Int J Cancer Manag. 2023 December; 16(1):e135020. https://doi.org/10.5812/ijcm-135020.

Published online 2023 April 30. **Systematic Review**

# Incidence Trend of Lung Cancer in Iran: A Systematic Review and Meta-analysis

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**Received** 2023 January 17; **Revised** 2023 February 25; **Accepted** 2023 February 28.

## Abstract

**Context:** Lung cancer (LC) is one of the common diseases in the pulmonary system, which is defined as the uncontrolled growth of cells in the lung tissue.
**Objectives:** The present investigation was conducted with the aim of the prevalence of LC in Iran by meta-analysis method.
**Methods:** In this meta-analysis study, the articles that were conducted to determine age-standardized incidence rates (ASRs) in the field of LC were included in the study. The inclusion criteria included determining the number of ASRs in Iranian LC patients, reporting the sample size in men and women groups, and publishing articles between 2000 and January 2023. Data were analyzed, using CMA software.
**Results:** In this meta-analysis study, 889 articles were found in the initial search, and after the final search, 23 articles were included in the meta-analysis stage. Out of the 22 final articles, the prevalence of LC was 3.7% (95% CI, 2.6 - 5.3) in women and 7.1% (95% CI, 5.7 - 9) in males.
**Conclusions:** Considering that the incidence rate of LC in this study was high, it is essential to carry out necessary preventive interventions in this field.

*Keywords:* Lung Cancer, Iran, Systematic Review, Meta-analysis

## 1. Context

Iran is a developing country that has seen a period of communicable diseases prevalence and is currently facing the spread of non-communicable chronic diseases, which have high morbidity and mortality rate (1-3). Cancer is one of these chronic diseases that affect different parts of the body including the breast (4), brain (5), prostate (6), kidney, digestive system (7), and lung (8). By the way, cancer leads to physical and mental problems in the patient or the caregivers (9).

Lung cancer (LC) is one of the pulmonary systems, which is defined as the uncontrolled growth of cells in the lung tissue. Lung cancer does not show any symptoms in the early stages of the disease. So, when the patient refers to the doctor, it may be in advanced stages and create severe complications of the disease or may lead to death (10-12). According to the type and characteristics of each of the mentioned types, survival chances may be significantly different (13-15).

The high mortality rate of LC is due to the high incidence and low survival rate of this disease, and the metastasis of the disease is one of the factors affecting the survival and longevity of patients. Metastasis can be a new source for the occurrence of cancer in another part of the body, and with the spread of the disease and metastasis to other parts of the body, the patient's condition worsens and the patient's survival becomes a challenge (16-19).

Various factors, including age, affect the occurrence of cancer. So, most cancer patients are in the age range of over 65 years. Also, other factors such as smoking and exposure to industrial compounds (including arsenic, asbestos, and chromium), suffering from chronic lung diseases, occupational exposure, and a previous history of tuberculosis are effective in causing primary carcinoma of the lung (20-22). Each of the LC symptoms can have destructive effects on the quality of life, life expectancy, and mental health of patients and can lower the life expectancy of patients (23-25).

Based on the incidence rate of LC in some countries,

this rate has been investigated in published articles. In terms of incidence rate, China is in the first place and the cause of about 30% of cancer deaths, and in the United States, LC is the second most common and cause of about 25% of cancer deaths (26-29). However, in Iran, accurate statistics on the incidence of l LC are not available.

## 2. Objectives

The present investigation was conducted with the aim of the prevalence of LC in Iran by meta-analysis method.

## 3. Methods

In this meta-analysis study, articles that were conducted to determine age-standardized incidence rates (ASRs) in the field of LC were included in the study. The inclusion criteria included determining the number of ASRs in Iranian LC patients, reporting the sample size in men and women groups, and publishing articles between 2000 and January 2023.

The search was conducted in the domestic databases of Iran such as SID, MagIran, IranMedex, and IranDoc, and the international databases such as Cochrane, Embase, ScienceDirect, Scopus, PubMed, and Web of Science. If the articles were entered, the inclusion and exclusion criteria of the study were collected according to the checklist made by the researcher (which had questions about the author's name, city, year of publication, sample size, and ASRs). Then, the data were analyzed, using CMA 3 software.

