

RESEARCH ARTICLE



Global burden of liver cirrhosis 1990–2019 and 20 years forecast: results from the global burden of disease study 2019

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ABSTRACT

Background: Cirrhosis is a disease that imposes a heavy burden worldwide, but its incidence varies widely by region. Therefore, we analysed data on the incidence and mortality of cirrhosis in 204 countries and territories from 1990–2019 and projected the disease development from 2019–2039.

Methods: Data on the incidence and mortality of liver cirrhosis from 1990 to 2019 were acquired from the public Global Burden of Disease (GBD) study. In addition, the average annual percentage change (AAPC) and estimated annual percentage change (EAPC) of the age-standardized rate (ASR) of cirrhosis in different regions were calculated. The estimates of risk factor exposure were summarized, and the proportion of causes and risk factors of liver cirrhosis and their relationship with the human development index (HDI) and socio-demographic index (SDI) were analysed. Trends in the incidence of cirrhosis in 2019–2039 were predicted using Nordpred and BAPC models.

Results: Globally, the ASR of cirrhosis incidence decreased by 0.05% per year from 25.7/100,000 in 1990 to 25.3/100,000 in 2019. The mortality risk associated with cirrhosis is notably lower in females than in males (13 per 100,000 vs 25 per 100,000). The leading cause of cirrhosis shifted from hepatitis B to C. Globally, alcohol use increased by 14%. In line, alcohol use contributed to 49.3% of disability-adjusted life years (DALYs) and 48.4% of global deaths from liver cirrhosis. Countries with a low ASR in 1990 experienced a faster increase in cirrhosis, whereas in 2019, the opposite was observed. In countries with high SDI, the ASR of cirrhosis is generally lower. Finally, projections indicate that the number and incidence of cirrhosis will persistently rise from 2019–2039.

Conclusions: Cirrhosis poses an increasing health burden. Given the changing etiology, there is an imperative to strengthen the prevention of hepatitis C and alcohol consumption, to achieve early reduce the incidence of cirrhosis.

KEY MESSAGES

- This study is an updated assessment of liver cirrhosis prevalence trends in 204 countries worldwide and the first to project trends over the next 20 years.
- The disease burden of cirrhosis is still increasing, and despite the decline in ASR, the number and prevalence of cirrhosis will continue to increase over the next two decades after 2019.
- It is alarming that the global surge in alcohol use is accompanied by an increase in DALYs and deaths due to liver cirrhosis.
- Liver cirrhosis remains a noteworthy public health event, and our study can further guide the development of national healthcare policies and the implementation of related interventions.

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1. Introduction

Liver cirrhosis is an integral part of the development of chronic liver disease. It is characterized by diffuse liver fibrosis due to prolonged injury and inflammation, regrowth of small nodules surrounded by fibrotic septa

and intrahepatic vascular shunting [1]. As cirrhosis progresses, it impairs important liver functions, including protein synthesis, detoxification, and the regulation of related metabolic processes and increases the risk of liver cancer. The main causes of liver cirrhosis include

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long-term alcohol abuse, viral hepatitis infection (especially hepatitis B and C), non-alcoholic fatty liver disease (NAFLD) and autoimmune diseases [2,3].

The incidence of liver cirrhosis varies widely in various regions of the world. Globally, cirrhosis causes approximately two million deaths each year [4]. In the United States, the prevalence of cirrhosis is estimated at 0.15% [5], resulting in more than 25,000 deaths in 1998 [6]. In China, the incidence of liver cirrhosis per thousand people increased by 73.7%, from 6833.3 in 1990 to 11869.6 in 2016 [7]. Due to the great differences in the level of economic development and population composition in different regions, the burden caused by liver cirrhosis also varies greatly. For the 1980–2010 global burden of disease study (GBD), the study of liver cirrhosis by Mokdad et al., the number of deaths from liver cirrhosis increased from 676,000 in 1980 (95% uncertainty interval (UI): 452,863 to 1,004,530) in 2010 1,029,042 (95% UI: 670,216 to 1,554,530); but the age-standardized death rate decreased by 22% [4]. The same changes were also shown in a 2017 GBD study. The study analysed cirrhosis data from 195 countries and found that the number of deaths increased from 899 000 (95% UI: 829 000–948 000) in 1990 to 1.32 million (95% UI: 1.27–1.45) in 2017; the age-standardized death rate decreased from 21.0 (19.2–22.3) per 100,000 in 1990 to 16.5 (15.8–18.1) per 100,000 in 2017 [8]. Both of these previous studies showed the same trend, with an increase in cirrhosis deaths and a gradual decline in age-standardized death rates.

Therefore, based on the latest GBD data in 2019, this study analyses and evaluates the disease burden of liver cirrhosis in 204 countries and regions around the world from 1990 to 2019, and predicts the changing trend of its health burden in the next 20 years, to provide a reference for decision-makers.

2. Methods

2.1. Data sources

The data used in this article comes from GBD 2019, which systematically assessed 369 diseases and 87 risk factors in 204 countries and territories [9]. We extracted data on incidence, deaths, age-standardized incidence and deaths, summary exposure value, and risk factors for morbidity associated with cirrhosis by country and territory from 1990 to 2019 from the Global Health Data Exchange Query Tool (<http://ghdx.healthdata.org/gbd-results-tool>) [9]. In terms of age selection, in addition to selecting 'all ages' and 'age-standardized' for analysis, we also selected the following age groups: '<1 year',

'1–4 years', '5–9 years', '10–14 years', '15–19 years', '20–24 years', '25–29 years', '30–34 years', '35–39 years', '40–44 years', '45–49 years', '50–54 years', '55–59 years', '60–64 years', '65–69 years', '70–74 years', '75–79 years', '80–84 years', '85–89 years', '90–94 years', '95+ years'. Further, we retrieved and analysed the composition ratio of liver cirrhosis cases in five aetiological groups (hepatitis B, hepatitis C, NAFLD, alcohol use, and other causes) and studied two risk factors (alcohol use) and (drug use) rate of liver cirrhosis.

We also collected national-level Human Development Index (HDI) data (<https://hdr.undp.org/data-center/human-development-index#/indicies/HDI>) from the World Bank to explore the relationship between HDI and cirrhosis. In addition, we obtained the global population forecast information for 2017–2100 in the GBD database (<https://ghdx.healthdata.org/record/ihme-data/global-population-forecasts-2017-2100>), to further predict the future development trend of liver cirrhosis.

2.2. Statistical analysis

Because the included data had different age groups and changed over time, we assessed them using age-standardized rates (ASR). The calculation of ASR is based on the world standard population in the GBD database, and heterogeneity is estimated using a 95% uncertainty interval (UI) [10]. Further, we use estimated annual percentage change (EAPC) and average annual percentage change (AAPC) to assess the trend of ASR over time. The regression line is fitted to the natural logarithm of the ratio, $y = \alpha + \beta x + e$, where $y = \ln(\text{ASR})$ and $x = \text{calendar year}$. EAPC is calculated as $100 \times [\exp(\beta) - 1]$, and its 95% confidence interval (CI) can also be obtained from the linear regression model [11]. In addition, we used Joinpoint Regression Program version 4.9.1.0 (Statistical Research and Applications Branch, National Cancer Institute) to calculate AAPC, $\text{AAPC} = \{\exp(\sum w_i b_i / \sum w_i) - 1\} * 100$, where b_i is the slope coefficient for each segment in the desired year range, and w_i is the length of each segment in the year range. Next, EAPCs for morbidity and mortality were clustered using hierarchical cluster analysis, and countries with similar trends in EAPCs were identified. In addition, the relationships between EAPCs, ASRs (1990 and 2019), and HDI (2022) were determined for each country. To clarify the relationship between socioeconomic development and the occurrence of liver cirrhosis, we included the GBD database (<https://ghdx.healthdata.org/record/ihme-data/gbd-2019-socio-demographic-index-sdi-1950-2019>) of socio-demographic index (SDI) data from 1950–2019. The national economic development level is divided into low, medium-low, medium, high-medium,

and high SDI according to the quintiles of the SDI value, and the value ranges from 0 to 1.

To predict the incidence of future cirrhosis, we used the Nordpred package in the R software to analyse the number and incidence of cirrhosis in different age groups from 2019 to 2039 and calculated ASR by gender. To verify the reliability of the predicted results, we used the BAPC and INLA packages in R software for analysis. Statistics of all data in this study were performed using R software (version 4.2.1) and $p < 0.05$ was considered statistically significant.

3. Results

3.1. Global disease burden of cirrhosis

First, we analyzed the age-standardized incidence rate (ASIR) of each country and territory in 2019. Moldova (80 per 100000, 95% UI: 71.7–86.3) has the highest ASIR, followed by Mongolia (79.6 per 100000, 95% UI: 66.4–94.2) and Egypt (78.7 per 100000, 95% UI: 62.3–99). Papua New Guinea (6.1 per 100000, 95% UI: 4.9–7.2), by comparison, has the lowest ASIR among countries and territories, followed by Cook Islands (6.1 per 100000, 95% UI: 5–7.1) and Jamaica (8.5 per 100000, 95% UI: 7.3–9.8) (Figure 1(A) and Table 1). Further, we analysed the changes in the number of cases of cirrhosis in each country and territory from 1990 to 2019. As shown in Figure 1(B), the number of cases in the United Arab Emirates increased by 820%, from 219.5 in 1990 to 2019.1 in 2019 (Figure 1(B) and Table 1). Meanwhile, the number of cases in the Republic of Korea dropped 43.9%, from 30,126.5 in 1990 to 16,886.5 in 2019 (Figure 1(B) and Table 1). To better assess the changes of ASIR in liver cirrhosis, we performed an EAPC analysis. The results show that Kazakhstan has the fastest ASIR growth with an average annual growth rate of 4.3% (95% CI: 4.1–4.5), while the Republic of Korea has the fastest ASIR decline with an average annual growth rate of 3.9% (95% CI: –4.1 to –3.7) (Figure 1(C) and Table 1). The results of the AAPC analysis are consistent. Kazakhstan is the fastest growing ASIR with an average annual growth rate of 3.632% (95% CI: 3.505–3.759), while the Republic of Korea is the fastest declining ASIR with an average annual growth rate of 3.345% (95% CI: –3.548 to –3.14) (Table 2).

Furthermore, the mortality burden of liver cirrhosis was analysed by countries and regions in 2019. Egypt had the highest age-standardized death rate (ASDR) (126.7 per 100000, 95% UI: 87.3–169.5), followed by Mongolia (72.9 per 100000, 95% UI: 56.9–91.3). However, Singapore (3.3 per 100000, 95% UI: 2.9–3.6) and Iceland (3.3 per 100000, 95% UI: 2.9–3.7) had the lowest ASDR globally (Figure 2 (A) and Table 3). The

change in the number of deaths from cirrhosis from 1990 to 2019 also shows large differences across countries. The number of deaths from cirrhosis in the United Arab Emirates increased by 607.7% from 71.4 in 1990 to 505.6 in 2019. In Portugal, however, there was a 42.8% decrease, from 3,658.6 cases in 1990 to 2,091.7 cases in 2019 (Figure 2(B) and Table 3). EAPC analysis found that Belarus and Lithuania had the fastest annual average growth rate of 3.7% (95%CI: 2.6–4.9; 95%CI: 2.6–4.8;). However, the Republic of Korea experienced the fastest annual decrease in ASDR of 5.6% (95% CI: –5.9 to –5.2) globally (Figure 2(C) and Table 3).

In addition, the burden of cirrhosis was different between the genders. Globally, the number of deaths, death rate, and ASDR of liver cirrhosis in females is significantly lower than those in males. Among them, the Republic of Moldova had the highest death rate among female patients (67.8 per 100000, 95% UI: 59.3–77.5), while Papua New Guinea had the lowest (1.9 per 100000, 95% UI: 1.3–2.7). Analysis of the ASDR data, however, found that Egyptian females had the highest (141.4 per 100000, 95% UI: 103.9–191) and Iceland the lowest (1.9 per 100000, 95% UI: 1.6–2.2). Analysis of the data for males found that the highest cirrhosis death rate remained in the Republic of Moldova (81.7 per 100000, 95% UI: 70.7–93.8), while the lowest became Singapore (5.2 per 100000, 95% UI: 4.7–5.8). However, Egyptian males still have the highest ASDR of cirrhosis (124.5 per 100000, 95% UI: 78.7–170.3), as do females; Singapore still has the lowest ASDR (3.9 per 100000, 95% UI: 3.5–4.4) (Table 4).

We performed a stratified cluster analysis for each country based on EAPC incidence and death. A total of 173 countries and territories, including Tunisia, the Syrian Arab Republic, and Egypt, were designated to the ‘remained stable or minor decrease’ group. 10 countries and territories, including Spain, Mauritius, and Taiwan (Province of China), were classified as a ‘significant decrease’ group. 6 countries including Lithuania, Belarus, and Armenia are classified as the ‘significant increase’ group. 15 countries and territories, including Kuwait, Azerbaijan, and India, are divided into the ‘minor increase’ group (Figure 3 and Supplementary Table 1).

3.2. Percentage change of cirrhosis caused by different causes

The percentage of the five causes of cirrhosis has changed greatly from 1990 to 2019. Globally, the top three causes of cirrhosis in 1990 were hepatitis

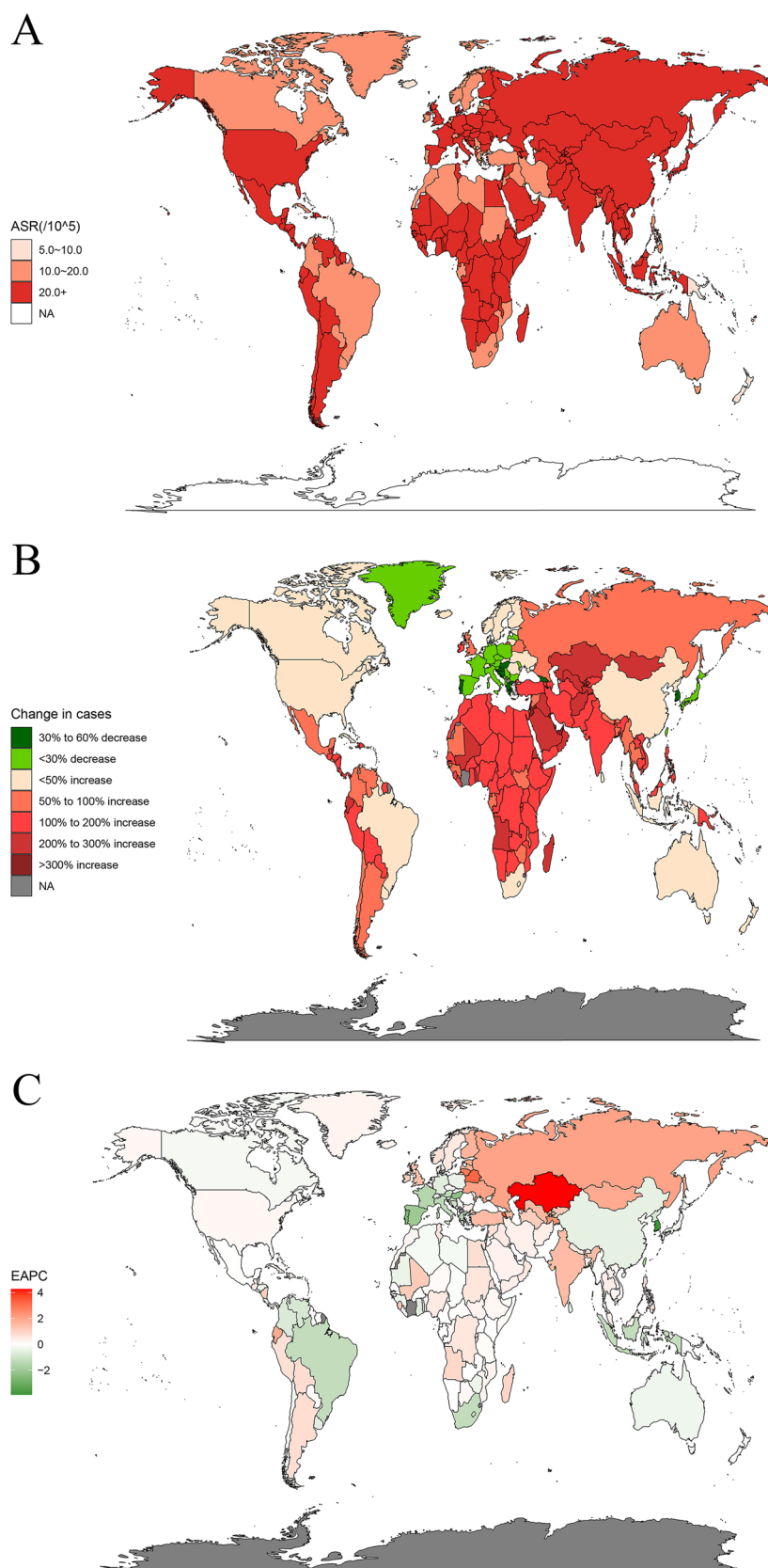


Figure 1. Incidence of cirrhosis in 204 countries and regions worldwide burden of disease: A. ASR for the incidence of cirrhosis in 2019; B. Changes in the cases of cirrhosis from 1990 to 2019; C. EAPC analysis of cirrhosis ASR from 1990 to 2019. ASIR, age-standardized rate; EAPC, estimated annual percent change. *Source:* Institute for Health Metrics and Evaluation. Used with permission. All rights reserved.

Table 1. ASIR, change in case numbers and EAPC for cirrhosis in different countries.

Country	ASIR per 100,000 NO. (95% UI)	Cases change		Cases change (%)	EAPC NO. (95%CI)
		Case_1990	Case_2019		
Afghanistan	22.5 (17.7–27.9)	1883.6	6354.9	237.4	0.4 (0.3–0.5)
Albania	21.9 (19.1–24.6)	710.8	640.7	–9.9	–0.5 (–0.7 to –0.4)
Algeria	19.2 (15.8–23.1)	3379.8	7823.4	131.5	–0.2 (–0.3–0)
American Samoa	13.8 (11.6–16.1)	6.3	7.3	16.0	–0.4 (–0.4 to –0.3)
Andorra	20.2 (17.5–22.7)	14.7	22.3	51.9	–0.6 (–0.6 to –0.5)
Angola	23.5 (18.6–29.1)	1629.1	6052.1	271.5	0.9 (0.7–1.1)
Argentina	27.3 (23.9–30.8)	6741.4	13006.4	92.9	0.8 (0.7–0.8)
Armenia	44.3 (38.5–50.7)	660.3	1595.6	141.6	3.3 (3.1–3.5)
Australia	10.5 (8.9–12.1)	2073.0	2876.7	38.8	–0.3 (–0.4 to –0.3)
Austria	29.3 (26.7–31.7)	3449.1	2913.7	–15.5	–1.3 (–1.5 to –1.2)
Azerbaijan	51.5 (43.2–60.5)	2210.3	6436.9	191.2	1.5 (1.4–1.7)
Bahamas	18.8 (16.1–21.5)	50.8	82.1	61.6	–0.9 (–1 to –0.8)
Bahrain	28 (23.5–33.3)	89.4	480.2	437.4	0.3 (0.1–0.4)
Bangladesh	18.6 (15.5–21.6)	18413.6	28892.6	56.9	0.4 (0.2–0.5)
Barbados	14.2 (12.2–16.2)	36.6	47.0	28.2	–0.5 (–0.6 to –0.5)
Belarus	26.5 (23.5–29.3)	1372.9	2576.5	87.7	3.2 (2.7–3.7)
Belgium	23.8 (21.2–26.5)	2602.2	2920.3	12.2	–0.2 (–0.3 to –0.1)
Belize	24.6 (20.9–28.4)	26.7	97.2	264.4	0.4 (0.3–0.6)
Benin	26 (21.2–31.2)	951.0	2722.1	186.2	0.1 (–0.1–0.3)
Bermuda	13.9 (11.9–15.8)	11.4	10.6	–7.8	–1 (–1.1 to –0.9)
Bhutan	25.9 (21–31.2)	125.9	200.9	59.6	0.6 (0.6–0.7)
Bolivia	31.6 (26.4–38.3)	1220.9	3422.0	180.3	0.8 (0.7–0.9)
Bosnia and Herzegovina	21.2 (18.7–23.5)	1322.5	802.1	–39.3	–1 (–1.1 to –1)
Botswana	24.1 (19.5–28.9)	269.9	589.5	118.4	0.2 (0–0.3)
Brazil	19.9 (14.4–25.8)	35430.2	49123.8	38.6	–1.3 (–1.4 to –1.2)
Bulgaria	31.7 (28.8–34.6)	2651.3	2425.5	–8.5	0.4 (0.4–0.4)
Burkina Faso	22.5 (17.1–28.6)	1778.9	4254.8	139.2	–0.1 (–0.2–0.1)
Burundi	22 (16.8–28.2)	882.1	2004.6	127.3	0.4 (0.3–0.5)
Cambodia	52.1 (42.3–63.3)	3738.9	8387.8	124.3	0.2 (0.2–0.2)
Cameroon	25.6 (20.6–31.4)	2237.8	6303.9	181.7	–0.1 (–0.2–0)
Canada	19.4 (17.2–21.7)	6170.2	7771.6	26.0	–0.2 (–0.3 to –0.2)
Central African Republic	28.6 (20.9–37)	667.5	1359.6	103.7	0 (0–0.1)
Chad	28 (22.5–33.8)	1360.7	3690.3	171.2	–0.1 (–0.1–0)
Chile	40.4 (36–44.7)	4865.2	8553.4	75.8	–0.3 (–0.4 to –0.1)
China	22.5 (17.6–27.6)	310191.3	409693.6	32.1	–0.5 (–0.6 to –0.4)
Colombia	15.3 (13.5–17.3)	4961.9	7858.1	58.4	–0.8 (–0.8 to –0.7)
Comoros	24.6 (19–30.5)	84.2	165.0	96.0	0.3 (0.2–0.3)
Cook Islands	6.1 (5–7.1)	1.0	1.1	5.2	0 (0–0.1)
Costa Rica	30.4 (27–34.3)	762.1	1575.2	106.7	0 (0–0)
Côte d'Ivoire	26.6 (21.1–32)	2504.0	6084.0	143.0	0.1 (–0.1–0.3)
Croatia	32.5 (29.7–35.3)	2404.6	1532.5	–36.3	–1.2 (–1.3 to –1.1)
Cuba	17 (15–19)	1508.2	2228.3	47.7	0.6 (0.5–0.6)
Cyprus	18.4 (15.8–21.1)	161.4	287.7	78.3	–0.6 (–0.7 to –0.5)
Czech Republic	22.1 (19.9–24.4)	2715.2	2670.6	–1.6	–0.2 (–0.3 to –0.1)
Democratic Republic of the Congo	28.7 (22.8–35.3)	7896.2	21836.7	176.5	0.6 (0.5–0.6)
Denmark	21.4 (18.9–23.7)	1015.3	1242.0	22.3	0.6 (0.2–1)
Djibouti	22.9 (18.5–27.7)	92.2	263.6	186.0	–0.3 (–0.4 to –0.2)
Dominica	15 (12.6–17.4)	10.2	10.9	7.3	–0.7 (–0.8 to –0.6)
Dominican Republic	30 (24.8–35.4)	1417.6	3263.1	130.2	0.4 (0.3–0.5)
Ecuador	38.5 (34.9–42.3)	1689.3	6405.9	279.2	1.9 (1.6–2.1)
Egypt	78.7 (62.3–99)	24559.5	65387.7	166.2	0.7 (0.7–0.8)
El Salvador	36.3 (31.3–41.3)	1372.8	2188.5	59.4	0.2 (0.1–0.3)
Equatorial Guinea	24 (19.3–29.4)	92.2	282.1	205.8	–0.2 (–0.3 to –0.1)
Eritrea	29.1 (22.8–35.6)	539.9	1631.3	202.2	0.7 (0.6–0.8)
Estonia	22 (19.5–24.5)	209.3	277.6	32.6	1.8 (1.4–2.2)
Ethiopia	28.1 (17.5–39.8)	10269.5	22299.5	117.1	0.2 (0.1–0.3)
Fiji	10.2 (8.4–12)	79.7	96.2	20.6	–0.4 (–0.5 to –0.4)
Finland	21.8 (19.7–23.7)	837.2	1124.6	34.3	1.7 (1.3–2)
France	21.2 (18.8–23.4)	18974.9	14331.2	–24.5	–1.6 (–1.6 to –1.5)
Gabon	17 (13.6–20.8)	144.2	280.9	94.8	0 (–0.1–0.1)
Gambia	26.7 (21.7–32)	208.8	492.7	136.0	–0.1 (–0.1–0)
Georgia	31.6 (27.3–35.5)	1833.3	1247.7	–31.9	–0.2 (–0.3–0)
Germany	28.8 (26.2–31.4)	29343.9	25398.9	–13.4	–0.6 (–0.8 to –0.5)
Ghana	21.9 (17.7–26.4)	3065.5	6227.0	103.1	–0.6 (–0.7 to –0.5)
Greece	15.8 (13.7–17.6)	2627.2	1803.4	–31.4	–1.6 (–1.6 to –1.5)
Greenland	16 (13.8–17.9)	9.9	9.1	–7.8	0.2 (0.2–0.3)
Grenada	21.3 (18–24.7)	13.2	24.3	84.0	–0.2 (–0.2 to –0.1)
Guam	19.2 (16.2–22.3)	30.7	31.8	3.5	–0.9 (–1 to –0.8)
Guatemala	52 (45.2–58.9)	2898.9	8092.3	179.2	0.5 (0.4–0.5)

(Continued)

Table 1. Continued.

