

Supplementary Materials

Global burden of liver cancer mortality due to alcohol use from 1990 to 2021 and predictions to 2050

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Supplementary Methods

Annual Percent Change and Average Annual Percent Change

To analyze time trends in age-standardized mortality rates (ASMR) for liver cancer from 1990 to 2021, we adopted a Joinpoint log-linear regression model. This method identifies connections where there are significant changes in the trend, and estimates the annual percentage change (APC) for each component and the average annual percentage change (AAPC) for the entire study period. For each identified fragment, the relationship between the value and time of ASMR can be expressed as:

$$\log(y_t) = \beta_0 + \beta_1 t.$$

The APC for each segment is calculated using the formula:

$$APC = \frac{y_{t+1} - y_t}{y_t} \times 100 = \frac{e^{\beta_0 + \beta_1(t+1)} - e^{\beta_0 + \beta_1 t}}{e^{\beta_0 + \beta_1 t}} \times 100 = (e^{\beta_1} - 1) \times 100.$$

This equation provides the annual percentage change as a relative measure of the trend within a segment. Confidence intervals (CIs) for APC values are calculated using a Monte Carlo permutation method to ensure robust statistical inference. There are two ways to determine the number of join points, one is to select the optimal number by Bayesian information criteria (BIC), the other is to provide a specified number of join points, and then the model recognizes the join point location.

The AAPC was calculated as a weighted average of APCs across all identified segments and can be simplified to:

$$AAPC = \left\{ \exp \left(\frac{\sum w_i \beta_i}{\sum w_i} \right) - 1 \right\} \times 100.$$

Where i indexes the segments within the selected time range, and w_i represents the length of each segment. The significance of joinpoints was evaluated at the 0.05 level. Significant positive APC or AAPC values indicate increasing mortality rates, whereas significant negative values suggest decreasing rates. Non-significant values imply stable trends. The above calculations are implemented in Joinpoint 4.9 software.

Bayesian Age-Period-Cohort model

The Bayesian age-period-cohort (BAPC) model was applied using the BAPC package available on R-forge (<https://r-forge.r-project.org/projects/bapc/>) to predict the ASMR

of liver cancer in 2022-2050, and its 95%CI was calculated. BAPC model is commonly used to predict the incidence and mortality trends of diseases with age, period and cohort effects as covariates(1, 2). Age is a risk factor for liver cancer mortality, and period and birth cohort can be viewed as surrogate variables for other factors that cannot be directly measured. Therefore, BAPC models can not only describe disease trends in terms of age, period, and birth cohort, but also predict future changes based on these trends. Assuming that the number of deaths observed in age group i and period j follows the Poisson distribution with an average of $\eta_{ij}\lambda_{ij}$, where η_{ij} is the exposure time, then the BAPC model we established is a log-linear Poisson model with multiplicative effects on age $\alpha_i(i=1,2,\dots,I)$, period $\beta_j(j=1,2,\dots,J)$ and cohort $\gamma_k(k=1,2,\dots,K, K=M[I-i]+j, M=5)$:

$$\log(\lambda_{ij}) = \mu + \alpha_i + \beta_j + \gamma_k.$$

Let age, period, and cohort effects be second-order random walk models. Furthermore, the default weakly informative log-gamma prior, $Gamma(1, 0.00005)$, was assigned to the precision parameters of these random effects. Then we used independent zero-mean Gaussian random effects to adjust for overdispersion:

$$\log(\lambda_{ij}) = \mu + \alpha_i + \beta_j + \gamma_k + e_{ij}, \alpha_i \sim N(2\alpha_{i-1} - \alpha_{i-2}, \chi^{-1}), i=2, \dots, I, e_{ij} \sim N(0, \chi^{-1}).$$

BAPC model adopts integrated nested Laplacian approximation (INLA) for posterior edge distribution approximation, which avoids mixing and convergence problems and shows relatively low error rate. The above calculation can be used in R 4.3.0 software BAPC to implement and the INLA package, from the R - Forge (<https://r-forge.r-project.org/projects/bapc/>).

