

Review Article

The incidence of prostate cancer in Iran: a systematic review and meta-analysis

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ABSTRACT

Background: Prostate cancer is one of the most common cancers among men. There are various estimates of prostate cancer incidence from different geographical areas in Iran. In addition, no systematic reviews are available regarding the incidence rate of prostate cancer in Iran. Therefore, the present systematic review aimed to address this epidemiological gap.

Method: This systematic review was performed based on the preferred reporting items for systematic reviews and meta-analyses in July 2017. In doing so, the researchers searched Medline/PubMed, Scopus, Embase, ScienceDirect, and Google Scholar for international articles and four Iranian databases (Scientific Information Database, MagIran, IranMedex, and IranDoc) for Persian articles.

Result: A total of 274 titles were retrieved in the initial search of the databases. Further refinement and screening of the retrieved studies produced a total of 21 studies. Based on the random-effect model, the age-standardized rate of prostate cancer was 9.11 and 95% confidence interval was 8.19–10.04. Besides, the results of Cochran's test indicated the heterogeneity of the studies ($Q = 1457.8$, $df = 46.0$, $I^2 = 96.8\%$, $P < 0.001$).

Conclusion: The incidence of prostate cancer was lower in Iran than in the other parts of the world. Yet, establishing cancer registries covering a broader perspective of the population and conducting further studies are required to map out the exact incidence rate and trend of prostate cancer in Iran.

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1. Introduction

Cancer is currently one of the leading causes of death worldwide.¹ In 2012, 14.1 million new cancer cases have occurred worldwide.² Prostate cancer is one of the most common cancers among men around the world. In addition, it is the second leading cause of cancer death, after lung cancer.³

The incidence rate of prostate cancer varies greatly among different parts of the world. The highest incidence rate was observed in North America, and the lowest incidence rate was observed in South Asia.⁴ It is estimated that 1.1 million men were diagnosed with prostate cancer in 2012, and 70% of them (795,000 new cases) were in developed countries.⁵

The first study on cancer-related data from Iran was published by Habibi in 1962.⁶ In 1984, the National Cancer Registry

System was established. Because of the National Cancer Registry System establishment, various inconsistent reports with a lot of controversies were published about the incidence and prevalence of various cancers from pathology centers and cancer registries.

Awareness of current status and trends in the incidence rate of cancer in the country can be useful for better planning and prevention. Although few studies have been conducted to address the systematic review on the incidence of different cancers in Iran,⁷ no systematic survey has been conducted to explore the incidence of prostate cancer in Iran. This study aims to systematically review the age-standardized incidence rate of prostate cancer in Iran.

2. Methods

This systematic review was designed and conducted in 2017. Our review was undertaken in accordance with the preferred reporting items for systematic reviews and meta-analyses⁸

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2.1. Search strategy of systematic review

In July 2017, the researchers searched MEDLINE/PubMed, Scopus, Embase, ScienceDirect, and Google Scholar for international articles and four Iranian databases, namely Scientific Information Database (www.sid.ir), MagIran (www.magiran.com), IranMedex (www.iranmedex.com), and IranDoc (www.irandoc.ac.ir), for Persian articles. The keywords included the following: “prostate cancer”, “prostate neoplasms”, “prostate tumor”, “cancer of prostate”, “neoplasms of prostate”, “incidence”, and “Iran”. The results were imported into an EndNote X5 library, and the duplicates were automatically removed. It should be mentioned that two reviewers (Hassanipour S and Fathalipour M) selected the articles independently.

2.2. Inclusion and exclusion criteria

The studies that clearly described the age-standardized rate (ASR) of prostate cancer and contained reports from Iranian populations were included in the review. On the other hand, the studies that reported the prevalence rate, the incidence that was exclusively based on pathological data, and the incidence of studies with inadequate sample size as well as posters and papers presented in conferences were excluded from the analysis.

2.3. Statistical analysis

Heterogeneity was assessed by Cochran's Q statistic (with a significance level of $P = 0.1$) combined with I^2 statistic (with a significance level of $\geq 50\%$). In the presence of significant heterogeneity ($P = 0.1$ and $I^2 \geq 50\%$), random-effect model (with inverse

variance method) was used. Furthermore, in case there was no evidence of heterogeneity ($P > 0.1$ and $I^2 < 50\%$), fixed-effect model was used. All the analyses were carried out using Stata software, version 12 (StataCorp LP, College Station, Texas).

3. Results

3.1. Description of literature search

The database, gray literature searches, and hand searching yielded 274 potentially relevant studies. In total, 189 unique studies were reviewed, and 32 studies entered into the second stage of evaluation. Overall, our review included 21 unique studies. Study retrieval and selection has been outlined in Fig. 1. Some studies were excluded from the review because of not being relevant to the topic ($n = 123$), incorrect study population ($n = 24$), duplicate study ($n = 3$), and inadequate data ($n = 27$). The flowchart of the included studies in this review has been shown in Fig. 1.

