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**Der Pharmacia Lettre, 2016, 8 (5):31-39**
***(http://scholarsresearchlibrary.com/archive.html)***

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ISSN 0975-5071
USA CODEN: DPLEB4

# Prevalence of Sinusitis in Iran: A systematic review and meta-analysis study

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**ABSTRACT**

*Sinusitis is one of the inflammatory-infectious diseases with a lot of side effects. Until know there has been no overall estimate of the prevalence of sinusitis in Iran. The Purpose of this study is to estimate the prevalence of sinusitis in Iran using Meta-Analysis method. The search was done using keywords of Prevalence, Sinusitis, Iran in the foreign databases of Pub, Scopus, med, ISI, Google Scholar and native databases such as Sid, Medlib, Iran medex, Magiran. The data was analyzed using Meta-Analysis (Random Effects Model). The heterogeneity of the studies was investigated using the $I^2$ index. Data was analyzed using STATA Ver.11 software. Among the 12 studied articles with the sample size of 1057 people, the prevalence of sinusitis in Iran was 53% (confidence interval 95%: 40% to 65%). Also, the prevalence of sinusitis maxillary, ethmoid sinusitis, sphenoid sinusitis, frontal sinusitis, maxillary sinusitis and fungal sinusitis was 68%, 31%, 17%, 87% and 39%, respectively. Also, the prevalence of sinusitis in the west of the country is less compared to the others, and more in the center of the country. The prevalence of sinusitis in Iran is high and among them, maxillary and frontal sinusitis have the least prevalence, and most of the patients suffering from sinusitis show clinical symptoms of nasal discharge.*

**Keywords:** Prevalence, Sinusitis, Iran.

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## INTRODUCTION

Sinusitis is one of the most infectious inflammatory diseases affecting the air holes around the nose known as frontal ethmoid, maxillary and sphenoid sinuses [1]. In chronic sinusitis, inflammation of the sinuses is persistent. This condition usually occurs after a period of acute sinusitis [2]. Symptoms such as stuffy nose, facial pain, coughing, headaches, and postnasal drip lasting for more than 12 weeks suggest that there is chronic sinusitis. Some references have mentioned fatigue in these patients [2] and [3]. In addition to medical therapy, chronic sinusitis will require surgery to remove the blockage and restore sinus drainage and optimal ventilation. Chronic sinusitis should be treated based on the study of microbiology, maxillary and ethmoid sinus mucosal biopsy and aspiration [4]. Clinically, chronic sinusitis is often referred to cases of infectious process not responding to medical treatment [3].

There are a variety of sinusitis. According to national statistics of the US, sinusitis is diagnosed as the fifth frequent disease for which antibiotics are prescribed [5]. Moreover, paranasal sinus infection is one of the most common diseases affecting all ages, especially children's age group [6]. According to clinical features and histopathology, the paranasal fungal infection has been divided into four distinct categories, including allergic fungal sinusitis, invasive sinusitis, noninvasive sinusitis and Mycetoma[7].

The most common cause of maxillary sinusitis is viral infections of the upper respiratory tract. About 10% of maxillary sinusitis involve dental causes. Tooth extraction, trauma to the face and maxillary osteotomy can lead to sinusitis by damaging the sinus membrane [8]. Acute maxillary sinusitis is accompanied with symptoms such as pain when pressure is exerted on the anterior wall of the maxillary sinus, inferior nasal concha on top of purulent discharge, fever, chills, decreased sense of smell, unusual sensations on the posterior maxillary teeth and increased pain when bending down. Drug therapy using antibiotics and topical/systemic decongestants may improve acute sinusitis [9].

The diagnostic value of symptoms has always been debatable, since CT scan is the gold-standard method for diagnosis of chronic sinusitis [10]. Symptoms usually include nasal congestion and obstruction, feeling of pressure or fullness in the face, anterior or posterior nasal discharge and headaches, fever, swelling of the forehead or cheek erythema, coughing and olfactory disorders. The signs are edema and nasal congestion, nasal posterior discharge drainage, nasal septum deviation and polyps [1].