Country	ASIR per 100,000 NO. (95% UI)	Cases change		Cases change (%)	EAPC NO. (95%CI)
		Case_1990	Case_2019		
Guinea	22.5 (18.1–27)	1262.3	2419.0	91.6	−0.4 (−0.6 to −0.3)
Guinea-Bissau	25.8 (20.2–31.5)	238.9	429.9	80.0	−0.5 (−0.6 to −0.5)
Guyana	34 (28.2–39.4)	214.7	262.8	22.4	0 (−0.1–0.1)
Haiti	25.3 (20.3–30.8)	1084.3	2778.6	156.3	0.6 (0.5–0.6)
Honduras	36.6 (30.1–42.9)	1361.8	3080.4	126.2	−0.4 (−0.5 to −0.3)
Hungary	32 (29–35)	6257.7	3701.0	−40.9	−2.4 (−2.6 to −2.1)
Iceland	9.6 (8.4–10.8)	23.3	33.5	44.2	0.3 (0.3–0.4)
India	23.2 (16.5–30.6)	138576.4	326903.9	135.9	1.5 (1.4–1.6)
Indonesia	23.2 (14.5–32.3)	47107.3	64125.6	36.1	−1.3 (−1.5 to −1)
Iran	16.6 (12.1–21.7)	6502.4	14346.0	120.6	0.3 (0.2–0.5)
Iraq	18.3 (15.5–21.1)	2161.7	6593.1	205.0	0.5 (0.3–0.6)
Ireland	15.4 (13.6–17.2)	391.5	826.0	111.0	1.1 (0.9–1.3)
Israel	17.3 (14.9–19.6)	826.6	1588.8	92.2	−0.6 (−0.7 to −0.4)
Italy	32.7 (26.6–39.1)	30032.3	24482.7	−18.5	−1.4 (−1.5 to −1.2)
Jamaica	8.5 (7.3–9.8)	196.2	246.2	25.4	−0.9 (−1 to −0.8)
Japan	25.9 (21–31.3)	46734.0	33114.8	−29.1	−0.3 (−0.5 to −0.2)
Jordan	17.4 (14.8–20.4)	424.5	1763.5	315.4	0.1 (0.1–0.2)
Kazakhstan	63.3 (55.6–71.2)	3469.9	12698.3	266.0	4.3 (4.1–4.5)
Kenya	36.5 (22.2–52.3)	5233.6	14848.4	183.7	−0.1 (−0.2–0)
Kiribati	17.4 (13.3–21.8)	13.6	20.0	47.1	−0.6 (−0.8 to −0.5)
Kuwait	15.2 (13–17.4)	174.8	755.7	332.2	1.3 (1.1–1.4)
Kyrgyzstan	48.9 (43.2–55.4)	1311.3	3182.6	142.7	1.3 (1–1.5)
Laos	24.9 (20.2–29.9)	739.5	1683.1	127.6	0.3 (0.2–0.4)
Latvia	20 (17.9–22.3)	360.5	353.7	−1.9	1.8 (1.4–2.2)
Lebanon	21.3 (17.8–25.3)	469.6	1109.6	136.3	1 (0.9–1.1)
Lesotho	20.6 (15.9–25.8)	343.4	431.8	25.7	−0.6 (−0.8 to −0.5)
Liberia	21.3 (17–26)	315.4	897.2	184.5	0.4 (0.2–0.5)
Libya	17.1 (14.3–20.4)	548.0	1142.4	108.4	−0.2 (−0.3 to −0.1)
Lithuania	27.8 (25–30.6)	529.6	677.8	28.0	2.8 (2.3–3.4)
Luxembourg	26.4 (23.2–29.3)	157.9	196.1	24.2	−1.4 (−1.6 to −1.1)
Madagascar	25.3 (20.4–30.4)	1900.9	5724.3	201.1	0.9 (0.7–1.2)
Malawi	27.7 (21.8–34.6)	2095.8	3866.0	84.5	−0.2 (−0.3 to −0.2)
Malaysia	21.1 (17.9–24.6)	2622.6	6861.1	161.6	0.3 (0.2–0.5)
Maldives	13.8 (11.6–16.1)	19.9	76.1	282.4	0.3 (0.1–0.5)
Mali	28 (21.8–34.5)	1683.6	5093.2	202.5	1.1 (1–1.3)
Malta	13.5 (12–15)	66.9	61.1	−8.7	−0.6 (−0.7 to −0.5)
Marshall Islands	16.8 (13.3–20.3)	6.9	9.8	41.4	−0.6 (−0.7 to −0.5)
Mauritania	23.8 (19.4–28.9)	432.6	826.0	90.9	−0.4 (−0.5 to −0.3)
Mauritius	17.8 (15.4–20.3)	315.0	252.6	−19.8	−2.1 (−2.3 to −1.8)
Mexico	55.4 (41.4–69.9)	39192.5	73785.2	88.3	0 (−0.1–0)
Moldova	80 (71.7–86.3)	4338.6	3504.2	−19.2	−0.6 (−0.9 to −0.3)
Monaco	23.8 (20.7–26.6)	7.4	8.6	16.9	0.3 (0.2–0.4)
Mongolia	79.6 (66.4–94.2)	816.8	2950.8	261.2	1.9 (1.7–2.1)
Montenegro	10.6 (9.1–12)	68.0	66.6	−2.0	0 (−0.1–0)
Morocco	18.8 (15.6–22.6)	3296.2	6917.5	109.9	0.3 (0.1–0.4)
Mozambique	17.7 (13.8–22.4)	1754.9	4206.3	139.7	0.3 (0.1–0.4)
Myanmar	34.3 (28.5–40)	12459.9	19740.1	58.4	−0.1 (−0.2 to −0.1)
Namibia	21.9 (17.7–26.4)	236.4	492.6	108.4	0 (−0.1–0.1)
Nauru	17.4 (13.9–20.9)	1.5	1.8	16.8	0.1 (0–0.1)
Nepal	24.3 (20.2–28.9)	3745.8	7106.8	89.7	0.5 (0.5–0.6)
Netherlands	15.3 (13.3–17.3)	2751.7	2786.8	1.3	−0.4 (−0.5 to −0.2)
New Zealand	8.7 (6.8–10.8)	318.9	438.2	37.4	−0.1 (−0.2 to −0.1)
Nicaragua	37.9 (32.9–42.7)	838.8	2395.9	185.6	1 (0.8–1.2)
Niger	30.8 (24–38.4)	1939.0	5636.0	190.7	0.1 (0.1–0.2)
Nigeria	27.1 (17.8–37.2)	17729.5	47955.3	170.5	0.5 (0.4–0.6)
Niue	14.7 (12.1–17.3)	0.3	0.2	−16.1	−0.1 (−0.2–0)
Democratic People's Republic of Korea	20.3 (16.3–24.1)	5236.6	6457.5	23.3	−0.8 (−1 to −0.7)
Northern Mariana Islands	29.8 (24.5–35.5)	17.4	14.2	−18.5	−0.8 (−0.9 to −0.6)
Norway	15.1 (11.8–18.7)	701.0	835.0	19.1	0.7 (0.4–0.9)
Oman	29.3 (24.2–35.2)	317.8	1036.5	226.1	0.5 (0.4–0.6)
Pakistan	25.1 (17–33.9)	24805.7	50880.2	105.1	0 (0–0)
Palau	17 (13.9–20.3)	2.4	3.6	50.5	0.1 (0–0.2)
Palestine	21.6 (18.3–25.5)	272.4	821.2	201.4	0.4 (0.1–0.7)
Panama	22.3 (19.4–24.9)	425.7	950.0	123.2	0.2 (0–0.3)
Papua New Guinea	6.1 (4.9–7.2)	236.5	617.3	161.0	−0.1 (−0.1–0)
Paraguay	15.7 (13.3–18.2)	471.0	1062.9	125.6	0.1 (0–0.2)
Peru	29.4 (25.3–33.9)	4297.5	10145.3	136.1	0.7 (0.5–0.9)
Philippines	19.6 (13.6–25.9)	8344.5	21019.1	151.9	0.8 (0.7–1)

(Continued)

Table 1. Continued.

Country	ASIR per 100,000 NO. (95% UI)	Cases change		Cases change (%)	EAPC NO. (95%CI)
		Case_1990	Case_2019		
Poland	21.1 (15.7–27.1)	9550.3	8644.4	–9.5	–0.4 (–0.7 to –0.1)
Portugal	18.5 (16.3–20.5)	3889.6	2238.9	–42.4	–2.8 (–3 to –2.6)
Puerto Rico	24.4 (20.9–27.4)	1216.4	948.1	–22.1	–1.6 (–1.7 to –1.4)
Qatar	39.4 (32.4–47.9)	102.4	934.2	812.8	1 (0.8–1.2)
Republic of Congo	20.7 (16.6–25.2)	426.4	1022.1	139.7	0.1 (0–0.2)
Romania	51.2 (46.9–55.2)	11829.8	12134.7	2.6	0.1 (–0.1–0.3)
Russia	29.9 (21.6–39.4)	28493.8	45082.2	58.2	2 (1.8–2.3)
Rwanda	32.4 (25.6–39.4)	1688.6	3382.7	100.3	0.3 (0.2–0.4)
Saint Lucia	19.2 (16.4–22)	23.2	39.8	71.4	–0.8 (–0.9 to –0.6)
Samoa	17.5 (14.5–20.9)	23.1	33.7	46.0	–0.2 (–0.3 to –0.1)
San Marino	33.1 (29–36.9)	9.0	12.1	34.6	–0.4 (–0.5 to –0.4)
Sao Tome and Principe	33.5 (27.1–40.3)	38.0	62.9	65.7	–0.5 (–0.5 to –0.4)
Saudi Arabia	32.5 (26.9–38.5)	2998.5	10224.5	241.0	0.3 (0.2–0.3)
Senegal	27.4 (21.9–33)	1672.4	3594.2	114.9	0 (0–0.1)
Serbia	17.7 (15.8–19.6)	1975.1	1640.8	–16.9	–0.3 (–0.4 to –0.2)
Seychelles	28.3 (23.7–32.8)	17.3	34.7	100.3	–0.1 (–0.2 to –0.1)
Sierra Leone	24.4 (19.6–29.6)	595.0	1747.1	193.6	1.3 (1.1–1.5)
Singapore	11.2 (9.8–12.6)	560.6	747.6	33.3	–1.6 (–1.8 to –1.4)
Slovakia	32.6 (29–36.1)	2042.8	2056.9	0.7	–0.3 (–0.4 to –0.2)
Slovenia	31.1 (28–34)	992.6	740.0	–25.5	–1.5 (–1.6 to –1.3)
Solomon Islands	20.6 (16.7–24.8)	63.9	132.8	107.9	–0.4 (–0.5 to –0.3)
Somalia	29.7 (21.4–39.1)	1548.3	4398.1	184.1	0.1 (0–0.2)
South Africa	13.8 (9.6–18.3)	6346.7	7807.5	23.0	–1.3 (–1.4 to –1.2)
Republic of Korea	25.5 (22.5–28.9)	30126.5	16886.5	–43.9	–3.9 (–4.1 to –3.7)
South Sudan	23 (17.2–29.4)	953.9	1705.5	78.8	0.3 (0.2–0.3)
Spain	23.3 (20.6–25.9)	15287.3	13480.1	–11.8	–2 (–2.1 to –1.9)
Sri Lanka	23.3 (19.7–26.8)	4156.9	5600.8	34.7	–0.7 (–0.9 to –0.5)
Sudan	15.8 (12.4–19.8)	1954.9	4800.6	145.6	0.6 (0.3–0.9)
Suriname	23.7 (20–27.6)	74.3	151.2	103.5	0 (–0.1–0)
Sweden	15.3 (12–19)	1238.3	1605.4	29.6	0.5 (0.4–0.7)
Switzerland	17.5 (15.5–19.6)	1468.5	1747.1	19.0	–0.3 (–0.5 to –0.2)
Syria	24 (20.3–28.3)	1902.8	3557.6	87.0	0.7 (0.6–0.7)
Taiwan	26.6 (23–29.9)	9075.2	8204.8	–9.6	–2.1 (–2.4 to –1.9)
Tajikistan	53.8 (45.9–62.3)	1251.9	4716.5	276.7	2.4 (2.3–2.5)
Tanzania	22.2 (17.6–27.5)	4065.5	10011.0	146.2	0.1 (0–0.2)
Thailand	24.2 (20.7–27.9)	12333.2	20264.9	64.3	0.4 (0.3–0.5)
Timor-Leste	26.4 (20.9–32)	140.4	275.5	96.2	0.7 (0.7–0.8)
Togo	26.6 (21–32.7)	736.9	1880.5	155.2	0.3 (0.2–0.4)
Tokelau	12.4 (10.2–14.6)	0.2	0.2	–0.8	–0.1 (–0.1–0)
Tonga	20.1 (16.5–23.9)	15.9	18.5	16.6	–0.4 (–0.5 to –0.3)
Tunisia	20.7 (17.3–24.6)	1153.7	2680.9	132.4	0.6 (0.5–0.7)
Turkey	18.7 (16.2–21.5)	6651.2	16568.3	149.1	1.5 (1.4–1.6)
Turkmenistan	53.3 (46.7–60.2)	1188.5	2843.1	139.2	1.1 (1–1.2)
Tuvalu	14.3 (11.7–16.9)	1.2	1.6	40.5	0.2 (0.1–0.2)
Uganda	23.4 (18.2–29.6)	2791.9	6934.0	148.4	0 (–0.1–0)
UK	23.9 (19.8–28.4)	8657.4	16129.7	86.3	1.5 (1.2–1.7)
Ukraine	33.7 (22.6–47.3)	10702.4	14401.2	34.6	2 (1.8–2.3)
United Arab Emirates	18 (14.9–21.6)	219.5	2019.1	820.0	0.1 (0–0.2)
Uruguay	17.1 (14.7–19.3)	580.3	637.3	9.8	–0.6 (–0.7 to –0.5)
USA	26.3 (21.8–31.2)	65860.2	90854.4	38.0	0.2 (0.1–0.3)
Uzbekistan	65.2 (57.6–72.9)	6750.2	22488.6	233.2	1.6 (1.3–1.9)
Vanuatu	23.1 (18.1–28.1)	33.4	61.8	84.9	–0.6 (–0.6 to –0.5)
Venezuela	20.1 (17.5–22.8)	3887.7	6248.9	60.7	–0.9 (–0.9 to –0.8)
Vietnam	29.3 (25.1–33.7)	13537.6	32979.7	143.6	0.3 (0–0.5)
Yemen	20.2 (16.5–24.4)	1737.0	4660.3	168.3	0.4 (0.2–0.5)
Zambia	32.2 (26–39)	1839.1	4513.0	145.4	0 (–0.1–0)
Zimbabwe	20.1 (15.8–25)	1753.3	2657.4	51.6	–0.4 (–0.7–0)

ASIR: age-standardized incidence rate; CI: confidence interval; EAPC: estimated annual percentage change; UI: uncertainty interval.

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B (28.2%), other causes (24.3%), and hepatitis C (23.2%). However, in 2019, the top three causes changed to hepatitis C (26.9%), hepatitis B (25.4%), and alcohol use (21.3%). Notably, the proportion of cirrhosis due to NAFLD also increased significantly (Figure 4).

From the perspective of different causes, liver cirrhosis caused by hepatitis B mostly occurs in East Asia, whether in 1990 (37.7%) or 2019 (30.9%). Liver cirrhosis caused by hepatitis C mostly occurred in North America and high-income North America, accounting for 41.1% in 1990 and increasing to

Table 2. Incidence rate and age-standardized incidence of cirrhosis in various countries of the world from 1990 to 2019 and temporal trends from 1990 to 2019.

Country	1990		2019		1990–2019
	Incident rate per 100,000 NO. (95% UI)	ASR per 100,000 NO. (95% UI)	Incident rate per 100,000 NO. (95% UI)	ASR per 100,000 NO. (95% UI)	AAPC NO. (95%CI)
Afghanistan	1883.6 (1475.1–2358.6)	19.4 (14.4–24.9)	6354.9 (5272.2–7632.4)	22.5 (17.7–27.9)	0.556 (0.464–0.648)
Albania	710.8 (608.4–798.3)	25.2 (21.4–28.5)	640.7 (551.8–728.8)	21.9 (19.1–24.6)	−0.488 (−0.508 to −0.468)
Algeria	3379.8 (2808.5–4044.2)	18.2 (14.6–22.6)	7823.4 (6480.6–9296.7)	19.2 (15.8–23.1)	0.175 (0.095–0.255)
American Samoa	6.3 (5.3–7.4)	14.5 (12–17.3)	7.3 (6.1–8.7)	13.8 (11.6–16.1)	−0.213 (−0.32 to −0.105)
Andorra	14.7 (12.5–16.7)	23.1 (19.7–26.3)	22.3 (18.9–25.6)	20.2 (17.5–22.7)	−0.483 (−0.524 to −0.443)
Angola	1629.1 (1312.1–1985)	18 (13.4–23)	6052.1 (5063.1–7307)	23.5 (18.6–29.1)	0.931 (0.887 to 0.975)
Antigua and Barbuda	9.6 (8.2–10.9)	18.2 (15.6–21.1)	19.2 (16.1–22.3)	18.1 (15.4–20.7)	−0.027 (−0.056 to 0.002)
Argentina	6741.4 (5845.4–7740.9)	21.3 (18.5–24.6)	13006.4 (11347.4–14688.7)	27.3 (23.9–30.8)	0.857 (0.79–0.923)
Armenia	660.3 (577.4–755.4)	20.1 (17.5–22.9)	1595.6 (1345.3–1842.6)	44.3 (38.5–50.7)	2.757 (2.65–2.864)
Australia	2073 (1780.8–2348.8)	11.5 (9.9–13)	2876.7 (2420.9–3347.4)	10.5 (8.9–12.1)	−0.338 (−0.432 to −0.243)
Austria	3449.1 (3147.9–3703.4)	41.8 (38.4–44.8)	2913.7 (2644.9–3163.1)	29.3 (26.7–31.7)	−1.222 (−1.29 to −1.154)
Azerbaijan	2210.3 (1872.8–2623.4)	34.3 (29–40.3)	6436.9 (5306.1–7645.3)	51.5 (43.2–60.5)	1.427 (1.339–1.516)
Bahamas	50.8 (42.6–59.1)	22.2 (18.6–25.9)	82.1 (69.2–94.8)	18.8 (16.1–21.5)	−0.58 (−0.628 to −0.532)
Bahrain	89.4 (75.2–103.9)	25.6 (21–31)	480.2 (388.5–563)	28 (23.5–33.3)	0.314 (0.252–0.377)
Bangladesh	18413.6 (15552.6–21213.3)	16.7 (13.7–19.9)	28892.6 (24167.3–33674)	18.6 (15.5–21.6)	0.359 (0.32–0.398)
Barbados	36.6 (31.2–42.2)	15.4 (13–17.8)	47 (40.3–54.4)	14.2 (12.2–16.2)	−0.307 (−0.359 to −0.254)
Belarus	1372.9 (1180.1–1546.7)	13.2 (11.3–14.9)	2576.5 (2265.8–2869.9)	26.5 (23.5–29.3)	2.44 (2.301–2.58)
Belgium	2602.2 (2314.1–2836.9)	24.4 (21.8–26.7)	2920.3 (2567.5–3260.5)	23.8 (21.2–26.5)	−0.104 (−0.149 to −0.058)
Belize	26.7 (22.9–30.8)	20.5 (17.1–24.1)	97.2 (82.7–112.2)	24.6 (20.9–28.4)	0.603 (0.558–0.647)
Benin	951 (785.7–1137.9)	23.6 (17.7–30)	2722.1 (2317.1–3176.3)	26 (21.2–31.2)	0.359 (0.253–0.465)
Bermuda	11.4 (9.7–13.1)	17 (14.4–19.5)	10.6 (8.9–12.3)	13.9 (11.9–15.8)	−0.721 (−0.779 to −0.662)
Bhutan	125.9 (106.1–147.3)	22 (17.7–26.4)	200.9 (163–242.2)	25.9 (21–31.2)	0.569 (0.521–0.617)
Bolivia (Plurinational State of)	1220.9 (1002.3–1464.5)	24.2 (19–29.7)	3422 (2898.3–4084.2)	31.6 (26.4–38.3)	0.943 (0.893 to 0.993)
Bosnia and Herzegovina	1322.5 (1162.6–1463.4)	27.7 (24.2–30.7)	802.1 (711.3–893.2)	21.2 (18.7–23.5)	−0.934 (−0.967 to −0.901)
Botswana	269.9 (221.2–321.5)	24.5 (19–29.9)	589.5 (478.7–704.5)	24.1 (19.5–28.9)	−0.02 (−0.133 to 0.093)
Brazil	35430.2 (25727.3–45963.4)	26.3 (18.6–34.4)	49123.8 (35225.2–64420.4)	19.9 (14.4–25.8)	−0.946 (−1.107 to −0.785)
Brunei Darussalam	52.2 (45.1–59.6)	21.3 (18.4–23.8)	77.5 (67–86.8)	14.9 (13–16.7)	−1.218 (−1.258 to −1.178)
Bulgaria	2651.3 (2384.6–2913.5)	28.5 (25.7–31.3)	2425.5 (2154.8–2669.1)	31.7 (28.8–34.6)	0.372 (0.341–0.403)
Burkina Faso	1778.9 (1509.9–2074.7)	22.1 (17.5–26.8)	4254.8 (3471.2–5182.5)	22.5 (17.1–28.6)	0.095 (0.032–0.157)
Burundi	882.1 (702.6–1082.6)	20.4 (15–26.4)	2004.6 (1626.6–2447.9)	22 (16.8–28.2)	0.257 (0.224–0.29)
Cabo Verde	64.7 (54.2–76.4)	21.3 (17.1–26)	135 (116–155.5)	23.7 (20–27.3)	0.366 (0.351–0.382)
Cambodia	3738.9 (3007.5–4509.9)	48 (37.4–59.3)	8387.8 (6893.1–10055.1)	52.1 (42.3–63.3)	0.235 (0.085–0.385)
Cameroon	2237.8 (1877.5–2661.1)	25.4 (20.1–31.1)	6303.9 (5271–7498.5)	25.6 (20.6–31.4)	0.035 (0.003–0.067)
Canada	6170.2 (5519.5–6796.8)	20.4 (18.3–22.4)	7771.6 (6934.5–8737.3)	19.4 (17.2–21.7)	−0.196 (−0.285 to −0.106)
Central African Republic	667.5 (506.3–832.9)	27.9 (20–36.6)	1359.6 (1053.5–1693.1)	28.6 (20.9–37)	0.076 (0.057–0.095)
Chad	1360.7 (1123.8–1624.1)	27.8 (20.9–34.6)	3690.3 (3118.7–4332.1)	28 (22.5–33.8)	−0.003 (−0.052–0.047)
Chile	4865.2 (4226.1–5397)	39.7 (34.4–44.1)	8553.4 (7583.4–9515.8)	40.4 (36–44.7)	0.009 (−0.087–0.105)
China	310191.3 (224363.1–399447.1)	27 (19.1–35.2)	409693.6 (308245.1–514354.1)	22.5 (17.6–27.6)	−0.621 (−0.721 to −0.522)
Colombia	4961.9 (4317.7–5590.8)	18.6 (16–21)	7858.1 (6925–8849)	15.3 (13.5–17.3)	−0.666 (−0.702 to −0.629)
Comoros	84.2 (68–102.6)	22.8 (16.9–29)	165 (131.2–200.2)	24.6 (19–30.5)	0.284 (0.211–0.357)
Congo	426.4 (341.2–517.3)	19.9 (15–25.1)	1022.1 (832.9–1226.4)	20.7 (16.6–25.2)	0.138 (0.103–0.173)
Cook Islands	1 (0.8–1.2)	5.8 (4.7–6.9)	1.1 (0.9–1.3)	6.1 (5–7.1)	0.167 (0.14–0.195)
Costa Rica	762.1 (675.5–849.6)	30.1 (26.4–33.7)	1575.2 (1395.8–1773.1)	30.4 (27–34.3)	0.02 (−0.022–0.062)
Côte d'Ivoire	2504 (2081.9–2970.6)	24.6 (19–30.3)	6084 (5035.3–7199.8)	26.6 (21.1–32)	0.307 (0.109–0.505)
Croatia	2404.6 (2190.7–2595)	44.8 (40.7–48.6)	1532.5 (1400.5–1663)	32.5 (29.7–35.3)	−1.116 (−1.194 to −1.039)
Cuba	1508.2 (1327.2–1703.7)	14.2 (12.5–15.9)	2228.3 (1906.2–2568.3)	17 (15–19)	0.622 (0.597–0.648)
Cyprus	161.4 (135.1–187.5)	20.6 (17.3–23.9)	287.7 (244.9–331.6)	18.4 (15.8–21.1)	−0.413 (−0.491 to −0.334)
Czechia	2715.2 (2411.8–3001.2)	24 (21.5–26.2)	2670.6 (2335.2–2975.4)	22.1 (19.9–24.4)	−0.28 (−0.359 to −0.2)
Democratic People's Republic of Korea	5236.6 (4246.4–6194.4)	25.2 (20.5–29.7)	6457.5 (5025.9–7874.2)	20.3 (16.3–24.1)	−0.757 (−0.822 to −0.692)
Democratic Republic of the Congo	7896.2 (6443.1–9461.8)	23.9 (18.2–30.2)	21836.7 (18102–25885.2)	28.7 (22.8–35.3)	0.643 (0.605–0.68)
Denmark	1015.3 (913.5–1117.7)	18.3 (16.6–20.2)	1242 (1084.4–1385)	21.4 (18.9–23.7)	0.535 (0.343–0.727)
Djibouti	92.2 (76.3–109)	24.4 (18.8–30.2)	263.6 (215.7–314.7)	22.9 (18.5–27.7)	−0.214 (−0.246 to −0.183)
Dominica	10.2 (8.7–11.6)	17.1 (14.3–19.8)	10.9 (9–12.9)	15 (12.6–17.4)	−0.451 (−0.496 to −0.407)

(Continued)

Table 2. Continued.

