Potential impact of controlling opium use prevalence on future cancer incidence in Iran

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Summary

Background The International Agency for Research on Cancer (IARC) recently classified opium consumption as carcinogenic to humans. This study aimed to estimate the potential reduction in incident cancers by 2035 in Iran, which accounts for 42% of global opium consumption, through decreasing opium use prevalence.

Methods The population attributable fraction (PAF) of opium-related cancers was projected using national cancer incidence, age- and gender-specific opium use prevalence, relative cancer risks associated with opium use, and annual percentage changes in cancer incidence rates in Iran. Opium-related cancers were defined based on IARC monographs as cancers of lung, larynx, bladder, esophagus, stomach, pancreas, and pharynx. The number of preventable cancer cases under different opium prevalence scenarios was determined by subtracting attributable cases in each year based on current prevalence from those in alternative scenarios.

Findings By 2035, an estimated 3,001,421 new cancer cases are expected in Iran, with 904,013 (30.1%) occurring in opium-related sites. Maintaining the current opium prevalence (5.6%) is projected to cause 111,130 new cancer cases (3.7% of all cancers, 12.3% of opium-related). A 10%, 30%, and 50% reduction in opium prevalence could prevent 9,016, 28,161, and 49,006 total incident cancers by 2035 in Iran, respectively. Reducing opium use prevalence by 10%–50% is projected to have the highest impact on lung cancer (prevention of 2,946–15,831 cases), stomach cancer (prevention of 2,404–12,593 cases), and bladder cancer (prevention of 1,725–9,520 cases).

Interpretation Our results highlight the significant benefits that can be achieved through effective cancer prevention policies targeting opium use in Iran. Neglecting this risk factor is estimated to pose a significant burden on cancer incidence in the next decade in this population.

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Keywords: Addiction; Burden; Carcinogen; Opioid; Population attributable fraction

Introduction

Opium is a highly addictive narcotic drug that is extracted from the poppy plant. It is used by millions of people, particularly in central and western Asia, for recreational and pain-relieving purposes.[1,2] In the past five decades, more than 35 separate case–control and cohort studies, along with multiple experimental and genetic studies, have documented the increased risk of various cancer types associated with opium use.[1–3] This evidence led to the classification of opium consumption as "carcinogenic to humans" by the International Agency for Research on Cancer (IARC)[2] in 2020, based

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Research in context

Evidence before this study

Use of opium, a highly addictive narcotic, was recently classified as carcinogenic to humans by the International Agency for Research on Cancer (IARC). Approximately 42% of global opium consumption occurs in Iran, where 30% of total cancer deaths are linked to cancer types causally associated with opium use. Despite recognizing the established role of opium consumption in the etiology of various cancer types, there remains a lack of knowledge regarding the impact and benefits of reducing the prevalence of this newly identified carcinogen on the future cancer burden in regions where opium use is prevalent.

Added value of this study

This study is the first to quantify the potential advantages of reducing the prevalence of the newly identified carcinogen, opium use, at the population level and its impact on future cancer burden. The findings reveal that maintaining the current prevalence of opium use could lead to 111,130 new cancer cases by 2035, constituting approximately 3.7% of total incident cancers and 12.3% of incident opium-related cancers. Our analysis indicates reducing opium use prevalence could lead to a potential prevention of 9,016 (with a 10% decrease in prevalence) to 49,006 new cancer cases (with a 50% decrease in prevalence) in Iran by 2035. Lung cancer emerged as the most impacted cancer type, with a potential prevention of 2,946–15,831 cases resulting from reducing opium use prevalence by 10%–50%, followed by stomach cancer (with a prevention range of 2,404–12,593 cases) and bladder cancer (with a prevention range of 1,725–9,520 cases).

Implications of all the available evidence

In nations where opium is extensively utilized, prioritizing the reduction of opium use prevalence becomes crucial within cancer control programs. Even a modest 10% decrease in opium use prevalence has the potential to exert a substantial impact on the future cancer burden in countries characterized by high opium use prevalence. Overlooking this risk factor is anticipated to impose a considerable burden on cancer incidence, especially for opium-related cancers known for their poor prognoses and high mortality rates.

on sufficient evidence for cancers in lung, larynx, and bladder, and limited evidence for cancers in the esophagus, pharynx, pancreas, and stomach.[2]

