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Burden of alcohol use disorder and its consequences in Iran from 1990 to 2019: Findings from the global burden of disease study

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ABSTRACT

Background: This study aimed to provide an up-to-date evaluation of the burden of alcohol use disorder and its consequences in Iran from 1990 to 2019.
Methods: We assessed the burden of alcohol use disorder and its three subsequent disorders, including cirrhosis and other chronic liver diseases, liver cancer, and cardiomyopathy using Global Burden of Disease (GBD) data. We retrieved data on incidence, prevalence, death, Years of Life Lost from mortality (YLL), Years of healthy life Lost due to Disability (YLD), and Disability-Adjusted Life Year (DALY), which is calculated by summing YLL and YLD values, indices, as well as sociodemographic index (SDI) values.
Results: Age-standardized DALY rate of alcohol use disorder reduced from 55.5 in 1990 to 41.8 per 100,000 in 2019 (−24.1 %). Similarly, age-standardized DALY rates of cirrhosis due to alcohol use (−28.7 %), liver cancer due to alcohol use (−20.9 %), and alcoholic cardiomyopathy (−36.3 %) decreased in Iran from 1990 to 2019. In 2019, alcohol use disorder had the highest DALY rate among individuals younger than 55 years, while cirrhosis due to alcohol use imposed the greatest burden on those older than 55. After adjusting for the year, SDI was negatively associated with the age-standardized DALY rate of liver cancer due to alcohol use (p < 0.001), positively associated with that of alcoholic cardiomyopathy (p = 0.002), and not significantly associated with the burden of other conditions (p > 0.05).
Conclusions: Despite reductions in the age-standardized DALY rate of alcohol use disorders and related consequences among Iranians, they remain a serious public health concern in Iran.

1. Introduction

Alcohol use disorder is a widespread global issue characterized by impaired control over alcohol intake and compulsive heavy alcohol use (Carvalho et al., 2019). This disorder frequently co-occurs with psychiatric conditions, such as anxiety, depression, sleep disorders, and suicide. (Carvalho et al., 2019; Witkiewitz et al., 2019). Regardless of its amount, chronic alcohol consumption is also linked to serious organic disorders, such as liver cirrhosis, liver cancer, alcohol-related cardiomyopathy, and other alcohol use-related disorders. The World Health Organization (WHO) released a report in 2022 that linked over 200

disorders and injuries to alcohol consumption (Belay et al., 2023).

Despite several national and international attempts to minimize alcohol usage, the global pattern of alcohol abuse shows a growing tendency, producing a tremendous global burden. Alcohol use was the second most common risk factor for cancer-related deaths and disability-adjusted life years (DALYs) in 2019 according to a Global Burden of Disease (GBD) study (Liu et al., 2023). The 2018 Global Status Report on Alcohol and Health, published by the WHO, revealed that excessive alcohol use caused around three million fatalities in 2016. This represented 5.3 % of all mortality, going beyond the combined mortality rates of diabetes and hypertension. This WHO study also concluded that

alcohol intake is accountable for 5.1 % of the global burden of disease and injury, which is equivalent to 132.6 million DALYs (Glantz et al., 2020; Liu et al., 2023).

Assessing alcohol consumption in Muslim-majority countries has always been challenging since Islam prohibits the use of alcohol (Alhashimi et al., 2018). It was estimated that in 2019, there were 22,000 deaths attributable to alcohol use disorder in the Middle East and North Africa (MENA) region, with Iran being the only country where DALY increased from 1990 to 2019 (Safiri et al., 2022). In Iran, alcohol sale is banned, and the stigma prevents a thorough investigation of the current condition of alcohol use. Moreover, due to restrictions, alcohol is made at home or sold on the black market. The consumption of this type of alcohol can cause negative consequences, including methanol poisoning and even death (Rezaei et al., 2022). Meanwhile, reports show a growing trend of alcohol use in Islamic countries, probably due to globalization and shifts in socio-economic norms and beliefs in these countries (Al-Ansari et al., 2016). All this evidence necessitates a thorough investigation of the burden of alcohol use in countries like Iran.

In brief, there are limited studies on the burden of alcohol use disorders and related consequences in Iran. Although there are studies on the burden of these disorders in other countries, regions, and at the global level (Degenhardt et al., 2018; Qu et al., 2021; Rehm et al., 2009; Safiri et al., 2022), their findings may not be applicable to Iran due to its unique socioeconomic status. Furthermore, regional and global studies do not allow for in-depth analysis across demographic groups within the country. Given the limited information on alcohol use disorder and its related diseases, this study aims to present an up-to-date evaluation of the disorder and its consequences in Iran at both national and subnational levels from 1990 to 2019, while also comparing these trends with global and regional trends in the MENA region. The findings of our study will shed light on the trends of the burden attributed to alcohol use disorder and its three related disorders, namely cirrhosis and other chronic liver diseases, liver cancer, and cardiomyopathy.

2. Methods and materials

2.1. Sources

We utilized the GBD 2019 data in our study, which was conducted by the Institute of Health Metrics and Evaluation (IHME) to determine the burden and epidemiology of 369 diseases and 87 risk factors across 204 countries and territories (Murray et al., 2020; Vos et al., 2020). The details of the methodological aspects of the GBD study have been previously explained elsewhere (Murray et al., 2020; Vos et al., 2020). As we used publicly available data in our study, it didn't required ethical approval.