## 4. Results and Discussion

In this meta-analysis study, 889 articles were found in the initial search, and 23 articles were included in the meta-analysis stage (Figure 1 and Table 1).

The prevalence of LC was 3.7% (95% CI, 2.6 - 5.3) in women and 7.1% (95% CI, 5.7 - 9) in males. (Figures 2 and 3). Also, the funnel plot diagram is shown in Figures 4 and 5, and the regression of LC incidence in Figures 6 and 7.

The prevalence of LC was 3.7% (95% CI, 2.6 - 5.3) in women and 7.1% (95% CI, 5.7 - 9) in males. In the meta-analysis study by Hassanipour et al., which reviewed 14 original articles on the incidence of LC; the incidence rate was 6.33% in men and 2.57% in women (52). From the difference between this meta-analysis study and Hassanipour et al. study, 14 articles in the group of women and 14 articles in the group of men were included in the meta-analysis study between 1996 and 2010 (52). In this meta-analysis study, 21 articles for the group of men and 20 articles for the group of women were included in the study.

The incidence rate of LC in men was 7.1%, which was found in 21 reviewed articles between 2021 and 2023. Sun et al. reported an incidence of 50.04 per 100 000 (53), which was higher than the results of this study. Also, regarding women in the study of DeRouen et al., the incidence of LC among women who had no history of smoking was 13.1%, and among women who smoked was 17.1%, which is much higher than the results of this study (54).

In this meta-analysis study, the incidence rate of LC was higher in men (7.1%). In the study of Sun et al. in China (53) and the study of Yang et al. in China and the United States, the incidence rate was 69% in men and 31%in women (55), which was consistent with the results of this study. On the other hand, in the study of Jemal et al. in the United States and the group born in 1950 in people aged 45 to 49 years, the incidence rate in women was 27% per 100 000, and in men, it was 36.5% per 100 000. In the group born in 1965, the incidence in women was 24.5% per 100 000, and in men, it was 23.1% per 100 000 (56). One of the reasons for the difference between this meta-analysis study and Jemal et al.'s study is the difference in the risk factors that cause cancer. In Iran, smoking, as one of these risk factors, is less common in women than in men. The prevalence of chronic diseases is increasing and all the efforts of the health and treatment staff are to reduce chronic diseases. For this reason, prevalence studies in the field of chronic diseases are a priority (57, 58).

Among the strengths of this study, we can mention updating the data related to the occurrence of LC in Iran. By updating the incidence of LC, health policymakers can make the necessary decisions in the field of prevention and early detection of LC.

## 5. Conclusions

Considering that the incidence rate of LC in this study was high, it is essential to carry out necessary preventive interventions in this field.