An estimated 42% of global consumption of opium occurs in Iran,[2] where 30% of the total cancer deaths are due to cancer types that are causally linked to opium consumption.[4] In our previous work, we identified using opium to be the third major cause of cancers in Iran that is responsible for 4%–8% of the new cancer cases/deaths among the Iranian population.[5,6] Importantly, in specific regions where opium is widely consumed, as high as 50%–70% of opium-related cancers such as lung, bladder, and laryngeal cancers, could be attributed to using opium.[6] Despite the major contribution of opium consumption to the overall cancer burden in these regions, comprehensive opium prevention policies are still lacking and opium control measures have not been implemented in the cancer control programs of the corresponding countries.[7,8]

To inform cancer control policies in regions where opium is widely used, studies are urgently needed to quantify the future burden of cancers in relation to using opium and estimate the number of cancer cases that could be potentially prevented under different scenarios of decreasing opium use prevalence. Therefore, we undertook this study to calculate the total number of new cancer cases that could occur between 2020 and 2035 due to opium use and to estimate the number of cancer cases that could be potentially prevented if the prevalence of opium use is reduced by 10%, 30%, and 50% of the current prevalence. We provide these estimates for incident cancers combined, opium-related cancers combined, each site-specific cancer linked to opium use, and incident cancers across various age and sex strata.

Methods

Data sources

For this analysis, we used four data sources to extract information on (i) national cancer incidence rates, (ii) age-and gender-specific prevalence of opium use, (iii) relative risk for various cancer types in relation to using opium, and (iv) annual change rate in the incidence of various cancers in Iran. We estimated the total number and proportion of incident cancer cases that could be attributed to using opium for the period between 2020 and 2035. These estimations were conducted for all incident cancers, all incident opium-related cancers, and for each opium-related cancer site separately. Opium-related cancer sites were defined as cancer sites that were identified by the IARC monographs to have strong (lung, larynx, bladder cancers) or limited (esophagus, stomach, pharynx, and pancreas) evidence for their causal association with opium consumption.[2]

Cancer incidence data

Gender-specific cancer incidence data for the year 2020 was extracted from the Global Cancer Observatory (GLOBOCAN 2020) of IARC.[9] The GLOBOCAN obtains these estimates from the Iranian national population-based cancer registry that collects population-based cancer data at the national level covering all 31 provinces of Iran (100% coverage).[10]

Exposure prevalence

Because opium consumption is prohibited in Iran, there is a lack of national-level data on regular opium use. In this study, we used estimates from our recent research, wherein we calculated the prevalence of regular opium consumption to be 10% among men and 1.2% among women in the general population of Iran.[5] Briefly, we utilized data from the Prospective Epidemiologic Research Studies in Iran (PERSIAN cohort) that recruited 180,000 participants from 18 provinces of Iran,[11] and the control group of the Iranian Study of Opium and Cancer (IROPICAN) study that recruited over 3300 cancer cases and 3400 controls from 10 provinces of Iran.[12] These studies collected information on opium use from various rural and urban populations in Iran, using validated questionnaires,[11–13] allowing for estimation of the average prevalence of opium use among Iranian men and women. Since the data obtained from these sources were not obtained through random sampling across all age groups, we standardized the prevalence rates in men and women by adjusting for age using the age distribution of the total Iranian population provided by the National Statistical Center of Iran (SCI).[14] Table S1 illustrates the unadjusted age-specific prevalence of opium use for each age group (10-year intervals).

Relative risks

The relative risks for various cancers in relation to opium use were retrieved from a recently published meta-analysis that included 2 prospective cohort studies and 33 case–control studies.[15] For pharyngeal cancer, we used the risk estimate that was reported in the IROPICAN study.[16] These studies had considered adjustments for the main potential confounders such as age, sex, and tobacco smoking in assessing the risk estimates.[15,16]

Annual change rate of cancer incidence

Data on the annual change rate of cancer incidence were retrieved from a former analysis by Roshandel et al. that calculated the trends for the incidence of various cancers in Iran using sequential data from Iran's national population-based cancer registry.[10] We also considered the population growth rate that was extracted from the national statistics database to predict the total number of incident cases for each cancer site from 2020 to 2035.