In our study, we retrieved data on the burden of four diseases associated with alcohol use in the GBD study. Our primary disorder of interest was alcohol use disorder. Furthermore, we assessed the burden of three other disorders associated with alcohol use, including cirrhosis and other chronic liver diseases due to alcohol use, liver cancer due to alcohol use, and alcoholic cardiomyopathy in our study. Details of the definition of each condition and the methods to calculate the burden attributable to each one were described previously (Choi et al., 2023; Dong et al., 2023; Liu et al., 2022, 2023; Qu et al., 2021; Vos et al., 2020; Yang et al., 2022; Zareei and Azizmohammad, 2023; J. Zhang et al., 2022; X. Zhang et al., 2022). We extracted data on the burden of these disorders across Iran's 31 provinces, age groups, and sexes from 1990 to 2019. Furthermore, we retrieved this data at the global level and for the MENA region to make comparisons.

2.2. Indices

We retrieved data on the incidence, prevalence, death, Years of life lost from mortality (YLL), Years of healthy life lost due to disability (YLD), and DALY indices across age groups, sexes, provinces, and years.

YLL represents the years of life lost due to a specific cause when compared to the average life expectancy. YLD represents the years that an individual has lived with a condition of less than complete health due to a specific cause of disability. DALY is calculated by summing YLD and YLL values and indicates the total burden of a disease (Kim et al., 2022). This data included crude numbers, rates (per 100,000 people), and age-standardized rates (per 100,000 people) for each index.

We also retrieved the sociodemographic index (SDI) values for Iran across time from 1990 to 2019 (Global Burden of Disease Collaborative Network, 2020). SDI is calculated by taking the fertility rate among people younger than 25 years, the average educational years among those aged 15 years or older, and income per capita into account. SDI values range from 0 to 1, and higher values indicate better status.

2.3. Statistical analyses

We utilized SPSS version 26 and Python version 3.10.12 for the data analyses and drawing figures in our study. Furthermore, we used Numpy, Pandas, Geopandas, Matplotlib, and Seaborn Python libraries in our study. We used linear regression models for each condition to assess the relationship between the age-standardized DALY rate of diseases (dependent variable) and SDI (independent variable), with the models adjusted for the year. We considered $p < 0.05$ statistically significant.

3. Results

3.1. DALY trends

Age-standardized DALY rate of alcohol use disorder reduced by 24.6 % from 55.5 per 100,000 in 1990 to 41.8 per 100,000 in 2019 in Iran (Table 1). Similarly, age-standardized DALY rates of cirrhosis due to alcohol use (−28.7 %), liver cancer due to alcohol use (−20.9 %), and alcoholic cardiomyopathy (−36.3 %) all decreased in Iran from 1990 to 2019 (Table 1). Age-standardized DALY rate of alcohol use disorder, cirrhosis due to alcohol use, and liver cancer due to alcohol use was constantly lower in Iran compared to MENA and the world from 1990 to 2019. In contrast, the age-standardized DALY rate of alcoholic cardiomyopathy was the lowest in Iran when compared to MENA and the world until 2005 when rates in Iran exceeded those in MENA. During these years (1990–2019), age-standardized rates of alcoholic cardiomyopathy in the world were still higher in the world than in Iran and MENA (Fig. 1).

3.2. Association between SDI and age-standardized DALY

After adjusting for the year, SDI had no significant associations with age-standardized DALY rates of alcohol use disorder (beta = 7.006, 95 % CI=[-59.156, 73.169], p = 0.830) and cirrhosis due to alcohol use (beta = 18.917, 95 %CI=[-18.033, 55.868], p = 0.303) in the regression models. On the other hand, SDI had a negative association with age-standardized DALY rate of liver cancer due to alcohol use (beta = -94.130, 95 %CI=[-119.377, −68.882], p < 0.001) and a positive association with age-standardized DALY rate of alcoholic cardiomyopathy (beta = 14.500, 95 %CI=[5.635, 23.364], p = 0.002).

3.3. Age and sex patterns

Age-standardized DALY rate of alcohol use disorder was higher among males than females in 2019 (58.3 vs. 24.9 per 100,000). Furthermore, age-standardized DALY rates of all diseases associated with alcohol use were higher among males than females in that year (Supplementary Table S1). In 2019, total DALY rates of alcohol use disorder and diseases associated with alcohol use were the highest in the 70–74 years and ≥ 95 years age groups among males and females, respectively (Fig. 2). Meanwhile, in 1990, total DALY rates of alcohol use disorder and diseases associated with alcohol use were the highest in

Table 1

Burden of alcohol use disorder and alcohol-related diseases in the world, Iran, and Middle East and North Africa in 1990 and 2019.

