Incidence Trends of Gastric Cancer in Southern Iran: Adenocarcinoma and Non-cardia Gastric Cancer Are More Rising Among Younger Ages

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Abstract

Background Gastric Cancer (GC) is still one of the major causes of cancer mortality. Due to health-related transitions, the epidemiology of GC subtypes may change. These changes may have profound effects on clinical approaches as well as on public health management of GC. Iran, as a developing country, has experienced huge demographic and epidemiological transitions during the recent decades. This study aimed to investigate the subtype-specific population-based incidence trends of GC in southern Iran.

Methods We used data on GC incidence in southern Iran during 2001–2015. Data preparation and subtype grouping were done based on the ICD-O-3. The trends of Age-Standardized incidence Rate (ASR), truncated ASRs, incidence rate of adenocarcinoma, and cardia GC, and age-gender specific rates were analyzed using joinpoint regression modeling. Annual Percentage Change (APC) and its 95% Confidence Intervals (CIs) were estimated.

Results Overall APC was estimated as 7.2 for males and 8.7 for females. The estimated APCs for the trends of overall GC, and gastric adenocarcinoma were stable in both genders during 2009-2015. Nonetheless, cardia GC showed increasing trends in both genders. The estimated APCs for the trends of non-cardia GC was also stable.

Conclusion The overall trends of the GC incidence in southern Iran were stable during the past decade. However, significant and different changes have occurred in the pattern of GC. Thus, etiological and prognostic studies are needed for the improvement of GC management in Iran.

Keywords Gastric · Malignancy · Incidence · Subtypes · Adenocarcinoma · Cardia · Iran

Introduction

Gastric Cancer (GC) is still one of the major causes of cancer mortality despite the decrease in its incidence trend over the past decades [1, 2]. In spite of the decreasing trend of the GC incidence, decomposing this trend has provided valuable information [3]. For instance, the incidence trends of cardia and non-cardia GC have shown different patterns across the globe [4, 5]. There is also evidence regarding a morphological transition in GC. The incidence trend of gastric adenocarcinoma has been increasing in some developed countries in the recent decade [6].

Furthermore, the incidence trends of the GC subtypes have changed in different ways amongst males and females [7]. On the other hand, in some areas, the incidence rates have increased more in younger age groups compared to other age groups [8]. These trends have also shown variations across different geographical regions and sociodemographic statuses [2, 9]. These geographical and demographic differences may be attributed to the differences in the distribution of the GC risk factors, completeness of the cancer incidence data, differences in the quality of diagnostic services, or treatment-seeking behaviors these populations.

Overall, decomposing the GC incidence trend may provide evidence on its risk factors and subtype transitions, consequently providing updated evidence for developing more effective preventive programs, diagnostic approaches, and clinical management of GC.
Methods

In the present study, we used data on GC incidence in the catchment area of Shiraz Population-Based Cancer Registry (SPBCR) during 2001–2015.

Shiraz Population-Based Cancer Registry (SPBCR) is affiliated to Shiraz University of Medical Sciences. This registry was initiated as a pathology-based registry in 2001 and was improved to a population-based system in 2007. As in since, the quality and accessibility of cancer diagnosis and treatment services is much better in Shiraz, the capital city of the Fars province, than in other cities in southern Iran. Shiraz is the referral center for cancer care in south of the country. On the other hand, The Shiraz Population-Based Cancer Registry (SPBCR) collects the data on new cancer reports from almost all diagnostic and therapeutic centers as well as death registries in Fars province. SPBCR is the most qualified cancer registry in southern Iran regarding the completeness of case ascertainment, comparability, data quality, and timeliness [14].

Based on the most recent census, the population of the SPBCR catchment area, i.e., Fars province, is more than 4,851,000 with the female: male ratio of 1:1.03. Generally, Fars (80%), Turk (10%), and Lor (7.7%) are the most common ethnicities in Fars province. Additionally, Most of its inhabitants (≥ 68%) live in urban/suburban areas [15].

In SPBCR, patient data including age, gender, place of birth, living place, date of birth, date of current cancer diagnosis, and date of death are collected, abstracted, and computerized by well-experienced cancer registrars. In addition, topographic and morphological data of the malignancies are abstracted and registered using the third edition of the International Classification of Diseases for Oncology (ICD-O-3).

Duplicated cases are identified and removed via software-based techniques [16]. Multiple primaries are registered as new cases. An adapted version of CanReg5 software is used in SPBCR.

