaire on respiratory symptoms/diseases and risk factors was designed using questions from previously validated questionnaires [13,15,16] (http://ec.europa.eu/health/major_chronic_diseases/diseases/asthma/index_en.htm#fragment1). A subsample (n = 689) performed spirometry (forced vital capacity maneuver) according to the ATS/European Respiratory Society (ERS) protocol [17], through an hand-held ultrasonic spirometer (EasyOne Model 2001 Spirometer, NDD Medical Technologies).

Italian law didn't request the approval of Ethical Committee at the time of PI1/PI2. The protocol was approved by an Internal Revision Board within the Preventive Medicine Targeted Project of the Italian CNR. PI3 study protocol, patient information sheet and consent form were approved by the ethics committee of the Pisa University Hospital (Azienda Ospedaliero-Universitaria Pisana, Prot. no. 23887, April 16, 2008).

2.2. Statistical analyses

Detailed information on investigated respiratory outcomes are reported in the supplemental material.

Statistical Package STATA (Stata Statistical Software Release 9.0; StataCorp 2005, College Station, TX, USA) was applied: chi-square test and analysis of variance were used for comparing the symptoms/diseases prevalence and descriptive characteristics among the surveys.

Adjusted prevalence of symptoms/diseases was obtained through logistic regression models with respiratory symptoms/diseases as dependent variables and sex, age, smoking habits, educational level, occupational exposure to fumes/gases and area of residence as independent variables.

Chi square test and Cuzick test for trend were used to assess the linear trend among the 3 surveys.

Generalised estimating equations (GEE) with a logit link was used to analyze the association among respiratory symptoms/diseases and risk factors (sex, age, pack-years, educational level, occupational exposure, area of residence, survey); all risk factors were time-dependent, except for sex. GEE allowed to take into account data correlation for the serial observations on the same subjects (within-subject correlation); an unstructured working correlation was used.

COPD diagnosis was analyzed in the subsample of adult subjects (≥ 18 yrs).

P-values less than 5% were considered statistically significant.

3. Results

3.1. General characteristics

3865 subjects participated in PI1, 2841 in PI2, 1620 in PI3. 2276 participated in at least 1 survey (47%), 1723 in at least 2 surveys (35.5%) and 849 in all the 3 surveys (17.5%) (Table 1).

Descriptive characteristics and symptoms/diagnoses of participating subjects vs. those lost to follow-up are reported in the supplemental material (e-Table 1). A larger proportion of subjects