Country	1990		2019		1990–2019
	Incident rate per 100,000 NO. (95% UI)	ASR per 100,000 NO. (95% UI)	Incident rate per 100,000 NO. (95% UI)	ASR per 100,000 NO. (95% UI)	AAPC NO. (95%CI)
Dominican Republic	1417.6 (1224.6–1631.1)	24.7 (20.9–29)	3263.1 (2705–3864.3)	30 (24.8–35.4)	0.697 (0.593–0.8)
Ecuador	1689.3 (1487.1–1918.6)	20.9 (18–23.9)	6405.9 (5833.2–7013.8)	38.5 (34.9–42.3)	2.089 (1.99–2.188)
Egypt	24559.5 (20171.4–29515)	61 (47.7–76.1)	65387.7 (52830.4–80948.6)	78.7 (62.3–99)	0.87 (0.806–0.934)
El Salvador	1372.8 (1201.2–1538.8)	33.4 (28.7–38)	2188.5 (1894.5–2491)	36.3 (31.3–41.3)	0.298 (0.26–0.336)
Equatorial Guinea	92.2 (71.2–114)	25.2 (18–33.1)	282.1 (234.8–336.6)	24 (19.3–29.4)	–0.165 (–0.196 to – 0.135)
Eritrea	539.9 (434–652.4)	23.2 (17.8–29)	1631.3 (1336.4–1952.2)	29.1 (22.8–35.6)	0.795 (0.757–0.833)
Estonia	209.3 (184.9–235.1)	13.4 (11.9–15.1)	277.6 (243.7–309.3)	22 (19.5–24.5)	1.707 (1.536–1.879)
Eswatini	129.9 (105.7–157.6)	18.9 (14.5–23.4)	204.2 (165.7–243.4)	18.4 (14.7–22.1)	–0.113 (–0.206 to –0.019)
Ethiopia	10269.5 (7040.7–13905.9)	27 (15.2–40.5)	22299.5 (16351.8–29076.2)	28.1 (17.5–39.8)	0.154 (0.107–0.202)
Fiji	79.7 (65.9–93.9)	11 (8.9–13.1)	96.2 (79.3–113.1)	10.2 (8.4–12)	–0.258 (–0.285 to –0.231)
Finland	837.2 (752.4–926)	14.8 (13.5–16.3)	1124.6 (1010.2–1228.8)	21.8 (19.7–23.7)	1.35 (1.285–1.415)
France	18974.9 (17062.9–20888)	31.1 (27.8–34.1)	14331.2 (12629.1–15952.4)	21.2 (18.8–23.4)	–1.338 (–1.469 to –1.208)
Gabon	144.2 (116.5–174.1)	16.6 (12.6–20.9)	280.9 (230–339.4)	17 (13.6–20.8)	0.077 (0.058–0.095)
Gambia	208.8 (175.8–246.1)	26.4 (20.5–32.7)	492.7 (415.4–577.2)	26.7 (21.7–32)	0.019 (–0.016–0.054)
Georgia	1833.3 (1624.3–2082.4)	32.1 (28.3–36.2)	1247.7 (1080–1405.3)	31.6 (27.3–35.5)	–0.059 (–0.091 to –0.026)
Germany	29343.9 (26426.2–32070.5)	33.7 (30.6–36.8)	25398.9 (22962.1–27925.6)	28.8 (26.2–31.4)	–0.532 (–0.588 to –0.477)
Ghana	3065.5 (2488.6–3698.3)	24.2 (18.6–30.6)	6227 (5170.6–7376.8)	21.9 (17.7–26.4)	–0.373 (–0.418 to –0.328)
Greece	2627.2 (2262.8–2991)	22.9 (19.8–26)	1803.4 (1567.3–2039.2)	15.8 (13.7–17.6)	–1.286 (–1.352 to –1.219)
Greenland	9.9 (8.6–11.1)	15.1 (13.1–17)	9.1 (7.8–10.4)	16 (13.8–17.9)	0.191 (0.16–0.222)
Grenada	13.2 (11.3–15.3)	20.6 (17.2–24.1)	24.3 (20–28.5)	21.3 (18–24.7)	0.116 (0.081–0.151)
Guam	30.7 (25.7–35.9)	22.3 (18.5–26.1)	31.8 (26.4–37.5)	19.2 (16.2–22.3)	–0.548 (–0.675 to –0.421)
Guatemala	2898.9 (2525.1–3271.2)	46.1 (39.5–52.8)	8092.3 (7089.4–9165.3)	52 (45.2–58.9)	0.435 (0.384–0.486)
Guinea	1262.3 (1005.8–1546.8)	23.2 (17.1–29.8)	2419 (2037.3–2833.5)	22.5 (18.1–27)	–0.065 (–0.211 to 0.081)
Guinea-Bissau	238.9 (193.8–289.3)	28.7 (21.5–36.5)	429.9 (354.9–512.9)	25.8 (20.2–31.5)	–0.386 (–0.437 to –0.334)
Guyana	214.7 (178.6–249.7)	34 (27.6–40.3)	262.8 (217.3–304.8)	34 (28.2–39.4)	–0.027 (–0.098–0.045)
Haiti	1084.3 (852.8–1321.7)	21.2 (15.9–26.6)	2778.6 (2254.1–3349.8)	25.3 (20.3–30.8)	0.607 (0.578–0.635)
Honduras	1361.8 (1174.4–1558.7)	40.1 (33.9–46.7)	3080.4 (2548.6–3573.6)	36.6 (30.1–42.9)	–0.299 (–0.331 to –0.267)
Hungary	6257.7 (5687.6–6872.3)	56.2 (51.3–61.3)	3701 (3293.1–4087)	32 (29–35)	–1.939 (–2.035 to –1.843)
Iceland	23.3 (20.3–26.1)	9 (7.9–10.1)	33.5 (29.1–37.5)	9.6 (8.4–10.8)	0.229 (0.173–0.286)
India	138576.4 (101108.2–183003.6)	16.3 (11–22.1)	326903.9 (231217.7–432794)	23.2 (16.5–30.6)	1.285 (1.18–1.39)
Indonesia	47107.3 (30183.3–66201.9)	29.9 (17.3–43.7)	64125.6 (39655.2–88214.1)	23.2 (14.5–32.3)	–0.867 (–1.071 to –0.662)
Iran (Islamic Republic of)	6502.4 (4915.4–8376.8)	14.2 (9.7–19.4)	14346 (10406.8–18651.6)	16.6 (12.1–21.7)	0.531 (0.446–0.616)
Iraq	2161.7 (1832.5–2516.8)	16.1 (13.2–19.3)	6593.1 (5692.1–7553.6)	18.3 (15.5–21.1)	0.452 (0.387–0.518)
Ireland	391.5 (344.1–435.1)	11.3 (9.9–12.5)	826 (720.8–931.3)	15.4 (13.6–17.2)	1.073 (1.036–1.111)
Israel	826.6 (725.9–926.7)	18.7 (16.4–20.9)	1588.8 (1371.7–1802.6)	17.3 (14.9–19.6)	–0.291 (–0.359 to –0.224)
Italy	30032.3 (23039.5–37582.4)	48 (37.3–59.5)	24482.7 (19411.1–30069.1)	32.7 (26.6–39.1)	–1.285 (–1.341 to –1.23)
Jamaica	196.2 (168.6–224.4)	10.2 (8.7–11.8)	246.2 (208.4–285.8)	8.5 (7.3–9.8)	–0.604 (–0.653 to –0.555)
Japan	46734 (34542.6–59459.2)	31.1 (23.9–39.1)	33114.8 (25347.4–41069.2)	25.9 (21–31.3)	–0.61 (–0.73 to –0.489)
Jordan	424.5 (356.9–500.7)	16.3 (13.4–19.7)	1763.5 (1510.2–2044.7)	17.4 (14.8–20.4)	0.233 (0.199–0.266)
Kazakhstan	3469.9 (3027.9–3930.8)	22.6 (19.7–25.6)	12698.3 (11180.6–14267.1)	63.3 (55.6–71.2)	3.632 (3.505–3.759)
Kenya	5233.6 (3699.3–6934.3)	34 (19.6–50)	14848.4 (10357.3–19692.6)	36.5 (22.2–52.3)	0.261 (0.143–0.379)
Kiribati	13.6 (10.3–17.3)	19.6 (14.6–25.2)	20 (15.5–24.9)	17.4 (13.3–21.8)	–0.414 (–0.463 to –0.365)
Kuwait	174.8 (145.7–203)	10.7 (9–12.3)	755.7 (630.4–884.2)	15.2 (13–17.4)	1.226 (1.181–1.271)
Kyrgyzstan	1311.3 (1142.5–1495)	35.9 (30.8–41.5)	3182.6 (2821.6–3608.4)	48.9 (43.2–55.4)	1.07 (0.99–1.15)
Lao People's Democratic Republic	739.5 (585–895.4)	22.6 (17.4–27.9)	1683.1 (1375.9–2009.8)	24.9 (20.2–29.9)	0.326 (0.285–0.368)
Latvia	360.5 (315.5–405.3)	13.7 (12–15.3)	353.7 (311–395.8)	20 (17.9–22.3)	1.343 (1.268–1.419)
Lebanon	469.6 (389.1–564.4)	15.9 (13–19.5)	1109.6 (927.7–1312.7)	21.3 (17.8–25.3)	1.013 (0.961–1.065)
Lesotho	343.4 (275.8–422.6)	22.7 (17.3–28.6)	431.8 (340.5–536.9)	20.6 (15.9–25.8)	–0.342 (–0.394 to –0.29)
Liberia	315.4 (247.1–396.2)	18.2 (13–24.2)	897.2 (740.3–1075.2)	21.3 (17–26)	0.598 (0.487–0.709)
Libya	548 (457.9–645.9)	17.8 (14.2–22.1)	1142.4 (943.4–1338.4)	17.1 (14.3–20.4)	–0.124 (–0.176 to –0.072)
Lithuania	529.6 (467.6–591)	14.5 (12.9–16.2)	677.8 (607–744.7)	27.8 (25–30.6)	2.268 (2.029–2.507)
Luxembourg	157.9 (140.9–174.2)	36.3 (32.5–40.2)	196.1 (171.5–219.8)	26.4 (23.2–29.3)	–1.141 (–1.257 to –1.025)
Madagascar	1900.9 (1505.1–2332)	19.9 (14.4–26.4)	5724.3 (4774.8–6766.8)	25.3 (20.4–30.4)	0.844 (0.765–0.923)
Malawi	2095.8 (1742.5–2517.5)	29.6 (22.8–37.2)	3866 (3200.7–4606.7)	27.7 (21.8–34.6)	–0.229 (–0.294 to –0.164)
Malaysia	2622.6 (2170.9–3059)	17.8 (14.6–21.1)	6861.1 (5848.4–7993.4)	21.1 (17.9–24.6)	0.58 (0.519–0.641)
Maldives	19.9 (16.1–24.2)	12.7 (10.1–15.6)	76.1 (63.6–89.5)	13.8 (11.6–16.1)	0.296 (0.259–0.334)
Mali	1683.6 (1344.7–2086.5)	21.5 (15.5–28.6)	5093.2 (4247.7–6067.8)	28 (21.8–34.5)	0.897 (0.834–0.961)
Malta	66.9 (58.6–74.8)	16.1 (14.2–17.9)	61.1 (53.9–68.1)	13.5 (12–15)	–0.602 (–0.65 to –0.554)
Marshall Islands	6.9 (5.6–8.5)	19 (14.8–23.6)	9.8 (7.8–11.9)	16.8 (13.3–20.3)	–0.444 (–0.493 to –0.394)
Mauritania	432.6 (363.1–510.4)	24.8 (19.5–30.5)	826 (690.2–979)	23.8 (19.4–28.9)	–0.151 (–0.211 to –0.09)
Mauritius	315 (269.6–357.6)	28 (23.8–32)	252.6 (216.2–292)	17.8 (15.4–20.3)	–1.585 (–1.892 to –1.277)

(Continued)

Table 2. Continued.

Country	1990		2019		1990–2019
	Incident rate per 100,000 NO. (95% UI)	ASR per 100,000 NO. (95% UI)	Incident rate per 100,000 NO. (95% UI)	ASR per 100,000 NO. (95% UI)	AAPC NO. (95%CI)
Mexico	39192.5 (28579.5–50933.8)	58.8 (41.2–77.7)	73785.2 (55023.3–93216.2)	55.4 (41.4–69.9)	–0.174 (–0.225 to –0.123)
Micronesia (Federated States of)	17.3 (13.7–21.2)	20.2 (15.6–25.1)	18.7 (14.9–22.7)	18.8 (15.1–23)	–0.286 (–0.401 to –0.171)
Monaco	7.4 (6.3–8.4)	21.9 (18.9–24.7)	8.6 (7.3–10)	23.8 (20.7–26.6)	0.273 (0.253–0.292)
Mongolia	816.8 (676.2–968)	52.1 (42.1–63.2)	2950.8 (2468.2–3491.8)	79.6 (66.4–94.2)	1.479 (1.335–1.622)
Montenegro	68 (59.1–76.9)	10.8 (9.4–12.2)	66.6 (56.9–75.4)	10.6 (9.1–12)	–0.045 (–0.079 to –0.011)
Morocco	3296.2 (2729.5–3961)	16.6 (13.2–20.8)	6917.5 (5691.9–8264)	18.8 (15.6–22.6)	0.447 (0.401–0.492)
Mozambique	1754.9 (1419.5–2135.5)	16.1 (12.3–20.4)	4206.3 (3449.4–5027.6)	17.7 (13.8–22.4)	0.328 (0.298–0.359)
Myanmar	12459.9 (9800.2–15229.5)	34.5 (26.3–42.4)	19740.1 (16363.4–23090.3)	34.3 (28.5–40)	–0.034 (–0.098–0.03)
Namibia	236.4 (190.9–281.9)	20.6 (15.7–25.6)	492.6 (404.1–581.9)	21.9 (17.7–26.4)	0.201 (0.111–0.292)
Nauru	1.5 (1.2–1.9)	16.2 (12.6–20)	1.8 (1.4–2.2)	17.4 (13.9–20.9)	0.225 (0.129–0.322)
Nepal	3745.8 (3102.7–4417.4)	20 (16.1–24.3)	7106.8 (5950.4–8378.4)	24.3 (20.2–28.9)	0.675 (0.604–0.746)
Netherlands	2751.7 (2402.3–3123.6)	16.6 (14.5–18.8)	2786.8 (2408.9–3209.2)	15.3 (13.3–17.3)	–0.29 (–0.334 to –0.246)
New Zealand	318.9 (229.3–411.9)	9.1 (6.6–11.8)	438.2 (330.2–559)	8.7 (6.8–10.8)	–0.148 (–0.169 to –0.126)
Nicaragua	838.8 (736.9–945.8)	30.5 (26.2–34.5)	2395.9 (2082.8–2688.6)	37.9 (32.9–42.7)	0.763 (0.682–0.845)
Niger	1939 (1594.7–2348.5)	29.4 (22.2–37.6)	5636 (4687.8–6724.5)	30.8 (24–38.4)	0.145 (0.098–0.191)
Nigeria	17729.5 (12682.4–23418.8)	23.4 (14.3–33.9)	47955.3 (35981–61740.1)	27.1 (17.8–37.2)	0.522 (0.439–0.605)
Niue	0.3 (0.2–0.4)	14.4 (11.7–17.2)	0.2 (0.2–0.3)	14.7 (12.1–17.3)	0.051 (–0.067–0.17)
North Macedonia	353.4 (305.8–398.6)	17.1 (14.8–19.3)	500.2 (438.7–556.2)	19.8 (17.3–21.9)	0.513 (0.485–0.541)
Northern Mariana Islands	17.4 (13.7–21)	33.2 (26.2–40.2)	14.2 (10.8–18.3)	29.8 (24.5–35.5)	–0.392 (–0.635 to –0.148)
Norway	701 (526.7–884.4)	16.1 (12.3–20.1)	835 (629.7–1050.7)	15.1 (11.8–18.7)	–0.111 (–0.234–0.012)
Oman	317.8 (269–377.3)	23.9 (19.3–29)	1036.5 (858.9–1229.7)	29.3 (24.2–35.2)	0.633 (0.4–0.865)
Pakistan	24805.7 (18362.2–32278.6)	25.1 (16.4–34.4)	50880.2 (37887.4–66260.7)	25.1 (17–33.9)	0.008 (–0.007–0.023)
Palau	2.4 (1.9–2.9)	15.4 (12.3–18.6)	3.6 (2.8–4.4)	17 (13.9–20.3)	0.316 (0.222–0.411)
Palestine	272.4 (231.3–320.1)	18.8 (15.4–22.6)	821.2 (707.3–957.4)	21.6 (18.3–25.5)	0.502 (0.362–0.643)
Panama	425.7 (368.8–484.5)	21.6 (18.5–24.6)	950 (827.5–1063.9)	22.3 (19.4–24.9)	0.133 (0.069–0.196)
Papua New Guinea	236.5 (185.3–286.4)	6 (4.7–7.3)	617.3 (500.5–739)	6.1 (4.9–7.2)	0.036 (0.013–0.059)
Paraguay	471 (402.9–539.3)	15 (12.7–17.4)	1062.9 (906.8–1226)	15.7 (13.3–18.2)	0.156 (0.138–0.174)
Peru	4297.5 (3756.2–4899.9)	24.1 (20.5–28.1)	10145.3 (8729.6–11717.3)	29.4 (25.3–33.9)	0.679 (0.533–0.825)
Philippines	8344.5 (5828.1–10959.2)	15.9 (10.4–21.6)	21019.1 (15022.8–27539.8)	19.6 (13.6–25.9)	0.726 (0.697–0.756)
Poland	9550.3 (7025.7–12367.6)	23.7 (17.3–30.4)	8644.4 (6080.3–11391.3)	21.1 (15.7–27.1)	–0.391 (–0.468 to –0.314)
Portugal	3889.6 (3428.5–4295.7)	37.6 (33–41.4)	2238.9 (1935.1–2532.8)	18.5 (16.3–20.5)	–2.433 (–2.542 to –2.324)
Puerto Rico	1216.4 (1051.4–1381.1)	33.9 (29.4–38.5)	948.1 (814.1–1084.5)	24.4 (20.9–27.4)	–1.142 (–1.214 to –1.07)
Qatar	102.4 (83.7–123.6)	31.2 (24.8–38.6)	934.2 (774.3–1107.3)	39.4 (32.4–47.9)	0.782 (0.696–0.868)
Republic of Korea	30126.5 (26539.9–33492.2)	67.5 (58.8–75.4)	16886.5 (14580.1–19355.5)	25.5 (22.5–28.9)	–3.345 (–3.548 to –3.14)
Republic of Moldova	4338.6 (4021–4620.4)	98.5 (90.6–105.6)	3504.2 (3160.8–3776.6)	80 (71.7–86.3)	–0.723 (–0.834 to –0.612)
Romania	11829.8 (10829.5–12867.3)	49.1 (44.8–54.1)	12134.7 (11012.3–13100.8)	51.2 (46.9–55.2)	0.16 (0.045–0.275)
Russian Federation	28493.8 (20826.9–37066.2)	18.3 (13.4–23.6)	45082.2 (30894.5–61098.7)	29.9 (21.6–39.4)	1.734 (1.629–1.839)
Rwanda	1688.6 (1373–2052.3)	30.4 (22.8–38.8)	3382.7 (2780.2–4007.9)	32.4 (25.6–39.4)	0.226 (0.18–0.271)
Saint Kitts and Nevis	8.7 (7.3–10)	29.1 (23.8–34.4)	18.3 (15.1–21.3)	25.1 (20.9–28.8)	–0.522 (–0.57 to –0.473)
Saint Lucia	23.2 (19.8–26.7)	22.3 (18.6–26.1)	39.8 (33.5–46.2)	19.2 (16.4–22)	–0.518 (–0.597 to –0.439)
Saint Vincent and the Grenadines	13.3 (11.4–15.4)	16 (13.5–18.9)	18.6 (15.6–21.8)	15.2 (12.9–17.6)	–0.178 (–0.244 to –0.112)
Samoa	23.1 (19.2–27.1)	17.7 (14.4–21.2)	33.7 (27.8–39.8)	17.5 (14.5–20.9)	–0.028 (–0.071–0.015)
San Marino	9 (7.8–10.1)	36.6 (31.9–41.2)	12.1 (10.3–13.7)	33.1 (29–36.9)	–0.389 (–0.453 to –0.325)
Sao Tome and Principe	38 (32.2–45.1)	36.8 (29.6–44.9)	62.9 (52.3–74.7)	33.5 (27.1–40.3)	–0.333 (–0.372 to –0.294)
Saudi Arabia	2998.5 (2514.1–3517.2)	29.8 (23.6–36.9)	10224.5 (8517–11958.4)	32.5 (26.9–38.5)	0.305 (0.255–0.354)
Senegal	1672.4 (1407.8–1961.5)	26.3 (20.4–32.1)	3594.2 (2980.6–4281.3)	27.4 (21.9–33)	0.145 (0.122–0.167)
Serbia	1975.1 (1691.1–2223.8)	19.8 (17–22.2)	1640.8 (1451.3–1826.5)	17.7 (15.8–19.6)	–0.366 (–0.413 to –0.319)
Seychelles	17.3 (14.5–20.3)	28.1 (22.8–33.4)	34.7 (28.8–40.8)	28.3 (23.7–32.8)	0.011 (–0.042–0.064)
Sierra Leone	595 (471.3–731.4)	18.2 (13.3–23.8)	1747.1 (1445.8–2065.2)	24.4 (19.6–29.6)	1.034 (0.956–1.112)
Singapore	560.6 (493.1–629.7)	17 (15–19.1)	747.6 (636.6–857.7)	11.2 (9.8–12.6)	–1.434 (–1.527 to –1.34)
Slovakia	2042.8 (1831.6–2245.6)	36.5 (32.6–40)	2056.9 (1808.9–2296.6)	32.6 (29–36.1)	–0.38 (–0.398 to –0.363)
Slovenia	992.6 (883.7–1076.4)	46.1 (40.8–49.8)	740 (668.9–812.5)	31.1 (28–34)	–1.367 (–1.459 to –1.274)
Solomon Islands	63.9 (50.9–77.3)	21.9 (17.1–27.2)	132.8 (108.5–158.9)	20.6 (16.7–24.8)	–0.217 (–0.301 to –0.133)

(Continued)

Table 2. Continued.

Country	1990		2019		1990–2019
	Incident rate per 100,000 NO. (95% UI)	ASR per 100,000 NO. (95% UI)	Incident rate per 100,000 NO. (95% UI)	ASR per 100,000 NO. (95% UI)	AAPC NO. (95%CI)
Somalia	1548.3 (1170.8–1965.5)	29 (19.8–40.3)	4398.1 (3505.5–5329.3)	29.7 (21.4–39.1)	0.111 (0.045–0.177)
South Africa	6346.7 (4603–8240.3)	18.5 (12.3–24.9)	7807.5 (5523.8–10344)	13.8 (9.6–18.3)	–1.031 (–1.119 to –0.942)
South Sudan	953.9 (762.5–1153.7)	21.7 (16–27.9)	1705.5 (1343.3–2093)	23 (17.2–29.4)	0.225 (0.132–0.318)
Spain	15287.3 (13838.9–16797.6)	39 (35.3–43)	13480.1 (11838.4–15148)	23.3 (20.6–25.9)	–1.78 (–1.945 to –1.614)
Sri Lanka	4156.9 (3483.3–4783.3)	24.7 (20.7–28.6)	5600.8 (4693.8–6530.8)	23.3 (19.7–26.8)	–0.248 (–0.345 to –0.151)
Sudan	1954.9 (1514.9–2478.2)	12.7 (9–17.2)	4800.6 (3939.4–5755.5)	15.8 (12.4–19.8)	0.755 (0.543–0.969)
Suriname	74.3 (63.1–86.3)	22.3 (18.8–26.2)	151.2 (125.8–179.3)	23.7 (20–27.6)	0.196 (0.092–0.301)
Sweden	1238.3 (908.1–1580)	13.6 (10.3–17.2)	1605.4 (1217.3–2012.1)	15.3 (12–19)	0.432 (0.346–0.517)
Switzerland	1468.5 (1293.6–1645.3)	18.6 (16.5–20.9)	1747.1 (1526.4–1982.6)	17.5 (15.5–19.6)	–0.293 (–0.387 to –0.199)
Syrian Arab Republic	1902.8 (1634.9–2196.3)	20.1 (16.4–23.9)	3557.6 (2967.6–4203.1)	24 (20.3–28.3)	0.617 (0.589–0.645)
Taiwan (Province of China)	9075.2 (7704.6–10231.4)	44.7 (37.6–51.3)	8204.8 (7102.7–9258.7)	26.6 (23–29.9)	–1.814 (–1.969 to –1.658)
Tajikistan	1251.9 (1096–1425.3)	28.9 (24.8–33.1)	4716.5 (4028.7–5447.5)	53.8 (45.9–62.3)	2.167 (2.102–2.231)
Thailand	12333.2 (10221.8–14514.2)	22 (17.9–25.9)	20264.9 (17000.3–23767.8)	24.2 (20.7–27.9)	0.3 (0.157–0.443)
Timor-Leste	140.4 (110.4–170.4)	21.8 (16.8–27)	275.5 (224.6–330.6)	26.4 (20.9–32)	0.668 (0.633–0.704)
Togo	736.9 (618.4–870.1)	24.4 (18.9–30.2)	1880.5 (1518.2–2275.9)	26.6 (21–32.7)	0.297 (0.265–0.328)
Tokelau	0.2 (0.1–0.2)	12.1 (9.9–14.4)	0.2 (0.1–0.2)	12.4 (10.2–14.6)	0.069 (0.044–0.095)
Tonga	15.9 (13–19.1)	21.1 (16.8–25.5)	18.5 (15.2–22.1)	20.1 (16.5–23.9)	–0.189 (–0.251 to –0.127)
Trinidad and Tobago	168.1 (145.2–192.5)	15.1 (12.9–17.5)	201.8 (170.3–231.5)	13.2 (11.2–15.1)	–0.483 (–0.521 to –0.445)
Tunisia	1153.7 (957.9–1380.8)	17 (13.6–20.8)	2680.9 (2211.4–3208.3)	20.7 (17.3–24.6)	0.686 (0.64–0.731)
Turkey	6651.2 (5554.3–7838.4)	13.1 (10.9–15.7)	16568.3 (14288.5–19074)	18.7 (16.2–21.5)	1.252 (1.156–1.348)
Turkmenistan	1188.5 (1036.1–1344.9)	40.5 (34.7–46.5)	2843.1 (2491.8–3203.5)	53.3 (46.7–60.2)	0.921 (0.764–1.078)
Tuvalu	1.2 (0.9–1.4)	13.1 (10.4–15.7)	1.6 (1.3–1.9)	14.3 (11.7–16.9)	0.303 (0.239–0.367)
Uganda	2791.9 (2300.7–3351.1)	23 (17.6–28.9)	6934 (5750–8290.5)	23.4 (18.2–29.6)	0.07 (0.038–0.102)
Ukraine	10702.4 (7653.6–14131.9)	20.7 (15–27.2)	14401.2 (9090.2–21069.5)	33.7 (22.6–47.3)	1.663 (1.501–1.824)
United Arab Emirates	219.5 (178.5–266.2)	16.5 (13.2–20.2)	2019.1 (1587.4–2473.4)	18 (14.9–21.6)	0.307 (0.253–0.362)
United Kingdom	8657.4 (6713.8–10658.1)	14.9 (11.7–18.3)	16129.7 (13136.1–19379)	23.9 (19.8–28.4)	1.668 (1.456–1.882)
United Republic of Tanzania	4065.5 (3449.9–4751.3)	21.2 (17.3–25.6)	10011 (8280.3–11940.5)	22.2 (17.6–27.5)	0.142 (0.083–0.201)
United States of America	65860.2 (50497.6–82940.7)	23.8 (18.1–30)	90854.4 (73757.5–108952.6)	26.3 (21.8–31.2)	0.369 (0.213–0.526)
United States Virgin Islands	25.1 (20.6–29.8)	22.1 (18.5–25.9)	27.5 (22.8–32.9)	24.1 (20.3–27.9)	0.289 (0.25–0.328)
Uruguay	580.3 (507.4–660.6)	18.7 (16.3–21.2)	637.3 (548.6–721.1)	17.1 (14.7–19.3)	–0.311 (–0.378 to –0.244)
Uzbekistan	6750.2 (5980.7–7600.9)	41.7 (36–48)	22488.6 (19881.9–25080.7)	65.2 (57.6–72.9)	1.57 (1.427–1.713)
Vanuatu	33.4 (26.8–40.2)	25.9 (19.9–32.2)	61.8 (49.1–74.3)	23.1 (18.1–28.1)	–0.397 (–0.45 to –0.344)
Venezuela (Bolivarian Republic of)	3887.7 (3421–4342.4)	25.4 (22.1–28.4)	6248.9 (5380.9–7078.2)	20.1 (17.5–22.8)	–0.812 (–0.859 to –0.766)
Viet Nam	13537.6 (11280.1–15929.3)	26.3 (21.4–31.5)	32979.7 (28013.8–38176.4)	29.3 (25.1–33.7)	0.381 (0.3–0.463)
Yemen	1737 (1440.8–2108.4)	18.3 (13.7–23.9)	4660.3 (3931–5457.4)	20.2 (16.5–24.4)	0.338 (0.288–0.389)
Zambia	1839.1 (1519–2198.3)	31.8 (24.4–39.6)	4513 (3781.4–5296.7)	32.2 (26–39)	0.041 (0.021–0.061)
Zimbabwe	1753.3 (1477–2069.9)	21.4 (17.4–26.5)	2657.4 (2177.9–3199.5)	20.1 (15.8–25)	–0.197 (–0.337 to –0.058)

ASR: age-standardized rate; CI: confidence interval; AAPC: average annual percent change; UI: uncertainty interval.