Data Preparation and Analysis

In this study, new cancer cases with ICD-O-3 codes C16.0 to C16.9 were retrieved and prepared. New annual cases were counted for the categories defined based on age group (under 25, 25–34, 35–44, 45–54, 55–64, 65–74, and 75 and older), gender (male, female), topography (cardia (ICD-O-3 code: C16.0), non-cardia (ICD-O-3 code: C16.1–C16.5), overlapping lesions (ICD-O-3 code: C16.8), and others], and morphology [adenocarcinoma (ICD-O-3 behavior code: 8140–8573), and others [3]. Cases with missing data were redistributed, if applicable.

Crude incidence rates and their 95% Confidence Intervals (CI) were calculated by dividing the number of new cases by the stratum-specific mid-year population. Annual Age-Standardized incidence Rates (ASR) and their 95% CIs were also estimated based on the 2000 world population. The incidence data were truncated at 25 (considering a very low number of new cases aging below 25 years, and assuming that younger populations are less at risk of GC), and truncated incidence rates were then estimated.

Temporal trends of the estimated stratum-specific ASRs were analyzed using joinpoint regression program (version 4.7.0), and the Average Annual Percentage Change (AAPC) and its 95% CIs were estimated for each trend. As the quality of the data was stable after 2009, the APCs were also estimated for the trend lines from 2009 to 2015 and these estimates were considered as the most plausible APCs to show the current incidence trend of GC in southern Iran. The data were prepared and analyzed using the MS Office Excel and Stata software (release 11, College Station, TX: StataCorp LLC) and p value of less than 0.05 was considered statistically significant.

Results

Descriptive

A total of 3413 new GC cases (2312 males and 1101 females) were registered in SPBCR from 2001 to 2015. The estimated mean age at diagnosis was 66.0 years (95% CI: 65.4, 66.5) for males and 62.0 years (95% CI: 61.0, 62.0) for females. The majority of cases had gastric adenocarcinoma (87.7%; 95% CI: 86.5, 88.8), 21.2% had cardia GC (95% CI: 23.0, 29.8) and 65.8% had non-cardia
GC (95% CI: 68.6, 79.0). Overall proportion of female cases was 32.2% (95% CI: 30.38, 34.2) among adenocarcinomas, and also 33.3% (95% CI: 29.0, 38.2) among non-cardia GCs.

**Recent Gastric Cancer Incidence Rate**

The estimated annual ASR of GC was 14.39 (95% CI: 14.37, 14.40) per 100,000 population for males and 7.17 (95% CI: 7.14, 7.20) per 100,000 population for females by 2015. The age-specific incidence rate in males was more than females across age groups except for 35–44 years age groups (Fig. 1).

**Trends of Overall and Age-Specific Incidence of GC**

Overall APC was estimated at 7.2(95% CI: 5.3, 9.1) for males and 8.7(95 CI: 5.3, 12.1) for females. Estimated APCs for trends of ASRs from 2009 to 2015 was not statistically significant for males (APC2009–2015: 3.0%, 95% CI: −2.0, 8.3) and females (APC2009–2015: 3.4%, 95% CI: −6.5, 14.4) (Fig. 2).

Estimated APC2009–2015 for trends of age-specific incidence rates were not statistically significant for all age groups in both genders, except for 25–34-year-old males with an APC of 78.2 (95% CI: 56.7, 102.7; Table 1).

**Adenocarcinoma**

Despite of increasing trends of gastric adenocarcinoma in males (APC2001–2015: 5.0%, 95% CI: 1.5, 8.5) and females (APC2001–2015: 8.0%, 95% CI: 1.8, 14.6) over the study period, estimated APCs for these trends were not statistically significant for both of males (APC2009–2015: 1.5%, 95% CI: −5.4, 8.9) and females (APC2009–2015: 3.7%, 95% CI: −5.7, 14.2) for the period of 2009 to 2015 (Table 1).

**Cardia and Non-cardia**

Trends of ASRs of cardia GC were increasing for males (APC2009–2015: 31.9%, 95% CI: 23.8, 40.5) and females (APC2009–2015: 15.5%, 95% CI: 5.9, 25.9) from 2009 to 2015. But estimated APCs of trends of ASRs of non-cardia GC were not statistically significant for males (APC2009–2015: 9.1%, 95% CI: −2.6, 22.3) and females (APC2009–2015: 1.9%; 95% CI: −29.1, 46.5; Table 2).