Disorder	Region	DALY rate per 100,000			Age-standardized DALY rate per 100,000		
		1990	2019	Percentage change	1990	2019	Percentage change
Alcohol use disorder	World	235.0	220.0	−6.4	256.2	207.3	−19.1
	MENA	48.1	54.1	12.6	58.9	51.8	−12.1
	Iran	42.9	47.5	10.8	55.5	41.8	−24.6
Cirrhosis and other chronic liver diseases due to alcohol use	World	136.7	144.6	5.8	169.0	133.3	−21.1
	MENA	26.4	29.4	11.4	50.4	39.0	−22.5
	Iran	11.1	14.8	33.6	22.3	15.9	−28.7
Liver cancer due to alcohol use	World	23.8	28.2	18.3	30.6	26.1	−14.8
	MENA	7.4	11.1	50.0	14.0	14.6	4.8
	Iran	5.0	7.3	47.2	10.8	8.5	−20.9
Alcoholic cardiomyopathy	World	32.9	31.5	−4.0	40.2	29.2	−27.4
	MENA	4.1	2.9	−30.2	7.0	3.4	−51.7
	Iran	3.2	3.5	11.5	5.6	3.6	−36.3

Abbreviations: DALY: Disability-adjusted life years; MENA: Middle East and North Africa.

the 70–74 years and 75–79 years age groups among males and females, respectively (Fig. 2). In 2019, among those who were younger than 55 years, alcohol use disorder had the highest DALY rate compared to other diseases associated with alcohol use. On the other hand, among those who were 55 years or older, cirrhosis due to alcohol use had the highest burden (Fig. 3).

In Iran and in 2019, the DALY rate of alcohol use disorder was the highest in the 30–34 years age groups in both females (51.0 per 100,000) and males (117.1 per 100,000). On the other hand, the DALY rate of alcoholic cardiomyopathy was the highest in the 90–95 years age group in females (11.0 per 100,000) and the 60–64 years age group in males (22.7 per 100,000) (Fig. 4). Meanwhile, the DALY rate of cirrhosis due to alcohol use was the highest in the + 95 years age group in females (59.3 per 100,000) and 65–69 years age group in males (111.5 per 100,000). DALY rate of liver cancer due to alcohol use was the highest in the 70–74 years age group in both males (110.5 per 100,000) and females (25.0 per 100,000) (Fig. 4). In 2019, DALY rates of alcohol use disorder, cirrhosis due to alcohol use, and liver cancer due to alcohol use were higher among males than females across all age groups. Alcoholic cardiomyopathy DALY rates were also higher in males than in females in 2019 in all age groups, except for the 20–34 years age group (Fig. 4).

3.4. Differences in provinces

3.4.1. Total burden of alcohol use disorder and related consequences

The total age-standardized DALY rate of alcohol use disorder and diseases related to alcohol was reduced across all of Iran's provinces from 1990 to 2019 (Fig. 5). Furthermore, alcohol use disorder had the highest burden across all of Iran's provinces compared to three related disorders (Fig. 5). In 2019, with the exception of Ardebil—where the age-standardized DALY rate for liver cancer due to alcohol use exceeded those of cirrhosis due to alcohol use and alcoholic cardiomyopathy—the age-standardized DALY rate for cirrhosis due to alcohol use was higher than that of the other two alcohol-related diseases across the other provinces (Fig. 5). Age-standardized DALY rates of alcohol use disorder and its consequences across all Iran provinces in 1990 and 2019 are presented in Supplemental Figures S1-S4.

3.4.2. Alcohol use disorder

In 2019, the age-standardized DALY rate of alcohol use disorder was the highest in Kermanshah (56.3 per 100,000), Sistan and Baluchistan (56.0 per 100,000), and Hormozgan (52.1 per 100,000). On the other hand, it was the lowest in Tehran (37.2 per 100,000), Lorestan (37.6 per 100,000), and Isfahan (37.8 per 100,000).

3.4.3. Alcoholic cardiomyopathy

Alcoholic cardiomyopathy had the highest age-standardized DALY rate in West Azarbayejan (9.8 per 100,000), Lorestan (9.1 per 100,000), and Khuzestan (6.6 per 100,000) and the lowest age-standardized DALY

rate in Ilam (1.9 per 100,000), South Khorasan (1.9 per 100,000), and Kohgiluyeh and Boyer-Ahmad (2.11 per 100,000).

3.4.4. Cirrhosis and other chronic liver diseases due to alcohol use

The lowest age-standardized DALY rate of cirrhosis and other chronic liver diseases due to alcohol use were in Chahar Mahaal and Bakhtiari (9.6 per 100,000), Tehran (10.0 per 100,000), and Kohgiluyeh and Boyer-Ahmad (10.3 per 100,000). On the other hand, it was the highest in Qazvin (31.2 per 100,000), Golestan (26.5 per 100,000), and Sistan and Baluchistan (26.1 per 100,000).

3.4.5. Liver cancer due to alcohol use

Liver cancer due to alcohol use had the lowest age-standardized DALY rate in Lorestan (5.9 per 100,000), Hormozgan (6.2 per 100,000), and Qazvin (6.9 per 100,000), and the highest in Ardebil (13.7 per 100,000), Sistan and Baluchistan (13.1 per 100,000), and Golestan (13.1 per 100,000).

4. Discussion

The present study provided a comprehensive evaluation of the trends in the burden and epidemiology of alcohol use disorder and its consequences in Iran during 1990–2019. We found that the burden of alcohol use disorder and other associated diseases has decreased in Iran over time. The burden of these disorders was the highest among males and provinces along the country's border.