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50.8% in 2019. The proportion of cirrhosis due to NAFLD was highest in Central and Latin America, which increased from 12.8% in 1990 to 16.2% in 2019. Interestingly, we found that the region with the largest proportion of cirrhosis due to alcohol use changed from Western Europe in 1990 (38.3%) to Central Europe in 2019 (43.1%). The region with the highest proportion of cirrhosis that could not be classified into the above four causes changed from South Asia (53.4%) in 1990 to Western Sub-Saharan Africa (47.8%) in 2019.

3.3. Summary exposure value (SEV) and proportion of DALYs and deaths attributable to alcohol or drug use in different regions

Further, we analysed how the SEV of alcohol consumption and drug use varied across regions of the globe. As shown in Figure 5 and Supplementary Table 2, there has been a significant 14% increase in alcohol use globally; The SEV of alcohol use in Western Europe and Oceania was consistently high, exceeding 15 since 1990. Notably, the largest increase in SEV attributable to alcohol use was observed in Southeast Asia,

reaching 104.1%. The global SEV change in drug use was stable, increasing by only 2.7%. However, the 101% increase in SEV attributable to drug use in North America should be of concern.

In addition, we focused on the effects of alcohol use and drug use on cirrhosis. Globally, 49.3% of DALYs and 48.4% of deaths can be attributed to alcohol use. By region, the effects of alcohol use were highest in Western Europe (75.6% DALYs and 73% deaths) and lowest in the Middle East & North Africa-WB (11.8% DALYs and 10.4% deaths) (Figure 6(A)).

Drug use has a smaller effect on cirrhosis than alcohol use. Globally, 14.9% of DALYs and 14.1% of deaths were attributed to drug use. The effect of drug use was greatest in North America and high-income North America (41.6% of DALYs and 39.4% of deaths), whereas the effect was smallest in Western Sub-Saharan Africa (0.1% of DALYs and deaths) (Figure 6(B)).

3.4. Correlation analysis of EAPC with ASR and HDI

Further, we analysed the correlation between EAPC, ASR, and HDI. In 1990, EAPC showed a significant negative correlation with ASIR ($\rho = -0.29$, $p < 0.001$) and ASDR ($\rho = -0.17$, $p = 0.0137$) (Figure 7(A)). Interestingly, as of 2019, there is a significant positive correlation between EAPC and ASIR ($\rho = 0.34$, $p < 0.001$) and ASDR ($\rho = 0.22$, $p = 0.0018$) (Figure 7(B)). As a result, the pattern of cirrhosis has changed considerably over the past 30 years. Surprisingly, there was no significant correlation between HDI and EAPC ($p > 0.05$) (Figure 7(C)).

Therefore, we found a significant negative association of EAPC with baseline ASR in 1990 but showed a significant positive association in 2019. The reasons may be related to two factors, first, the lower the baseline of ASR, the more significant the changes. Second, cirrhosis has insufficient priority over other public problems, so these countries with lower ASR will invest fewer resources in it. While in 2019, countries with higher ASR were more likely to increase liver cirrhosis. This result may be attributed to the aging population, with a large elderly population increasing the incidence of cirrhosis.

3.5. Changes in ASR trends in cirrhosis by SDI-based region and country

As shown in Figure 8, we studied the variation trend of ASR based on SDI in different regions and countries. The changes in North Africa and the Middle East, South Asia, and southern Latin America are consistent with the expected trends. However, in many areas of the mid-posterior region of SDI, the phase ASR fluctuates greatly. For example, ASR in central Asia was significantly higher than

expected, and the fluctuation increased. Although the overall ASR of the high-income Asia Pacific region is higher than expected the fluctuation decreases (Figure 8(A)). At the national level, with some exceptions, the ASR of liver cirrhosis was negatively associated with SDI in various countries in 2019 (Figure 8(B)).

3.6. Prediction of global cirrhosis incidence

Further, we predicted the number of episodes of liver cirrhosis in the next 20 years by using the Nordpred and the BAPC software packages of the R software. The results found that the number of cirrhosis increased. Based on the Nordpred model analysis, the incidence number of liver cirrhosis has increased from 1,317,848.92 in 1990–1994 to 2,409,435.31 in 2035–2039 (Figure 9(A) and Supplementary Table 3). The BAPC analysis similarly indicated that the incidence number of liver cirrhosis had increased from 1,273,961 in 1990 to 3,438,491 in 2039 (Figure 9(B) and Supplementary Table 3).

In all age groups, the analysis found that the number of cases of liver cirrhosis showed a rising trend, and the incidence rate was relatively stable and slightly increased (Figure 10, Supplementary Tables 4 and 5). The same conclusion was obtained using the BAPC model, but the growth was more (Figure 11, Supplementary Tables 6–9). The reason for the larger increase in the BAPC model may be that the Nordpred model analysis uses the average of the 5-year data, which makes the increase less obvious than the BAPC model analysis due to the average.

Due to changes in time and age, we projected ASR changes in the next 20 years based on the analysis of ASR changes in cirrhosis over the past 30 years. Nordpred model analysis showed that ASR in females decreased from 20.86 per 100 in 1990–1994 to 20.4 in 2010–2014 and then continued to increase to 21.38 in 2035–2039 (Figure 12(A) and Supplementary Table 10). However, the ASR for males was 29.81 per 100,000 in 1990–1994, then fluctuated and dropped to 29.5 in 2020–2024 and then rose to 29.62 in 2035–2039 (Figure 12(B) and Supplementary Table 10). The prediction results of the BAPC model showed a similar trend change. The ASR value for females fluctuated from $(21.04206 \pm 2.96e-07)$ per 100,000, in 1990 to the lowest level in 2014 $(20.29454 \pm 2.30e-07)$, and then gradually increased to $(27.38541 \pm 7.01e-05)$ (Figure 12(C) and Supplementary Table 11) in 2039. Similarly, the 1990 ASR value for males was $(30.10715 \pm 3.47e-07)$ per 100,000, then fluctuated and reached the lowest $(29.24959 \pm 2.73e-07)$ in 2015, and then gradually rose to $(40.54755 \pm 1.36e-04)$ (Figure 12(D) and Supplementary Table 11) in 2039.

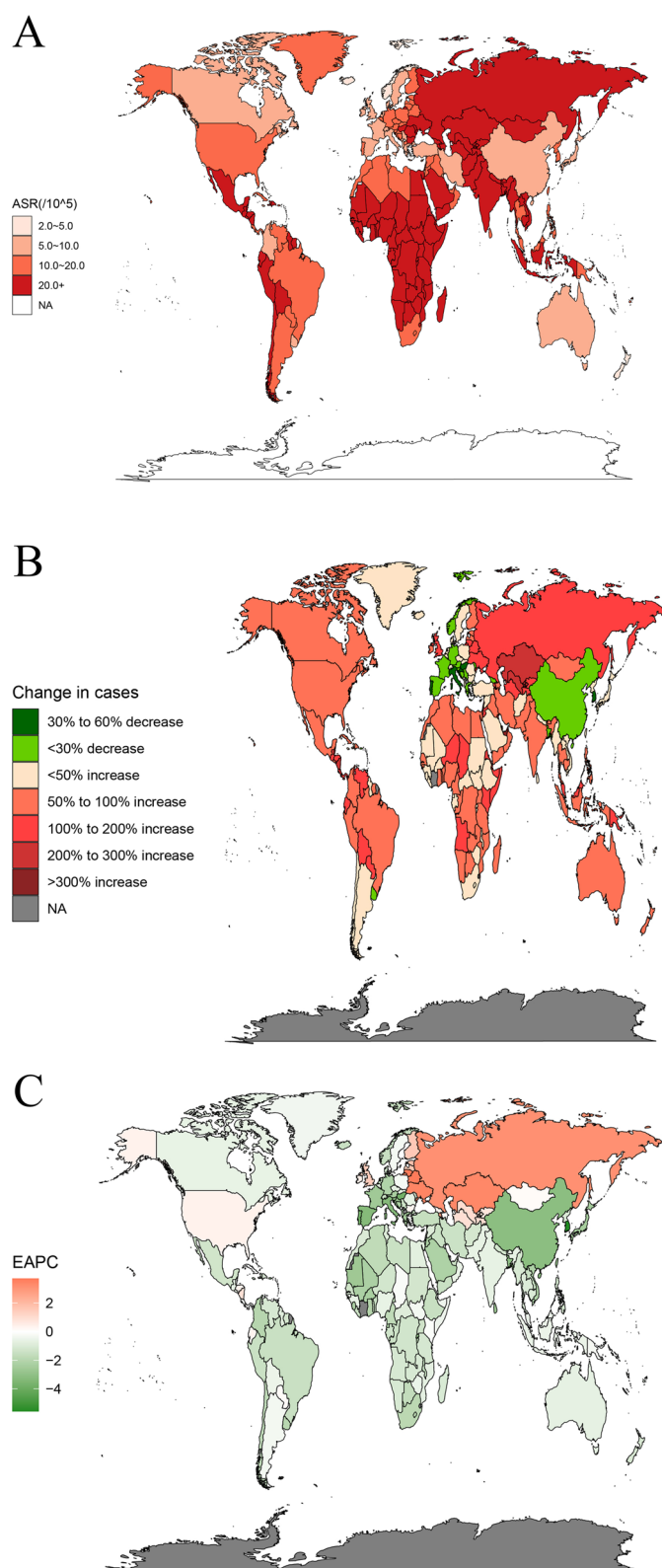


Figure 2. Disease burden of cirrhosis mortality in 204 countries and territories worldwide: A. ASR for cirrhosis mortality in 2019; B. Changes in the cases of cirrhosis from 1990 to 2019; C. EAPC analysis of cirrhosis ASR from 1990 to 2019. ASR, age-standardized rate; EAPC, estimated annual percent change. *Source:* Institute for Health Metrics and Evaluation. Used with permission. All rights reserved.

Table 3. ASDR, change in case numbers and EAPC for cirrhosis in different countries.

Country	ASDR per 100,000 NO. (95% UI)	Cases change		Cases change (%)	EAPC NO. (95%CI)
		Case_1990	Case_2019		
Afghanistan	27.5 (18.8–36.7)	2673.5	3797.4	42	–1.2 (–1.3 to –1)
Albania	8.2 (5.9–11.1)	326.4	332.7	1.9	–2.1 (–2.4 to –1.7)
Algeria	13.7 (10.6–17.4)	2401	4044.9	68.5	–1.7 (–1.8 to –1.7)
American Samoa	14.3 (11.6–17.4)	4.8	6.9	44.4	–0.9 (–1.1 to –0.8)
Andorra	8.6 (6.4–11.3)	6.2	12.2	96.8	–1 (–1.1 to –0.9)
Angola	44.5 (35.3–55.7)	2782.2	5665.6	103.6	–1.1 (–1.2 to –1.1)
Argentina	16.2 (14.9–17.5)	5942.6	8524.5	43.4	–0.3 (–0.5 to –0.2)
Armenia	28 (23.6–32.6)	405.7	1114.2	174.6	2.8 (2.2–3.4)
Australia	5.8 (5.3–6.3)	1394.5	2214.8	58.8	–0.7 (–0.9 to –0.5)
Austria	11.3 (10.5–12.1)	2253.1	1809.4	–19.7	–2.3 (–2.4 to –2.3)
Azerbaijan	38.1 (29.4–48.1)	1560.3	3118	99.8	0.2 (–0.3–0.6)
Bahamas	15.1 (12.3–18.6)	39.7	61.5	54.9	–1.7 (–1.9 to –1.5)
Bahrain	18.3 (14–23.3)	50.1	138.3	176.4	–2.3 (–2.6 to –2.1)
Bangladesh	20.2 (15.8–25.6)	26628.4	26164.6	–1.7	–3 (–3.3 to –2.7)
Barbados	9.9 (7.9–12)	35.7	46.7	31.1	–1.4 (–1.6 to –1.2)
Belarus	15.5 (11.9–20.3)	836.7	2234.6	167.1	3.7 (2.6–4.9)
Belgium	10.1 (9.2–11)	1765.6	2105.2	19.2	–0.8 (–0.9 to –0.7)
Belize	21.8 (18.9–25.2)	20.1	65.5	225.8	0 (–0.4–0.3)
Benin	34.8 (27.1–45.1)	1145	1943.1	69.7	–1.5 (–1.7 to –1.3)
Bermuda	6.4 (5.2–7.9)	9.9	7.9	–20.2	–3.3 (–3.7 to –2.9)
Bhutan	29.8 (19.8–56.5)	111.2	176.3	58.6	–0.6 (–0.7 to –0.5)
Bolivia	38.2 (28.5–49.5)	1487.3	3318.8	123.1	–0.5 (–0.6 to –0.5)
Bosnia and Herzegovina	10.3 (8–13.2)	758.7	593.3	–21.8	–2.3 (–2.6 to –2.1)
Botswana	26.5 (19–35.8)	231.4	417.7	80.5	–1.7 (–2.1 to –1.3)
Brazil	15.8 (14.9–16.9)	24474	38028.6	55.4	–1.5 (–1.5 to –1.4)
Brunei Darussalam	9.2 (7.8–10.7)	18	31.2	73	–2 (–2.2 to –1.7)
Bulgaria	22.5 (17.5–28.3)	2246.2	2707.1	20.5	0.3 (0.1–0.5)
Burkina Faso	30.1 (17.8–42.8)	2275.6	2993	31.5	–2.3 (–2.6 to –2)
Burundi	37.8 (22.8–62.7)	1458.6	1905.7	30.7	–1.9 (–2.1 to –1.7)
Cabo Verde	25.2 (21.1–30)	58.8	114.3	94.3	–0.8 (–1.1 to –0.5)
Cambodia	67.4 (54.1–81.5)	4703.6	8387.8	78.3	–1 (–1 to –0.9)
Cameroon	30.2 (20.6–42.7)	2283.2	4130.8	80.9	–1.7 (–2 to –1.5)
Canada	8.4 (7.6–9.2)	3144.3	5442	73.1	–0.6 (–0.7 to –0.6)
Central African Republic	43.3 (28.6–65.6)	740.6	1105.3	49.2	–0.9 (–1 to –0.8)
Chad	44.3 (34.4–56.9)	1429	2885.6	101.9	–0.2 (–0.3 to –0.1)
Chile	21.7 (20.2–23.2)	3929.5	5157.3	31.2	–1.7 (–1.8 to –1.6)
China	7.8 (6.6–9.2)	167670.7	152261.9	–9.2	–3.1 (–3.3 to –3)
Colombia	7.5 (5.7–9.7)	2098.3	3984.5	89.9	–2 (–2.1 to –1.8)
Comoros	32.5 (21.5–47)	89	161.1	81	–0.8 (–0.9 to –0.6)
Cook Islands	8.4 (6.4–10.5)	1.9	2	5.7	–1.9 (–2 to –1.7)
Costa Rica	18.5 (14.3–23.5)	317.2	959.6	202.5	–0.3 (–0.6 to –0.1)
Côte d'Ivoire	32 (21.6–43.4)	2280.4	3947.6	73.1	–1.6 (–1.8 to –1.4)
Croatia	14.6 (11.4–18.5)	1882.7	1150.7	–38.9	–2.6 (–2.8 to –2.4)
Cuba	11.1 (8.8–13.7)	1127.1	2035.8	80.6	–0.1 (–0.4–0.2)
Cyprus	7.8 (6.7–9.2)	102.3	140.4	37.2	–2.5 (–2.7 to –2.4)
Czech Republic	12.9 (10.4–15.8)	2287.4	2319.7	1.4	–0.7 (–0.9 to –0.5)
Democratic Republic of the Congo	34.5 (24.4–45.8)	8622.5	14392.7	66.9	–1.3 (–1.3 to –1.2)
Denmark	9.6 (8.7–10.5)	770.1	954.7	24	–1.2 (–1.6 to –0.7)
Djibouti	35.3 (22.2–55.1)	68.1	226	231.8	–0.7 (–0.7 to –0.6)
Dominica	12.4 (9.8–15.5)	11.8	10.9	–8	–1.3 (–1.4 to –1.2)
Dominican Republic	31.7 (23.5–42.1)	1530	2945.2	92.5	–0.9 (–1.4 to –0.5)
Ecuador	26.5 (20.7–33.7)	1472.9	3904.7	165.1	0.4 (0.1–0.6)
Egypt	126.7 (87.3–169.5)	39203.3	62635.4	59.8	–0.8 (–0.9 to –0.6)
El Salvador	25.1 (19–32.5)	970.6	1500	54.5	–0.8 (–1 to –0.6)
Equatorial Guinea	23 (15.2–35.4)	91.7	126.2	37.6	–2.4 (–2.6 to –2.2)
Eritrea	52.9 (39.9–70.8)	610.4	1572.3	157.6	–0.1 (–0.3–0.1)
Estonia	13.9 (10.5–17.8)	143.2	277.2	93.5	1.8 (0.9–2.7)
Eswatini	29.1 (21–39.7)	115.3	189.5	64.4	–0.5 (–0.8 to –0.1)
Ethiopia	52.2 (44.2–62.1)	16794	22772.5	35.6	–1.5 (–1.6 to –1.4)
Fiji	11.4 (8.9–14.3)	62.2	86.5	39	–0.9 (–1 to –0.8)
Finland	12.3 (11.3–13.3)	619.5	1152.2	86	1.6 (1.1–2)
France	8.9 (8.2–9.7)	13685.9	10722.4	–21.7	–2.6 (–2.7 to –2.5)
Gabon	35.9 (25.3–47.2)	301.6	397.2	31.7	–1.3 (–1.4 to –1.2)
Gambia	34.1 (24–45.5)	173.5	357.4	106	–1.2 (–1.4 to –1)
Georgia	29.3 (24.3–34.9)	1719.4	1562	–9.2	0.4 (0.2–0.6)
Germany	12.3 (11.4–13.3)	22262.8	20491.6	–8	–2.1 (–2.3 to –1.9)
Ghana	34.9 (26.3–44.7)	4065.8	6124.5	50.6	–2 (–2.1 to –1.9)
Greece	6.2 (5.7–6.7)	1748.3	1366.4	–21.8	–2.4 (–2.7 to –2.2)
Greenland	11.5 (8.9–14.4)	6	8.6	43.6	–0.4 (–0.5 to –0.3)

(Continued)

Table 3. Continued.

Country	ASDR per 100,000 NO. (95% UI)	Cases change		Cases change (%)	EAPC NO. (95%CI)
		Case_1990	Case_2019		
Grenada	16.1 (14.1–18.2)	15.6	18.3	17.4	–1.3 (–1.5 to –1.2)
Guam	17.6 (14.6–21)	20.5	33	60.8	–1.5 (–1.7 to –1.2)
Guatemala	45.8 (36.1–57.5)	2345.7	5520.7	135.4	–0.7 (–0.9 to –0.5)
Guinea	38.5 (27.8–52.1)	1686.1	2381.9	41.3	–0.6 (–0.8 to –0.5)
Guinea–Bissau	53.1 (39.7–68.4)	298.5	449.4	50.5	–0.6 (–0.6 to –0.5)
Guyana	37 (28.8–46.9)	218.5	250.9	14.8	–0.8 (–1 to –0.6)
Haiti	28.2 (14.8–39.9)	1474.5	2151.4	45.9	–1.1 (–1.3 to –1)
Honduras	49 (33.1–67.7)	1124.6	2952.2	162.5	0.4 (0.2–0.5)
Hungary	21.1 (17.2–25.6)	5950.8	3510.5	–41	–3.8 (–4.3 to –3.4)
Iceland	3.3 (2.9–3.7)	12.7	16.9	33.2	–1.5 (–1.5 to –1.4)
India	22.5 (19.1–26.8)	144247.3	270036.8	87.2	–0.6 (–0.8 to –0.4)
Indonesia	43.7 (36.8–49.3)	57982.7	88670.1	52.9	–0.6 (–0.7 to –0.5)
Iran	9.9 (8.8–11.1)	3999.1	6831.7	70.8	–1.4 (–1.5 to –1.2)
Iraq	11.8 (9.3–14.4)	1490.1	2720.1	82.5	–1.4 (–1.5 to –1.3)
Ireland	5.5 (5–6.1)	194.9	388.5	99.3	0.5 (0.1–1)
Israel	6.5 (5.8–7.5)	399.1	756	89.4	–1.5 (–1.9 to –1.2)
Italy	8.8 (8.2–9.3)	18129.4	12450.5	–31.3	–3.3 (–3.4 to –3.2)
Jamaica	6.1 (4.7–7.7)	155.6	185.1	19	–1.5 (–1.8 to –1.1)
Japan	7.6 (6.9–8.2)	25310.2	26248.4	3.7	–2.4 (–2.5 to –2.3)
Jordan	11 (8.9–13.3)	247.1	644.1	160.6	–2.3 (–2.5 to –2.1)
Kazakhstan	37.5 (31.9–45)	2184.3	6705	207	3.4 (2.8–4)
Kenya	57.5 (41.7–80.6)	5429.6	13094.9	141.2	–0.1 (–0.3–0.1)
Kiribati	34.5 (19.8–52.3)	23.6	27.1	14.5	–1.8 (–1.9 to –1.6)
Kuwait	7.9 (6.5–9.5)	60.9	203.9	234.7	0.1 (–0.6–0.7)
Kyrgyzstan	40.9 (36–46.6)	1024.4	2143.1	109.2	0.7 (0.1–1.4)
Laos	26.5 (19–35.6)	896.3	1272.8	42	–1.5 (–1.6 to –1.3)
Latvia	12.9 (10.4–16)	248.1	387.9	56.3	1.6 (0.9–2.3)
Lebanon	11.6 (7.2–18.5)	357.9	596.3	66.6	–1.3 (–1.4 to –1.2)
Lesotho	28.6 (19.5–39.3)	307.8	395	28.3	0 (–0.1–0.2)
Liberia	41.1 (30.2–56.4)	694.7	954.7	37.4	–1.4 (–1.6 to –1.3)
Libya	14.7 (10.3–20.1)	416.7	723.9	73.7	–1.4 (–1.5 to –1.3)
Lithuania	19.5 (15.6–24.5)	353.1	830.5	135.2	3.7 (2.6–4.8)
Luxembourg	9.4 (8.2–10.9)	99.7	90.3	–9.5	–2.7 (–2.9 to –2.6)
Macedonia	10.1 (7.8–12.8)	197.9	316.6	60	–0.2 (–0.3–0)
Madagascar	37.8 (28.5–49.3)	2798.3	4523.8	61.7	–1 (–1.2 to –0.9)
Malawi	46.5 (36.3–57.8)	2900.1	3690.7	27.3	–1.6 (–1.9 to –1.4)
Malaysia	18.3 (14.3–22.7)	1651.5	4782.9	189.6	–0.5 (–0.9 to –0.2)
Maldives	9.8 (8.1–11.7)	20.1	32.6	62.8	–2.9 (–3.1 to –2.6)
Mali	33.1 (24.6–45.5)	2579.3	3266.8	26.7	–2.3 (–2.5 to –2)
Malta	5 (4.4–5.7)	36.7	40.5	10.2	–2 (–2.1 to –1.9)
Marshall Islands	25.3 (14.7–38.4)	7.5	10.2	36.1	–1.5 (–1.6 to –1.5)
Mauritania	27.6 (19.8–37.4)	595.5	602.7	1.2	–2.6 (–2.7 to –2.5)
Mauritius	15.4 (12.5–18.9)	265.3	263.2	–0.8	–3.3 (–3.7 to –3)
Mexico	38.7 (32.7–45.2)	24012.6	46327.6	92.9	–1.3 (–1.4 to –1.1)
Micronesia (Federated States of)	25.3 (13.7–39.8)	20.6	19.7	–4.6	–1.6 (–1.8 to –1.3)
Moldova	48.9 (42.7–56)	3144	2744.8	–12.7	–1.1 (–1.5 to –0.7)
Monaco	9.1 (7–11.2)	6.2	7.4	20.3	–0.3 (–0.4 to –0.2)
Mongolia	72.9 (56.9–91.3)	832.6	1656.5	98.9	0.1 (–0.2–0.4)
Montenegro	5.4 (4.3–6.8)	35.5	49.9	40.4	–0.1 (–0.3–0)
Morocco	16.1 (12.4–19.5)	2732.7	4551.3	66.6	–1 (–1.2 to –0.8)
Mozambique	21.4 (13.1–30.1)	1679.9	2546.6	51.6	–0.7 (–0.9 to –0.5)
Myanmar	38.2 (30.5–47.2)	14646.6	20361.3	39	–1.1 (–1.1 to –1)
Namibia	22.5 (15.5–31.1)	219.8	339	54.2	–1.1 (–1.3 to –0.8)
Nauru	26.7 (15–39.5)	1.8	1.5	–17.8	–1.1 (–1.3 to –1)
Nepal	35.4 (26.3–49.5)	5458.7	7945.4	45.6	–1.2 (–1.3 to –1)
Netherlands	5.4 (4.8–6)	1454.3	1810.4	24.5	–1.6 (–1.9 to –1.3)
New Zealand	3.9 (3.6–4.4)	192.3	297.2	54.6	–1 (–1.1 to –1)
Nicaragua	36.2 (29.6–43.4)	495.7	1623.2	227.4	0.9 (0.7–1)
Niger	36.6 (25.3–52.6)	1650.3	3324.9	101.5	–1.2 (–1.4 to –1.1)
Nigeria	42 (29.3–60.8)	25713.1	40380.6	57	–0.6 (–0.8 to –0.5)
Niue	17.9 (13–23.2)	0.6	0.4	–32.5	–1.4 (–1.5 to –1.4)
North Korea	16 (10.6–20.9)	3621.9	5170.8	42.8	–1 (–1 to –0.9)
Northern Mariana Islands	25.2 (20.8–30)	10.2	12.8	25.3	–2 (–2.2 to –1.9)
Norway	3.9 (3.6–4.4)	367.4	360.3	–1.9	–1.5 (–1.6 to –1.4)
Oman	17.6 (14.6–21.7)	164.6	278.7	69.3	–0.6 (–0.8 to –0.3)
Pakistan	35 (25.2–49.8)	25978.9	44070.2	69.6	–0.6 (–0.8 to –0.5)
Palau	17.5 (10.7–26)	2.5	3.8	55.3	–0.9 (–1 to –0.9)
Palestine	17.1 (14.3–20.4)	206.4	358.7	73.7	–1.1 (–1.2 to –0.9)

(Continued)

Table 3. Continued.