Bayesian spatiotemporal model

Further, The overall spatial (S_i) and temporal (θ_t) effects were decomposed into structured and unstructured components. Structured spatial effects u_i captured smooth geographic variation driven by similarity between adjacent countries, implemented through an intrinsic conditional auto-regressive (ICAR) prior. In contrast, unstructured spatial effects v_i followed independent and identically distributed (IID)

normal priors, representing country-specific deviations independent of spatial adjacency. For temporal patterns, the structured component φ_t was modeled via a second-order random walk (RW2) prior to estimate the long-term ASMR trend, while unstructured temporal effects ψ_t accommodated annual random fluctuations using IID normal priors. For the precision parameters (inverse variances) of all these random effects (ICAR, RW2, and IID components), we assigned the default independent log-gamma prior, $Gamma(1, 0.00005)$. So the model can be expressed in more detail as follows:

$$\mu_{it} = \alpha + u_i + v_i + \varphi_t + \psi_t + \delta_{it}.$$

Frontier analysis

The DEA method was used to calculate the relative efficiency score of each country/territory. Then the traditional DEA assumption on convexity was relaxed by the free disposal hull to construct an efficiency frontier that was more consistent with the actual data distribution. By comparing the ASMR of each country with the ASMR of the frontier, namely the theoretical optimal ASMR, the effective difference (*ED*) was calculated as follows:

$$ED_j = ASMR_j - Frontier_ASMR_j,$$

where $ED_j = 0$ was defined as country j had reached the theoretical optimal ASMR, while $ED_j > 0$ indicated that country j had room for improvement in the control of ASMR for LCA. The greater the effective distance, the greater the room for improvement. From this, the optimal ASMR achievable in each country and its potential for improvement were obtained.

Decomposition analysis

In this study, Das Gupta's standardization and decomposition method(3) was used to decompose the regional difference in LCA deaths from 1990 to 2021 by age structure, population growth, and epidemiological changes to explain the differences in the burden of LCA deaths due to population composition among different regions. This method separated the observed changes into additive multiple components.

$Deaths_{ay,py,ey}$ represented the number of deaths in year y , p_y represented the total population in year y , $a_{i,y}$ represented the population proportion of age group i among the 20 age groups, and $e_{i,y}$ represented the death rate. The relationship between variables was expressed as follows:

$$Deaths_{ay,py,ey} = \sum_{i=1}^{20} a_{i,y} p_y e_{i,y} .$$

For the difference in the number of deaths between 1990 and 2021, the contribution of each factor to that difference was determined by changing one factor while keeping the others constant. For example, the effect of age structure was calculated as follows:

$$\begin{aligned} \alpha = & [(Deaths_{a2021,p1990,e1990} + Deaths_{a2021,p1990,e2021})/3 + \\ & (Deaths_{a2021,p2021,e2021} + Deaths_{a2021,p2021,e1990})/6] - \\ & [(Deaths_{a1990,p2021,e2021} + Deaths_{a1990,p1990,e1990})/3 + \\ & (Deaths_{a1990,p2021,e1990} + Deaths_{a1990,p1990,e2021})/6] . \end{aligned}$$

Then the contribution of age structure was calculated as:

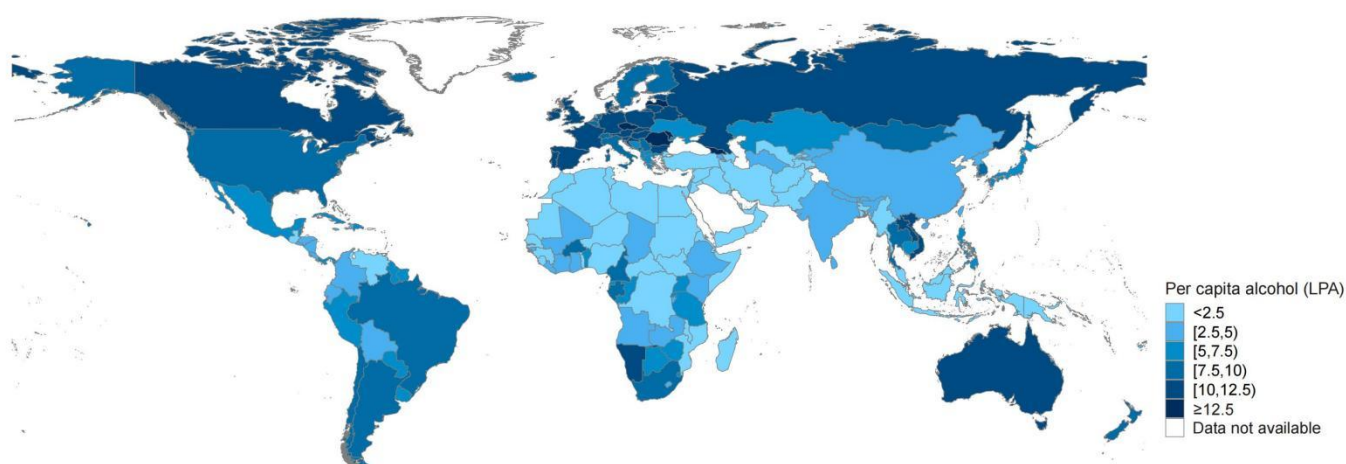
$$K_a = (\alpha / (Deaths_{a2021,p2021,e2021} - Deaths_{a1990,p1990,e1990})) \times 100\% .$$