Infectious agents that cause chronic sinusitis can be aerobic and anaerobic microorganisms and fungi, or combination thereof [11]. One underlying factor is nasal septum deviation [12]. Many of the factors causing asthma and sinusitis including the nediatora, cytokines and neurotransmitters function similarly in developing the two diseases [13]. Involvement of people with sinusitis usually follows a series of predisposing factors such as the presence of viral infections in the upper respiratory tract, allergic rhinitis, improper use of nasal topical decongestants, and immune deficiency [14]. Pathogens in sinusitis are divided into several major categories, including bacteria bacteroides, Haemophilusinfluenzae], viral agents, rhinovirus, adenovirus and fungi, i.e. species of Aspergillus, Alternaria, Mucor, korolaria, and Cryptococcus neoformans[7].

The optical conditions occurring as a result of untreated sinusitis are orbital and periorbital cellulitis, eye infections, which often occur when affected by ethmoid sinus [6]. Cerebral complications of untreated sinusitis include meningitis, subdural abscesses , epidural, brain abscess, osteomyelitis of adjacent bones and sagittal sinus thrombosis, and cavernous sinus [15]. Complications of chronic sinusitis are orbital cellulitis, periosteal abscesses, orbital abscess to the extent of blindness, osteomyelitis, intracranial complications, and cavernous sinus thrombosis [16]. With regard to the fact mentioned above, it is inevitable to examine the prevalence of sinusitis in Iran.

One of the main goals of meta-analysis studies is to provide an accurate estimate of the unknown parameters of population. Due to the increased sample size resulting from a combination of various studies, meta-analysis curtails the confidence interval of parameters. According to numerous studies conducted on the prevalence of sinusitis and to validate the results of these studies, it was crucial to conduct a meta-analysis so as to achieve a precise and valid measure for planners and researchers in the field. The aim of this study was to estimate the prevalence of sinusitis in Iran through a systematic review and meta-analysis. This study was designed to first review the previous studies systematically and then perform a meta-analysis on the data at final stage involving the prevalence of sinusitis in Iran.

## MATERIALS AND METHODS

### Searching strategy

This was a meta-analysis study to determine the prevalence of sinusitis in Iran. The relevant literature was obtained through Internet search and manual search of documents reviewed in the library at Tehran University of Medical Sciences. The searching involved several Internet databases such as Iranmedex, SID, Magiran, Irandoc, Medlib, IranPsych, Science Direct, ISI, PubMed and Scopus. It was limited to 22 years and updated up to the autumn of 2012. Selection focused on theses, scientific journals in Iran and abroad, papers presented at congresses and organizational reports.

The domestic search in Persian was not sensitive to operators OR, AND and NOT. Hence, the terms “prevalence, sinusitis and Iran” were inserted to achieve higher sensitivity. As for searching through foreign databases, the same terms Iran, prevalence and sinusitis were included. The keywords were standardized in MeSH and eventually the strategy of Iran AND Sinusitis was used to search. In addition to this reference, the selected papers were screened so as to find relevant studies.

**Selection of papers:**
A list was prepared containing the titles and abstracts for all papers searched the domestic databases. This was performed independently by two researchers. The papers with duplicate titles were then removed. At the next stage, the abstracts were reviewed to find the suitable studies. In the case of foreign databases, the same procedure to domestic databases was adopted. In fact, all studies were stored in EndNotex6 and the rest of stages were possessed by the software application.

The inclusion criteria were: 1. all studies were descriptive, 2. prevalence of sinusitis was mentioned. It should be noted that the sensitivity of paper selection was increased through minimum inclusion criteria. However, the most relevant and highest quality studies were achieved through the exclusion criteria as follows: 1. unrelated studies in terms of study and research topic, 2. studies with insufficient information on, 3. low-quality of studies. The checklist Strengthening the reporting of observational studies in epidemiology was used to assess STROBE (17). The checklist has 22 sections that cover different parts of a report. Each section is given a score, while some other sections with greater importance were given higher scores.