**Discussion**

The present study aimed to determine the incidence trends of GC in southern Iran. The results demonstrated that the overall and age-specific incidence trends of GC were stable in both genders from 2009 to 2015, after a rising trend from 2001 to 2008. In this regard, an increasing trend was observed in 25–34-year-old males. Similar trends were also obtained for gastric adenocarcinoma and non-cardia GC. The results also revealed an ascending trend for cardia GC in males. However, the incidence trend of cardia GC followed a descending trend among younger females.

The ASR of GC was 14.3 among males and 7.2 among females in 2015. These rates were lower compared to most available estimates from Iran. Hajizadeh and Pourhoseingholi also disclosed that Fars province had the lowest risk of GC in Iran [17, 18]. This might be due to the higher social development, lower prevalence of *H. pylori*, and higher healthcare coverage in this region [19–21].
The current study findings showed that the overall trend of ASRs of GC was stable from 2009 to 2015. According to the results of joinpoint regression, the last observed trend started in 2009, which might be partially attributed to the stability of procedures, data sources, and competency of registrars and standards used by the Shiraz Cancer Registry since 2007 [14]. It might also result from the very low and stable exposure to *H. pylori* among the population in this region [20]. In contrast, previous reports from developed countries revealed a descending trend in the incidence of GC [22, 23]. Yet, this could be considered a starting point for the significant decrease in the incidence of GC in this region.

The findings of the current research indicated the ascending trend of gastric adenocarcinoma only amongst younger males, which was inconsistent with reports from developed countries [6]. This result could be associated with higher alcohol consumption in this age group and very low and ignorable alcohol consumption among older age groups in Iran. The increasing trend of alcohol consumption has been reported among Iranian younger males in several studies [24, 25]. On the other hand, a lower exposure to *H. pylori* among younger Iranians has been reported [26]. The present study findings demonstrated the increasing trend of ASRs of cardia GC in both genders after 2009, rising more amongst males. This finding was in agreement with those of the studies performed in western countries as well as in countries with a westernized lifestyle [4, 5]. Although limited knowledge is available regarding the etiology of cardia GC, it is well known that its prognosis is poor compared to non-cardia GC [9]. The high prevalence of cigarette smoking as well as increasing prevalence of obesity among Iranian males might be the underlying reasons for this rising trend [27–29].

The current study findings revealed a decreasing trend in the incidence of cardia GC among females in most of the age groups. This might be explained by the lower rate of cigarette smoking among Iranian females, except for elderly
Table 1  Trends of age-specific, age standardized, and age truncated incidence rate of gastric adenocarcinoma in southern Iran

| Age group/gender | 2001–2015 AAPC (95% CI) | 2009–2015 AAPC (95% CI) | 2001–2015 Overall AAPC (95% CI) | 2009–2015 Overall AAPC (95% CI) |
|------------------|--------------------------|--------------------------|---------------------------------|---------------------------------|
| Female Under 25  | 51.8 (−28.6, 222.7)      | −40.5 (−95.6, 697.8)     | 123.7 (−51.8, 937.7)            | 66.9 (−53.6, 500.1)             |
| 25–34            | 57.1 (−14.4, 188.1)      | 16.2 (−55.2, 201.0)      | 88.6 (−56.1, 710.3)             | 20.8 (−52.5, 207.7)             |
| 35–44            | 4.2 (−1.3, 10.1)         | 17.4 (−5.6, 46.1)        | 3.8 (−8.4, 17.7)                | 25.1 (−2.8, 60.8)               |
| 45–54            | 11.3 (5.9, 16.9)         | −3 (−10.3, 5.0)          | 11.4 (6.1, 16.9)                | −3.8 (−11.0, 4.0)               |
| 55–64            | 4.7 (−8.4, 19.5)         | −0.1 (−24.6, 32.3)       | 8.3 (−4.3, 22.7)                | 11.0 (−14.6, 44.3)              |
| 65–74            | 6.1 (−3.7, 16.8)         | 3.4 (−8.8, 17.2)         | 4.7 (−5.2, 15.6)                | 2.4 (−12.7, 20.0)               |
| 75+              | 15.1 (7.3, 23.4)         | 4.7 (−9.0, 25.4)         | 13.9 (3.4, 25.4)                | 7.8 (−12.1, 32.2)               |
| Overall          | 8.7 (2.0, 15.9)          | 3.2 (−6.9, 14.3)         | 7.6 (1.3, 14.4)                 | 2.6 (−9.2, 15.9)                |
| Overall truncated| 8.7 (2.0, 15.9)          | 3.2 (−6.9, 14.3)         | 7.6 (1.3, 14.4)                 | 2.6 (−9.2, 15.9)                |