We found that the age-standardized DALY rate of alcohol use disorders and all related diseases has reduced in Iran from 1990 to 2019, which aligns with the global trends in the current and previous studies (Dong et al., 2023; Liu et al., 2023; Zhang et al., 2022). On the other hand, the DALY rate of all these disorders had increased in Iran. These findings can be interpreted in several ways. First is the presence of an age shift in alcohol-related disorders as the most affected age groups in 2019 were older than those in 1990. This is well reflected in the comparison of the burden of alcohol use disorder and related diseases among Iranian females in 1990 and 2019, where the burden was the highest in the + 95 years age group in 2019 and 75–79 years age group in 1990. Another factor affecting our results might be the improved knowledge about alcohol among Iranians during these years; a previous study in 2019 on the knowledge of Iranians about alcohol use and its consequences indicated that Iranians have an acceptable level of knowledge in this regard (Mehrabi et al., 2019). Furthermore, despite the barriers, there have been some recent advancements in implementing screening and treatment programs for alcohol use disorders in Iran (Al-Ansari et al., 2019, 2020), which may have led to improved care, especially among younger Iranian adults.

We found SDI had no significant associations with alcohol use disorder and cirrhosis due to alcohol use. This finding is in contrast with previous studies as they indicated worse socioeconomic status was
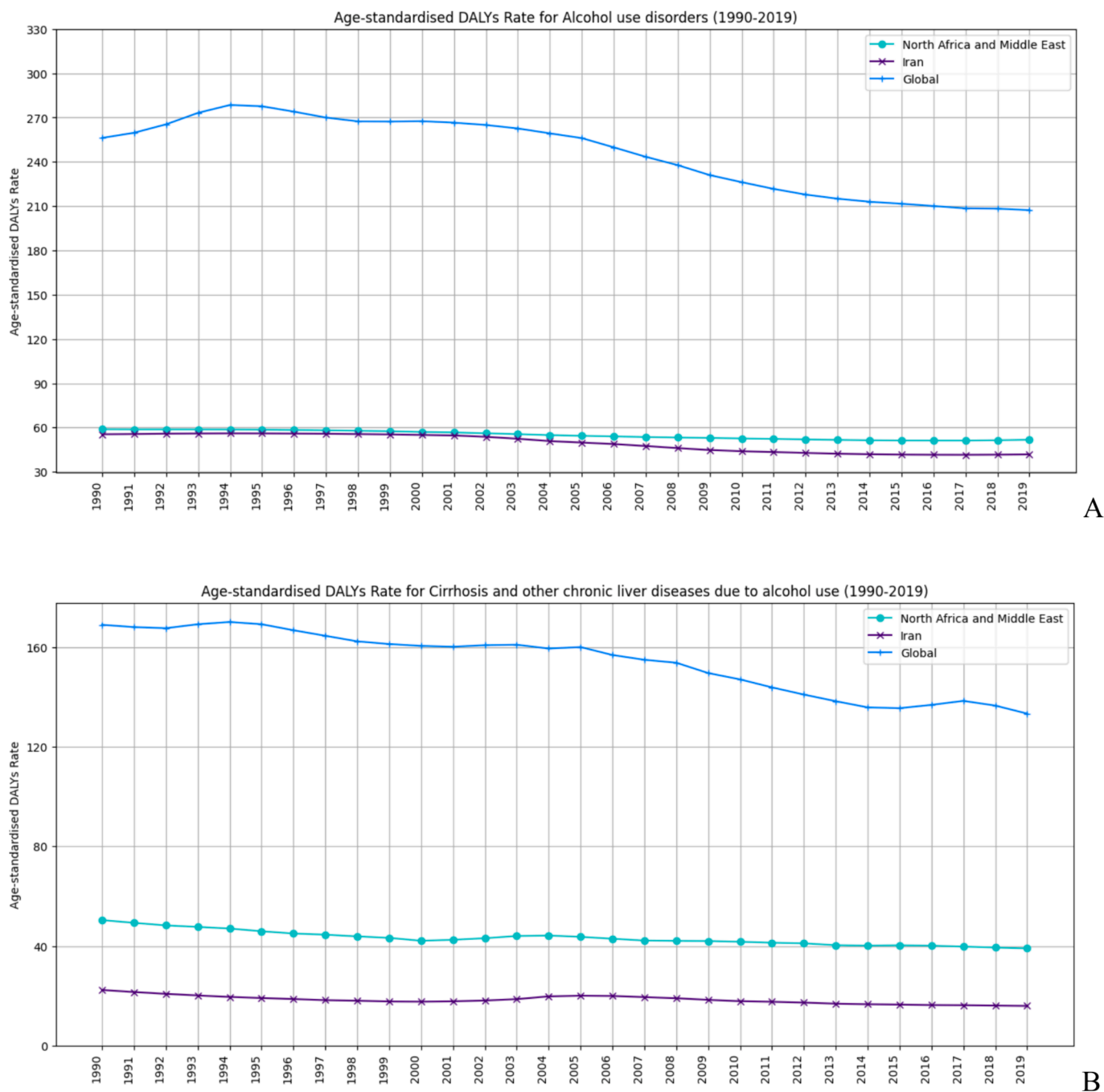
Fig. 1. Trends in the age-standardized DALY rate of A) alcohol use disorder, B) cirrhosis and other chronic liver diseases due to alcohol use, C) liver cancer due to alcohol use, and D) alcoholic cardiomyopathy in Iran, Middle East and North Africa, and world from 1990 to 2019.

associated with alcohol use, alcohol use disorders, and negative consequences (Calling et al., 2019; Collins, 2016; Lasserre et al., 2022). The lack of such an association with regard to alcohol use disorder and cirrhosis due to alcohol use in the Iranian context might be due to the fact that SDI values in Iran ranged from 0.404 to 0.670 from 1990 to 2019 (Global Burden of Disease Collaborative Network, 2020). Studies have shown that while severe economic loss can lead to problematic alcohol use and its associated consequences, moderate loss does not typically result in these issues (Collins, 2016). Thus, the 0.266 increase in SDI in Iran from 1990 to 2019 may be insufficient to demonstrate the impact of socioeconomic changes on alcohol use disorder and cirrhosis due to alcohol use. Lifestyle and economic changes within this SDI range

may not significantly affect alcohol use disorder and cirrhosis due to alcohol use among the Iranian population. Notably, liver cancer due to alcohol was the only condition whose burden decreased with improvements in the socioeconomic status of the Iranian people, with changes in the socioeconomic status having more impact on its burden.