**Data Extraction:**
To reduce bias and error in reporting data collection, two researchers independently extracted data from the papers through a standard form of data collection that was already prepared. The form was first designed by the research team, including the following items: Author's name, research title, publish date, journal name, research design, inclusion and exclusion criteria, sample size and so on. .

**Statistical analysis:**
This study analyzed the prevalence of sinusitis in Iran so as to estimate the point prevalence at 95% confidence interval. The variance of each study was calculated using the binomial distribution formula and heterogeneity between studies was examined through Cochran Q-test with a significant level of less than 0.1 and an indicator of heterogeneity-attributed changes ($I^2$). All statistical analyses were conducted through STATA Ver.11 using the command "metan". Significance level of the test was considered to be P>0.05.

The meta-regression analysis was used to investigate the relationship between the prevalence of sinusitis in Iran with samples and research date. Moreover, the sensitivity analysis was adopted to evaluate the impact of each research on the overall result obtained from the analysis.

## RESULTS

**A summary of how the papers were imported into meta-analysis**
In the first phase of the search, 23 papers were selected. After reviewing the titles, only 19 related papers made it to the second phase, i.e. evaluation of abstracts. Finally, a total of 12 papers were selected to enter into the meta-analysis phase (chart 1).

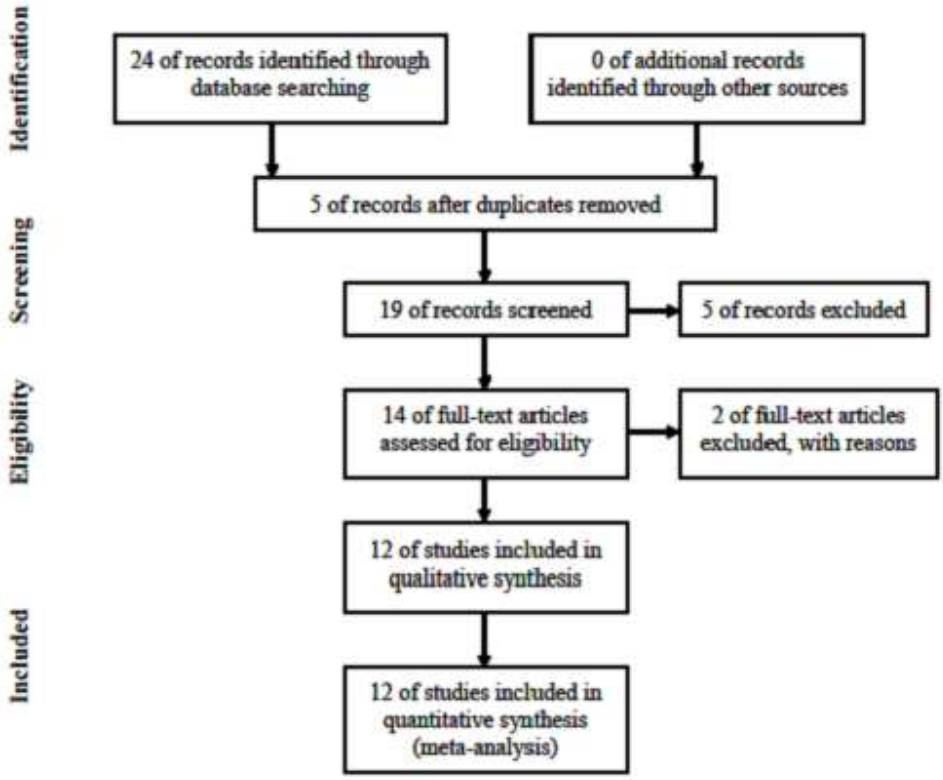


**Chart 1: Flowchart of inclusion of studies to the systemic review and meta-analysis**

Moreover, 7 out of the 12 papers under investigation with a sample of 1057 subjects reported the prevalence of sinusitis in patients, where the prevalence of sinusitis in Iran was 53% (CI=95%: 40% to 65%). In this study, the lowest and highest prevalence of sinusitis in Iranian patients were found in studies by Ehsanpour et al. (2000) (23%) and Khajavi et al. (69%), respectively. Due to the heterogeneity of the studies, the confidence interval for each study and for every single study was displayed based on random-effects model in Figure 1.