Country	ASDR per 100,000 NO. (95% UI)	Cases change		Cases change (%)	EAPC NO. (95%CI)
		Case_1990	Case_2019		
Panama	12.1 (9.3–15.4)	212.5	502.9	136.6	−0.2 (−0.4 to −0.1)
Papua New Guinea	10.2 (7.5–13.7)	279.3	660.5	136.4	−0.3 (−0.3 to −0.2)
Paraguay	13 (9.7–17.1)	300.9	749.7	149.1	0.1 (0–0.3)
Peru	21.1 (15.1–28.6)	4065.8	6828.3	67.9	−1.4 (−1.6 to −1.3)
Philippines	17.2 (14.1–21.1)	7843.6	14286.9	82.1	−1.1 (−1.3 to −1)
Poland	14.2 (11.6–17.1)	6450.1	8564.8	32.8	−0.2 (−0.5–0)
Portugal	10.2 (9.4–11)	3658.6	2091.7	−42.8	−3.8 (−4 to −3.7)
Puerto Rico	15.6 (11.9–19.9)	1066.5	1018.8	−4.5	−3 (−3.3 to −2.7)
Qatar	32.3 (23.4–44.3)	36.8	176.7	380.2	−0.2 (−0.4–0.1)
Republic of Congo	37.3 (26.2–48.3)	652	1070.6	64.2	−1.4 (−1.5–1.3)
Romania	31.2 (25.4–37.5)	8646.7	10386.5	20.1	−0.7 (−1 to −0.3)
Russia	22.1 (19–25.5)	16501.9	46101.8	179.4	3.1 (2.3–4)
Rwanda	40.7 (32.1–53.1)	2416.7	2599.1	7.5	−3 (−3.3 to −2.7)
Saint Lucia	15.3 (12.8–18.1)	23.3	32.9	41.3	−2.3 (−2.7 to −1.9)
Samoa	19.4 (14.9–24.9)	25	30.1	20.2	−1.1 (−1.2 to −0.9)
San Marino	12.6 (8.4–18.4)	4.8	8.2	72	−0.5 (−0.6 to −0.4)
Sao Tome and Principe	44 (31.7–58.2)	41.5	49.5	19.1	−1.4 (−1.7 to −1.1)
Saudi Arabia	28.3 (22.9–34.6)	2614.2	3763.1	44	−2.2 (−2.3 to −2.1)
Senegal	29.2 (20.3–40.7)	1489.5	2364.7	58.8	−1.3 (−1.4 to −1.2)
Serbia	9.6 (7.4–12.3)	1516.4	1401.1	−7.6	−1.3 (−1.5 to −1.1)
Seychelles	29 (24.7–33.3)	17.8	33.4	88.1	−0.8 (−1.1 to −0.6)
Sierra Leone	29 (20.4–39.3)	1037.1	1192.3	15	−2.2 (−2.5 to −2)
Singapore	3.3 (2.9–3.6)	205.8	253	23	−3.5 (−3.7 to −3.2)
Slovakia	19.9 (15.2–26.1)	1634.2	1693.7	3.6	−0.8 (−1.1 to −0.6)
Slovenia	14.9 (11.4–20)	781.7	569.3	−27.2	−3 (−3.3 to −2.7)
Solomon Islands	30.8 (24.3–37.7)	70.6	133.1	88.5	−0.8 (−0.8 to −0.7)
Somalia	50.2 (34.7–72.1)	1656.1	3790.4	128.9	−0.5 (−0.6 to −0.4)
South Africa	12.5 (11.1–14.1)	4683.9	5824.4	24.3	−1.9 (−2.3 to −1.4)
South Korea	11.9 (10.6–13.8)	15888.2	10355.6	−34.8	−5.6 (−5.9 to −5.2)
South Sudan	42.1 (28.6–61.7)	1209.5	1706.9	41.1	−0.3 (−0.4 to −0.3)
Spain	8.9 (8.1–9.7)	11524.6	8218	−28.7	−3.3 (−3.5 to −3.2)
Sri Lanka	17.8 (13.6–23.5)	3849.8	4368.8	13.5	−2.7 (−3.2 to −2.1)
Sudan	21.7 (14.1–35.1)	3055.6	4099.7	34.2	−1.2 (−1.3 to −1.1)
Suriname	20.9 (16.8–25.2)	73.3	126.7	72.9	−1.2 (−1.4 to −1)
Sweden	5.5 (5.1–6)	841.8	1068.9	27	−0.3 (−0.4 to −0.2)
Switzerland	6.5 (5.9–7.3)	884.1	1065	20.5	−1.4 (−1.6 to −1.3)
Syria	19.3 (14.3–24.9)	1354.3	2023.6	49.4	−0.9 (−1.2 to −0.7)
Taiwan	19.3 (15.3–24.6)	5646.8	7287.1	29	−2.7 (−3 to −2.5)
Tajikistan	38.8 (31.5–47.5)	927.2	2187.7	136	1 (0.8–1.2)
Tanzania	31.9 (22.5–41.3)	5355.7	8546.7	59.6	−1.1 (−1.4 to −0.8)
Thailand	19.7 (14.9–25.7)	10445.9	19603.4	87.7	−0.9 (−1.1 to −0.8)
Timor-Leste	25.5 (15.8–38)	103.6	210.3	103	−0.4 (−0.5 to −0.2)
Togo	31 (22.4–40.9)	696	1272.1	82.8	−1.7 (−1.9 to −1.5)
Tokelau	16.7 (12.1–22)	0.3	0.2	−31.2	−1.3 (−1.4 to −1.3)
Tonga	23.3 (17.8–29.6)	17.9	19	6.4	−1 (−1.1 to −0.9)
Trinidad and Tobago	10.3 (7.6–13.6)	150	187.5	25	−1.8 (−2 to −1.6)
Tunisia	11.6 (8.3–16.8)	743.8	1366.8	83.8	−0.9 (−1 to −0.9)
Turkey	8.7 (7–10.6)	4950.2	7349.3	48.5	−1.6 (−1.6 to −1.5)
Turkmenistan	52.1 (42.4–64.7)	845.6	2381	181.6	0.9 (0.7–1.2)
Tuvalu	21.9 (14.1–31.8)	2.3	2.3	−2.7	−1.3 (−1.5 to −1.2)
Uganda	33.6 (24.4–41.6)	3010.2	5188.9	72.4	−1.3 (−1.5 to −1.1)
UK	9.5 (9.1–10.1)	4899.2	10031.5	104.8	1.5 (1.1–1.9)
Ukraine	32.4 (27.1–38.9)	7986.6	20141	152.2	3.5 (2.6–4.3)
United Arab Emirates	12.5 (7.5–18.7)	71.4	505.6	607.7	−1.4 (−1.8 to −1)
United States Virgin Islands	19.1 (15.3–22.4)	20.3	33.2	63.6	−0.4 (−0.7 to −0.2)
Uruguay	9.1 (8.2–10)	533	471	−11.6	−1.9 (−2 to −1.8)
USA	13.2 (12.6–13.6)	37385.8	67286.5	80	0.4 (0.3–0.5)
Uzbekistan	53.3 (45.2–62)	4146.9	13042.3	214.5	1 (0.4–1.7)
Vanuatu	25.8 (15.7–37.1)	26.5	49.4	86.8	−1.3 (−1.5 to −1.1)
Venezuela	15.8 (11.6–20.7)	2124.1	4691.7	120.9	−1.1 (−1.3 to −0.9)
Vietnam	25.1 (19.5–31.4)	16676.2	23636.9	41.7	−2.1 (−2.5 to −1.8)
Yemen	20.9 (14.7–30.4)	1546.2	2785.8	80.2	−1.5 (−1.6 to −1.3)
Zambia	60.5 (48.3–75.3)	2373.1	4593	93.5	−1.1 (−1.3 to −0.8)
Zimbabwe	27.3 (17.2–38.9)	1449.6	2065.1	42.5	−0.5 (−0.8 to −0.3)

ASDR: age-standardized death rate; CI: confidence interval; EAPC: estimated annual percentage change; UI: uncertainty interval.

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Table 4. Number of liver cirrhosis mortalities, death rate and ASDR by gender in 2019.

Country	Female			Male		
	Mortalities NO. (95% UI)	Death rate per 100,000 NO. (95% UI)	ASDR per 100,000 NO. (95% UI)	Mortalities NO. (95% UI)	Death rate per 100,000 NO. (95% UI)	ASDR per 100,000 NO. (95% UI)
Global	502944.1 (459202–550914.2)	13 (11.9–14.3)	11.7 (10.7–12.8)	969067.7 (899212.9–1045344.5)	25 (23.2–26.9)	24.8 (23.1–26.8)
Afghanistan	1852.2 (939.1–2848.3)	9.9 (5–15.3)	26.4 (15.6–37.2)	1945.1 (1289.4–2646.8)	9.9 (6.6–13.5)	28.9 (18.7–40)
Albania	116.1 (83.1–154.6)	8.6 (6.1–11.4)	5.3 (3.9–7)	216.6 (152.7–296.9)	15.9 (11.2–21.8)	11.4 (8.1–15.5)
Algeria	1639.3 (1301.1–2005.3)	7.9 (6.3–9.7)	12.1 (9.5–15)	2405.6 (1643.2–3460)	11.3 (7.8–16.3)	15.3 (10.7–21.5)
American Samoa	2.4 (1.9–3.1)	8.8 (6.9–11.1)	10 (7.8–12.6)	4.5 (3.6–5.6)	16.2 (12.7–19.9)	18.7 (14.9–22.8)
Andorra	4.1 (2.8–5.7)	10.1 (7–14)	5.6 (3.9–8)	8.1 (6.1–10.4)	19 (14.2–24.5)	11.6 (8.7–14.9)
Angola	1780.9 (1291.9–2430.4)	11.5 (8.3–15.7)	26 (19.1–35.9)	3884.7 (2936–4956.1)	26.6 (20.1–33.9)	67.9 (54.2–84.2)
Antigua and Barbuda	4.8 (4–5.7)	10.7 (8.9–12.6)	9.2 (7.7–10.9)	8.1 (6.7–9.5)	18.6 (15.6–22)	17 (14.2–20)
Argentina	2426.4 (2093.2–2780.2)	10.5 (9.1–12)	7.9 (6.9–9)	6098.1 (5606.1–6616.4)	27.7 (25.5–30.1)	26 (23.9–28.2)
Armenia	459.6 (384.9–546.6)	29.4 (24.6–35)	19.1 (15.9–22.7)	654.6 (550.2–773)	44.9 (37.7–53)	38.9 (32.7–45.9)
Australia	763.2 (653.9–867.9)	6.1 (5.3–7)	3.6 (3.2–4.1)	1451.6 (1315.2–1582.9)	12 (10.8–13.1)	8.1 (7.4–8.8)
Austria	590.1 (525.4–651.4)	13 (11.6–14.4)	6.4 (5.8–7)	1219.4 (1139–1303)	27.8 (25.9–29.7)	16.6 (15.6–17.7)
Azerbaijan	1321.7 (939.8–1755.4)	25.7 (18.3–34.2)	31.5 (21.5–43.1)	1796.3 (1396.1–2317.4)	34.9 (27.2–45.1)	45.5 (34.7–58.7)
Bahamas	19.7 (15.5–24.5)	10.1 (8–12.6)	9.3 (7.4–11.5)	41.8 (33.4–52.4)	22.9 (18.3–28.7)	21.8 (17.5–27.3)
Bahrain	38.2 (28.6–49.6)	7 (5.2–9.1)	14.8 (11.4–18.7)	100.1 (72–137.6)	11.2 (8–15.3)	20.8 (15.5–27.3)
Bangladesh	8200 (6015.5–12178.3)	10.2 (7.5–15.1)	12.4 (9.2–18.6)	17964.6 (13649.9–22907.3)	22.9 (17.4–29.2)	27.5 (21.1–34.7)
Barbados	13.4 (10.5–16.5)	8.7 (6.8–10.7)	5 (4–6.2)	33.4 (25.9–41.4)	23.2 (18.1–28.8)	15.6 (12.2–19.2)
Belarus	907.7 (688.5–1189.7)	17.9 (13.6–23.5)	10.8 (8.1–14.3)	1326.9 (1004.9–1765.3)	30 (22.7–39.9)	21.6 (16.5–28.7)
Belgium	849.9 (729.6–971.8)	14.7 (12.6–16.8)	7.1 (6.3–7.9)	1255.4 (1134.5–1390.9)	22.3 (20.2–24.8)	13.4 (12.1–14.7)
Belize	19.5 (16.6–22.6)	9.5 (8–11)	13.7 (11.6–15.9)	46 (39.3–53.7)	22.5 (19.2–26.3)	29.9 (25.7–35)
Benin	727.2 (538.6–974.8)	11.3 (8.4–15.1)	25.3 (19.3–33.4)	1215.8 (867.2–1646.2)	19.5 (13.9–26.4)	45 (33.4–59.6)
Bermuda	2 (1.5–2.7)	6 (4.6–8.2)	2.7 (2.1–3.6)	5.9 (4.8–7.1)	19.1 (15.6–23.1)	10.7 (8.8–13)
Bhutan	47.3 (34.3–69.6)	13.1 (9.5–19.2)	17.3 (12.7–25.4)	128.9 (80.3–287.3)	32.8 (20.4–73.2)	41.5 (26.4–91.8)
Bolivia (Plurinational State of)	1287.1 (941.2–1685.1)	21.5 (15.7–28.1)	29 (21.4–37.4)	2031.7 (1448.8–2687.4)	33.8 (24.1–44.7)	48.2 (34.7–63.5)
Bosnia and Herzegovina	180.5 (137–238.4)	10.7 (8.1–14.1)	5.6 (4.2–7.4)	412.8 (316.4–534.6)	25.6 (19.7–33.2)	15.7 (12.1–20.2)
Botswana	131.9 (81.3–194.8)	11.1 (6.8–16.4)	15.7 (9.9–22.8)	285.8 (195.4–398.9)	24.8 (17–34.7)	40.5 (29–56.2)
Brazil	9775 (8853.2–10763)	8.8 (8–9.7)	7.6 (6.8–8.3)	28253.7 (26552.2–30278.5)	26.7 (25.1–28.6)	25.3 (23.7–27.1)
Brunei Darussalam	11.7 (9.6–13.9)	5.6 (4.6–6.7)	7.6 (6.3–8.8)	19.5 (15.5–24.3)	8.5 (6.8–10.6)	10.5 (8.5–12.8)
Bulgaria	616.9 (476.5–772.4)	17.3 (13.4–21.6)	8.9 (6.8–11.3)	2090.1 (1616.9–2621.8)	62.1 (48–77.9)	37.6 (29.2–47.2)
Burkina Faso	1261.5 (509.9–1891)	10.8 (4.4–16.2)	23.6 (8.3–35.9)	1731.6 (787.7–2969.3)	15.7 (7.1–26.9)	37.9 (17.2–64.6)
Burundi	600.7 (318.8–907.3)	10 (5.3–15.1)	26.2 (13.4–39.6)	1305 (702.2–2599.5)	22 (11.8–43.8)	48.3 (25.7–94.4)
Cabo Verde	35.6 (26.7–45.2)	12.7 (9.5–16.2)	14.1 (10.6–17.9)	78.7 (65.1–94.4)	27.7 (22.9–33.3)	38.3 (32.2–45.5)
Cambodia	3654.1 (2889.3–4485)	43.2 (34.2–53.1)	54 (42.5–65.8)	4733.7 (3691.6–5927)	58.1 (45.3–72.7)	83.5 (65.7–102.5)
Cameroon	1405.6 (779.7–2116.6)	9.6 (5.3–14.5)	21 (11.4–31.4)	2725.2 (1783.1–3933.2)	18.8 (12.3–27.1)	39.7 (26.8–56.7)
Canada	2119.4 (1807.7–2472.4)	11.4 (9.7–13.3)	5.9 (5.2–6.7)	3322.6 (2992–3666.4)	18.5 (16.7–20.4)	11 (10–12.1)
Central African Republic	366.1 (222.7–565.5)	13.5 (8.2–20.9)	27.3 (16.7–42)	739.1 (390.7–1293.3)	28.5 (15.1–49.8)	63.6 (37–105.1)
Chad	962.2 (724.6–1256.9)	11.6 (8.8–15.2)	32.3 (24–42)	1923.4 (1433–2551.2)	23.6 (17.6–31.4)	54.8 (40.8–72.5)
Chile	1578.7 (1415.9–1745)	17 (15.3–18.8)	12 (10.8–13.2)	3578.6 (3328–3846.3)	40.1 (37.3–43.1)	32.7 (30.4–35.1)
China	42296.9 (33866.1–52045.4)	6.1 (4.9–7.5)	4.2 (3.4–5.2)	109964.9 (88138.9–136103.1)	15.2 (12.2–18.8)	11.8 (9.6–14.4)
Colombia	1664.1 (1282.2–2153.1)	6.8 (5.2–8.8)	5.7 (4.4–7.3)	2320.4 (1710.1–3058.9)	9.9 (7.3–13.1)	9.6 (7.1–12.7)
Comoros	68.2 (35.5–98.1)	19.1 (9.9–27.4)	26 (13.5–37.4)	93 (57.1–161.7)	26.1 (16–45.3)	40 (24.9–71.2)
Congo	378.1 (248.2–554.2)	14.2 (9.3–20.9)	26 (17.4–37.9)	692.6 (449–920.7)	26.5 (17.2–35.3)	49.9 (33.8–64)
Cook Islands	0.3 (0.2–0.4)	3.7 (2.7–4.9)	2.8 (2–3.6)	1.6 (1.2–2.1)	18.8 (13.6–23.6)	14.3 (10.6–17.8)
Costa Rica	354.3 (273.7–446.3)	14.6 (11.3–18.4)	12.8 (9.8–16)	605.3 (464.7–781.8)	26.5 (20.3–34.2)	25.1 (19.2–32.4)
Croatia	292.8 (228.1–372.9)	13.4 (10.4–17)	6.4 (4.9–8.1)	857.9 (668.7–1082.3)	41.7 (32.5–52.5)	24.4 (18.9–30.8)
Cuba	583.3 (457.5–745.1)	10.2 (8–13.1)	5.9 (4.6–7.5)	1452.5 (1150.7–1809.7)	25.7 (20.4–32)	16.6 (13.2–20.7)
Cyprus	49.8 (40.9–60.1)	7.5 (6.2–9)	5.3 (4.3–6.4)	90.5 (74.6–105.9)	13.9 (11.5–16.3)	10.6 (8.8–12.6)
Czechia	750.4 (601.5–912.2)	13.9 (11.1–16.9)	7.7 (6.2–9.4)	1569.3 (1257.1–1948.7)	30 (24–37.2)	18.5 (14.8–23)

(Continued)

Table 4. Continued.

Country	Female			Male		
	Mortalities NO. (95% UI)	Death rate per 100,000 NO. (95% UI)	ASDR per 100,000 NO. (95% UI)	Mortalities NO. (95% UI)	Death rate per 100,000 NO. (95% UI)	ASDR per 100,000 NO. (95% UI)
Côte d'Ivoire	1160.6 (728.6–1696.1)	9.2 (5.8–13.4)	21.1 (13.7–30.1)	2787 (1890.4–3821.4)	20.6 (14–28.3)	41.8 (28.6–56.6)
Democratic People's Republic of Korea	1881.3 (1217.1–2454.2)	14.3 (9.2–18.6)	10.1 (6.5–13.3)	3289.5 (1839.6–4483.5)	25.2 (14.1–34.4)	23.5 (13.5–30.9)
Democratic Republic of the Congo	3754.9 (2755.9–4957.8)	8.6 (6.3–11.3)	17.1 (12.3–23.3)	10637.8 (7061.5–14977.3)	24.2 (16.1–34.1)	56.1 (37.2–78)
Denmark	340.1 (297.3–390.3)	11.7 (10.2–13.4)	6.2 (5.5–7)	614.6 (553–681.4)	21.3 (19.1–23.6)	13 (11.8–14.4)
Djibouti	60.7 (34.5–99.7)	10.8 (6.1–17.7)	22.7 (13.3–36.2)	165.3 (102.8–280.1)	25.9 (16.1–43.8)	46.2 (29–77.7)
Dominica	4 (3.1–5)	11.9 (9.3–14.9)	8.7 (6.8–10.9)	6.9 (5.3–8.6)	19.6 (15.1–24.6)	15.8 (12.2–19.8)
Dominican Republic	1081.3 (805.4–1419.9)	20 (14.9–26.2)	22.6 (17–29.5)	1864 (1277.8–2530.7)	34.1 (23.4–46.3)	41.4 (29.5–55.6)
Ecuador	1522.4 (1160.7–1932.3)	17.2 (13.1–21.9)	20.1 (15.3–25.3)	2382.3 (1820.7–3109)	27.2 (20.8–35.5)	33.4 (25.7–43.5)
Egypt	25635.4 (18067.9–35618.5)	53.7 (37.9–74.7)	141.4 (103.9–191)	37000 (22031.1–50885.4)	72 (42.9–99.1)	124.5 (78.7–170.3)
El Salvador	547.7 (406.9–717.7)	16.5 (12.2–21.6)	15.8 (11.7–20.7)	952.3 (714.6–1242.3)	32.5 (24.4–42.4)	37.6 (28.2–49.1)
Equatorial Guinea	46.2 (27.9–74.3)	7.1 (4.3–11.4)	15.5 (9.5–24.3)	80 (45–134.2)	10.4 (5.9–17.5)	33.4 (20.1–53.3)
Eritrea	606.9 (437.7–843.7)	18.2 (13.1–25.3)	40.4 (29.4–55.2)	965.4 (678.5–1348.7)	28.6 (20.1–40)	68.2 (49.1–93.7)
Estonia	91.1 (69.5–116.7)	13.1 (10–16.8)	8 (6–10.3)	186.1 (138.7–243.4)	30.1 (22.4–39.4)	20.8 (15.6–27.1)
Eswatini	57.6 (31.5–88.8)	9.9 (5.4–15.2)	16 (9.1–24.3)	132 (92.9–181.3)	23.7 (16.7–32.5)	48 (36.2–63.5)
Ethiopia	7259.1 (5543.9–9222.7)	13.6 (10.4–17.3)	36.1 (28.2–44.1)	15513.4 (12404.6–19601.3)	28.6 (22.8–36.1)	67.8 (54.4–84.7)
Fiji	30.8 (23–40)	6.9 (5.1–8.9)	8.1 (6.1–10.5)	55.7 (41.4–72.4)	12.1 (9–15.7)	14.9 (11.4–18.9)
Finland	341.5 (304.8–377.8)	12.2 (10.9–13.5)	6.5 (5.9–7.1)	810.7 (740.8–882.3)	29.7 (27.1–32.3)	18.3 (16.7–19.9)
France	3653.4 (3135.8–4122.4)	10.7 (9.2–12.1)	5.1 (4.6–5.6)	7069 (6419.4–7847)	22 (20–24.4)	13.3 (12.1–14.7)
Gabon	109.4 (71.5–160.2)	12.1 (7.9–17.7)	19.1 (12.1–28.3)	287.8 (201.5–387.3)	34.1 (23.8–45.8)	56.1 (39.9–74.3)
Gambia	127.3 (86.1–188.1)	11.2 (7.5–16.5)	24.3 (15.8–36.4)	230.1 (166.2–306)	20.8 (15–27.7)	43.9 (31.4–58)
Georgia	378.3 (302.4–475)	19.8 (15.8–24.9)	10.6 (8.6–13.1)	1183.7 (982.8–1408.3)	67.4 (56–80.2)	51.9 (43.1–61.6)
Germany	7480.5 (6646–8453.7)	17.5 (15.6–19.8)	7.9 (7.1–8.7)	13011.1 (11909–14350.7)	30.8 (28.2–34)	17.1 (15.7–18.8)
Ghana	2104.4 (1379.9–2851.8)	13 (8.5–17.6)	22.5 (14.8–29.9)	4020.1 (2874.8–5353.1)	26.3 (18.8–35)	50.2 (36.1–66.1)
Greece	480 (403.6–575.4)	9 (7.6–10.8)	3.5 (3–4)	886.4 (797.9–973.8)	17.6 (15.9–19.4)	9.2 (8.4–10)
Greenland	3.8 (2.9–5)	14.4 (11.1–18.7)	11.5 (8.9–14.8)	4.7 (3.5–6.1)	16 (11.7–20.5)	11.3 (8.4–14.3)
Grenada	4.5 (3.8–5.2)	8.9 (7.5–10.3)	7.8 (6.5–9.1)	13.8 (12–16)	26.2 (22.8–30.2)	25 (22–28.8)
Guam	9.6 (7.7–11.7)	11.6 (9.3–14.2)	9.7 (7.7–11.8)	23.4 (19–28.3)	26.6 (21.7–32.2)	25.6 (20.9–31)
Guatemala	1844.7 (1451.8–2318.5)	20.2 (15.9–25.4)	29.6 (23.4–37.1)	3676 (2851.3–4673.6)	42.5 (33–54.1)	66 (51.4–83.8)
Guinea	862 (513.4–1299.7)	13.2 (7.9–19.9)	28.3 (17.3–42.4)	1519.9 (1132.8–1986.2)	24.8 (18.5–32.4)	48.8 (36.4–63.5)
Guinea-Bissau	167.5 (120.3–219.2)	17.2 (12.3–22.4)	38 (27.7–49.2)	281.9 (196.7–380.9)	30.5 (21.3–41.2)	70.1 (50.8–92.1)
Guyana	57.6 (44.4–73.4)	14.8 (11.4–18.9)	16.9 (13.1–21.4)	193.2 (148–247.9)	50.7 (38.8–65)	59.1 (45.8–75.2)
Haiti	789.9 (364.1–1218.6)	12.4 (5.7–19.1)	20 (9.5–30.4)	1361.5 (722.3–1965)	22.6 (12–32.7)	37.5 (20.2–53.6)
Honduras	1464.1 (926.3–2095.5)	29.1 (18.4–41.6)	46.7 (29.6–66)	1488.1 (981.2–2066.1)	31.1 (20.5–43.2)	51.7 (33.8–71.6)
Hungary	1045 (861.2–1264.5)	20.6 (17–25)	11.1 (9.1–13.5)	2465.5 (2021.1–3005.1)	53.5 (43.9–65.2)	33.1 (27.1–40.1)
Iceland	5 (4.2–5.9)	3 (2.5–3.4)	1.9 (1.6–2.2)	11.9 (10.4–13.6)	6.8 (6–7.8)	4.8 (4.2–5.4)
India	80525 (60942.9–106127.8)	11.9 (9–15.7)	13.7 (10.4–18)	189511.8 (151610–232564.6)	26.6 (21.3–32.6)	31.3 (25.1–38.4)
Indonesia	36755.7 (29384.3–44683.1)	28.6 (22.9–34.8)	36.3 (29.4–43.4)	51914.5 (41228.9–64969.4)	39.7 (31.5–49.6)	51.5 (41.7–62.5)
Iran (Islamic Republic of)	2593.5 (2300.6–2993.7)	6.3 (5.5–7.2)	7.9 (6.9–9.2)	4238.3 (3713.1–4791)	9.9 (8.7–11.2)	11.9 (10.4–13.4)
Iraq	1021.5 (795.6–1295.2)	5 (3.9–6.3)	8.8 (7–10.8)	1698.6 (1284.4–2127.1)	7.9 (6–9.9)	15 (11.5–18.5)
Ireland	148.6 (126.7–169.8)	6 (5.1–6.8)	4 (3.4–4.5)	239.9 (211.9–268.6)	9.9 (8.7–11.1)	7.2 (6.3–8)
Israel	331.6 (277.8–400.3)	7.1 (5.9–8.6)	4.9 (4.2–5.8)	424.4 (375.8–488.5)	9.2 (8.1–10.5)	8.2 (7.3–9.4)
Italy	5470.4 (4631.7–5986.9)	17.7 (15–19.3)	6.1 (5.4–6.6)	6980.1 (6486.2–7472.3)	23.8 (22.1–25.5)	11.8 (11.1–12.6)
Jamaica	67.5 (50.9–85.7)	4.8 (3.6–6.1)	4.2 (3.1–5.3)	117.6 (87.9–153.8)	8.4 (6.3–11)	8.2 (6.2–10.7)
Japan	11436 (8664.8–13656)	17.5 (13.2–20.8)	4.7 (3.9–5.2)	14812.4 (13505.9–16342.6)	23.8 (21.7–26.2)	10.7 (10–11.5)
Jordan	255.5 (196.2–330)	4.7 (3.6–6.1)	9.9 (7.7–12.7)	388.5 (289.4–504.1)	6.3 (4.7–8.1)	12 (8.7–15.5)
Kazakhstan	2729.7 (2321.8–3192.1)	28.8 (24.5–33.7)	27 (23–31.4)	3975.3 (3266.2–5180.8)	44.6 (36.7–58.2)	51.7 (43–65.9)
Kenya	4867.1 (2810.8–7689.4)	19.3 (11.2–30.6)	42.7 (25.2–65.6)	8227.8 (5757.4–12340.4)	32.8 (23–49.2)	73.9 (53–110.1)