One surprising finding in our study was the positive association between SDI and the age-standardized DALY rate of alcoholic cardiomyopathy, which is in contrast to previous studies. In a study in the US, Shahid et al. found that social vulnerability resulted in higher mortality rates due to alcoholic cardiomyopathy (Shahid et al., 2023). In another study in Finland, socioeconomic factors didn't significantly impact the incidence of sudden cardiac death due to alcoholic cardiomyopathy
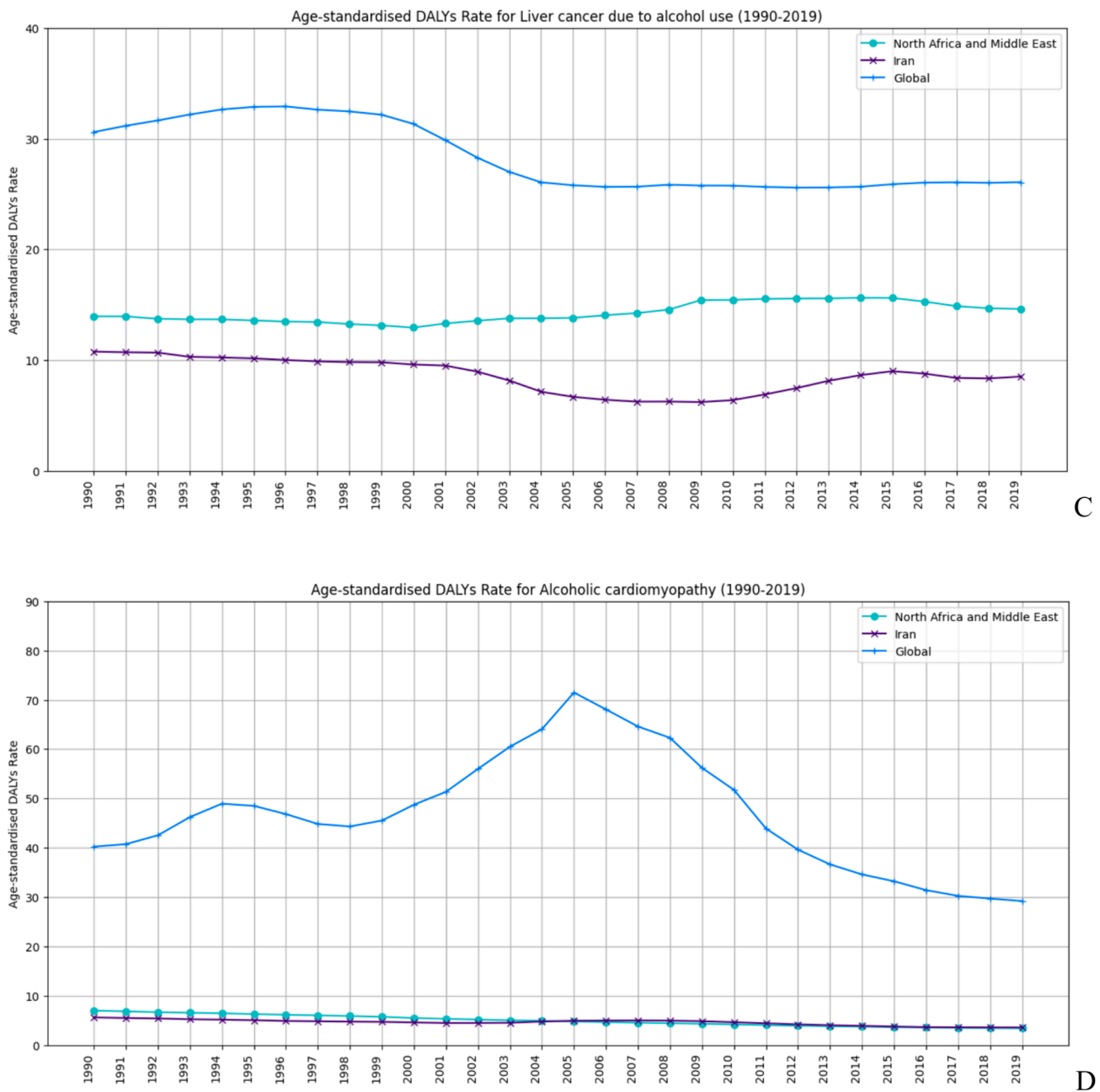
Fig. 1. (*continued*).