**Table 1: The specifications of the studied papers about sinusitis in Iran**

| Number | author | Year | City | Statistical Society | Sample | Prevalence of Sinusitis% |
|---|---|---|---|---|---|---|
| (18) | Ehsani poor | 1993 | Tehran | Childhood asthma | 52 | 38.5 |
| (19) | Ehsani poor | 2000 | Tehran | Childrenwithorbital and intracranial infections | 74 | 22.9 |
| (2) | Amini | 2004 | Tehran | Sinusitispatients | 59 | ---- |
| (20) | Semnani | 2000 | Rasht | Sinusitispatients | 83 | ---- |
| (10) | Mozafarinia | 2006 | Kerman | Sinusitispatients | 200 | 55.5 |
| (21) | Safari | 2009 | Hamedan | Childhood asthma | 60 | 48.3 |
| (22) | Barzin | 2000 | Sari | Sinusitispatients | 100 | 68 |
| (23) | Khajavi | 2001 | Tehran | Sinusitispatients | 53 | 68.8 |
| (9) | Khorasani | 2010 | Ghazvin | Sinusitispatients | 46 | ---- |
| (24) | Badiei | 2003 | Shiraz | Sinusitispatients | 142 | ---- |
| (25) | Noruzi | 2006 | Tehran | Neutropenicpatients | 108 | ---- |
| (26) | Naraghi | 1007 | Tehran | Sinusitispatients | 80 | 66 |

Moreover, the prevalence of maxillary sinusitis was 68% (CI 95%: 44% - 91%), ethmoid sinusitis was 31% (CI 95%: 15% - 47%), sphenoid sinusitis was 19% (CI 95%: 2% - 37%), frontal sinusitis was 17% (CI 95%: 1% - 34%), maxillary sinusitis was 87% (CI 95%: 75% - 99%) and fungal sinusitis was 39% (CI 95%: -26% -105%). The prevalence of clinical symptoms were nasal discharge by 66% (CI 95%: 17% - 114%), headache by 28% (95% CI: 8% - 48%), purulent sputum by 20% (CI 95%: 9% - 31%) and postnasal drip by 33% (CI 95%: 6% - 61%) (Table 2).

**Table 2: Prevalence of sinusitis in the examined groups in Iran**

| sub groups | Number of study | Sample size | mean score Prevalence of Sinusitis (CI %95) | Max Prevalence ofSinusitis (CI %95) | Min Prevalence ofSinusitis (CI %95) |
|---|---|---|---|---|---|
| Prevalence of sinusitis | 7 | 619 | 53 (40 -65 ) | 69 (58 - 81) | 23 (13 - 32) |
| Prevalence of maxillary sinusitis | 4 | 245 | 68 (44 - 91) | 86(73 - 1 ) | 33(10- 55) |
| Prevalence of clinical symptoms of nasal discharge | 2 | 132 | 66 (17 - 114 ) | 90 (83 - 97) | 41 (27 - 54) |
| Clinical symptoms of headache | 2 | 132 | 28 (8 - 48 ) | 39 (26 - 52) | 19 (10 - 27) |
| Prevalence of purulent sputum of clinical signs | 1 | 52 | 20 (9 - 31 ) | 20 (9 - 31 ) | 20 (9 - 31 ) |
| Prevalence of clinical symptoms of postnasal drip | 2 | 98 | 33 (6 - 61 ) | 48 (33 - 62 ) | 20 (9 - 31 ) |
| Prevalence of Ethmoid sinusitis | 4 | 245 | 31 (15 -47 ) | 41 (5 - 78 ) | 26 (-4 - 56 ) |
| Prevalence of sphenoid sinusitis | 3 | 185 | 19 (2 - 37 ) | 29 (-11 - 69 ) | 6 (-27 - 39 ) |
| Prevalence of frontal sinusitis | 4 | 245 | 17 (-1 و 34) | 34 (-59 - 128 ) | 13 (-20 - 46 ) |
| Prevalence of maxillary sinusitis | 1 | 46 | 87 (75- 99) | 87 (75- 99) | 87 (75- 99) |
| Prevalence of fungal sinusitis | 2 | 250 | 39 (-26- 105) | 74 (44- 104) | 7 (-8- 22) |