Statistical analysis

Age-specific population attributable fraction (PAF) was estimated for each cancer site and gender strata using Levin's formula.[17] This equation consists of the prevalence of opium use as the risk factor of interest (i) in a given age group and the associated RR (RR_i) of opium use for each cancer site.

$$PAF = \frac{P(RR-1)}{1+P(RR-1)} \qquad \text{Equation 1}$$

In Equation 1, the population proportion (P) represents the prevalence of opium use at the current exposure level, while the relative risk (RR) corresponds to the risk of developing cancer associated with opium use. Similar calculations were conducted using the prevalence of opium use in the alternative counterfactual scenarios, where the prevalence was reduced by 10%, 30%, and 50% compared to the current level. This allows for the estimation of the PAF under these alternative scenarios. To calculate the overall PAF for each specific cancer site, standardization by age and gender was performed by grouping the population into specific age and gender strata, and then applying standardization weights based on the size of the population in each stratum. To address data uncertainty, we utilized a simulation method, generating numbers from repeated draws for all estimated PAFs and the number of cancers. We replicated this process 1000 times for each sex and age group stratum to calculate 95% confidence intervals (CIs).[18]

To calculate number of preventable cancers in each opium use reduction scenario, the number of attributable cancers in each year of the study period with the current opium use prevalence were subtracted from number of attributable cancers in a given alternative scenario in that specific year.

$$\text{N of preventable cancers} = (PAF_{\text{with current prevalence}} - PAF_{\text{with the alternative scenario}}) * \text{N of predicted cancers}$$

Sensitivity analysis

Due to the possibility of underreporting opium use in national surveys and studies, we performed a sensitivity analysis to estimate the proportion of various future incident cancers under the scenario where opium use prevalence is 30% higher than the reported values.

All statistical analyses were conducted using Stata software (Version 17.0, College Station, Texas, USA).

Ethics statement

This article does not involve human participants or animal subjects. All analyses were conducted using data from secondary sources. Consequently, ethical approval was not needed for this specific analysis. Regarding exposure prevalence, the estimates utilized in this analysis were derived from our previous work,[5] which utilized data from the PERSIAN cohort and the IROPICAN study. Both studies obtained written informed consent from all participants upon recruitment. This prior research was approved by the Ethics Committee of Tehran University of Medical Sciences (Ref: IR.TUS.VCR.REF.1397.344).[5]

Role of funding source

The funders of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report. The corresponding authors had

full access to all the data in the study and had final responsibility for the decision to submit for publication.

Results

Opium use prevalence and cancer incidence rates

The overall age-standardized prevalence of opium use among Iranian adults over 30 years of age in 2020 was 5.6%. The prevalence of opium use was estimated at 10.0% among men and 1.2% among women.

Table 1 illustrates the relative risk in relation to using opium, number of incident cancers at the study baseline (2020), and crude incidence rates for each cancer site among men and women. We found a considerable difference in the incidence rates of opium-related cancers (but not all-cancers) between men and women. Incidence rates among men were estimated at 286.2 per 100,000 population for all-cancers, and 119.0 per 100,000 for opium-related cancers. While incidence rates among women were estimated at 246.9 per 100,000 population for all-cancers and at 54.1 per 100,000 for opium-related cancers.

The highest annual change rate in cancer incidence was observed for lung cancer that showed an annual 4.9% increased incidence rate. Conversely, esophageal cancer showed a decreasing trend in the incidence rates at −1.7%. The incidence rate for opium-related cancers showed a 3.3% increase each year.

Projected number of incident cancers that could be prevented by reducing opium use prevalence

Fig. 1 illustrates the projected fraction of incident cancers between 2020 and 2035 that will be attributed to opium use under four different scenarios: maintaining the current prevalence of opium use, reducing opium use prevalence by 10%, reducing opium use prevalence by 30%, and reducing opium use prevalence by 50%. Table 2 presents the projected number of incident cancers that will be diagnosed between 2020 and 2035, along with the projected number of cancers that could be potentially prevented under different scenarios of controlling opium use prevalence.

It is projected that 3,001,421 new cancer cases will occur cumulatively between 2020 and 2035 in Iran, out of which 904,013 cases will be cancers in 7 sites that have been identified to be causally linked to opium use (opium-related cancers). Continuing the current prevalence of opium use would result in approximately 3.7% of all incident cancers being attributable to opium consumption (PAF of opium use for the reference scenario = 3.7%, 95% CI = 2.0–5.5). For opium-related cancers, the PAF would be substantially higher, estimated at 12.3% (95% CI = 6.7–18.4), leading to a total of 111,130 (95% CI = 60,133–166,348) new cancer cases between 2020 and 2035 (Table 2).