(Hietanen et al., 2020). It appears there are differences concerning the association between socioeconomic status and the burden of alcoholic cardiomyopathy across different regions of the world. Further studies are needed to explore the socioeconomic factors associated with the incidence of alcoholic cardiomyopathy and its outcomes in Iran to understand the reasons for the positive association between SDI and the burden of this condition. One possible explanation could be improved access to healthcare services and advancements in diagnostic methods, driven by socioeconomic progress, which have reduced the rate of undiagnosed cases of alcoholic cardiomyopathy in recent years. However, more studies are required to uncover the exact reasons behind this association.

We found that provinces near Iran's border had the highest age-standardized DALY rate of alcohol use disorder and related diseases in Iran. This is in contrast to the prevalence of alcohol drinking in Iran, where its prevalence was the highest in the major provinces in the

National Surveillance of Non-Communicable Diseases Survey (STEPs) in Iran (Rezaei et al., 2022). Putting all these findings together, it appears that despite the lower prevalence of alcohol drinking in the border provinces in Iran, the prevalence of related disorders and consequences is higher in these regions. This disparity could stem from the unequal distribution of health services and the variability in people's access to and use of these services in Iran, with border provinces often being at a disadvantage in this respect (Fanni et al., 2014; Zanganeh and Andisheh, 2015). In addition, knowledge about alcohol use and its consequences may be lower among individuals with lower educational levels and poorer socioeconomic status (Demaio et al., 2013), a situation that might be applicable to Iran. This could lead to reduced awareness of alcohol-related issues among people in border provinces, which are less developed compared to the major ones. Furthermore, as previously explained, alcohol use and trade are prohibited in Iran according to governmental laws (Al-Ansari et al., 2019). As a result, many Iranians
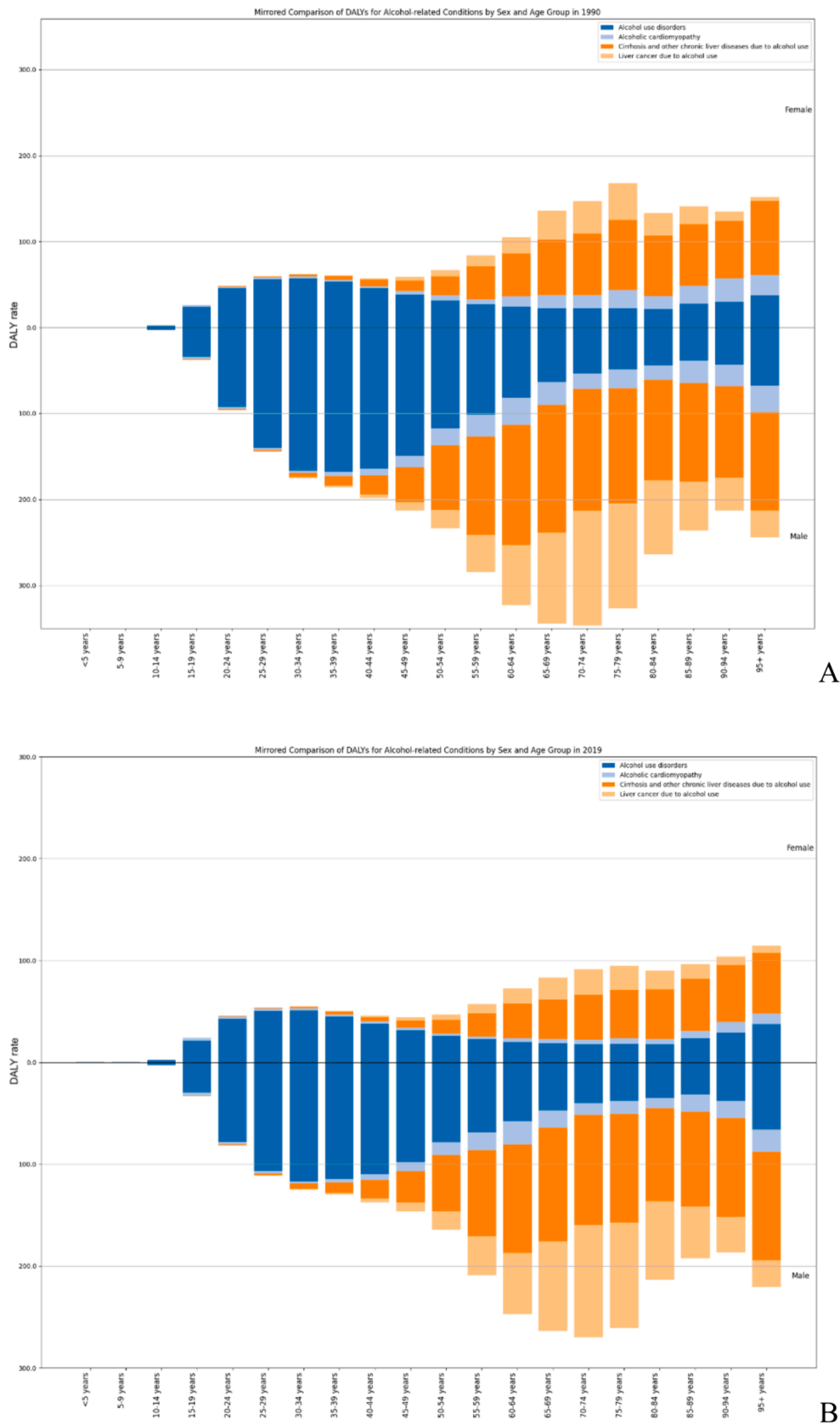
Fig. 2. DALY rate of alcohol use disorders and diseases related to alcohol use among males and females in Iran in A) 1990 and B) 2019.
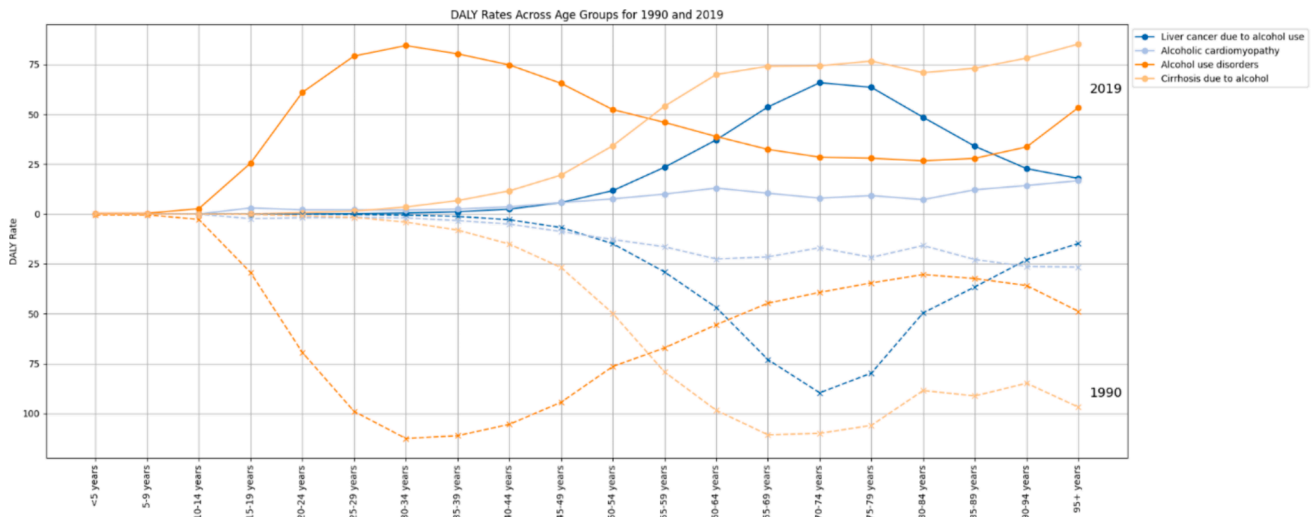
Fig. 3. DALY rate of alcohol use disorder and related consequences across age groups in 1990 and 2019.
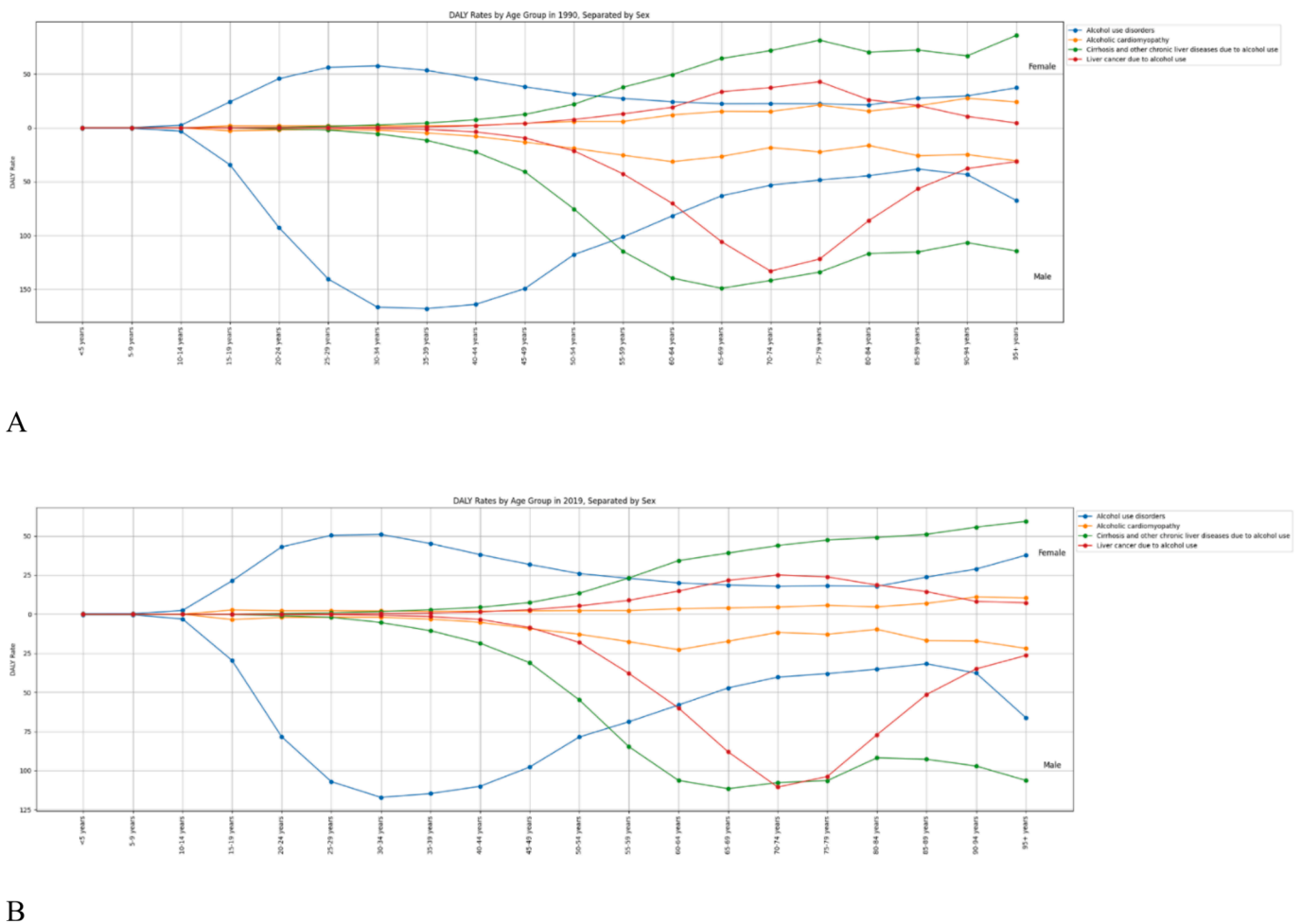