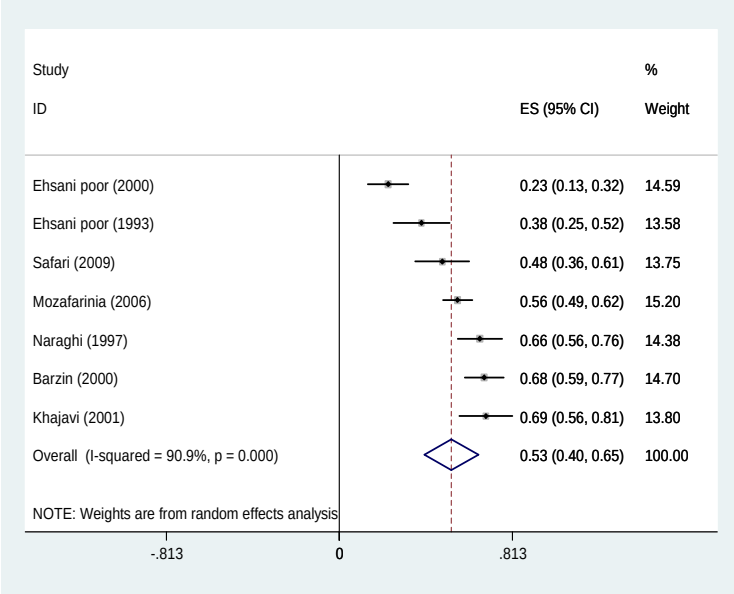


**Figure 1. Prevalence of sinusitis and 95% confidence interval in Iran, according to the author's name and year of the research, based on the random effects model. The midpoint of each segment reflects the prevalence of sinusitis in each research. Rhombus shape for prevalence of sinusitis in Iran for the total studies**

The prevalence of sinusitis varied in different regions of Iran. In the five studies conducted in the north of Iran, the prevalence of sinusitis was 53% (CI 95%: 33% to 72%). In the study conducted in central Iran, the prevalence of sinusitis was 56%, while it was 48% in a study conducted in West of Iran.

In analysis conducted by age groups, it was revealed that 2 studies had been conducted on subjects under 20 years of age, where the prevalence of was sinusitis was 30% (CI 95%: 15% to 45%). Two additional studies were conducted on 2 subjects aged 20 to 30 years, where the prevalence of sinusitis was 61% (CI 95%: 48% to 74%). Moreover, 3 studies focused on subjects over 30 years of age, where the prevalence of sinusitis was estimated to be 61% (CI 95%: 50% to 73%).

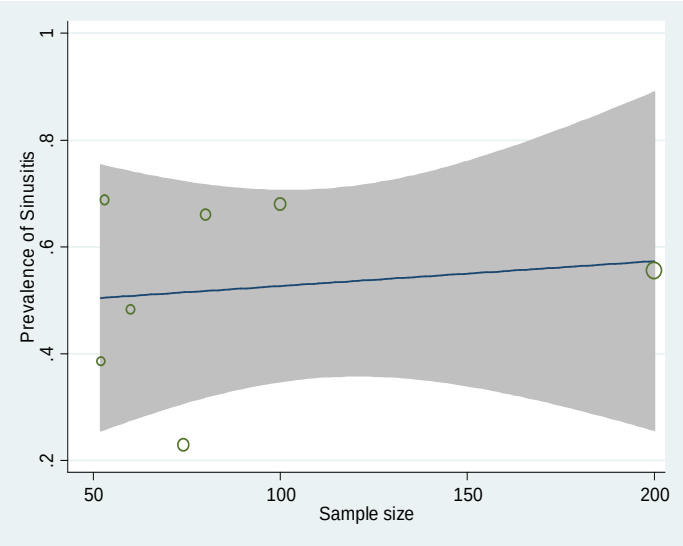


**Figure 2. The relationship between sinusitis and number of research samples using meta-regression. (Size of the circle indicates the number of samples. According to the diagram, there is no significant relationship between the prevalence of sinusitis in Iran and the number of samples (P=0.727). In fact, the increasing sample size does not increase the prevalence of sinusitis in Iran)**