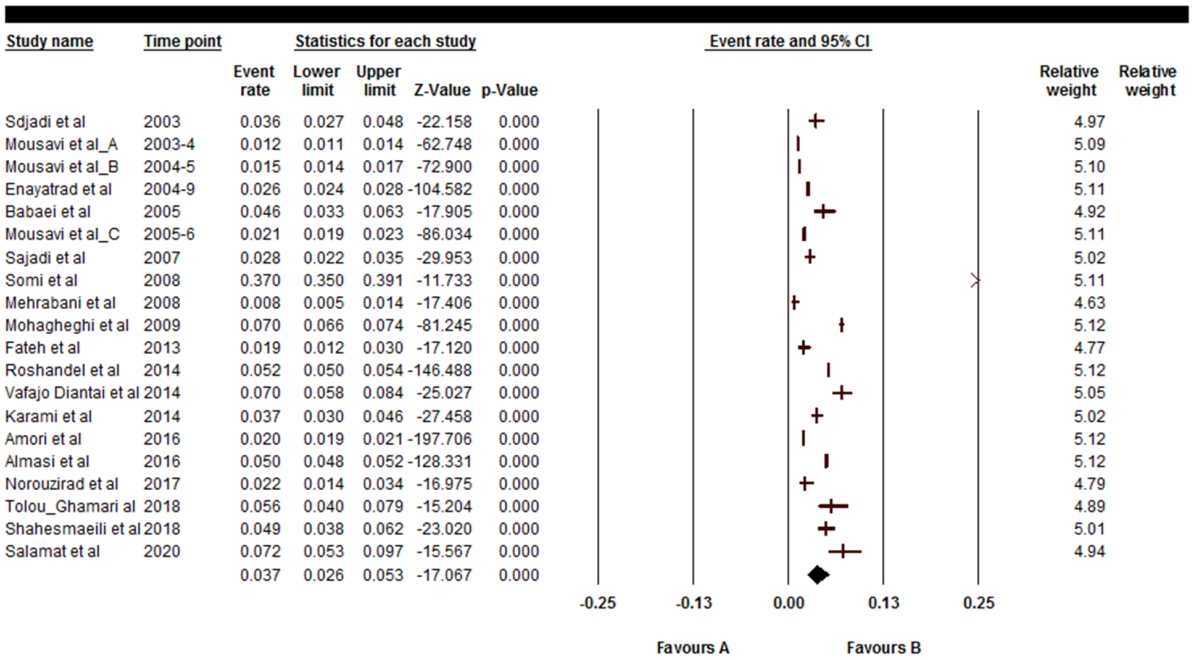


**Figure 2.** Prevalence of lung cancer in Iranian women (I-squared = 99.708, Q-value = 6504.051)

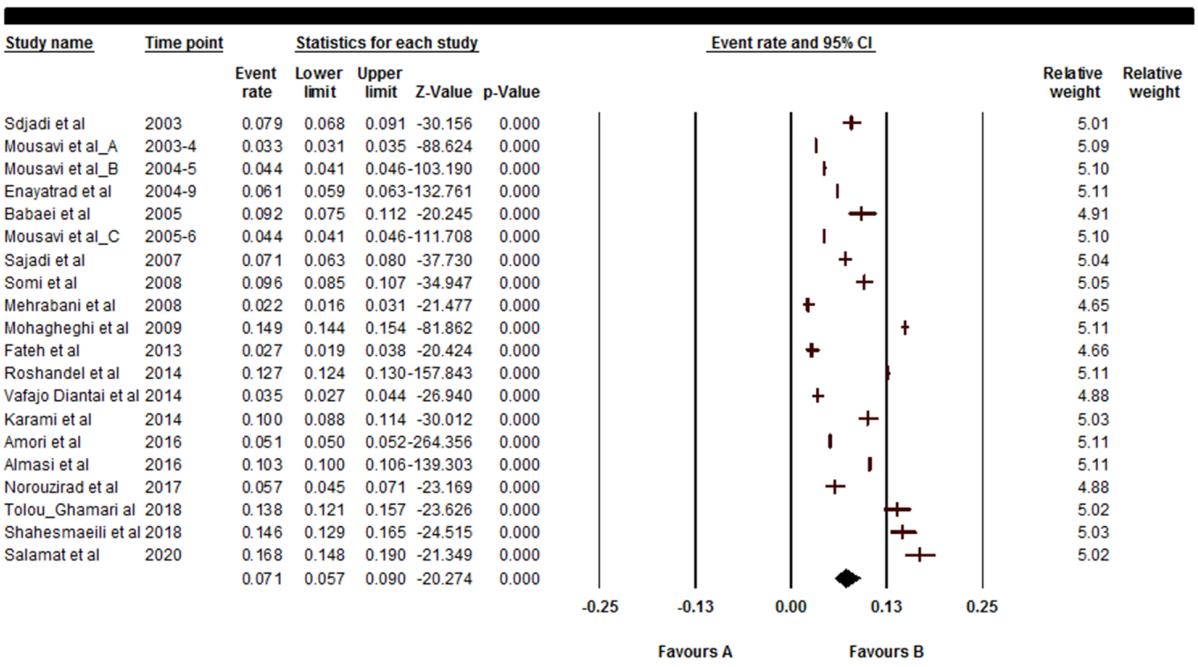


**Figure 3.** Prevalence of lung cancer in Iranian males (I-squared = 99.740, Q-value = 7314.729)

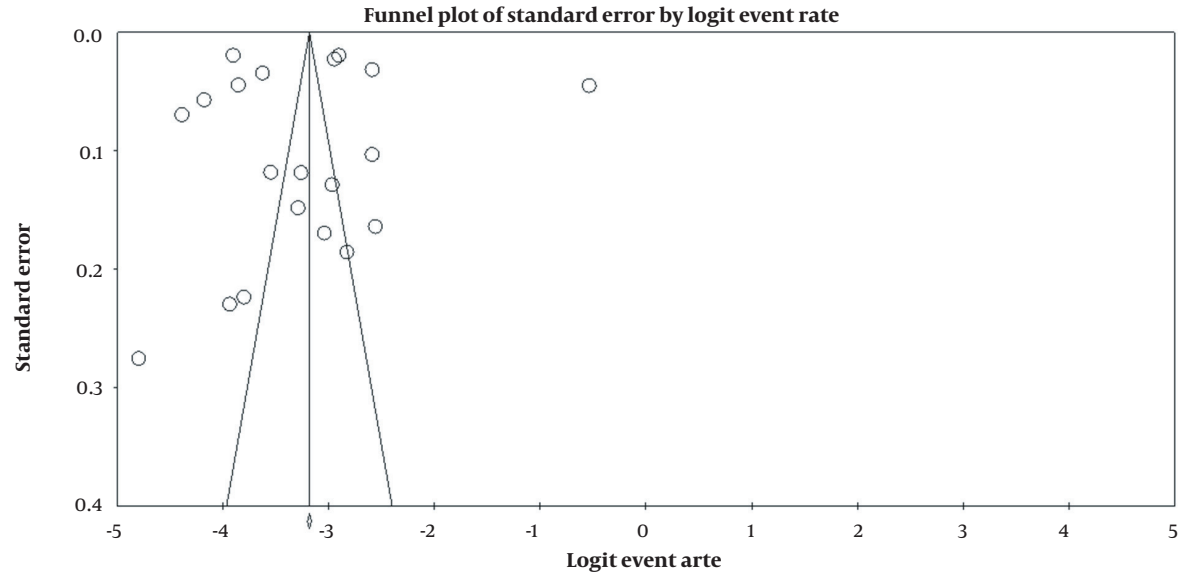