Similarly, the contribution of population growth and epidemiologic changes were calculated.

Supplementary References

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Supplementary Figure 1. The total per capita (15+) alcohol consumption (in litres of pure alcohol) for 204 countries and territories in 2022



Supplementary Table 1. The predicted ASMR for LCA in 2050 and AAPC stratified by sex and region from 2022 to 2050 worldwide and in the WHO regions

Sex	Location	2050 ASMR (95% UI)	2022-2050 AAPC (95% CI)
Total	Global	0.93 (0.00 - 1.86)	-0.50 (-0.50 - -0.50)
	African region	1.14 (0.00 - 2.60)	-0.37 (-0.38 - -0.37)
	Eastern Mediterranean region	0.65 (0.00 - 1.39)	0.38 (0.36 - 0.40)
	European Region	1.18 (0.00 - 2.67)	-0.46 (-0.46 - -0.45)
	Region of the Americas	0.99 (0.00 - 2.12)	-0.12 (-0.14 - -0.10)
	South-East Asia region	0.99 (0.03 - 1.95)	0.39 (0.38 - 0.40)
	Western Pacific region	0.82 (0.00 - 2.47)	-0.96 (-0.96 - -0.96)
Male	Global	1.59 (0.09 - 3.09)	-0.41 (-0.41 - -0.40)
	African region	1.63 (0.00 - 4.00)	-0.50 (-0.50 - -0.49)
	Eastern Mediterranean region	1.01 (0.00 - 2.22)	0.53 (0.52 - 0.54)
	European Region	2.05 (0.00 - 4.63)	-0.75 (-0.76 - -0.74)
	Region of the Americas	1.70 (0.00 - 3.60)	-0.17 (-0.19 - -0.14)
Female	South-East Asia region	1.70 (0.00 - 3.41)	0.49 (0.48 - 0.50)
	Western Pacific region	1.46 (0.00 - 4.08)	-0.46 (-0.46 - -0.45)
	Global	0.34 (0.00 - 0.70)	-1.03 (-1.04 - -1.02)
	African region	0.71 (0.00 - 1.49)	-0.08 (-0.09 - -0.08)
	Eastern Mediterranean region	1.01 (0.00 - 2.22)	0.53 (0.52 - 0.54)

Eastern Mediterranean region	0.26 (0.00 - 0.57)	-0.13 (-0.14 - -0.13)
European Region	0.37 (0.00 - 0.86)	-0.42 (-0.42 - -0.42)
Region of the Americas	0.46 (0.00 - 0.97)	0.65 (0.65 - 0.66)
South-East Asia region	0.41 (0.00 - 0.83)	0.65 (0.65 - 0.66)
Western Pacific region	0.23 (0.00 - 0.73)	-2.92 (-2.93 - -2.91)

ASMR: Age-standardized mortality rate; LCA: liver cancer due to alcohol use; AAPC: average annual percentage change; WHO: World Health Organization; UI: uncertainty interval; CI: confidence interval.