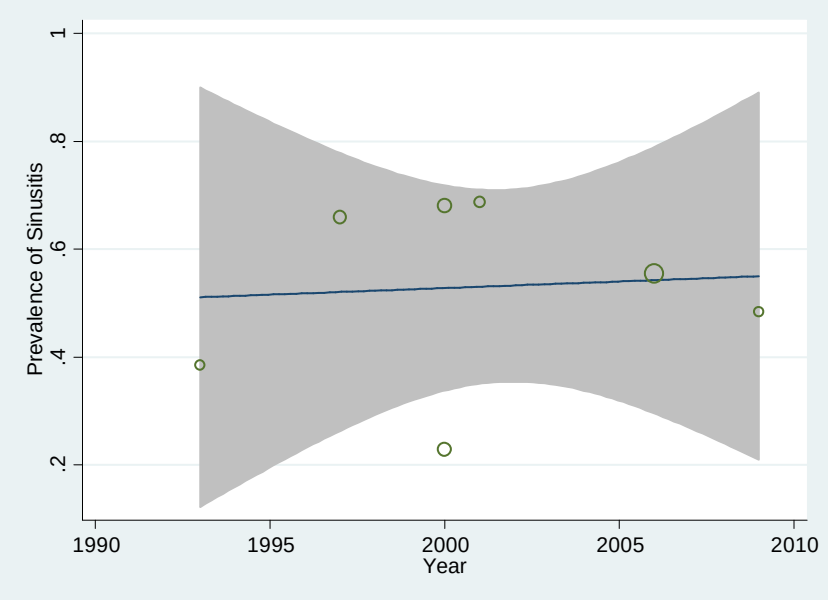


**Figure 3.The relationship between sinusitis and the research year using meta-regression. (According to the diagram, there is no significant relationship between the prevalence of sinusitis in Iran and research year (P=0.844). The prevalence of sinusitis in Iran did not increase in the years examined from 1990 to 2010.)**

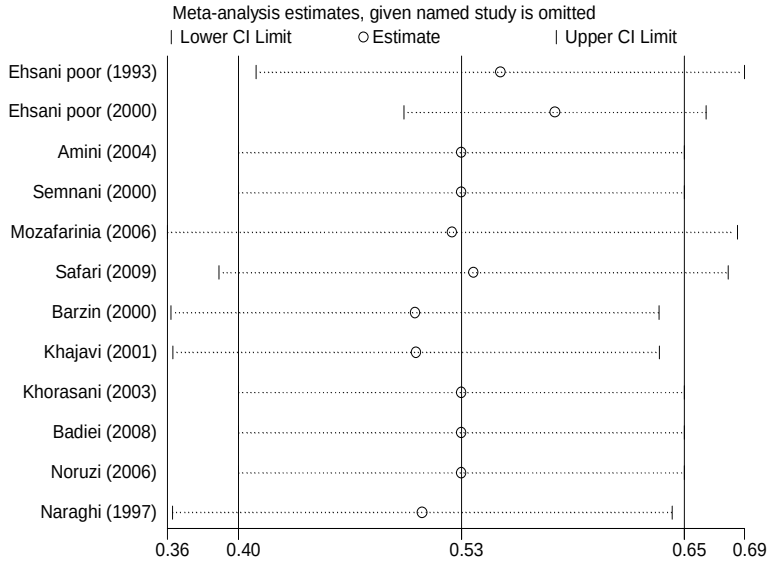


**Figure 4. The sensitivity analysis (circles indicate the relative risk (RR) by removing the studies while the segments reflect the confidence interval of 95% for RR). This figure shows how the final result of the current study is affected by the removal of each study. According to the above graph, the prevalence of sinusitis in Iran in 2000 increases to 57% by eliminating Ehsanpour's study (CI 95%: 49% to 66%). Moreover, the prevalence of sinusitis in Iran in 2000 decreases to 49% by eliminating Barzin's study (CI 95%: 36% to 63%). These were the two most effective studies on the final result of the current study.**