(Continued)

Table 4. Continued.

Country	Female			Male		
	Mortalities NO. (95% UI)	Death rate per 100,000 NO. (95% UI)	ASDR per 100,000 NO. (95% UI)	Mortalities NO. (95% UI)	Death rate per 100,000 NO. (95% UI)	ASDR per 100,000 NO. (95% UI)
Kiribati	9.3 (5.4–14)	15.3 (8.9–23.1)	24.1 (16.1–33.8)	17.8 (7.8–30.6)	30.6 (13.3–52.6)	46.4 (21.9–76.5)
Kuwait	49.9 (40.5–60.2)	2.4 (2–2.9)	5.2 (4.2–6.4)	153.9 (119.1–194.4)	6.5 (5–8.2)	9.8 (7.6–12.1)
Kyrgyzstan	715.2 (624.6–817.2)	21.7 (18.9–24.7)	26.2 (22.9–29.8)	1427.9 (1251.6–1626.7)	44.2 (38.7–50.3)	58 (50.7–65.9)
Lao People's Democratic Republic	392.4 (283.1–515.8)	11 (8–14.5)	17.2 (12.6–22.5)	880.4 (590.8–1244.3)	24.5 (16.4–34.6)	36.2 (24.6–51.3)
Latvia	153.3 (114.3–204.7)	14.8 (11.1–19.8)	8.7 (6.4–11.7)	234.6 (174.6–303.6)	26.6 (19.8–34.4)	18.2 (13.6–23.6)
Lebanon	258.8 (175–417.6)	9.8 (6.7–15.9)	9.2 (6.2–14.7)	337.6 (139.9–537.2)	13.3 (5.5–21.1)	14.6 (6.1–23.2)
Lesotho	132.5 (65.4–199.8)	12.5 (6.2–18.9)	17.4 (8.7–25.9)	262.5 (167.3–380.9)	25.4 (16.2–36.9)	44.1 (29.6–63.1)
Liberia	339.5 (233.9–479.1)	14.3 (9.8–20.1)	31.5 (22.6–43.2)	615.2 (399.8–905.5)	25.5 (16.6–37.5)	50.1 (33.7–70.8)
Libya	289.9 (214.3–375.2)	8.9 (6.6–11.5)	12.2 (8.8–15.9)	434 (256.7–633.9)	12.5 (7.4–18.2)	17 (10.7–25)
Lithuania	305.8 (242.8–385.3)	20.3 (16.1–25.6)	12.3 (9.8–15.6)	524.7 (415.3–652.4)	40.7 (32.2–50.6)	28.3 (22.4–35.1)
Luxembourg	31.5 (26.6–37.1)	10.3 (8.6–12.1)	6 (5.1–7)	58.8 (50.5–68.5)	18.9 (16.2–22)	13 (11.2–15.1)
Madagascar	1742.1 (1223.6–2324.3)	13.1 (9.2–17.4)	29.9 (21.3–40.1)	2781.7 (1979.7–3824.7)	20.8 (14.8–28.7)	46.1 (34.1–61.9)
Malawi	1148.8 (746.7–1515.4)	12.1 (7.9–16)	28.3 (17.8–37.5)	2541.9 (1925.4–3251)	28.3 (21.5–36.2)	68.7 (52.3–88.1)
Malaysia	1535.6 (1144.1–1943.6)	10.2 (7.6–12.9)	12.6 (9.4–15.9)	3247.3 (2485.4–4143.7)	20.1 (15.3–25.6)	23.7 (18–30.3)
Maldives	9.4 (7.6–11.5)	4.8 (3.8–5.8)	7.4 (5.9–9)	23.2 (18.8–28)	7.7 (6.3–9.3)	11.5 (9.4–13.9)
Mali	1251.4 (756.6–1911.1)	11.3 (6.9–17.3)	27 (16.1–40.4)	2015.4 (1311.5–3162.1)	18.5 (12–29)	39 (25.2–60.3)
Malta	13.5 (11.2–16)	6.1 (5.1–7.3)	3.1 (2.6–3.6)	27 (23.1–30.8)	12.3 (10.5–14.1)	7.1 (6.2–8.1)
Marshall Islands	3 (1.4–4.9)	10.7 (5.2–17.7)	16.6 (8.4–26.5)	7.2 (4–11.3)	24.7 (13.8–38.9)	33.5 (19.6–51.4)
Mauritania	241.8 (176.5–325.6)	11.8 (8.7–16)	23.1 (17–30.9)	360.8 (221.6–570.8)	18.3 (11.2–28.9)	32.4 (20.8–49.6)
Mauritius	60 (47.6–74.1)	9.3 (7.4–11.5)	6.6 (5.2–8.2)	203.2 (163–251.4)	32.3 (25.9–39.9)	24.9 (20–30.6)
Mexico	12967.1 (10634.4–15799.9)	20.3 (16.7–24.8)	21 (17.3–25.5)	33360.5 (26755.3–40980.8)	54.6 (43.8–67.1)	58.6 (47.1–71.7)
Micronesia (Federated States of)	5.8 (3–9.5)	11.5 (6–18.9)	15.8 (8.4–25.1)	13.9 (6.7–23.4)	26.8 (12.9–45)	35.3 (18.4–57.7)
Monaco	3 (2.2–3.8)	15.7 (11.2–19.6)	6.3 (4.5–8)	4.4 (3.5–5.4)	24 (19.1–29.8)	12.1 (9.6–15)
Mongolia	736.2 (551.5–953.6)	42.9 (32.1–55.6)	62.7 (47.2–79.6)	920.3 (718.7–1179.7)	55.1 (43–70.6)	83.6 (66.1–104.2)
Montenegro	11.8 (9.1–14.7)	3.7 (2.9–4.7)	2.4 (1.9–2.9)	38.2 (29.5–49.2)	12.4 (9.6–16.1)	8.7 (6.7–11.2)
Morocco	1852.4 (1428.1–2332.6)	10.4 (8–13)	13.1 (10.1–16.3)	2698.9 (1981.5–3388.9)	14.9 (11–18.7)	19.2 (14–24.1)
Mozambique	954.4 (340.1–1501.4)	6.2 (2.2–9.8)	16 (5.4–25.6)	1592.2 (893.6–2612.2)	11.2 (6.3–18.4)	28.2 (16.2–46.4)
Myanmar	5044.2 (3917.1–6385.8)	17.8 (13.8–22.5)	17.9 (14.1–22.4)	15317.1 (12051.9–19095.9)	58.2 (45.8–72.6)	62.4 (49.8–77.5)
Namibia	105.3 (53.9–169.3)	8.5 (4.3–13.7)	12.6 (6.5–19.7)	233.8 (161.1–315.1)	20.1 (13.8–27.1)	35.6 (24.9–47.8)
Nauru	0.4 (0.2–0.6)	7.5 (3.7–12.4)	15.5 (8.4–23.8)	1.1 (0.5–1.8)	21.1 (9.9–34.3)	38.6 (20.4–59.8)
Nepal	2903 (2171.1–3883.5)	18.2 (13.6–24.4)	25.2 (19–33.4)	5042.4 (3639.4–7743.6)	34.8 (25.1–53.4)	46.8 (33.8–72.5)
Netherlands	810.7 (674.1–960)	9.4 (7.8–11.1)	4.1 (3.5–4.7)	999.7 (886.7–1123.1)	11.7 (10.4–13.2)	6.9 (6.1–7.7)
New Zealand	112 (93.8–132.2)	4.8 (4.1–5.7)	2.6 (2.2–3.1)	185.2 (165–208.1)	8.5 (7.5–9.5)	5.4 (4.8–6)
Nicaragua	456.5 (376.9–537.9)	13.8 (11.4–16.3)	19.6 (16.2–22.9)	1166.7 (924.3–1446.6)	36.3 (28.8–45)	56.3 (44.9–68.7)
Niger	1275.3 (819.3–1794.3)	10.9 (7–15.3)	28.7 (17.6–40.3)	2049.6 (1230.1–3263.4)	17.7 (10.6–28.2)	45 (26.7–69.9)
Nigeria	13675.1 (8544.8–21010.4)	12.3 (7.7–18.8)	28.6 (18.8–42.1)	26705.5 (16876.8–42734)	25.9 (16.3–41.4)	57.3 (36.5–89.7)
Niue	0.1 (0.1–0.2)	14.1 (9–20)	10.3 (6.6–14.7)	0.3 (0.2–0.3)	30.4 (22.8–38.1)	26.2 (19.9–32.9)
North Macedonia	84.6 (63.9–108.6)	8 (6–10.3)	5.3 (4.1–6.8)	232.1 (176.8–300.6)	21.2 (16.2–27.5)	15 (11.6–19.3)
Northern Mariana Islands	3.8 (2.9–4.7)	18.3 (14.3–23)	16.3 (13.1–20.4)	9 (7.3–10.8)	41.2 (33.3–49.2)	33.6 (27.4–39.8)
Norway	143.3 (124.1–172.6)	5.4 (4.7–6.5)	2.7 (2.4–3.2)	217 (195.7–245.8)	8 (7.3–9.1)	5.1 (4.6–5.8)
Oman	90.5 (69.2–116.5)	5.6 (4.2–7.2)	13.6 (10.8–16.8)	188.2 (134.7–282.3)	6.4 (4.6–9.6)	21.5 (17.1–27.6)
Pakistan	24521.1 (17965.1–34663.4)	22.5 (16.4–31.7)	41.8 (30.3–59.6)	19549.1 (12206.9–31453.5)	17 (10.6–27.4)	28.4 (17.3–46.7)
Palau	0.8 (0.5–1.3)	10.3 (5.6–15.9)	8.5 (4.7–13)	3 (1.7–4.5)	30.2 (17.7–45.9)	25.8 (15.9–38.3)
Palestine	167.3 (135.7–200.6)	6.9 (5.6–8.3)	15.2 (12.2–18.3)	191.3 (155.9–229.6)	7.6 (6.2–9.1)	19.7 (16–23.5)
Panama	191.9 (148.5–241.1)	9.3 (7.2–11.7)	8.9 (6.8–11.1)	311 (236.4–402.6)	14.8 (11.3–19.2)	15.4 (11.7–19.9)
Papua New Guinea	88.3 (60–127.7)	1.9 (1.3–2.7)	2.9 (1.9–4.4)	572.2 (411–777.3)	11.2 (8.1–15.2)	17 (12.5–22.9)
Paraguay	162.1 (121.1–212.4)	4.7 (3.5–6.2)	5.5 (4.1–7.2)	587.6 (432.5–775.6)	16.8 (12.3–22.1)	21 (15.4–27.7)
Peru	2466.7 (1745.9–3349.6)	14.5 (10.3–19.7)	14.8 (10.5–20.1)	4361.6 (3047.4–6070.3)	25.6 (17.9–35.6)	27.9 (19.5–38.7)
Philippines	3953.8 (2999.3–5060.6)	7.2 (5.4–9.2)	9.9 (7.5–12.5)	10333.1 (7837–13384.3)	18.2 (13.8–23.5)	25.2 (19.2–32.5)
Poland	2503.2 (1959.6–3121.4)	12.6 (9.9–15.7)	7.3 (5.7–9.2)	6061.6 (4773–7722.6)	32.6 (25.6–41.5)	21.9 (17.3–27.8)

(Continued)

Table 4. Continued.

Country	Female			Male		
	Mortalities NO. (95% UI)	Death rate per 100,000 NO. (95% UI)	ASDR per 100,000 NO. (95% UI)	Mortalities NO. (95% UI)	Death rate per 100,000 NO. (95% UI)	ASDR per 100,000 NO. (95% UI)
Portugal	591.9 (508.9–668.9)	10.6 (9.1–12)	4.8 (4.3–5.3)	1499.7 (1382.5–1626.3)	29.6 (27.3–32.1)	16.7 (15.3–18)
Puerto Rico	337.6 (259.1–432.8)	18.3 (14–23.4)	8.3 (6.4–10.6)	681.2 (516.9–868.3)	40.7 (30.9–51.9)	24.2 (18.3–31.1)
Qatar	37.1 (25.7–50.9)	5.1 (3.5–7)	35.1 (25.7–46)	139.6 (94.1–199.7)	6.5 (4.4–9.3)	31.1 (21.9–44.4)
Republic of Korea	2929.9 (2415.7–3714.9)	11.1 (9.1–14.1)	6 (5–7.5)	7425.7 (6543.8–8505.1)	27.5 (24.3–31.5)	18.2 (16.1–21.4)
Republic of Moldova	1308 (1144.8–1495)	67.8 (59.3–77.5)	40.1 (35–45.9)	1436.8 (1244–1649.5)	81.7 (70.7–93.8)	59.5 (51.6–68.2)
Romania	3805.7 (3188.4–4593.4)	38.5 (32.3–46.5)	19.8 (16.4–24.1)	6580.8 (5352.1–7948.7)	70.3 (57.2–84.9)	44 (35.7–53)
Russian Federation	19070.5 (15589.7–23143.3)	24.3 (19.9–29.5)	15.9 (12.9–19.4)	27031.2 (21856–32860.8)	39.6 (32–48.1)	30 (24.3–36.4)
Rwanda	954 (671.2–1233.4)	14.6 (10.3–18.9)	28 (18.9–35.7)	1645.2 (1183.9–2426.3)	26.7 (19.2–39.3)	57.7 (42.9–82.3)
Saint Kitts and Nevis	2.6 (1.9–3.4)	8.6 (6.5–11.3)	7.8 (5.9–10.1)	9.9 (7.5–12.2)	33.2 (25.1–41)	29.1 (22.6–35.4)
Saint Lucia	11.4 (9.4–13.7)	13 (10.7–15.6)	10.1 (8.3–12.1)	21.5 (17.6–25.7)	24.7 (20.3–29.6)	20.8 (17.2–24.9)
Saint Vincent and the Grenadines	3.8 (3.1–4.6)	6.9 (5.7–8.2)	5.9 (4.8–7)	15.1 (12.3–18)	26.1 (21.2–31.1)	21.8 (17.8–25.9)
Samoa	9.6 (6.4–13.5)	9.4 (6.3–13.1)	12.8 (8.7–17.9)	20.5 (15.1–27)	18.8 (13.9–24.8)	26 (19.7–34)
San Marino	3.7 (2.4–5.4)	21.6 (14.2–31.6)	10.1 (6.6–15.1)	4.5 (3–6.4)	28.3 (18.7–40.1)	15.6 (10.3–22.6)
Sao Tome and Principe	13.4 (7.7–19.1)	13.1 (7.6–18.6)	24.5 (13.7–34.7)	36.1 (27.2–47.5)	35 (26.4–46.1)	64.7 (48.9–82.7)
Saudi Arabia	1291.1 (987–1691.2)	8.7 (6.6–11.4)	24.4 (18.5–31.6)	2472 (1818.8–3080.6)	11.9 (8.7–14.8)	30.9 (24.2–37.6)
Senegal	815.9 (490.1–1227.9)	10.8 (6.5–16.3)	20.4 (12.1–30.9)	1548.8 (1022.7–2453.2)	20.4 (13.5–32.3)	38.6 (25.9–60.1)
Serbia	362.7 (278.1–472)	8.2 (6.3–10.7)	4.5 (3.4–5.8)	1038.4 (783.4–1345.1)	23.9 (18.1–31)	15.3 (11.6–19.9)
Seychelles	8.7 (7.1–10.3)	17.9 (14.7–21.4)	15.5 (12.8–18.5)	24.7 (20–29.6)	46 (37.2–55)	41.1 (33.5–48.7)
Sierra Leone	452.1 (236.1–708.7)	10.8 (5.6–16.9)	22.6 (10.9–35.7)	740.2 (498.3–1046.2)	18 (12.1–25.5)	35.1 (23.7–49.5)
Singapore	102.1 (87.4–115.1)	3.7 (3.2–4.2)	2.6 (2.2–2.9)	150.9 (135.7–167.7)	5.2 (4.7–5.8)	3.9 (3.5–4.4)
Slovakia	492.4 (371.3–634.8)	17.7 (13.3–22.8)	10.6 (8–13.9)	1201.3 (910–1593.3)	45.3 (34.3–60)	30.4 (23.1–40.2)
Slovenia	151.3 (113.9–204.7)	14.5 (10.9–19.6)	7.3 (5.5–10)	418 (316.8–557)	40.6 (30.8–54.1)	23.4 (17.7–31.1)
Solomon Islands	39 (29.2–50.7)	12.1 (9.1–15.8)	19.5 (15.2–24.7)	94.1 (72.5–118.8)	28.2 (21.7–35.5)	41.8 (32.5–52.7)
Somalia	1375.8 (850.1–2125.6)	13.8 (8.5–21.3)	35.5 (22.2–54.5)	2414.6 (1555.2–3522.6)	23.3 (15–34)	69.1 (45.8–97.6)
South Africa	2002.9 (1699.1–2330.4)	7.1 (6–8.2)	7.7 (6.6–9)	3821.6 (3347.6–4414.6)	14 (12.3–16.2)	18.7 (16.5–21.5)
South Sudan	544.3 (351.7–824.4)	11.8 (7.6–17.8)	29.5 (20.1–43.5)	1162.6 (744–1833.4)	24.9 (16–39.3)	53.9 (35.6–83.1)
Spain	2983.5 (2470.9–3513.4)	12.7 (10.5–15)	5 (4.3–5.7)	5234.5 (4786.7–5787.1)	23.2 (21.2–25.7)	13.2 (12–14.4)
Sri Lanka	1038.8 (780.9–1353.2)	9.2 (6.9–12)	7.9 (5.9–10.3)	3330.1 (2446.3–4498.9)	31.5 (23.2–42.6)	29.5 (22–39.2)
Sudan	1549.9 (1001.3–2416.9)	7.7 (5–12)	17.5 (10.9–28.8)	2549.7 (1417.5–4150.2)	12.3 (6.9–20.1)	25.4 (14.1–42.8)
Suriname	42.6 (34.3–52.4)	14.6 (11.8–18)	13.4 (10.8–16.4)	84.1 (65.9–103.1)	29.5 (23.1–36.2)	29.4 (23.1–36.1)
Sweden	398.4 (348.4–448.9)	7.8 (6.8–8.8)	3.7 (3.3–4.1)	670.4 (612.9–732.8)	13.1 (11.9–14.3)	7.5 (6.9–8.2)
Switzerland	410.8 (345.1–507.1)	9.3 (7.8–11.5)	4.4 (3.8–5.2)	654.3 (586.4–736.8)	15 (13.4–16.9)	8.7 (7.9–9.7)
Syrian Arab Republic	848.9 (640.8–1107.8)	11.4 (8.6–14.9)	18.9 (14.9–23.7)	1174.7 (742.6–1603.8)	16.6 (10.5–22.7)	20.5 (13.3–27.4)
Taiwan (Province of China)	2324.2 (1803–2931.1)	19.5 (15.1–24.6)	10.9 (8.4–13.8)	4962.9 (3871.1–6399.5)	42.4 (33–54.6)	28.2 (22.1–36.2)
Tajikistan	909.6 (727–1131.4)	19.4 (15.5–24.1)	33.1 (26.5–40.3)	1278.1 (1024.7–1585.2)	26.6 (21.4–33)	44.8 (35.9–56.1)
Thailand	5812.3 (4327.7–7720)	16.2 (12.1–21.5)	10.6 (7.9–14.1)	13791.1 (10126.9–18214.7)	40.3 (29.6–53.2)	29.5 (21.8–38.7)
Timor-Leste	67.4 (44–95.9)	10.2 (6.7–14.5)	17 (11.4–24.1)	142.9 (75.9–234.4)	21.2 (11.2–34.7)	33.7 (18.6–55.4)
Togo	484.5 (301.1–690)	12 (7.4–17.1)	22.4 (13.1–32.1)	787.6 (524.7–1127.4)	20.3 (13.5–29.1)	41.3 (28.1–58.3)
Tokelau	0.1 (0.1–0.1)	12.8 (8–18.7)	13.6 (8.7–19.9)	0.1 (0.1–0.2)	17.7 (13.1–23.6)	19.6 (14.6–26.1)
Tonga	6.3 (4.6–8.4)	12.2 (8.9–16.3)	14.2 (10.4–19)	12.7 (9.7–16.4)	25 (19–32.1)	33.3 (25.6–42.4)
Trinidad and Tobago	56.2 (41.4–75.1)	8.1 (6–10.9)	6.1 (4.5–8.1)	131.3 (95.4–176.8)	18.9 (13.7–25.4)	14.8 (10.8–19.9)
Tunisia	545.2 (385.7–775.4)	9.4 (6.6–13.3)	9 (6.4–12.8)	821.6 (556.2–1233.7)	14.3 (9.7–21.4)	14.5 (10–21.3)
Turkey	3226.5 (2554.6–3970.7)	8 (6.3–9.9)	7.1 (5.7–8.8)	4122.8 (3253.7–5179.5)	10 (7.9–12.6)	10.3 (8.1–12.9)
Turkmenistan	803.6 (645–1010.5)	32.3 (25.9–40.6)	34.6 (27.9–43.6)	1577.4 (1275–1964.2)	60.8 (49.1–75.7)	71.1 (57.8–87.7)
Tuvalu	0.7 (0.4–1.1)	12.8 (7.5–19.4)	13.9 (8.3–20.9)	1.5 (1–2.3)	25 (16–36.8)	29.9 (19.8–43.5)
Uganda	1840.3 (1036.1–2466.8)	8.8 (5–11.8)	23 (13–30.3)	3348.6 (2285.2–4550.7)	16.6 (11.3–22.5)	46.9 (31.3–62.9)
Ukraine	6299.8 (4832–8161.8)	26.5 (20.3–34.4)	17.9 (13.5–23.2)	13841.2 (10878.7–17099.7)	68.2 (53.6–84.3)	50.1 (39.5–61.7)
United Arab Emirates	85.6 (51.9–125.9)	3.4 (2–5)	10.1 (5.9–15.7)	420.1 (252.3–622.9)	6.3 (3.8–9.3)	13.4 (7.6–20)
United Kingdom	3964.7 (3653.6–4328.6)	11.7 (10.8–12.7)	7 (6.5–7.5)	6066.8 (5765–6409.3)	18.2 (17.3–19.3)	12.2 (11.7–12.9)

(Continued)

Table 4. Continued.