Supplementary Table 2. The predicted ASMR for LCA in 1990, 2021 and 2050, and AAPC during 1990-2021 and predicted value during 2022-2050 in 204 countries and territories

Location	ASMR (95% UI)			AAPC (95% CI)	
	1990	2021	2050	1990-2021	2022-2050
Afghanistan	0.47(0.24 to 0.79)	0.47(0.26 to 0.75)	0.6(-0.15 to 1.35)	-0.02(-0.14 to 0.11)	0.99(0.97 to 1.01)
Albania	3.64(2.27 to 5.25)	2.82(1.72 to 4.33)	3.47(-11.81 to 18.76)	-0.8(-1.47 to -0.13)	0.68(0.66 to 0.71)
Algeria	0.12(0.08 to 0.19)	0.18(0.11 to 0.28)	0.57(-0.51 to 1.66)	1.21(1.07 to 1.34)	4.52(4.51 to 4.53)
American Samoa	0.44(0.27 to 0.68)	0.65(0.41 to 0.99)	0.7(-0.5 to 1.91)	1.3(0.69 to 1.91)	0.44(0.43 to 0.44)
Andorra	3.9(2.57 to 5.92)	3.24(2.04 to 4.94)	2.27(-2.62 to 7.17)	-0.61(-0.87 to -0.36)	-1.22(-1.23 to -1.21)
Angola	2.05(0.23 to 6.12)	1.48(0.31 to 4.03)	1.38(-0.31 to 3.07)	-1.06(-1.41 to -0.71)	-0.13(-0.14 to -0.11)
Antigua and Barbuda	0.9(0.65 to 1.19)	0.97(0.74 to 1.22)	4.09(-12.65 to 20.84)	0.25(-1.06 to 1.58)	5.17(5.17 to 5.18)
Argentina	0.2(0.15 to 0.26)	0.33(0.24 to 0.43)	0.22(-0.52 to 0.96)	1.69(0.91 to 2.47)	-1.18(-1.18 to -1.18)
Armenia	1.76(1.15 to 2.46)	1.6(1.13 to 2.19)	2.2(-21.4 to 25.8)	-0.21(-0.77 to 0.35)	1.02(1.01 to 1.02)
Australia	0.76(0.59 to 0.93)	2.01(1.57 to 2.5)	3.17(-0.67 to 7)	3.12(2.31 to 3.93)	1.52(1.50 to 1.54)
Austria	1.54(1.28 to 1.77)	2.75(2.25 to 3.27)	2.32(-1.86 to 6.49)	1.81(0.99 to 2.64)	-0.64(-0.65 to -0.63)
Azerbaijan	1.61(0.86 to 2.71)	2.41(1.33 to 4.05)	2.02(-2.88 to 6.92)	1.31(1.15 to 1.47)	-0.66(-0.68 to -0.65)
Bahamas	1.33(1.02 to 1.75)	0.99(0.72 to 1.31)	1.39(-2.09 to 4.87)	-0.92(-1.89 to 0.06)	1.25(1.24 to 1.26)
Bahrain	1.05(0.67 to 1.58)	0.52(0.32 to 0.8)	1.2(-2.43 to 4.83)	-2.3(-2.88 to -1.72)	3.29(3.29 to 3.30)
Bangladesh	0.43(0.28 to 0.63)	0.43(0.27 to 0.65)	0.53(-0.33 to 1.39)	0.03(-0.35 to 0.41)	0.81(0.80 to 0.81)
Barbados	0.69(0.51 to 0.91)	0.91(0.66 to 1.25)	1.64(-0.83 to 4.11)	0.95(0.04 to 1.87)	2.11(2.10 to 2.13)