3.2. Description of the included studies

The characteristics of the included studies have been summarized in Table 1. Considering the geographical region, seven studies were conducted in all states of Iran,^{9–15} three in Fars province,^{16–18} two in Golestan province,^{19, 20} one in British Columbia (BC) Iranians,²¹ one in Tehran province,²² one in East Azerbaijan province,²³ one in Khuzestan province,²⁴ one in Yazd province,²⁵ one in Qom province,²⁶ one in Shahroud city,²⁷ and one in Mazandaran province.²⁸ In addition, one survey was conducted in five provinces (Ardabil, Guilan, Mazandaran, Golestan, and Kerman).²⁹ It should be mentioned that all the studies reported ASRs.

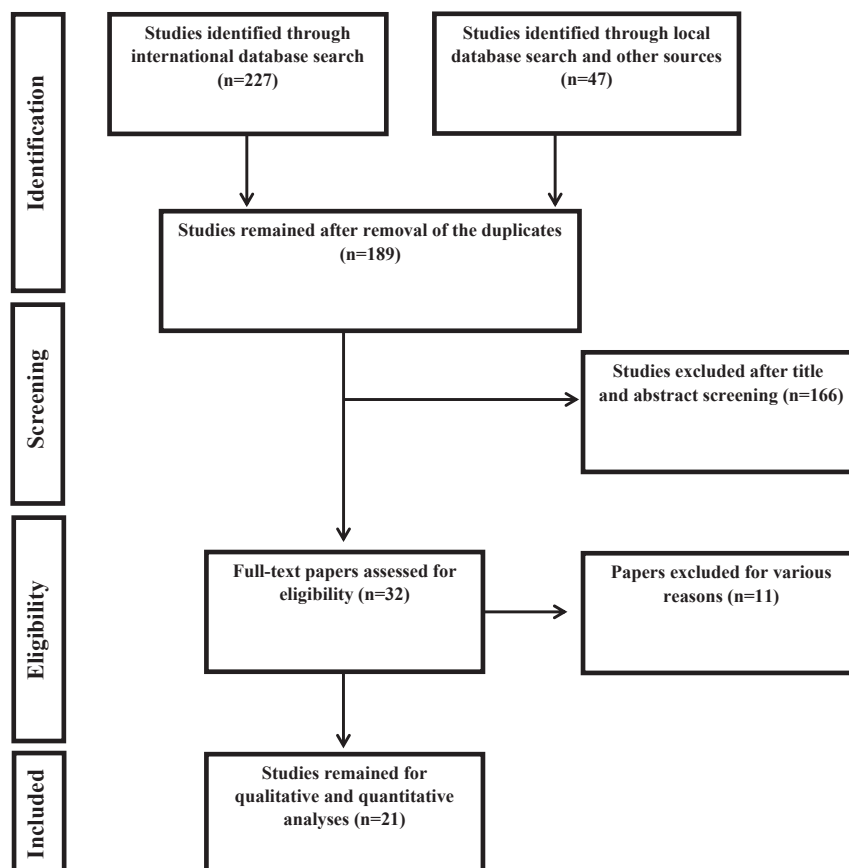


Fig. 1. Figure shows the flowchart of the included eligible studies in systematic review.

Table 1
Basic characteristics of the studies included in the review

Order	Author/Year	Time period	Location	Sample size	ASR (Males)
1	Yavari, 2006	1988–2003	BC Iranians	–	25.2
2	Sadjadi, 2007	1996–2000	Ardabil	58	3.4
			Guilan	182	4.4
			Mazandaran	273	6.1
			Golestan	106	5.2
			Kerman	120	3.2
			Total	703	5.1
3	Marjani, 2008	2004	Golestan	409	5.17
4	Mohagheghi, 2009	1998–2001	Tehran	34318	15.6
5	Mousavi, 2009	2003–2004	Iran	11346	5.70
		2004–2005			7.24
		2005–2006			9.41
6	Somi, 2009	2006–2007	East Azerbaijan	4922	10.19
7	Farahmand, 2010	2003	Fars	1212	4.69
		2004			7.16
		2005			15.09
		2006			14.04
		2007			16.65
		2008			16.02
8	Masoompour, 2011	1998–2002	Fars	8359	3.5
9	Roshandel, 2012	2004–2008	Golestan	9007	10.1
10	Fateh, 2013	2000–2010	Shahroud	2240	9.71
11	Amoori, 2014	2004–2008	Khuzestan	5075	12.4
12	Basiri, 2014	2003	Iran	5247	5.4
		2009		10285	12.59
13	Roshandel, 2014	2012	Iran	–	12.6
14	Vakili, 2014	2005	Yazd	4631	5.7
		2006			5.9
		2007			6.3
		2008			10.4
		2009			12.4
15	Pakzad, 2015	2012	Iran	556	8.7
16	Rafiemaneh, 2015	2004	Qom	3029	6.60
		2005			4.78
		2006			5.69
		2007			8.00
		2008			8.85
					Mean: 6.78
17	Almasi, 2016	2012	Iran	84,829	12.6
18	Masoompour, 2016	2007–2010	Fars	–	12.99
19	Pakzad, 2016	2003–2008	Iran	16071	2003: 5.40
					2004: 7.24
					2005: 9.22
					2006: 9.57
					2007: 10.91
					2008: 12.80
20	Salehiniya, 2016	2004–2009	Mazandaran	6177	11.6
21	Mohammadi, 2017	2002–2010	Iran	514550	13.79