A

B

Fig. 4. DALY related to alcohol use disorder and related consequences across age groups in the two sexes in A) 1990 and B) 2019.

turn to purchasing homemade and foreign smuggled alcohol from the black market, where there is no regulatory oversight from authorities (Ebrahimi Kalan et al., 2019; Lankarani and Afshari, 2014). Possible higher access to these foreign smuggled alcoholic products in the border provinces in Iran with no or minimum quality control (Ahmadypour and Elyasi, 2012; Mohammadi and Kazemi, 2019) may be a reason for a

higher prevalence of alcohol-related disorders in these provinces. Thus, it is crucial to enhance access to screening and treatment services in these provinces and increase oversight of alcohol smuggling in these areas to mitigate the alcohol-related burden.

This study had some limitations worth mentioning. Most importantly, our study employed data from the GBD, which relies on
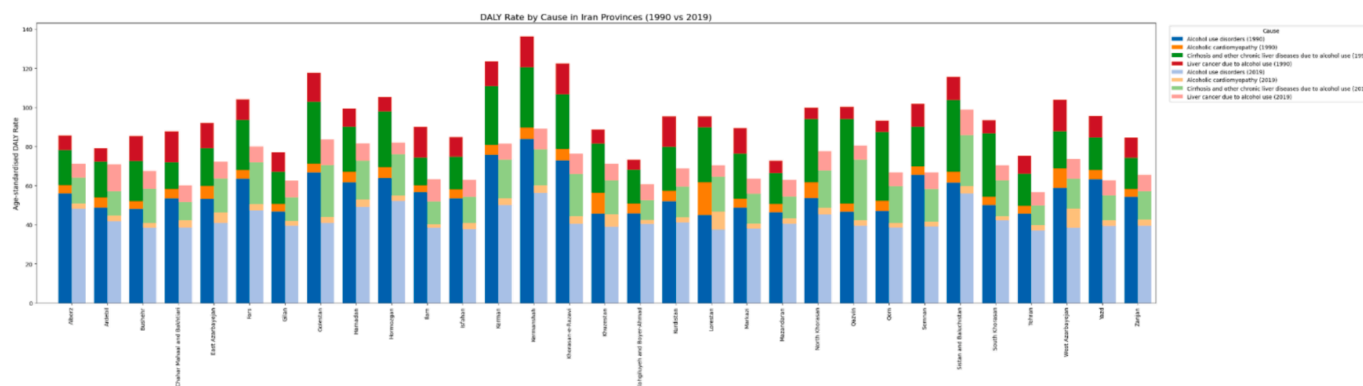
Fig. 5. Age-standardized DALY rate of alcohol use disorder and diseases related to alcohol across Iran provinces in 1990 and 2019.

estimations to determine the disease burden rather than direct evaluations at each specific time point and for every group. This limitation may impact the accuracy of the estimations, especially in developing countries, such as Iran, with limited epidemiological data available (Maher and Ferreira, 2022). However, it is important to note that our study can serve as a cornerstone for future studies on alcohol use disorders and related consequences in Iran to provide more accurate primary data on the burden of these disorders in Iran and further guide the policies in the country (Sepanlou et al., 2022). Finally, since our study relied on crude values from the GBD study, we were unable to use statistical tests to compare the burden of these disorders between groups and regions.

5. Conclusions

Despite a reduction in the age-standardized DALY rate of alcohol use disorders and related consequences among Iranians, these issues persist as public health concerns in Iran, especially its border provinces. Given the higher burden of these disorders among males and in provinces with poorer socioeconomic status, targeting these groups for interventions could effectively decrease the burden of alcohol use disorders and associated conditions in Iran.

CRediT authorship contribution statement

Khashayar Danandeh: Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Investigation, Conceptualization. **Pegah Rasoulian:** Writing – review & editing, Writing – original draft, Visualization, Project administration, Methodology, Investigation, Formal analysis, Data curation. **Homa Seyedmirzaei:** Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation. **Behnaz Mahmoudvand:** Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation. **Behnood Avand Amini:** Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation. **Fatemeh Samadian:** Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation. **Golnaz Ranjbar Pazuki:** Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation. **Amir Hossein Memari:** Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation. **Amin Nakhostin-Ansari:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Investigation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

We have used GBD 2019 study data in our study (https://vizhub. healthdata.org/gbd-results/)

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi. org/10.1016/j.pmedr.2024.102872.

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