If the prevalence of opium use is reduced by 10%, the proportion of incident cancers that would be caused by opium use would decrease to 3.4% (95% CI = 1.7–5.2) for all-cancers, and to 11.3% (95% CI = 5.7–17.4) for opium-related cancers. This indicates a potential prevention of 9,016 (95% CI = 4,883, 13,546) incident cancers in Iran by 2035. If the prevalence of opium use is reduced by 30%, the proportion of incident cancers that would be caused by opium use would decrease to 2.8% (95% CI = 1.4–4.2) for all-cancers, and to 9.2% (95% CI = 4.7–14.1) for opium-related cancers, indicating a potential prevention of 28,161 (95% CI = 15,615–42,134) incident cancers by 2035. Finally, If the prevalence of opium use is reduced by 50%, the proportion of incident cancers that would be caused by opium use would decrease to 2.1% (95% CI = 1.0–3.2) for all-cancers, and to 6.9% (95% CI = 3.4–10.6) for opium-related cancers, indicating a potential prevention of 49,006 (95% CI = 26,292, 73,707) incident cancers by 2035 (Fig. 1, Table 2).

Cancer sites	Opium prevalence		RR (95% CI)	N of incident cancers in 2020		Crude incidence rate per 100,000 persons per year		Annual change in cancer incidence rate
	Men	Women		Men	Women	Men	Women	
All incident cancers	10.0	1.2	–	65,055	55,824	286.2	246.9	4.3
Opium-related cancers	10.0	1.2	–	27,038	12,221	119.0	54.1	3.3
Stomach	10.0	1.2	2.3 (1.5–3.6)	9,524	4,997	41.9	22.1	3.0
Lung	10.0	1.2	3.2 (2.1–4.6)	7,092	3,211	31.2	14.2	4.9
Bladder	10.0	1.2	4.03 (3.2–5.1)	4,251	769	18.7	3.4	2.6
Pancreas	10.0	1.2	2.0 (1.3–3.2)	2,000	1,153	8.8	5.1	4.3
Larynx	10.0	1.2	7.9 (4.4–13.9)	1,909	475	8.4	2.1	4.3
Esophageal	10.0	1.2	1.4 (1.1–1.9)	1,955	1,424	8.6	6.3	−1.7
Pharynx	10.0	1.2	2.9 (1.4–6,0)	307	192	1.4	0.9	4.3

RR, Relative Risk; **N**, Number of Cancer cases; **95% CI**, 95% Confidence interval.

Table 1: **Opium prevalence, relative risk for cancers in relation to opium use, number incident cancers, and age-standardized incidence rates for ≥30-year-old Iranian adults.**