Country	Female			Male		
	Mortalities NO. (95% UI)	Death rate per 100,000 NO. (95% UI)	ASDR per 100,000 NO. (95% UI)	Mortalities NO. (95% UI)	Death rate per 100,000 NO. (95% UI)	ASDR per 100,000 NO. (95% UI)
United Republic of Tanzania	3072 (1700.8–4411.3)	10.5 (5.8–15.1)	23 (12–33.7)	5474.6 (3933.7–7571.9)	19.8 (14.3–27.4)	41.5 (29.3–57.1)
United States of America	26066.1 (24303.2–27545.6)	15.6 (14.6–16.5)	9.4 (8.9–9.9)	41220.4 (39347.1–42657)	25.6 (24.4–26.4)	17.3 (16.5–17.9)
United States Virgin Islands	9.3 (7.3–11.3)	17.1 (13.3–20.6)	9.4 (7.3–11.3)	23.8 (18.3–28.4)	48.3 (37.1–57.7)	30.7 (23.6–36.8)
Uruguay	142.5 (118.7–166.7)	8 (6.6–9.3)	4.3 (3.6–5)	328.5 (295.1–365.4)	19.9 (17.9–22.2)	15 (13.5–16.6)
Uzbekistan	5509.3 (4623.5–6541.2)	32.7 (27.4–38.8)	43.9 (37.3–51.2)	7533 (6291.9–8925.9)	44.8 (37.4–53.1)	64 (54.1–75.1)
Vanuatu	13.1 (7.7–19.6)	9 (5.3–13.5)	15 (9.1–21.9)	36.3 (21.5–53.5)	24.3 (14.4–35.8)	36 (21.4–53.2)
Venezuela (Bolivarian Republic of)	1065.8 (755–1415)	7.5 (5.3–9.9)	6.9 (4.9–9.2)	3626 (2653.4–4782.9)	26.3 (19.3–34.7)	25.6 (18.8–33.6)
Viet Nam	5686.6 (4209.6–7370.6)	11.7 (8.7–15.2)	11.5 (8.5–14.9)	17950.3 (13796.6–22803.6)	37.6 (28.9–47.8)	42.4 (32.9–52.3)
Yemen	1182.9 (803.7–1668.4)	7.6 (5.2–10.7)	17.5 (11.7–25.8)	1602.9 (1035.3–2353.6)	10.1 (6.5–14.8)	24.4 (15.8–37)
Zambia	1401.7 (1037.2–1848.6)	15.2 (11.2–20)	38 (29.1–50.4)	3191.3 (2460.2–4152.9)	35.4 (27.3–46.1)	84.6 (67.7–105.1)
Zimbabwe	685.1 (232.8–1142.5)	8.8 (3–14.6)	17 (5.8–28.4)	1380 (885.2–2016)	19.1 (12.3–28)	41.2 (27.2–59.6)

ASDR: age-standardized death rate; UI: uncertainty interval.

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Combined with the above analysis, it is clear that the incidence of liver cirrhosis will continue to rise in the future, and that the risk of developing liver cirrhosis is always much higher in males than in females.

4. Discussion

Our study is the first to report on changing trends in liver cirrhosis at the global, regional, and national levels over 30 years, and predicts changes over the next 20 years. Furthermore, the targeted analysis of the etiology, risk factors, and the impact of HDI and SDI on ASR, could further guide national healthcare policy development and the implementation of related interventions.

Globally, the number of cases of liver cirrhosis has increased by more than seven hundred thousand cases between 1990 and 2019, reaching a staggering more than 2 million cases by 2019, but the ASR has declined. The reason for this contradiction should be attributed to the rapid increase in population size and aging degree [12,13]. Furthermore, we noted significant differences in ASR across regions. In 2019, the ASR in the central Asia area was as high as 59.1 per 100,000, while the lowest Oceania area was only 8.5 (Table 1). This difference is mainly caused by the types of viral infection, alcohol consumption level, social development level, and the abundance of medical resources [4]. The country-level analysis found the most pronounced decline in the incidence of cirrhosis in the Republic of Korea. Between 1990 and

2019, the number of cases of liver cirrhosis decreased by 43.9%, and the ASR decreased by 3.9% annually (Table 1). The reason for this beneficial change should come from the introduction of vaccination in 1983 and the national immunization in 1995, which reduced the prevalence of hepatitis virus and thus caused a significant decrease in the incidence of cirrhosis [14]. Therefore, immunization at the national level is very effective in reducing the disease burden of liver cirrhosis.

The etiology of liver cirrhosis has similarly changed significantly over the last 30 years. In 1990, the main cause of liver cirrhosis was hepatitis B virus infection (24.3%), but by 2019, HCV infection rose to first place (26.9%) (Figure 4). The all-age prevalence of chronic hepatitis B decreased in all WHO regions between 1990 and 2019, from 6.0% in 1990 to 3.1% in 2019 [15]. This beneficial change was largely attributed to the availability of the hepatitis B vaccine, with its global coverage estimated at 81% by the end of 2013, and with childhood universal vaccination systems established in 183 out of 194 countries [16]. Our finding that East Asia continues to have the highest rate of HBV-related cirrhosis globally is consistent with the study by Lan et al. [17]. This is mainly due to the large number of hepatitis B patients in China, where about 30% of cirrhosis cases in 2019 were HBV-related [18]. As the other virus, which causes the most liver cirrhosis except for hepatitis B virus, the prevalence of HCV remained relatively stable between 1990 and 2019 [8,11,19]. Therefore, the proportion of liver cirrhosis caused by hepatitis C has increased.

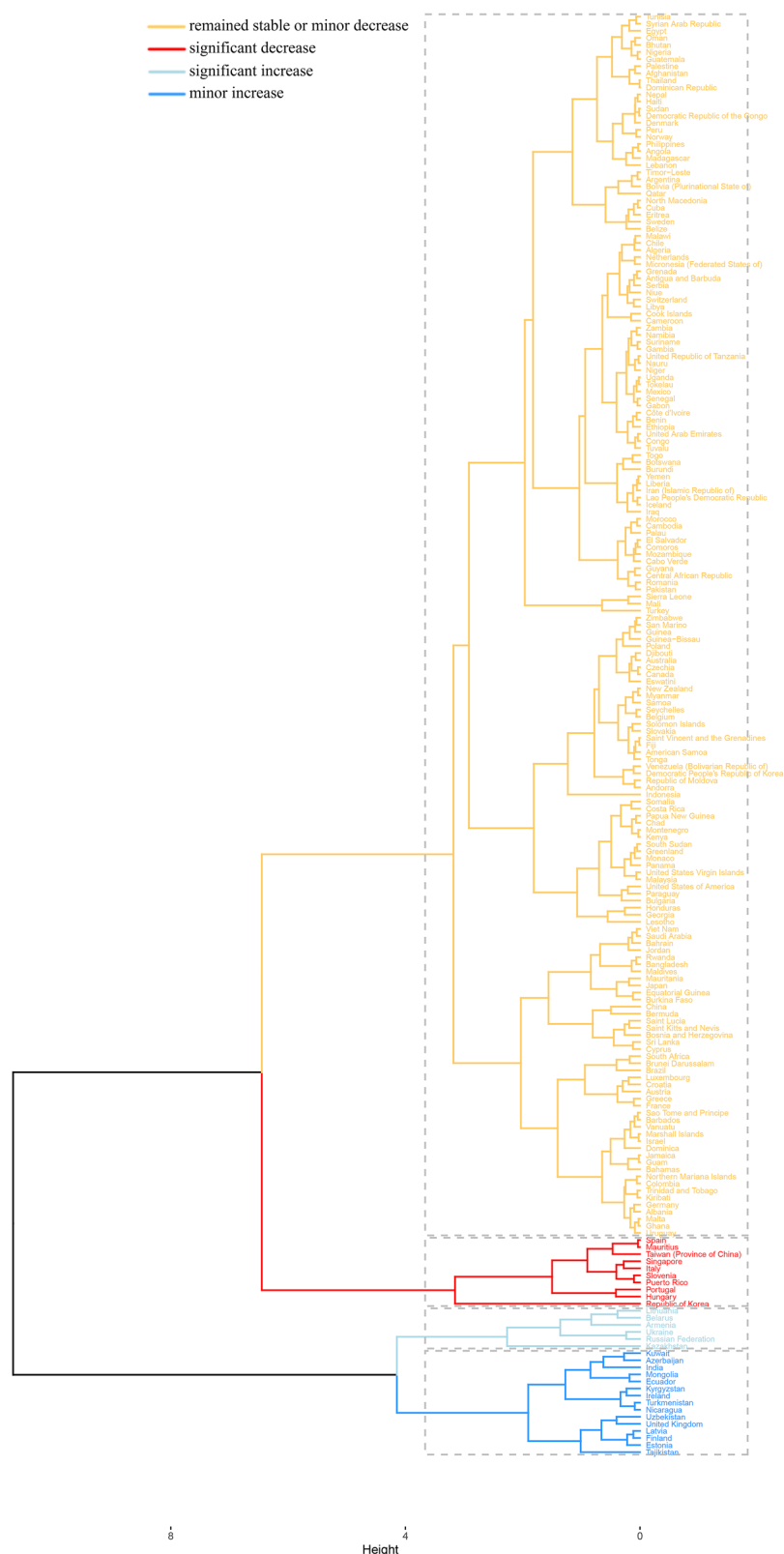


Figure 3. Cluster analysis: Estimated annual percent change data combining incidence and deaths. *Source:* Institute for Health Metrics and Evaluation. Used with permission. All rights reserved.

Notably, cirrhosis caused by non-alcoholic steatohepatitis (NASH), a type of NAFLD, is on the rise. A recent meta-analysis of population-based studies

suggests that the incidence of NASH has increased globally in recent years [20]. According to NHANES data, the prevalence of NASH cirrhosis increased

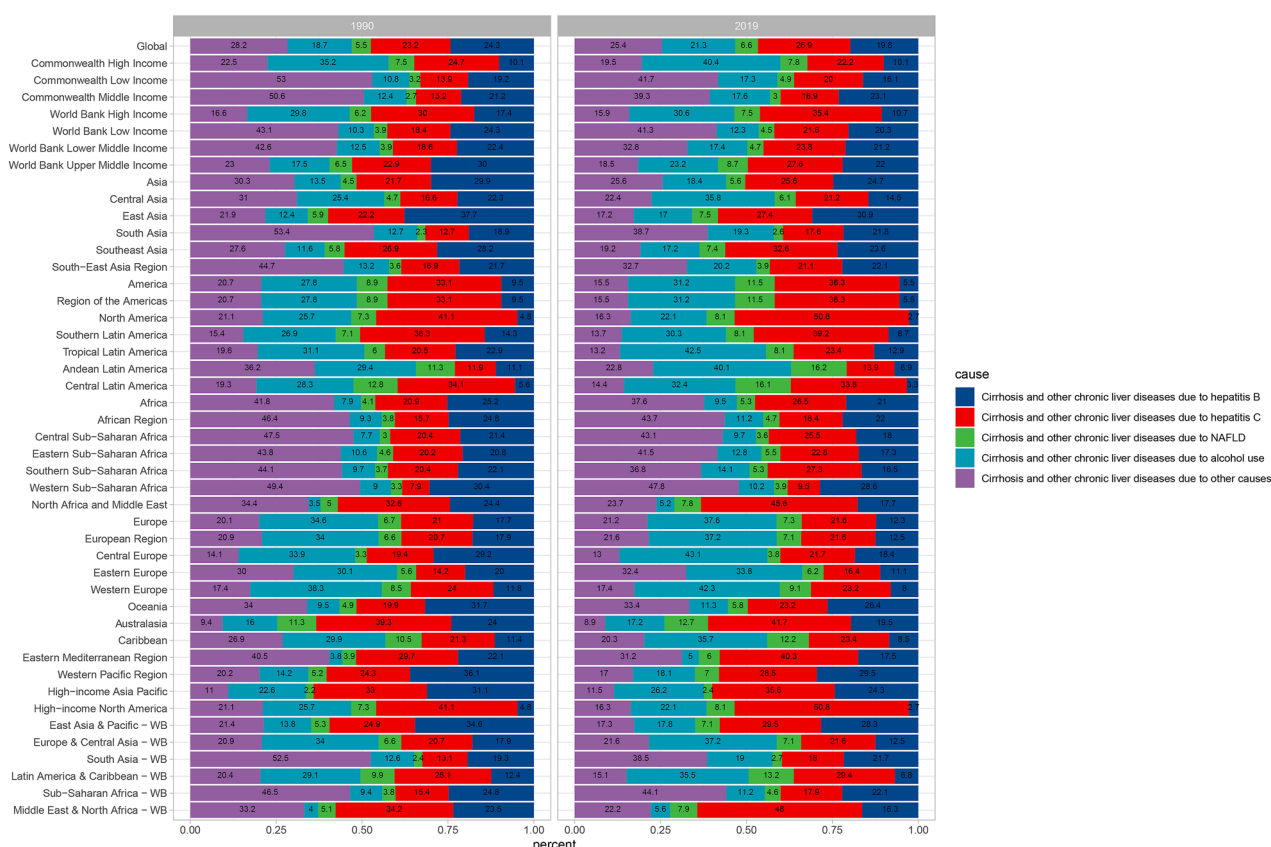


Figure 4. Contribution of hepatitis B, hepatitis C, NAFLD, alcohol use, and other causes to cirrhosis cases (in both genders), globally and regionally, in 1990 and 2019: A. The proportion of cirrhosis caused by various causes in 1990; B. The proportion of cirrhosis caused by various causes in 2019. NAFLD, Non-alcoholic fatty liver disease. *Source:* Institute for Health Metrics and Evaluation. Used with permission. All rights reserved.

2.5-fold from 1999–2002 to 2009–2012 [21]. Ye et al. also showed that the death rate of cirrhosis caused by NASH was increasing, and the increase was most obvious in Asia [22]. The burden of cirrhosis due to NASH will grow due to the global increase in metabolic syndrome and obesity and the lack of viable treatments [23,24]. It is particularly alarming that NASH has become one of the leading causes of liver cancer worldwide [25]. Therefore, weight loss to maintain a normal BMI range to reduce the risk of the metabolic syndrome caused by NASH should be actively promoted worldwide [26,27].

Cirrhosis caused by alcohol use still cannot be ignored. According to our analysis, the proportion of alcoholic cirrhosis and its impact on deaths and DALYs were highest in Central and Western Europe (Figures 4 and 6(A)). A previous study based on GBD 2017 similarly supported our conclusions. The study showed that the highest proportion of alcohol-related cirrhosis deaths was in Central Europe (44.0%) and Western Europe (41.7%) [8]. The burden of disease analysis of alcoholic cirrhosis in the study by Zhang et al. showed that the largest increase in age-standardized death rates was observed in the Eastern European region,

whereas the decline was observed in the Western European region [28]. In previous studies, alcohol consumption per capita was high in Eastern Europe and the prevalence of harmful alcohol consumption was still increasing in this region [29,30]. Together with our study, we can predict that the proportion of alcohol-related cirrhosis deaths in Eastern Europe will increase significantly in the future. Thus, regions with a high burden of alcohol-related cirrhosis, such as Central and Western Europe, could reduce alcohol consumption through policies such as increasing alcohol taxes, implementing minimum prices, and raising the national legal drinking age [30,31]. However, alcohol use in the Middle East has the lowest DALYs (11.8%) and deaths (10.4%), which is largely related to religious practices in the region [4]. Unsurprisingly, drug use in North America and high-income North America caused the highest DALYs (41.6%) and deaths (39.4%) (Figure 6(B)). Previous studies have shown that drug use is the second largest route of HCV transmission, widely affecting industrialized countries, especially the United States [32]. The rise in HCV infection in recent years the high levels of DALYs and deaths in liver cirrhosis due to drug use are directly related in North America.

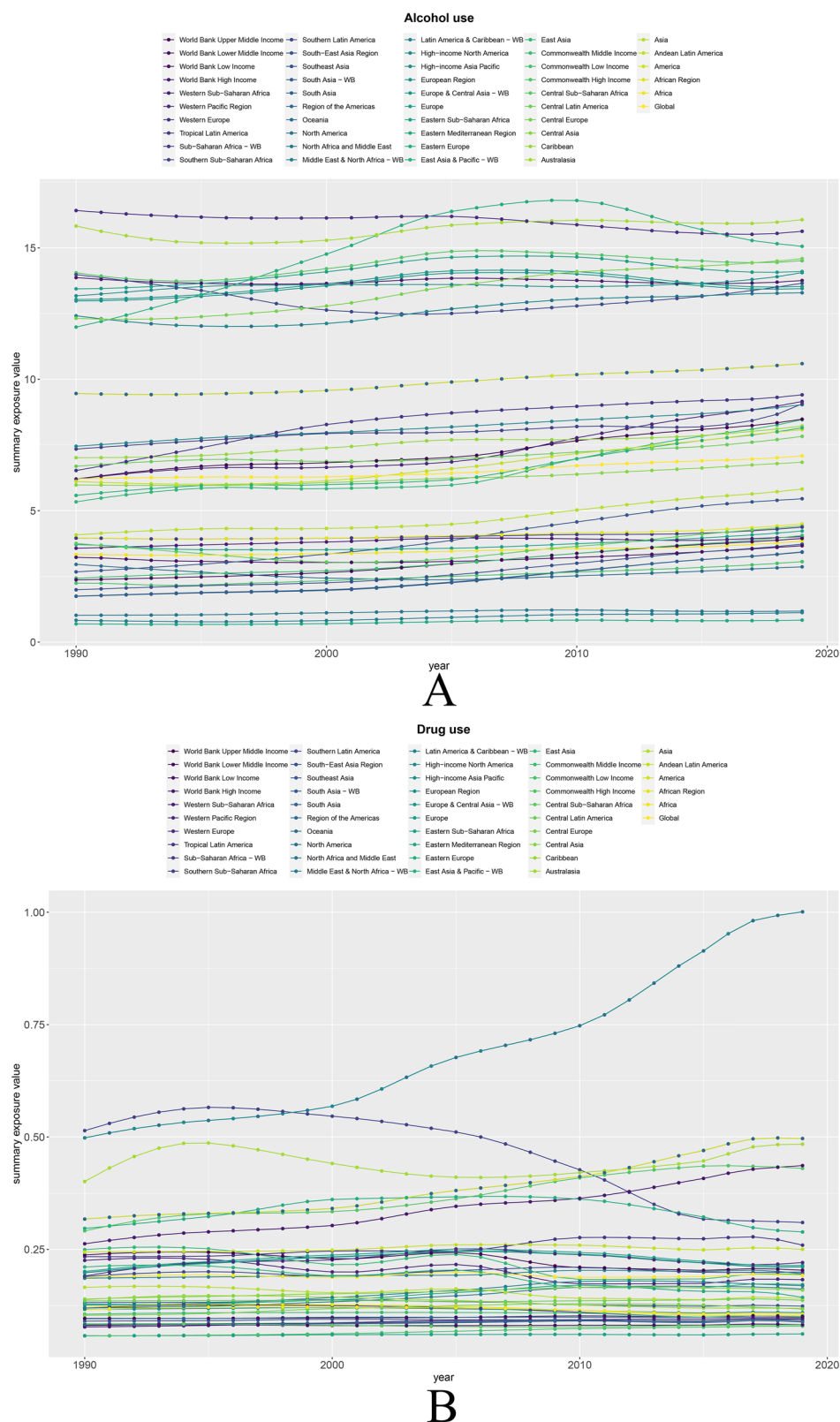


Figure 5. Summary exposure value changes of alcohol and drug use in 46 GBD regions from 1990 to 2019: A. Changes in SEV for alcohol use; B. Changes in SEV for alcohol use. *Source:* Institute for Health Metrics and Evaluation. Used with permission. All rights reserved.

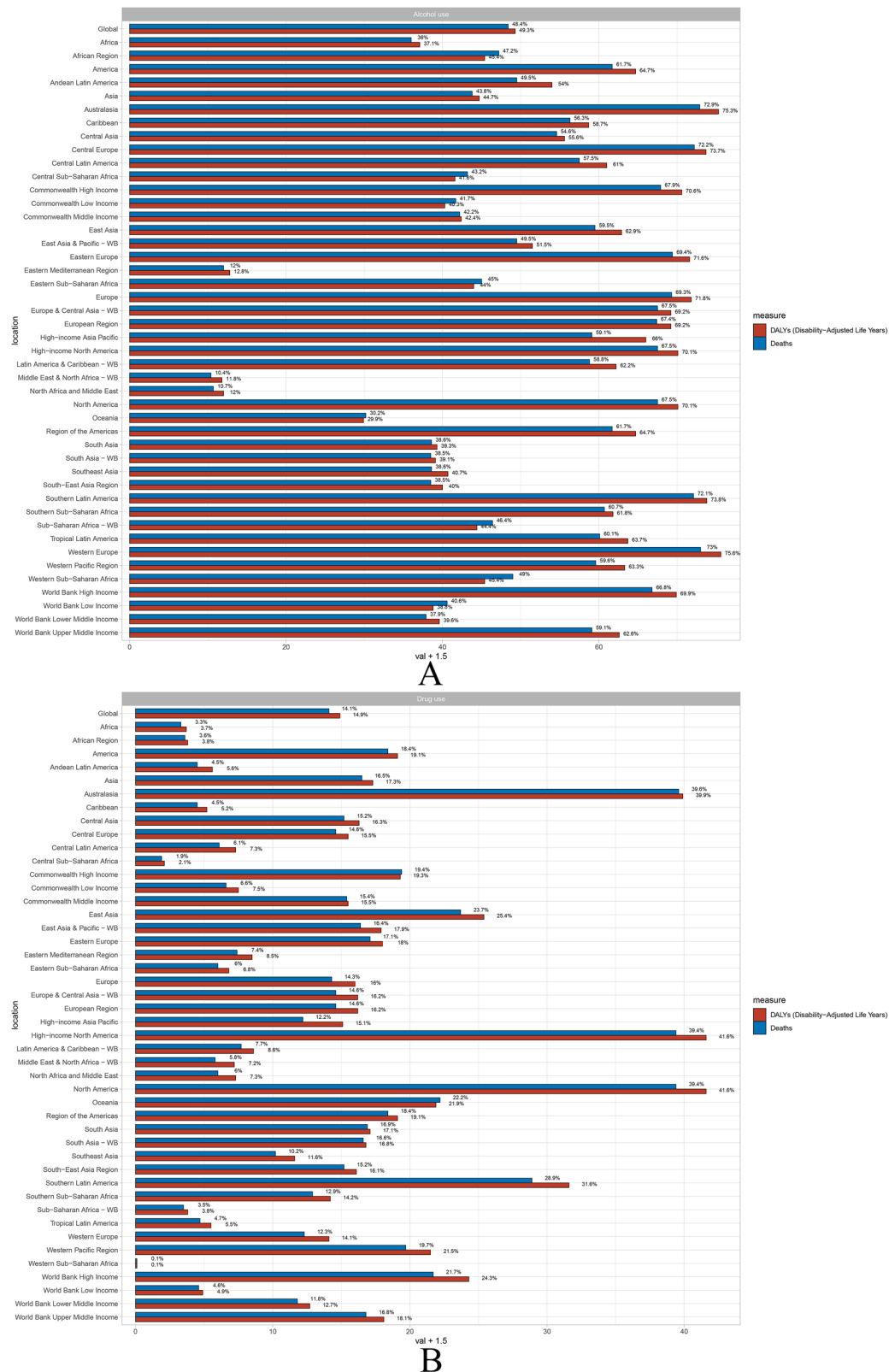


Figure 6. Proportion of DALYs and deaths from cirrhosis due to alcohol use and drug use in 46 GBD regions in 2019: A. Proportion of DALYs and death in cirrhosis due to alcohol use; B. Proportion of DALYs and death in cirrhosis due to drug use. DALYs, Disability Adjusted Life Year; GBD, Global Burden of Disease, Injury, and Risk Factors Study. *Source:* Institute for Health Metrics and Evaluation. Used with permission. All rights reserved.