3.3. The results of individual studies

The highest ASR was reported from BC Iranians between 1988 and 2003 (25.2),²¹ whereas the lowest ASR was reported from Kerman province between 1996 and 2000 (3.2).²⁹

3.4. The results of meta-analysis

Based on the random-effect model, the ASR of prostate cancer was 9.11 and 95% confidence interval was 8.19–10.04. Besides, the results of Cochran's test indicated the heterogeneity of the studies ($Q = 1457.8$, $df = 46.0$, $I^2 = 96.8\%$, $P < 0.001$). The forest plot of the random-effect meta-analysis for ASRs of prostate cancer in Iran has been presented in Fig. 2. Owing to the small values of ASRs, all the measurements in the forest plot were multiplied by 10^5 .

4. Discussion

Iran is the 18th largest country in the world and the second largest country in the Eastern Mediterranean. Iran has a wide

variety of climate, ethnicity, culture, and religion. Iran is divided into five main regions and 31 provinces. Recently, according to the World Bank's ranking, Iran has stood among the upper middle-income countries.³⁰

Cancer is the third cause of death in Iran.³¹ Based on Globocan 2012, prostate cancer is one of the most common cancers among Iranian men.³² One of the reasons for the discrepancy between the Globocan's reported incidence rate and Iran's reported incidence rate could be because of different estimates and different sources of information in Iran.¹⁴

So far, few studies have been conducted on the epidemiology of cancer in developing countries such as Iran, which could be due to the limited tools and structures available for the care and control of the disease. The first report on cancer incidence in Iran dates back to the 1970s, which investigated the cancer incidence in the Caspian littoral region between 1968 and 1972.³³

The result of this study showed that the incidence of prostate cancer in Iran is low (ASR = 9.11 per 100,000), whereas the Asian countries such as Turkey (40.6 per 100,000) and Lebanon (37.2 per 100,000) have a high standardized incidence ratio (SIR). In addition,