Location	ASMR (95% UI)			AAPC (95% CI)	
	1990	2021	2050	1990-2021	2022-2050
Belarus	0.87(0.64 to 1.14)	1.04(0.73 to 1.39)	1.21(-3.73 to 6.15)	0.57(-0.24 to 1.39)	0.51(0.49 to 0.52)
Belgium	1.08(0.83 to 1.36)	1.46(1.13 to 1.85)	0.81(-2.77 to 4.38)	1.02(0.42 to 1.63)	-2.06(-2.07 to -2.05)
Belize	0.55(0.39 to 0.76)	0.7(0.52 to 0.91)	0.78(-2.75 to 4.31)	0.89(-0.11 to 1.91)	0.45(0.42 to 0.47)
Benin	3.48(1.7 to 5.65)	2.18(1.38 to 3.26)	1.27(-1.27 to 3.8)	-1.48(-1.77 to -1.2)	-1.77(-1.78 to -1.76)
Bermuda	1.29(1.02 to 1.62)	0.59(0.43 to 0.76)	0.48(-0.76 to 1.73)	-2.59(-3.56 to -1.62)	-0.57(-0.57 to -0.56)
Bhutan	0.86(0.46 to 1.4)	0.91(0.52 to 1.44)	0.91(-0.19 to 2.01)	0.17(0 to 0.34)	0.04(0.04 to 0.05)
Bolivia (Plurinational State of)	0.86(0.54 to 1.3)	1.03(0.63 to 1.59)	1.41(-0.5 to 3.32)	0.54(0.24 to 0.83)	1.15(1.13 to 1.16)
Bosnia and Herzegovina	2.06(1.49 to 2.84)	2.29(1.57 to 3.21)	2.83(-1.67 to 7.33)	0.33(-0.48 to 1.16)	0.68(0.65 to 0.71)
Botswana	1.01(0.45 to 1.96)	1.2(0.54 to 2.47)	1.05(-2.89 to 4.98)	0.52(0.24 to 0.8)	-0.36(-0.36 to -0.35)
Brazil	0.5(0.44 to 0.57)	0.57(0.5 to 0.65)	0.27(-0.24 to 0.78)	0.48(-0.21 to 1.18)	-2.58(-2.58 to -2.57)
Brunei Darussalam	1.28(0.76 to 2.11)	0.8(0.51 to 1.27)	0.76(-0.27 to 1.79)	-1.6(-2.26 to -0.93)	-0.03(-0.05 to -0.02)
Bulgaria	3.06(2.23 to 3.92)	1.61(1.13 to 2.23)	2.63(-17.18 to 22.43)	-2.16(-3.27 to -1.05)	1.73(1.72 to 1.75)
Burkina Faso	5.7(2.6 to 11.11)	4.07(1.75 to 7.17)	2.78(-2.6 to 8.16)	-1.13(-1.38 to -0.87)	-1.25(-1.26 to -1.24)
Burundi	1.18(0.6 to 2.4)	0.56(0.28 to 1.19)	0.5(-0.79 to 1.79)	-2.41(-2.64 to -2.17)	-0.21(-0.21 to -0.20)
Côte d'Ivoire	1.43(0.8 to 2.27)	0.86(0.47 to 1.41)	0.47(-0.54 to 1.47)	-1.63(-1.83 to -1.44)	-2.01(-2.02 to -2.00)
Cabo Verde	1.6(0.97 to 2.74)	2.51(1.49 to 3.86)	3.61(-5.69 to 12.91)	1.43(1.13 to 1.74)	1.19(1.15 to 1.24)
Cambodia	1.31(0.59 to 2.7)	1.66(0.77 to 3.41)	2.66(-1.74 to 7.07)	0.74(0.57 to 0.92)	1.66(1.66 to 1.67)
Cameroon	3.45(2.15 to 5.7)	2.56(1.36 to 4.74)	2.15(-1.71 to 6)	-1(-1.25 to -0.74)	-0.50(-0.52 to -0.49)