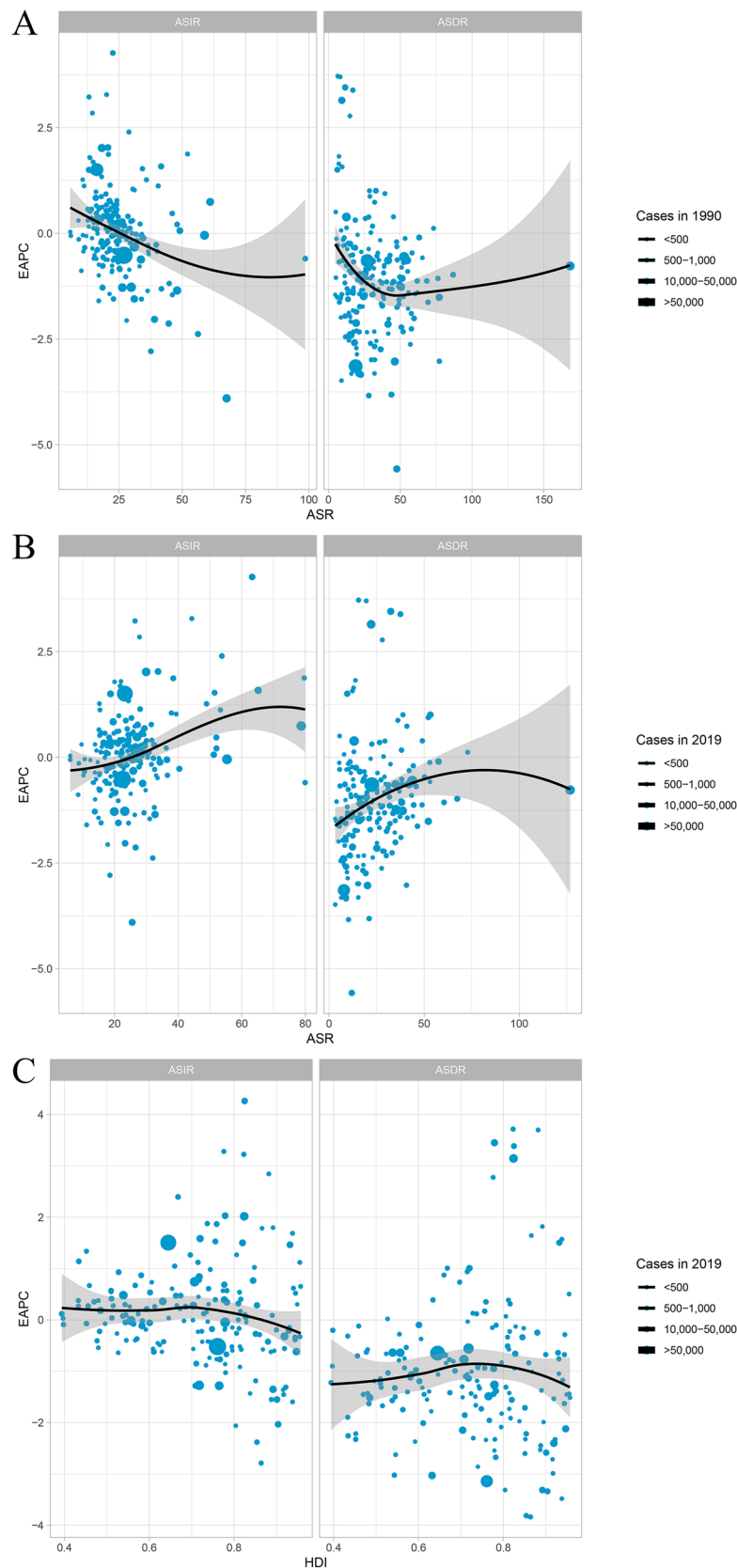


Figure 7. Correlation of EAPC with cirrhosis ASIR and HDI: A. Correlation of EAPC with cirrhosis ASIR and ASDR in 1990. B. Correlation of EAPC with 2019 cirrhosis ASIR and ASDR. C. Correlation of EAPC with 2019 HDI. The circles in the figure represent countries, and the size of the circles represents the number of cases of cirrhosis. ρ and P values were obtained from Pearson correlation coefficient analysis. ASR, age-standardized rate; ASIR, age-standardized incidence rate; ASDR, age-standardized death rate; EAPC, estimated annual percentage change; HDI, human development index. *Source:* Institute for Health Metrics and Evaluation. Used with permission. All rights reserved.

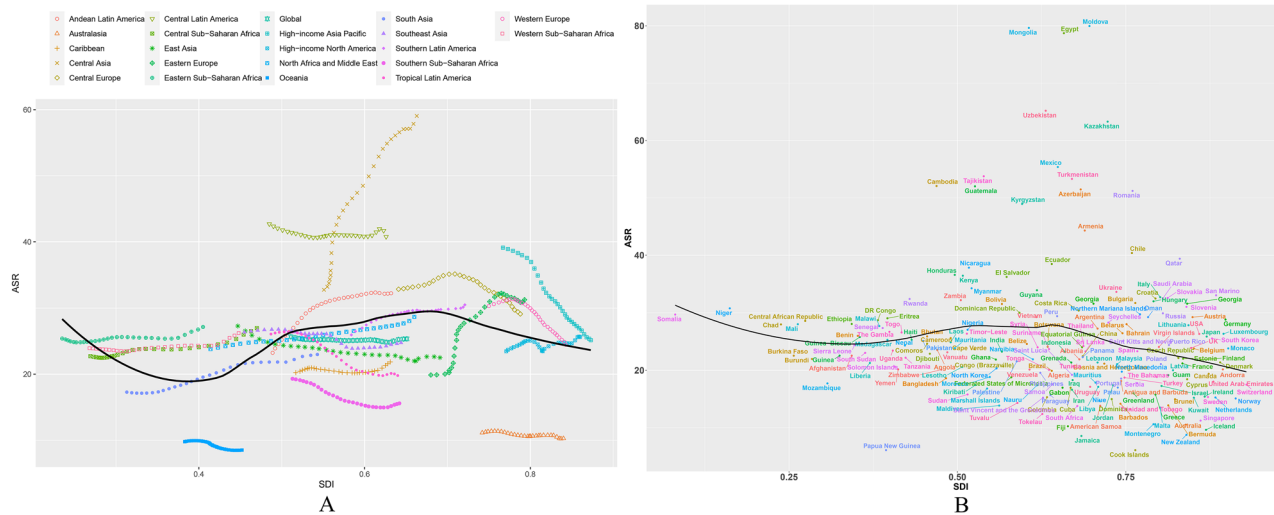


Figure 8. ASR trends in cirrhosis by socio-demographic index, 1990–2019: A. 21 GBD regions; B. 204 countries and territories. Expected values for sociodemographic indices and disease incidence based on all sites are shown as black lines. ASR, age-standardized rate; GBD, Global Burden of Diseases, Injuries, and Risk Factors Study. *Source:* Institute for Health Metrics and Evaluation. Used with permission. All rights reserved.

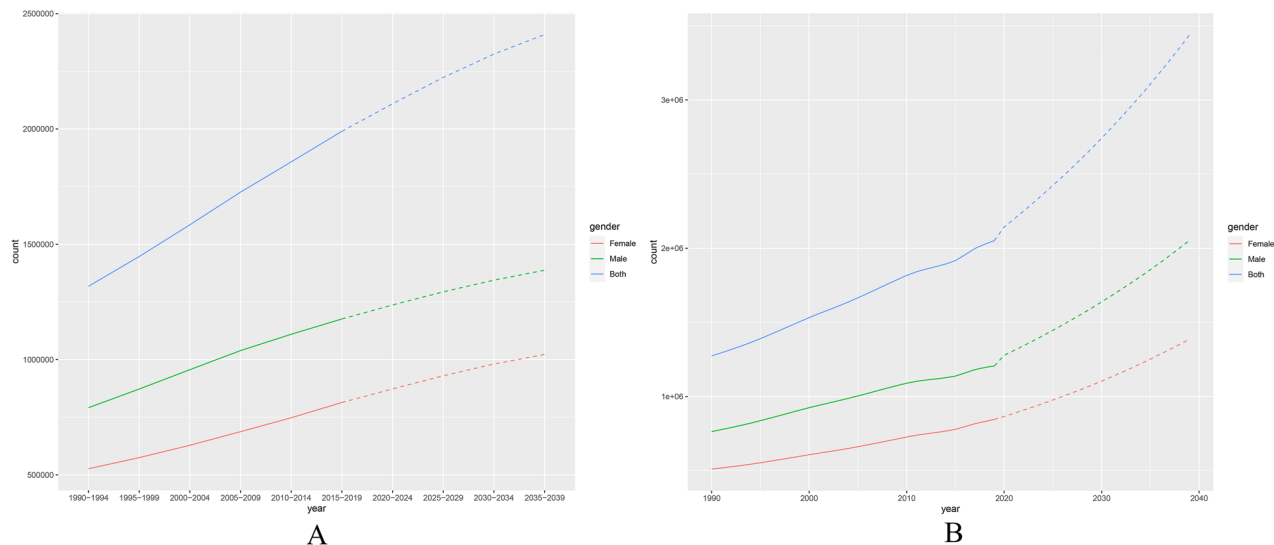


Figure 9. Statistics and predictions of the number of cases in all age groups: A. Prediction based on Nordpred model; B. Prediction based on BAPC model. *Source:* Institute for Health Metrics and Evaluation. Used with permission. All rights reserved.

Although there are some exceptions, the age-standardized incidence of liver cirrhosis is inversely associated with SDI at the national level. Correspondingly, a previous GBD 2017–based study showed that higher SDI levels also showed lower DALYs and deaths [8]. In general, a higher SDI in a country is associated with higher economic, educational, and healthcare levels [33]. The study by Gorgani et al. also confirmed that the quality-of-care index (Qci) was higher in countries with high SDI [34]. Therefore, well-developed infrastructure, higher education level, and medical quality may be associated with lower ASR of liver cirrhosis in areas

with high SDI. Notably in Central Asia and Latin America, the ASR was significantly higher than at baseline and tended to increase (Figure 8). As in the previous analysis in this paper, DALYs and deaths were equally high in alcohol use in these two areas (Figure 6(A)). The study by Manthey et al. also showed a high prevalence of alcohol use disorders in Central Asia [35]. Therefore, reasoned that the abnormal increase in ASR in these two regions should be attributed to alcohol use and that alcoholic cirrhosis due to high alcohol consumption should be the primary cause of the remaining high ASR in both regions [36,37].

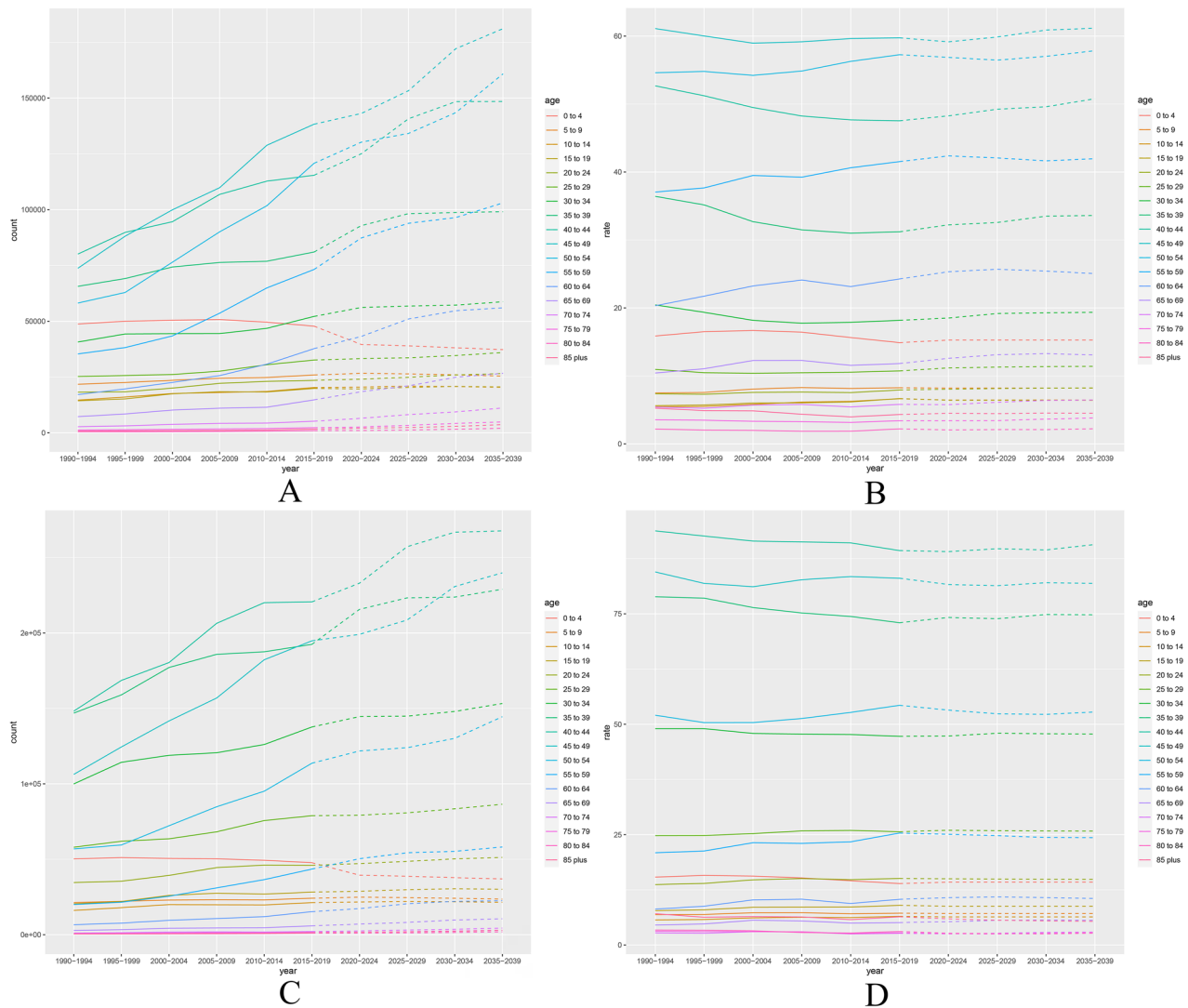


Figure 10. Cirrhosis incidence 1990–2019 and projections for the next 20 years, stratified by gender: A. Number of female cases; B. Female incidence rate; C. Number of male cases; D. Male incidence rate. Prediction of changes over the next 20 years based on the Nordpred model. Source: Institute for Health Metrics and Evaluation. Used with permission. All rights reserved.

Both Nordpred and BAPC models predict a significant increase in the number of cirrhosis cases over the next 20 years (Figures 9–12). This trend may result from the following two reasons, first, the growth and aging of the global population [38]. Second, there is an increased incidence of cirrhosis. As shown in Figure 12, the results predicted by both models indicated that the ASR of liver cirrhosis showed an overall increasing trend in the two decades after 2019. Interestingly, we found that the ASR of liver cirrhosis did not show a consistent upward trend since 1990 but fluctuated downward and then increased. Clearly, the decline in cirrhosis ASR has been due to widespread vaccination, screening, and antiviral treatment, but the increase in injection drug use, alcohol abuse, and metabolic syndrome in recent years has largely offset these benefits and will make the burden of cirrhosis even greater in the future [39].

Analyses for 1990–2019 and projections for the next 20 years both suggest that ASR is significantly higher in males than in females with cirrhosis. This difference stems from higher HBV and HCV infection, alcohol consumption, and drug injection in males [17,40]. Previous studies have shown that females have higher rates of hepatitis B surface antigen clearance and seroconversion, higher rates of hepatitis C virus clearance, and better response to interferon therapy [41–43]. In addition, oestrogen in premenopausal females can inhibit hepatic stellate cell activation and fibrosis, and lower alcohol consumption in females also leads to a significantly lower incidence of alcoholic liver disease than in males [37,44,45]. Thus, the combination of these factors contributes to a much higher global burden of cirrhosis among males than among females.

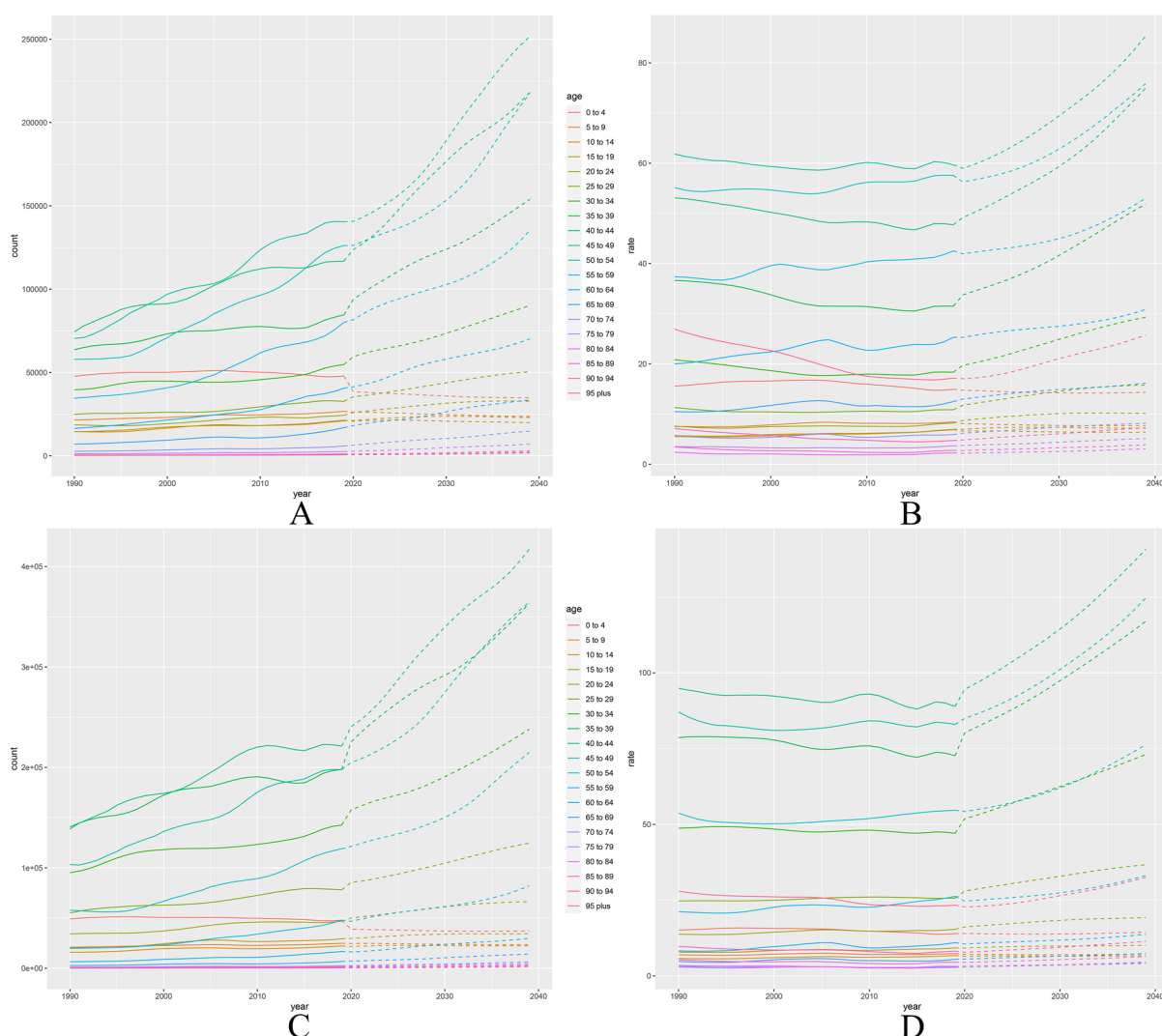


Figure 11. Cirrhosis incidence 1990–2019 and projections for the next 20 years, stratified by gender: A. Number of female cases; B. Female incidence rate; C. Number of male cases; D. Male incidence rate. Prediction of changes over the next 20 years based on the BAPC model. *Source:* Institute for Health Metrics and Evaluation. Used with permission. All rights reserved.

In recent years, the refugee problem caused by war, poverty, and economic and social reasons has also changed the disease burden of cirrhosis. Globally, refugees mostly come from developing countries in the south and enter advanced economies such as North America and Western Europe [46]. It is estimated that about 10% of the population of the European Region are migrants or refugees [47]. In addition, Italy has about half a million refugees, mainly from Central and East Asia, North Africa, Sub-Saharan Africa, and Eastern Europe [48]. However, these refugees often come from countries that have moderate or high prevalence rates of viral liver disease [49,50]. A survey of 12,880 refugees in Germany showed a significantly higher HCV seroprevalence than the general German population [51]. Coppola et al. screened 882 refugees from Italy and found that the HBV seropositive rate was as high as 8%, which was significantly higher than the level of

the Italian native population [52]. Similarly, a recent survey of refugees in Ontario, Canada, found a higher incidence of HBV-related cirrhosis among refugees than among native populations [53]. Therefore, the entry of refugees with high rates of viral hepatitis and the associated development of cirrhosis can greatly challenge the health care system of the host country. Strengthening the education of related protection knowledge, popularizing the detection of hepatitis virus infection, and injecting hepatitis B vaccine are effective methods to reduce the burden of liver cirrhosis in refugees.

In addition, considering that treatment of cirrhosis other than liver transplantation is not very prominent in improving the survival benefit of patients with decompensated cirrhosis [54]. Therefore, more extensive and effective methods should be implemented to prevent the occurrence of liver cirrhosis. The government should

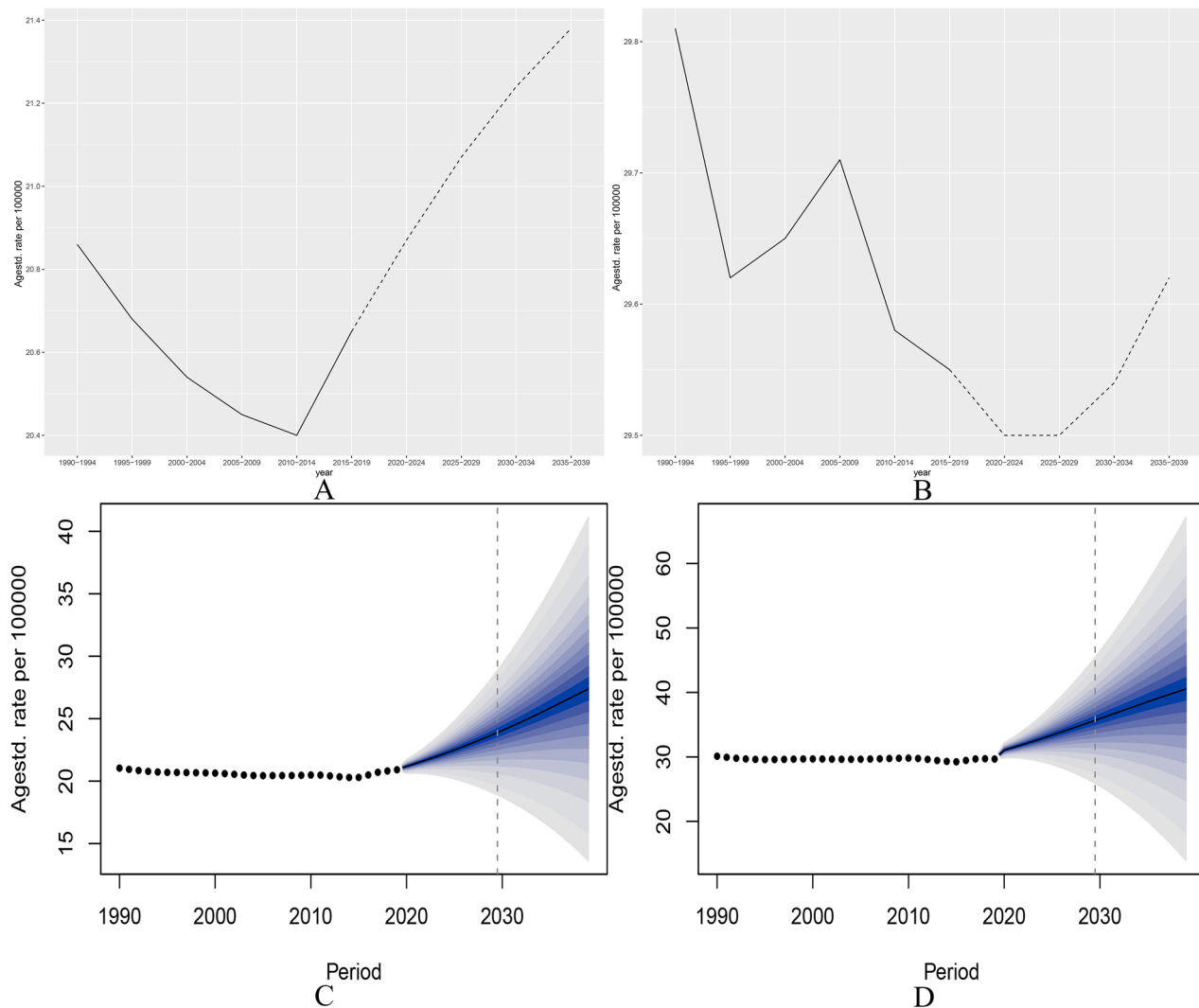


Figure 12. Statistics and predictions of cirrhosis ASR for different genders: A and B are based on the Nordpred model for females and males, respectively; C and D are based on the BAPC model, respectively. ASR, age-standardized rate. *Source:* Institute for Health Metrics and Evaluation. Used with permission. All rights reserved.

further formulate necessary public health policies to intervene in high-burden areas and high-risk populations. Examples include strengthening hepatitis B vaccination and publicizing the dangers of alcohol use and obesity. In addition, screening for transient elastography should be encouraged in patients with metabolic syndrome, chronic alcohol use, and chronic hepatitis for early diagnosis. We should not only focus on developed and developing regions but also provide essential vaccines and medicines to underdeveloped regions. Therefore, cooperation among countries and coordination among international organizations play a crucial role in reducing the global burden of liver cirrhosis.

Although the analysis of GBD in this paper can largely conclude the burden of liver cirrhosis and projections for the future, the text still has several limitations. First, this paper mainly discusses the trend of the incidence of liver cirrhosis, the number of

patients with liver cirrhosis, and the forecast value up to 2039. However, the analysis and prediction of DALYs and death trends were not analysed, only the changes in these two indicators caused by different risk factors in 1990 and 2019 were analysed. Further analyses of DALYs and deaths in liver cirrhosis are planned to better describe the disease burden of liver cirrhosis and complement the present study. Second, the accuracy of GBD estimation largely depends on the quality and quantity of the data. As in the analysis of risk factors for cirrhosis, we did not find data on smoking in the database to analyze its effect on cirrhosis. Third, the assessment of exposure risk has a delayed effect. Although we assessed SEV, DALYs, and Deaths attributable to alcohol and drug use, further follow-up is needed to determine whether related exposures contribute to the increased risk of long-term cirrhosis.

5. Conclusions

In conclusion, from 1990 to 2019, the ASR of liver cirrhosis showed a downward trend worldwide, but the number of cases continued to rise. HCV infection has also replaced HBV as the leading cause of cirrhosis. In addition, alcohol consumption as a risk factor for cirrhosis should raise alarm. Finally, our projections suggest that the number and incidence of cirrhosis will continue to increase until 2039. As a result, the global burden of cirrhosis will continue to increase, and countries should adopt broader and more effective approaches to prevent cirrhosis based on its most common causes.

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Author contributions

Yikai Wang conceived and designed the study. Yikai Wang analyzed data and wrote the manuscript. Muqi Wang and Chenrui Liu, checked the analysis results. Miao Hao, Wenjun Wang, and Juanjuan Shi helped collect data and references. Yaping Li, Xiaoli Jia, and Xin Zhang checked the article's format and language. Shuangsoo Dang is responsible for the overall content as a guarantor.

Ethical approval and consent to participate

The institutional review board of the Second Affiliated Hospital of Xi'an Jiaotong University in Shaanxi Province, China, determined that the study did not need approval because it used publicly available data.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Data availability statement

The data were obtained through an online query tool from the website of IHME (<http://ghdx.healthdata.org/>), and no permissions were required to access the data.

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