Table 2  Trends of age-specific age standardized and truncated incidence rate of gastric cancer in southern Iran by cardia/non-cardia

| Age group/gender | 2001–2015 Cardia APC (95% CI) | 2009–2015 Cardia APC (95% CI) | 2001–2015 Non-cardia APC (95% CI) | 2009–2015 Non-cardia APC (95% CI) |
|------------------|-------------------------------|-------------------------------|----------------------------------|----------------------------------|
| Female Under 25  | –                             | –                             | 50.9 (−7.0, 144.7)               | 27.6 (−60.0, 119.4)              |
| 25–34            | 19 (−20.9, 79.2)              | −37.9 (−37.9, −37.9)         | 106 (−2.2, 334.0)                | 40.6 (−58.5, 375.9)              |
| 35–44            | −61.2 (−79.7, −25.9)         | −90.8 (−97.5, −66.5)         | 122.5 (27.5, 288.3)              | 45.6 (−33.0, 216.1)              |
| 45–54            | −9.8 (−40.8, 37.5)           | −28.1 (−89.9, 411.5)         | 150.4 (43.8, 335.9)              | 13.5 (−61.8, 237.3)              |
| 55–64            | 16.9 (−79.7, −35.5)          | −92.8 (−97.9, −75.5)         | 208.5 (60.7, 492.2)              | −2.8 (−36.0, 47.7)               |
| 65–74            | −13.5 (−47.7, 43.0)          | −34.7 (−93.7, 578.6)         | 202.4 (54.4, 492.1)              | 76.7 (−27.8, 332.4)              |
| 75+              | 22.7 (21.5, 23.8)            | 48.0 (37.5, 59.3)            | 302.1 (76.6, 815.3)              | 7.8 (−45.7, 114.1)               |
| Overall          | 7.2 (−4.6, 20.5)             | 15.5 (5.9, 25.9)             | 195.8 (68.0, 420.9)              | 1.9 (−29.1, 46.5)                |
| Truncated        | 7.1 (−5.8, 22.6)             | 16.0 (5.8, 27.1)             | 208.4 (71.3, 455.0)              | 2.7 (−29.5, 49.7)                |

| Male Under 25    | –                             | –                             | –                                | –                                |
| 25–34            | 19.0 (−20.9, 79.2)            | −37.9 (−37.9, −37.9)         | 65.7 (−21.3, 248.9)              | 157.7 (12.0, 258.9)              |
| 35–44            | −2.6 (−36.0, 48.4)            | 87.3 (46.3, 139.7)           | 20.7 (−41.5, 149.1)              | −41.3 (−97.8, 149.1)             |
| 45–54            | 14.7 (8.8, 20.8)             | 24.8 (9.8, 41.7)             | 107.7 (16.8, 269.2)              | −2.6 (−32.6, 40.9)               |
| 55–64            | 17.9 (11.5, 24.7)            | 33.2 (23.8, 43.3)            | 53.3 (−4.1, 145.1)               | 8.2 (−57.2, 173.1)               |
| 65–74            | 20.1 (11.9, 28.9)            | 38.1 (26.0, 51.5)            | 246.9 (71.9, 600.3)              | −3.4 (−38.4, 51.6)               |
| 75+              | 10.2 (1.5, 19.7)             | 24.2 (10.1, 40.0)            | 64.1 (−0.8, 171.6)               | 23.5 (−47.6, 191.3)              |
| Overall          | 15.4 (11.9, 19.0)            | 31.9 (23.8, 40.5)            | 195.8 (68.0, 420.9)              | 9.1 (−2.6, 22.3)                 |
| Truncated        | 15.9 (13.2, 18.7)            | 32.6 (24.3, 41.4)            | 208.4 (71.3, 455.0)              | 9.4 (−5.0, 25.9)                 |
ones [28]. However, further studies are needed to explore the causes of GC in each age-gender subgroup, separately.

The incidence trend of non-cardia GC was increasing among young males (25-34 age group). Considering the increasing prevalence of exposure to *H. pylori* in Iran, the rising trend of non-cardia GC might result from the change in health-seeking behaviors among young Iranian populations including young males [30]. However, this trend was found to be stable for other age groups, which we think may be a result of the decrease in the prevalence of *H. pylori* exposure in Iran.