Location	ASMR (95% UI)			AAPC (95% CI)	
	1990	2021	2050	1990-2021	2022-2050
Canada	0.98(0.81 to 1.18)	2.24(1.82 to 2.66)	2.97(-0.81 to 6.75)	2.71(2.12 to 3.31)	0.93(0.92 to 0.95)
Central African Republic	1.97(0.72 to 4.15)	1.02(0.41 to 2.2)	0.57(-0.4 to 1.54)	-2.12(-2.35 to -1.89)	-1.90(-1.90 to -1.90)
Chad	2.78(1.08 to 5.72)	2.5(1.39 to 4.52)	1.7(-1.44 to 4.83)	-0.39(-0.95 to 0.18)	-1.21(-1.22 to -1.21)
Chile	0.48(0.35 to 0.64)	0.95(0.69 to 1.24)	2.29(-2.28 to 6.86)	2.28(1.17 to 3.39)	3.11(3.10 to 3.12)
China	0.87(0.69 to 1.1)	0.85(0.64 to 1.12)	0.41(-0.89 to 1.7)	0.01(-0.44 to 0.46)	-2.60(-2.61 to -2.58)
Colombia	0.81(0.61 to 1.03)	0.65(0.45 to 0.88)	1.05(-4.04 to 6.13)	-0.82(-2.82 to 1.22)	1.69(1.69 to 1.70)
Comoros	0.91(0.47 to 1.46)	0.71(0.38 to 1.19)	0.83(-0.47 to 2.13)	-0.84(-1.29 to -0.39)	0.64(0.63 to 0.64)
Congo	1.92(0.83 to 3.61)	1.17(0.58 to 2.27)	1.63(-1.58 to 4.84)	-1.56(-1.82 to -1.3)	1.16(1.16 to 1.17)
Cook Islands	1.16(0.71 to 1.75)	2.47(1.6 to 3.8)	3.89(-3.68 to 11.47)	2.49(2.1 to 2.88)	1.67(1.66 to 1.68)
Costa Rica	1.44(1.07 to 1.86)	1.7(1.23 to 2.29)	2.99(-26.79 to 32.76)	0.7(-0.71 to 2.14)	1.92(1.89 to 1.95)
Croatia	1.1(0.84 to 1.41)	1.39(1.06 to 1.8)	0.71(-9.87 to 11.29)	0.72(-0.34 to 1.8)	-2.31(-2.37 to -2.25)
Cuba	0.63(0.47 to 0.82)	0.48(0.36 to 0.63)	0.53(-1.71 to 2.78)	-0.79(-1.56 to -0.02)	0.30(0.28 to 0.32)
Cyprus	1.17(0.78 to 1.71)	1.13(0.76 to 1.65)	0.56(-0.17 to 1.3)	-0.09(-0.28 to 0.11)	-2.32(-2.34 to -2.30)
Czechia	2.2(1.74 to 2.67)	1.29(0.97 to 1.65)	0.83(-5.02 to 6.68)	-1.7(-2.74 to -0.64)	-1.50(-1.51 to -1.50)
North Korea	0.7(0.36 to 1.22)	0.52(0.31 to 0.88)	0.32(-0.11 to 0.76)	-0.94(-1.04 to -0.84)	-1.59(-1.59 to -1.59)
Democratic Republic of the Congo	0.62(0.27 to 1.35)	0.45(0.18 to 1.06)	0.53(-0.33 to 1.39)	-1.04(-1.29 to -0.79)	0.92(0.92 to 0.92)
Denmark	0.55(0.43 to 0.7)	1.1(0.81 to 1.41)	0.43(-1.24 to 2.1)	2.28(1.25 to 3.33)	-3.24(-3.29 to -3.18)
Djibouti	0.71(0.37 to 1.27)	0.81(0.48 to 1.38)	0.75(-0.43 to 1.92)	0.43(0.19 to 0.67)	-0.08(-0.08 to -0.08)