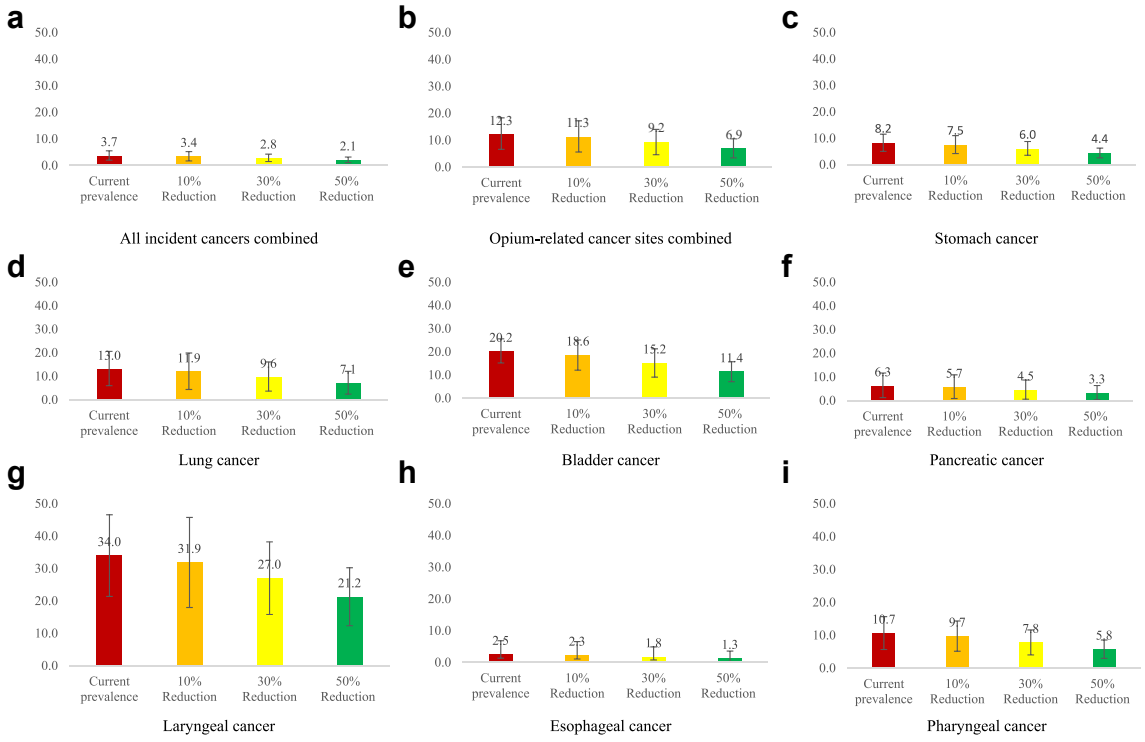

Fig. 1: Population attributable fraction of incident caners between 2020 and 2035 in relation to opium use by maintaining the current prevalence of opium use, reducing opium use prevalence by 10%, reducing opium use prevalence by 30%, and reducing opium use prevalence by 50%.

Among opium-related cancer sites, we estimate that reducing opium use prevalence would have the highest impact on the prevention of lung cancer, ranging from potential prevention of 2,946 (95% CI = 1,454–4,567) to 15,831 (95% CI = 7,290–25,095) incident cases in the 10%–50% opium use prevalence reduction scenarios. Stomach cancer ranked second, with potential prevention of 2,404 (95% CI = 1,364–3,523), 7,379 (95% CI = 4,101–10,988), and 12,593 (95% CI = 7,855–17,587) new cases in the respective scenarios of 10%, 30%, and 50% opium use prevalence reduction. Bladder cancer and laryngeal cancers also showed notable number for potentially preventable cases with the reduction in opium use prevalence (Table 2).

Cancer site	Projected number of incident cancers between 2020 and 2035	Estimated N (% of projected incident cancers) that would be prevented					
		10% reduction of opium use prevalence		30% reduction of opium use prevalence		50% reduction of opium use prevalence	
		N (95% CI)	Percent (95% CI)	N (95% CI)	Percent (95% CI)	N (95% CI)	Percent (95% CI)
All incident cancers	3,001,421	9,016 (4,883–13,546)	0.3 (0.2–0.5)	28,161 (15,615–42,134)	0.9 (0.5–1.4)	49,006 (26,292–73,707)	1.6 (0.9–2.5)
Opium-related cancers	904,013	9,016 (4,883–13,546)	1.0 (0.5–1.5)	28,161 (15,615–42,134)	3.1 (1.7–4.7)	49,006 (26,292–73,707)	5.4 (2.9–8.2)
Stomach	325,362	2,404 (1,364–3,523)	0.7 (0.4–1.1)	7,379 (4,101–10,988)	2.3 (1.3–3.4)	12,593 (7,855–17,587)	3.9 (2.4–5.4)
Lung	269,128	2,946 (1,454–4,567)	1.1 (0.5–1.7)	9,156 (4,896–13,948)	3.4 (1.8–5.2)	15,831 (7,290–25,095)	5.9 (2.7–9.3)
Bladder	108,607	1,725 (1,079–2,371)	1.6 (1.0–2.2)	5,430 (3,400–7,460)	5.0 (3.1–6.9)	9,520 (5,710–13,330)	8.8 (5.3–12.3)
Pancreas	77,653	447 (129–796)	0.6 (0.2–1.0)	1,365 (386–2,437)	1.8 (0.5–3.1)	2,318 (507–4,282)	3.0 (0.7–5.5)
Larynx	58,711	1,252 (712–1,793)	2.1 (1.2–3.1)	4,090 (2,400–5,793)	7.0 (4.1–9.9)	7,487 (4,148–10,825)	12.8 (7.1, –18.4)
Esophagus	52,160	128 (83–331)	0.2 (0.1–0.6)	388 (241–996)	0.7 (0.5–1.9)	652 (446–1,713)	1.2 (0.9–3.3)
Pharynx	12,391	114 (62–166)	0.9 (0.5–1.3)	352 (192–512)	2.8 (1.5–4.1)	606 (338–874)	4.9 (2.7–7.1)

N, Number of Cancer cases; **CI**, Confidence Interval.