This study had some limitations. Since some data were registered with an unspecified topography, they had to be redistributed using a proportional to size approach and to be classified into broad categories including cardia, non-cardia, and other types of GC. Therefore, although our findings were robust in terms of topography, there is a need for significant improvement in pathology reporting and abstracting.

As the pattern of lifestyle transition and trends of the prevalence of most of the risk factors of different subtypes of GC in Fars province are similar to other regions located in southern and central Iran, our study results are generalizable to most Iranian populations.

**Conclusion**

The incidence of GC in southern Iran is low. Gastric adenocarcinoma is the most common morphology. Cardia adenocarcinoma accounts for one-fifth of new cases. The trend of incidence of GC in southern Iran has been stable for the last decade. Significant and different changes in the pattern of GC have occurred in each age-gender subpopulation. These changes are in some cases different from those in developed countries. Early GCs show very different patterns of change among both males and females. Yet, further etiologic and prognostic studies in each population subgroup in Iran are warranted.

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**Author Contribution** KBL proposed the idea and supervised the study; HMV conceptualized and designed the study, analyzed the data, and revised the manuscript; MHB conducted data cleaning and data preparation, participated in conceptual frame-working and data analysis, and drafting the manuscript; ZKh was responsible for data collection and its quality. All authors read the final version of the manuscript.

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**Data Availability** The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

**Declarations**

**Ethics Approval** The study was approved by the Ethics Committee of Shiraz University of Medical Sciences.

**Consent to Participate** Not applicable.

**Consent for Publication** Not applicable.

**Conflict of Interest** ZK is affiliated with the Shiraz Population-Based Cancer Registry. Others declare no conflict of interests.

**References**

1. Rawla P, Barsouk A. Epidemiology of gastric cancer: global trends, risk factors and prevention. Prz Gastroenterol. 2019;14(1):26–38. https://doi.org/10.5114/pg.2018.80001.
2. Ferro A, Peleteiro B, Malvezzi M, et al. Worldwide trends in gastric cancer mortality (1980–2011), with predictions to 2015, and incidence by subtype. Eur J Cancer. 2014;50(7):1330–44.
3. Islami F, DeSantis CE, Jemal A. Incidence trends of esophageal and gastric cancer subtypes by race, ethnicity, and age in the United States, 1997–2014. Clin Gastroenterol Hepatol. 2019;17(3):429–39.
4. Colquhoun A, Arnold M, Ferlay J, Goodman KJ, Forman D, Soerjomataram I. Global patterns of cardi a and non-cardia gastric cancer incidence in 2012. Gut. 2015;64(12):1881–8. https://doi.org/10.1136/gutjnl-2014-308915.
5. Colquhoun A, Hannah H, Corriveau A, et al. Gastric cancer in northern Canadian populations: a focus on cardia and non-cardia subsites. Cancers (Basel). 2019;11(4):534. https://doi.org/10.3390/cancers11040534.
6. Matsuno K, Ishihara R, Ohmori M, et al. Time trends in the incidence of esophageal adenocarcinoma, gastric adenocarcinoma, and superficial esophageogastic junction adenocarcinoma. J Gastroenterol. 2019;54(9):784–91. https://doi.org/10.1007/s00535-019-01577-7.
7. Nicolas C, Sylvain M, Come L, Jean F, Anne-Marie B, Valerie J. Trends in gastric cancer incidence: a period and birth cohort analysis in a well-defined French population. Gastric Cancer. 2016;19(2):508–14. https://doi.org/10.1007/s10120-015-0509-9.
8. Merchant SJ, Kim J, Choi AH, Sun V, Chao J, Nelson R. A rising trend in the incidence of advanced gastric cancer in young Hispanic men. Gastric Cancer. 2017;20(2):226–34. https://doi.org/10.1007/s10120-016-0603-7.
9. Deans C, Yeo MS, Soe MY, Shabir A, Ti T, So JB. Cancer of the gastric cardia is rising in incidence in an Asian population and is associated with adverse outcome. World J Surg. 2011;35(3):617–24.
10. Danaei G, Farzadfar F, Kelishadi R, et al. Iran in transition. Lancet. 2019;393(10184):1984–2005. https://doi.org/10.1016/S0140-6736(18)33197-0.
11. Peykari N, Hashemi H, Dinarvand R, et al. National action plan for non-communicable diseases prevention and control in Iran; a response to emerging epidemic. J Diabetes Metab Disord. 2017;16(1):3. https://doi.org/10.1186/s40200-017-0288-4.
12. Abdi E, Latifi-Navid S, Zahri S, Yazdanbod A, Safaralizadeh R. Helicobacter pylori genotypes determine risk of non-cardia gastric cancer and intestinal-or diffuse-type GC in Ardabil: a very high-risk area in Northwestern Iran. Microb Pathog. 2017;107:287–92.