Location	ASMR (95% UI)			AAPC (95% CI)	
	1990	2021	2050	1990-2021	2022-2050
Dominica	0.93(0.62 to 1.31)	1.26(0.87 to 1.78)	1.07(-2.39 to 4.53)	0.98(0.69 to 1.26)	-0.54(-0.55 to -0.52)
Dominican Republic	0.42(0.27 to 0.58)	0.61(0.41 to 0.88)	1.04(-0.36 to 2.44)	1.3(0.47 to 2.13)	1.77(1.76 to 1.77)
Ecuador	0.89(0.64 to 1.23)	0.72(0.5 to 1)	0.75(-7.84 to 9.33)	-0.92(-2.17 to 0.35)	0.11(0.10 to 0.12)
Egypt	1.03(0.57 to 1.93)	1.71(1.03 to 2.72)	2.74(-0.8 to 6.28)	1.65(0.97 to 2.32)	1.62(1.59 to 1.64)
El Salvador	0.43(0.29 to 0.59)	0.41(0.28 to 0.57)	0.91(-1.34 to 3.17)	-0.21(-1.02 to 0.61)	2.83(2.82 to 2.84)
Equatorial Guinea	0.46(0.2 to 1.23)	0.94(0.52 to 1.75)	3.19(-3.65 to 10.04)	2.34(2.01 to 2.67)	4.36(4.34 to 4.39)
Eritrea	0.73(0.4 to 1.28)	0.61(0.36 to 1.12)	0.63(-0.56 to 1.82)	-0.52(-0.82 to -0.22)	0.19(0.18 to 0.20)
Estonia	1.06(0.79 to 1.37)	1.56(1.18 to 2.02)	0.52(-3.03 to 4.07)	1.42(0.2 to 2.65)	-3.74(-3.76 to -3.72)
Eswatini	1.74(0.56 to 3.3)	4.33(1.51 to 9.79)	3.42(-14.35 to 21.2)	2.98(2.47 to 3.5)	-0.83(-0.84 to -0.83)
Ethiopia	0.6(0.43 to 0.94)	0.44(0.29 to 0.73)	0.78(-1 to 2.56)	-1.02(-1.17 to -0.87)	2.29(2.28 to 2.30)
Fiji	0.47(0.27 to 0.78)	0.57(0.32 to 0.91)	0.64(-0.51 to 1.8)	0.65(0.14 to 1.15)	0.46(0.46 to 0.47)
Finland	0.97(0.73 to 1.26)	1.48(1.07 to 1.91)	0.8(-1.22 to 2.81)	1.28(0.64 to 1.93)	-2.15(-2.19 to -2.12)
France	1.84(1.39 to 2.34)	1.85(1.31 to 2.42)	1.08(-0.85 to 3.02)	0.02(-0.47 to 0.51)	-1.84(-1.85 to -1.84)
Gabon	1.96(0.79 to 4.11)	1.86(1.03 to 3.15)	2.14(-0.73 to 5.01)	-0.17(-0.33 to -0.02)	0.51(0.51 to 0.51)
Gambia	4.93(3.21 to 7.29)	6.15(3.55 to 10.46)	7.56(-22.67 to 37.79)	0.78(-0.04 to 1.61)	0.73(0.71 to 0.74)
Georgia	1.11(0.76 to 1.52)	1.22(0.87 to 1.64)	0.61(-10.69 to 11.9)	0.22(-2.21 to 2.72)	-2.40(-2.48 to -2.33)
Germany	1.24(1.03 to 1.48)	1.86(1.46 to 2.28)	1.24(-1.32 to 3.79)	1.32(0.94 to 1.71)	-1.42(-1.42 to -1.42)
Ghana	2.06(1.25 to 3.47)	1.57(0.94 to 2.58)	1.43(-2.18 to 5.03)	-0.89(-1.06 to -0.72)	-0.29(-0.30 to -0.28)

Location	ASMR (95% UI)			AAPC (95% CI)	
	1990	2021	2050	1990-2021	2022-2050
Greece	0.6(0.45 to 0.76)	1.2(0.89 to 1.6)	1.42(-9.68 to 12.52)	2.32(1.6 to 3.04)	0.54(0.52 to 0.57)
Greenland	2.18(1.52 to 2.94)	2.43(1.73 to 3.37)	1.76(-0.41 to 3.93)	0.41(-0.24 to 1.07)	-1.16(-1.17 to -1.15)
Grenada	0.72(0.5 to 0.99)	1.51(1.12 to 1.96)	1.91(-12.41 to 16.24)	2.51(0.89 to 4.15)	0.80(0.78 to 0.81)
Guam	0.4(0.26 to 0.58)	0.75(0.5 to 1.11)	1.31(-1.56 to 4.18)	2.02(1.5 to 2.54)	2.00(1.97 to 2.02)
Guatemala	1.68(1.2 to 2.24)	1.23(0.87 to 1.66)	1.37(-36.94 to 39.68)	-0.87(-2.98 to 1.29)	0.35(0.34 to 0.36)
Guinea	3.6(2.38 to 5.56)	3.02(1.79 to 4.86)	1.16(-0.47 to 2.8)	-0.58(-0.75 to -0.4)	-3.18(-3.18 to -3.17)
Guinea-Bissau	6.23(2.24 to 10.39)	3.59(2.05 to 5.48)	1.87(-1.84 to 5.59)	-1.83(-2.33 to -1.34)	-2.09(-2.11 to -2.08)
Guyana	0.96(0.71 to 1.27)	0.71(0.48 to 0.99)	0.67(-1.26 to 2.6)	-0.93(-2.22 to 0.38)	-0.14(-0.15 to -0.14)
Haiti	0.47(0.24 to 0.89)	0.41(0.19 to 0.83)	0.39(-0.12 to 0.89)	-0.48(-0.62 to -0.34)	-0.01(-0.01 to -0.01)
Honduras	0.41(0.22 to 0.82)	0.84(0.53 to 1.33)	0.77(-0.3 to 1.84)	2.36(2.01 to 2.71)	-0.25(-0.27 to -0.23)
Hungary	1.2(0.93 to 1.52)	0.75(0.56 to 0.99)	0.21(-1.37 to 1.8)	-1.5(-2.88 to -0.11)	-4.27(-4.30 to -4.23)
Iceland	0.7(0.52 to 0.92)	1.49(1.11 to 1.96)	4.76(-4.43 to 13.95)	2.46(1.77 to 3.16)	3.97(3.96 to 3.97)
India	0.49(0.4 to 0.59)	0.77(0.64 to 0.94)	0.93(-0.69 to 2.54)	1.48(1.06 to 1.9)	0.58(0.57 to 0.59)
Indonesia	0.56(0.39 to 0.89)	0.68(0.41 to 1.14)	0.58(-0.06 to 1.22)	0.6(0.48 to 0.71)	-0.50(-0.51 to -0.49)
Iran (Islamic Republic of)	0.17(0.13 to 0.23)	0.24(0.19 to 0.29)	0.31(-1.88 to 2.5)	1.14(0.29 to 1.99)	0.97(0.96 to 0.99)
Iraq	0.4(0.24 to 0.63)	0.48(0.27 to 0.74)	0.74(-0.94 to 2.43)	0.6(0.32 to 0.88)	1.65(1.64 to 1.65)
Ireland	0.65(0.49 to 0.83)	1.19(0.89 to 1.55)	0.88(-0.25 to 2.01)	1.87(1.21 to 2.55)	-1.04(-1.06 to -1.02)
Israel	0.51(0.36 to 0.68)	0.62(0.43 to 0.83)	0.55(-0.21 to 1.3)	0.53(-0.13 to 1.2)	-0.38(-0.38 to -0.38)