Table 2: **Projected cumulative number of incident cancers among ≥30-year-old Iranian adults for the period between 2020 and 2035, and the number and proportion of incident cancers that can be prevented under different scenarios of controlling opium use prevalence.**

Stratified and sensitivity analyses

We estimated the impact of decreasing opium use prevalence on future incident cancers among men and women (Table S2 and S3), and among various age groups (Table S4 and S5). The results showed that decreasing opium use prevalence would have higher impact among men [potential prevention of 8,449 (95% CI = 4,853–12,046)–46,116 (95% CI = 26,222–66,011) incident cancer cases] than women [potential prevention of 567 (95% CI = 29–1,505)–2,890 (95% CI = 70–7,697) incident cancer cases]. We also found that decreasing opium use prevalence would have higher impact among older individuals [potential prevention of 6,251 (95% CI = 402–14,317)–33,625 (95% CI = 2,142–78,801) incident cancers among ≥60-year-old individuals] than younger individuals [potential prevention of 109 (95% CI = 2–286)–586 (95% CI = 2–1,554) incident cancers among 30–39-year-old individuals].

Finally, our sensitivity analysis showed in the scenario where opium use is 30% higher than the current prevalence, an estimated 25,131 (95% CI = 8,787–46,119) additional incident cancers will be expected to occur by 2035. Under this scenario, opium consumption is projected to contribute to a total of 136,261 (95% CI = 74,283–203,537) new cancers between 2020 and 2035 [4.5% (95% CI = 2.5–6.8) of all incident cancers and 15.1% (95% CI = 8.2–22.5) of opium-related cancers] (Table S6).

Discussion

In this analysis, we estimated a total of 3,001,421 incident cancers will occur in Iran between 2020 and 2035. If opium consumption continues at its current prevalence, by 2035 an estimated 3.7% of the total incident cancers and 12.3% of incident opium-related cancers (n = 111,130) in Iran will be attributable to using opium. Our results showed any reduction in the prevalence of opium use in Iran, even a 10% decrease, could have a considerable impact on future caner burden in this country. We estimated the number of incident cancers that could be potentially prevented by decreasing opium use prevalence between 2020 and 2035 to range from 9,016 (95% CI = 4,883–13,546) (10% decrease in prevalence) to 49,006 (95% CI = 26,292–73,707) (50% decrease in prevalence) cancer cases.

Opium is a highly addictive narcotic that is obtained from the unripe seedpod of the poppy plant. It has been used for thousands of years for recreational and pain-relieving purposes in central and western Asia.[1] Opium is usually consumed though smoking (around 70%) and ingestion (around 30%). In 2020, IARC reviewed evidence from five decades of research and announced that opium consumption (regardless of the consumption route) causes cancer in humans.[2] Despite the established role of opium in the etiology of several cancer types, there is still lack of knowledge on the impact of this newly identified carcinogen on cancer burden, particularly in Iran where 42% of the global opium consumption occurs.[2] In a recent analysis of data from over 50,000 participants in northeast Iran, where 17% of the study population used opium, we found that 5% of all-cancers and 35% of opium-related cancers in this population could be attributed to using opium.[6] In another analysis we used national-level data and found opium consumption to be responsible for 3.9% of all-cancers in Iran.[5] In this analysis, we calculated the burden of opium use on opium-related cancers, which constitute 30% of cancer deaths in Iran. We found that almost 13% of these cancers (17% in men and 2% in women) could be attributed to opium consumption. Our results showed that opium use had the highest contribution to cancers in larynx (PAF = 34.0%), bladder (20.2%), and lung (13.0%), which are among the cancer types with poor prognosis in Iran.[19,20] These findings underscore the importance of reducing opium use prevalence to alleviate the heavy burden of opium-related cancers in Iran.

The present study marks the first effort to quantify the potential impact of decreasing opium use prevalence on future cancer burden. Our findings show even a marginal decrease in the prevalence of opium use could have a substantial impact on reducing the burden of cancer types with poorest prognosis, and subsequently reducing the overall cancer burden in Iran. We also estimated that decreasing opium use prevalence would have the highest impact on males and older individuals, who have the highest rates for opium consumption and for opium-related cancer incidence and mortality in Iran.[4,8,21] Therefore, effective strategies and national policies are urgently needed to reduce the national prevalence of opium consumption and implement this step as a crucial component of cancer prevention program in Iran.