## DISCUSSION

The prevalence of sinusitis was 53% in 12 papers under investigation with a sample of 1057 subjects (CI 95%: 40% to 65%). In this study, the lowest and highest prevalence of sinusitis were found in studies by Ehsanpour et al. (2000) (23%) and Khajavi et al. (69%), respectively. Moreover, the prevalence of maxillary sinusitis was 68%, ethmoid sinusitis was 31%, sphenoid sinusitis was 19%, frontal sinusitis was 17%, maxillary sinusitis was 87% and fungal sinusitis was 39%. The prevalence of sinusitis in Iran is high. Among its various types, maxillary sinusitis is the most common while frontal sinusitis is the least common. The prevalence of clinical signs was 66% for nasal discharge, 28% for headache, 20% for postnasal drip and 33% for purulent sputum. In fact, most patients with sinusitis show the clinical symptoms of nasal discharge.

About 5 to 15% of the population in Europe, and 12% of population in the United States (about 30 million people) suffer from chronic sinusitis, the treatment of which costs about $60 million annually (2). Affecting 25 million people, sinusitis costs nearly $2 million directly imposed annually in the United States medical system (27). Moreover, the incidence of acute and chronic sinusitis are on the rise, affecting between 10 to 15% of people in Central Europe annually (21). The incidence of death among patients with sinusitis with untreated complications is 15 to 40%, which can be curtailed to 11 to 7.3% by timely and appropriate treatment (28).

The prevalence of sinusitis varied in different regions of Iran. In fact, the prevalence of sinusitis is 53% in northern Iran, 56%, in central Iran, and 48% in west of Iran. The minimum and maximum prevalence's of sinusitis were found in West and Central Iran, respectively. However, there cannot be an accurate estimate due to unequal distribution of studies in Iran. In the analysis conducted by age group of subject, it was concluded that the prevalence of sinusitis was 30% in patients under 20 years of age, 61% in patients aged 20 to 30 and 61% in adults over 30 years. The results indicated that with increasing age, the prevalence of sinusitis increased among the subjects who were more likely to develop sinusitis.

In a study by Khajavi et al. to determine the capability of limited coronal CT scan in the diagnosis of chronic sinusitis in 2001 on a total of 53 subjects, it was found that 68.8% of subjects had sinusitis (23). In a study by F. Ehsanpour (2000) on 74 patients, it was concluded that 22.9% of the patients were diagnosed with sinusitis (18). The

current study was carried out though a meta-analysis, since there was a difference between the results obtained by the previous studies.

Sinusitis is the most common health care issue in the US, affecting more than 31 million people in this country each year, and more than 10% of American are suffering. The statistics show that Americans in 1989 spent approximately $150 million on diagnostic or therapeutic measures (29). In a study by Newman et al. (1994) followed by the Bresciani et al. (2001) on adults with asthma, the frequency of sinusitis was reported to be 74-90% (19). Albu S. et al. (2001) showed that out of 60 patients with orbital and intracranial infections, 23 cases (38.3%) were diagnosed with sinusitis (30). In another study on children with asthma, it was reported that 40-60% of cases had sinusitis 31. (31). According to Barnes, et al. as well as Ten Brink et al., involvement of sinuses may be a risk factor for severity of asthma and its complications (32). In their study, Lewis et al. examined 363 samples from Yorkshire and 1042 samples from York, finding out that particular environmental conditions and air pollution were effective in the prevalence of maxillary sinusitis (33).

There were a few limitations in this study, including: Lack of access to full text of papers, imperfect information about the research papers under study.

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