**Figure 4.** Funnel plot diagram for lung cancer in Iranian women

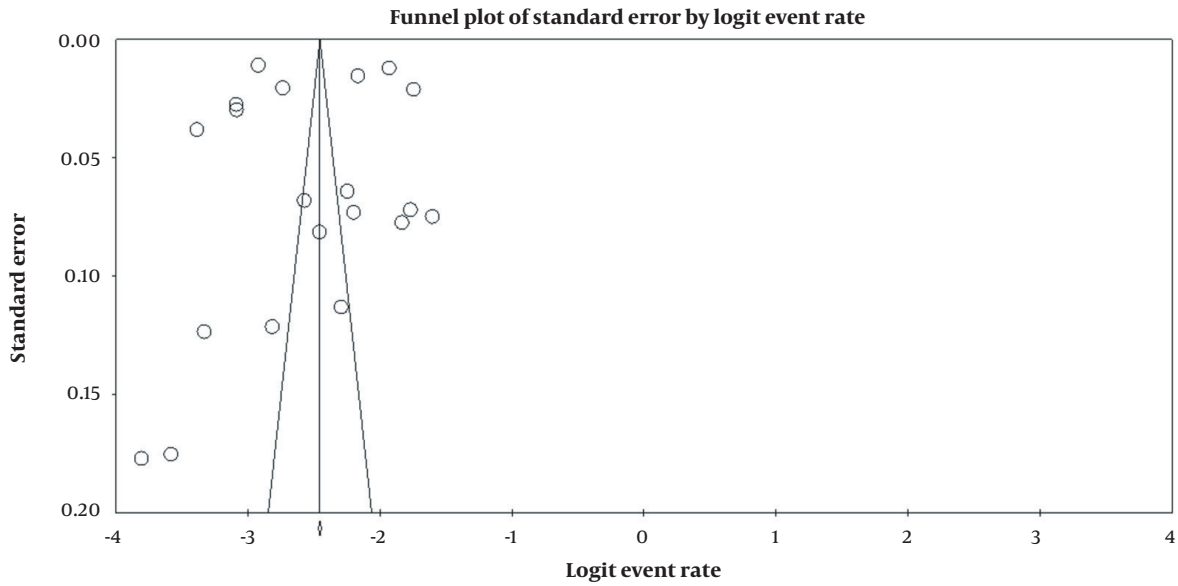


**Figure 5.** Funnel plot diagram for lung cancer in Iranian males

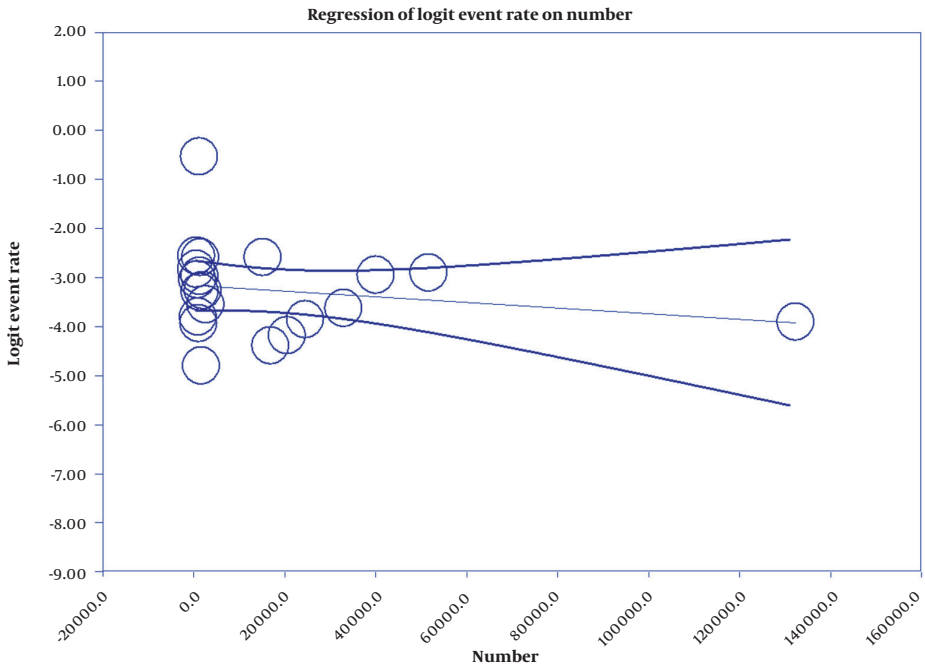