Opium use in Iran, traces its roots back to ancient times, when the opium poppy was cultivated in Mesopotamia (3400 BCE) and its analgesic properties were recognized by Hippocrates (460 BCE), Galen (200 CE), and Avicenna (1025 CE).[1] In this region, still a significant number of people, perceive opium as a traditional medicine. Evidence shows the presence of an attitude, particularly among the older individuals in Iran, that low-dose opium is not addictive and may have therapeutic effects for chronic diseases such as diabetes, cardiovascular diseases, and musculoskeletal disorders.[8,22,23] Consequently, targeted interventive efforts (e.g. among healthcare professional and students) and public campaigns are needed to increase public awareness about the long-term harmful effects of opium use, particularly on its role in cancer development, and to correct the false beliefs about having any therapeutic effects. Further, a reliable surveillance system should be established to collect regular data on opium use

prevalence and identify high-risk groups that may benefit from targeted interventions.

While the United Nations Office on Drugs and Crime (UNODC) indicated there may be a downward trend for using opium in Iran,[24] it is important to note that studies have frequently showed there is an underestimation for opium use prevalence in this country.[25,26] This could partly be due to underreporting of opium use by the participants in surveys because of fears from stigmatization and prosecution.[26] A recent study in Iran compared self-reported opium use with urinary opium metabolites and documented a significant underreporting in cancer case–control studies, not only among healthy hospital-based controls but also among neighborhood controls.[26] Our sensitivity analysis that assumed a 30% underreporting for opium use prevalence, shows that the burden of opium use may even be much higher than what we estimated, and be responsible for an additional 25,131 incident cancer cases, causing a total of 136,261 new cancers (4.5% of all incident cancers and 15.1% of opium-related cancers) between 2020 and 2035.

The strengths of the current study include being the first study to estimate the potential effects of decreasing the prevalence of opium use (newly identified carcinogen) on the future cancer burden, providing detailed estimates for the impact of opium use on current and future burden of each opium-related cancer type, and providing the estimates for opium use impact on current and future cancer burden for different strata of gender and age groups in Iran. This study also has several limitations; due to the absence of reliable national-level data on opium use prevalence, we used data from large prospective cohort and case–control studies to estimate opium use prevalence. These studies were predominantly conducted between 2014 and 2018, which limited our ability to establish an appropriate latency period between the exposure and outcomes. However, considering that no significant opium prevention policies were introduced in the decade preceding our baseline cancer estimates, it is improbable that national-level opium use prevalence has undergone substantial changes in the past decade. Therefore, it is unlikely that our estimates have been significantly affected by the lack of an appropriate latency period. Because of possible underreporting in the current evidence, and also the lack of data to assess risk of less prevalent cancer sites in relation to opium use, we may have underestimated the impact of opium use on future cancer burden. However, we tried to partly address this limitation by providing an estimate for the higher opium prevalence scenario. Furthermore, the wide variation in opium prevalence across different regions of Iran, and the unavailability of province-level opium use prevalence data, prevented obtaining a comprehensive understanding of the burden of opium-related cancers at the provincial level. Future studies are needed to obtain a reliable estimate of opium use prevalence and trends across different provinces in Iran to allow planning comprehensive cancer control policies for each province.

In conclusion, our results highlight the significant benefits that can be achieved through effective cancer prevention policies targeting opium use in the Iranian population. Neglecting this risk factor is estimated to pose a significant burden on cancer incidence, particularly for opium-related cancers that often have poor prognoses and high mortality rates, in the next decade in Iran. To provide a more comprehensive understanding of the impact of opium use on incident cancers in Iran and other high-risk regions, further research is needed to explore potential associations between opium use and other less prevalent cancer types, and to obtain an accurate estimate of opium use prevalence and trends in each region.

Contributors

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Data sharing statement

The data supporting the findings of this study can be found in the main tables and supplementary material of this article. Gender-specific cancer incidence data for the year 2020, are publicly available from the Global Cancer Observatory (GLOBOCAN) at https://gco.iarc.fr. Population growth rate and age distribution of the total Iranian population are publicly available from the national statistics database at https://www.amar.org.ir. Further information is available from the corresponding authors upon request.

Declaration of interests

The authors declare no conflicts of interest. Where authors are identified as personnel of the International Agency for Research on Cancer/World Health Organization, the authors alone are responsible for the views expressed in this article and they do not necessarily represent the decisions, policy, or views of the International Agency for Research on Cancer/World Health Organization.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.eclinm.2024.102650.

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