13. Rastaghi S, Jafari-Koshki T, Mahaki B, Bashiri Y, Mehrabani K, Soleimani A. Trends and risk factors of gastric cancer in Iran (2005–2010). Int J Prev Med. 2019;10.

14. Lankarani KB, Khosravizadegan Z, Rezaianzadeh A, et al. Data coverage of a cancer registry in southern Iran before and after implementation of a population-based reporting system: a 10-year trend study. BMC Health Serv Res. 2013;13(1):169.

15. Fars province. In: Population and geopolitical data. Statistical center of Iran, Tehran. 2016. https://www.amar.org.ir/english/Statistics-by-Topic/Population. Accessed 16 March, 2020.

16. Molavi Vardajani H, Haghdooost AA, Shahravan A, Rad M. Cleansing and preparation of data for statistical analysis: A step necessary in oral health sciences research. Journal of Oral Health and Oral Epidemiology. 2016;5(4):171–85.

17. Hajizadeh N, Pourhoseingholi MA, Baghestani AR, Abadi A, Zali MR. Bayesian adjustment for over-estimation and under-estimation of gastric cancer incidence across Iranian provinces. World J Gastrointest Oncol. 2017;9(2):87–93. https://doi.org/10.4251/wjgo.v9.i2.87.

18. Pourhoseingholi MA, Najafimehr H, Hajizadeh N, Zali MR. Pattern of Gastric Cancer Incidence in Iran is Changed after Correcting the Misclassification Error. Middle East Journal of Cancer. 2020;11(1):91–8.

19. Sabermahani A, Barouni M, Seyedin H, Aryankhesal A. Provincial human development index, a guide for efficiency level analysis: the case of iran. Iran J Public Health. 2013;42(2):149–57.

20. Niknam R, Fattahi MR, Sepehrimanesh M, Safarpour A. Prevalence of Helicobacter pylori in southern part of Iran. Jundishapur Journal of Microbiology. 2018;11(6).

21. Hatam N, Joulaei H, Kazemifar Y, Askarian M. Cost efficiency of the family physician plan in fars province, southern iran. Iran J Med Sci. 2012;37(4):253–9.

22. Newnham A, Quinn M, Babb P, Kang J, Majeed A. Trends in oesophageal and gastric cancer incidence, mortality and survival in England and Wales 1971–1998/1999. Aliment Pharmacol Ther. 2003;17(5):655–64.

23. Kaneko S, Yoshimura T. Time trend analysis of gastric cancer incidence in Japan by histological types, 1975–1989. Br J Cancer. 2001;84(3):400–5. https://doi.org/10.1054/bjoc.2000.1602.

24. Tramacere I, Pelucchi C, Bagnardi V, et al. A meta-analysis on alcohol drinking and esophageal and gastric cardia adenocarcinoma risk. Ann Oncol. 2012;23(2):287–97. https://doi.org/10.1093/annonc/mdr136.

25. Amin-Esmaeili M, Rahimi-Movaghar A, Shariﬁ V, et al. Alcohol use disorders in Iran: Prevalence, symptoms, correlates, and comorbidity. Drug Alcohol Depend. 2017;176:48–54.

26. Farshad S, Japoni A, Alborzi A, Zarenezhad M, Ranjbar R. Changing prevalence of Helicobacter pylori in south of Iran. 2010.

27. Esteghamati A, Khalilzadeh O, Mohammad K, et al. Secular trends of obesity in Iran between 1999 and 2007: National Surveys of Risk Factors of Non-communicable Diseases. Metab Syndr Relat Disord. 2010;8(3):209–13.

28. Moosazadeh M. Meta-Analysis of Prevalence of Smoking in 15–64-year-old Population of West of Iran. Int J Prev Med. 2013;4(10):1108–14.

29. Mysamie A, Ghaletaki R, Zhand N, Abbasi M. Cigarette smoking in iran. Iran J Public Health. 2012;41(2):1–14.

30. Khajeh A, Vardanjani HM, Salehi A, Rahmani N, Delavari S. Healthcare-seeking behavior and its relating factors in South of Iran. J Educ Health Promot. 2019;8:183. https://doi.org/10.4103/jehp.jehp_93_19.

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