**Figure 6.** Regression of lung cancer (LC) incidence in Iranian women according to the number of patients ($I^2$ = 99.6%, Q = 0.95, P = 0.32)

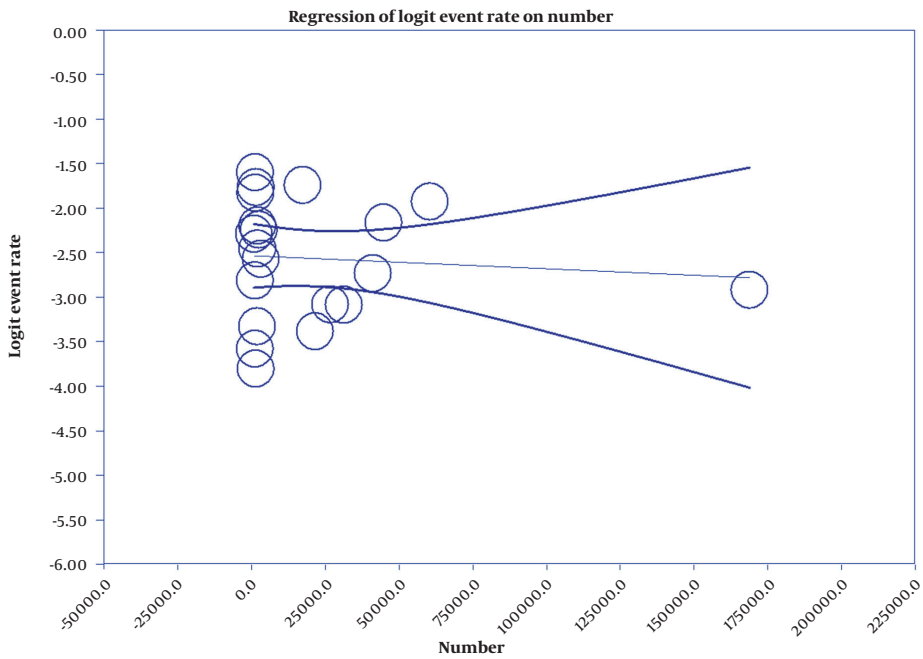


**Figure 7.** Regression of lung cancer (LC) incidence in Iranian males according to the number of patients ($I^2$ = 99.67%, Q = 0.19, P = 0.66)