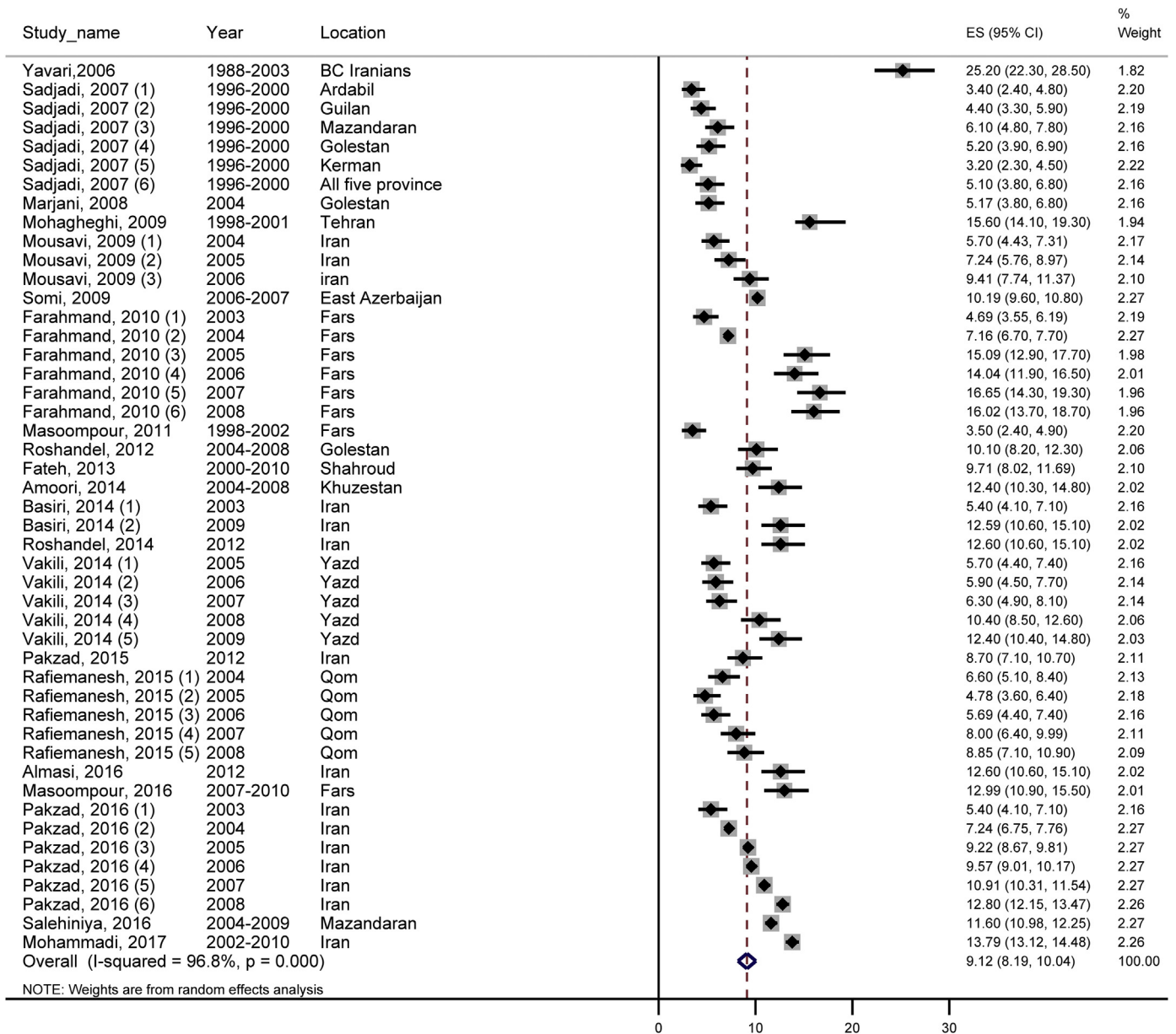


Fig. 2. Figure shows the forest plot of the random-effect meta-analysis for age-standardized incidence rates of prostate cancer in Iran.

countries such as Bhutan (1.2 per 100,000), Nepal (1.5 per 100,000), and Bangladesh (1.7 per 100,000) have the lowest SIR.¹² Globally, countries in the Oceania region, such as Australia and New Zealand (111.6 per 100,000), and North America (97.2 per 100,000) have the highest SIR. South-Central Asian countries (4.5 per 100,000), and South East Asia (5.5 per 100,000), have the lowest incidence rate.³ This difference can be explained by differences in the environmental contexts, income levels, lifestyles, and the existence of screening programs in higher-income areas for early detection of cancer.^{34–36} According to a study that examined the correlation between the human development index and the SIR of prostate cancer, the incidence of prostate cancer is high in countries with higher human development index.³

Based on the results of our study, the highest ASR in Iran was observed in Iranian immigrants to BC (25.2 per 100,000). The incidence rate of prostate cancer among Iranian immigrants is very close to that of the general population of BC, which can justify the

effects of lifestyle and environmental factors of the destination country on the risk of developing this particular type of cancer.³⁷

In addition, the lowest ASR in Iran was observed in Kerman province (3.2 per 100,000). The low incidence rate of prostate cancer in this province can be attributed to the demographic characteristics of people living in this area, lifestyle, and the presence of other types of diseases and cancers.^{38, 39} In Kerman province, prostate cancer is not among the five most common cancers of men. So that, people are at risk of diagnosing other types of cancers and are less likely to be diagnosed with prostate cancer. Prostate cancer is known as a cancer that affects people at elderly ages.⁴⁰

In the present study, the incidence of prostate cancer increased in some recent studies; this could be due to the improvement in cancer registry completeness, enhancement of life expectancy,¹² more access to screening and diagnosis of prostate cancer, change in lifestyle and diet, more exposure to environment and occupation risk factor, and increasing prevalence of smoking.^{3,14}

Finally, it should be noted that the prevalence of cancer risk factors in Iran is high and is facing an increasing trend. In fact, with the increasing number of elderly people and increasing life expectancy, we expect to see more new cancer cases in the coming years.

5. Conclusion

The incidence of prostate cancer in Iran was lower than in the other parts of the world. Therefore, establishing cancer registries covering a broader perspective of the population and performing further studies are required to map out the exact incidence rate and trend of prostate cancer in Iran.

Conflicts of interest

All authors have no conflict of interest to declare.

Appendix A. Supplementary data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.pnrl.2017.11.003>.

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