**Table 1.** Characteristic of Studies

| | Authors | City | Years | Sample Size | | ASRs | |
|---|---|---|---|---|---|---|---|
| | | | | Male | Female | Male | Female |
| 1 | Roshandel et al. (30) | Registry | 2014 | 60469 | 51628 | 12.7 | 5.21 |
| 2 | Sadjadi et al. (31) | Ardabil | 2003 | 2072 | 1309 | 7.9 | 3.6 |
| 3 | Fateh and Emamian (32) | Registry | 2013 | 1234 | 1006 | 2.71 | 1.92 |
| 4 | Mohagheghi et al. (33) | Registry | 2009 | 17407 | 15154 | 14.9 | 7 |
| 5 | Somi et al. (34) | East Azerbaijan | 2023 | 2546 | 1175 | 6.69 | 3.89 |
| 6 | Somi et al. (35) | East Azerbaijan | 2008 | 2798 | 2085 | 9.58 | 3.70 |
| 7 | Babaei et al. (36) | Semnan | 2005 | 936 | 796 | 9.19 | 4.57 |
| 8 | Vafajo Diantai et al. (37) | Ghom | 2014 | 1961 | 1438 | 3.46 | 7 |
| 9 | Mousavi et al. (38) | Southeast of Iran | 2003 - 2004 | - | 16849 | 3.28 | 1.23 |
| | | | 2004 - 2005 | - | 20473 | 4.38 | 1.51 |
| | | | 2005 - 2006 | - | 24495 | 4.73 | 2.08 |
| 10 | Mehrabani et al. (39) | Fars | 2008 | 1495 | 1620 | 2.18 | 0.82 |
| 11 | Amori et al. (40) | Iran | 2016 | 168783 | 132272 | 5.12 | 1.98 |
| 12 | Zeinalzadeh et al. (41) | East Azerbaijan | - | 2047 | 1782 | 5.2 | 5.5 |
| 13 | Salamat et al. (42) | Golestan | 2020 | 1274 | 555 | 16.8 | 7.2 |
| 14 | Tolou Ghamari (43) | Isfahan | 2018 | 1399 | 548 | 13.2 | 5.4 |
| | | | | 1399 | 548 | 14.5 | 5.5 |
| | | | | 1399 | 548 | 13.8 | 6.1 |
| | | | | 1399 | 548 | 13.8 | 5.4 |
| 15 | Almasi et al. (44) | Registry | 2016 | 44838 | 39991 | 10.3 | 5 |
| 16 | Karami et al. (45) | Khuzestan | 2014 | 2073 | 1992 | 10 | 3.7 |
| 17 | Shahesmaeili et al. (46) | Kerman | 2018 | 1545 | 1293 | 34.2 | 13.6 |
| 18 | Keyghobadi et al. (47) | Kerman | 2015 | 5793 | 4802 | - | - |
| 19 | Norouzirad et al. (48) | Dezful | 2017 | 1270 | 932 | 5.66 | 2.19 |
| 20 | Sadjadi et al. (49) | Kerman | 2007 | 3264 | 2620 | 7.1 | 2.8 |
| 21 | Masoompour et al. (50) | Fars | 2011 | 4549 | 3810 | - | - |
| 22 | Enayatrad et al. (51) | Iran | 2004 - 2009 | 41169 | 32898 | 6.1 | 2.6 |

Abbreviation: ASRs, age-standardized incidence rates.

## Footnotes

**Authors' Contribution:** EB and FSH conceived the study, performed data analysis, and wrote the manuscript. EB and FSH collected data and wrote the manuscript. EB and FSH interpreted the results and wrote the manuscript. EB and FSH designed the study, wrote, and edited the manuscript.

**Conflict of Interests:** No conflict of interest.

**Data Reproducibility:** The dataset presented in the study is available on request from the corresponding author during submission or after publication.

**Funding/Support:** Ilam University of Medical Sciences (A-10-3671-4).

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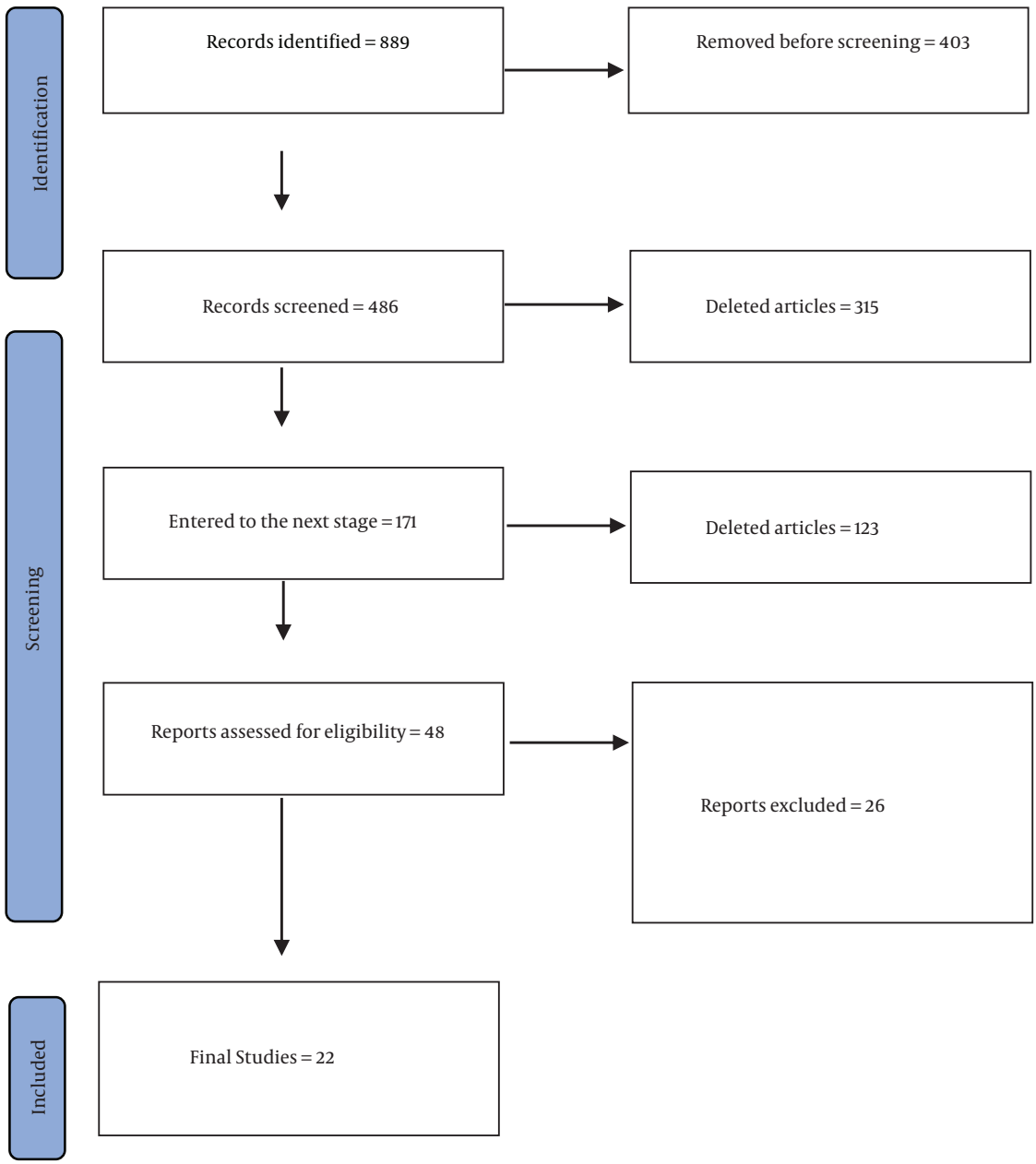


**Figure 1.** Flowcharts for systematic review