Location	ASMR (95% UI)			AAPC (95% CI)	
	1990	2021	2050	1990-2021	2022-2050
Italy	1.85(1.64 to 2.1)	1.1(0.95 to 1.28)	0.83(-7.67 to 9.32)	-1.65(-3.18 to -0.09)	-0.99(-1.01 to -0.97)
Jamaica	0.32(0.22 to 0.43)	0.48(0.31 to 0.68)	0.45(-13.87 to 14.78)	1.64(0.25 to 3.05)	-0.22(-0.22 to -0.21)
Japan	1.53(1.32 to 1.81)	0.83(0.71 to 0.99)	0.94(-3.48 to 5.35)	-1.98(-2.21 to -1.76)	0.43(0.42 to 0.45)
Jordan	0.19(0.11 to 0.34)	0.14(0.09 to 0.23)	0.11(-0.08 to 0.31)	-0.97(-1.31 to -0.63)	-0.29(-0.29 to -0.28)
Kazakhstan	3.18(2.25 to 4.2)	1.36(0.94 to 1.85)	1.4(-4.78 to 7.58)	-2.73(-3.34 to -2.12)	0.10(0.08 to 0.11)
Kenya	0.61(0.41 to 0.97)	0.94(0.71 to 1.3)	1.05(-0.36 to 2.45)	1.39(1.23 to 1.56)	0.48(0.47 to 0.48)
Kiribati	0.61(0.37 to 0.92)	0.54(0.33 to 0.84)	0.4(-0.33 to 1.14)	-0.39(-0.6 to -0.18)	-0.83(-0.84 to -0.82)
Kuwait	0.39(0.25 to 0.57)	0.11(0.07 to 0.16)	0.16(-4.81 to 5.13)	-3.91(-8.75 to 1.18)	1.36(1.36 to 1.37)
Kyrgyzstan	1.37(0.94 to 1.89)	0.88(0.59 to 1.23)	0.31(-4.41 to 5.04)	-1.19(-3.46 to 1.13)	-3.49(-3.51 to -3.47)
Lao People's Democratic Republic	2.22(1.34 to 3.5)	1.84(1.08 to 2.72)	1.88(-0.46 to 4.21)	-0.63(-0.75 to -0.52)	0.11(0.11 to 0.11)
Latvia	0.88(0.64 to 1.13)	1.39(1.07 to 1.75)	2.07(-27.92 to 32.06)	1.55(0.09 to 3.03)	1.31(1.30 to 1.32)
Lebanon	0.29(0.18 to 0.48)	0.2(0.12 to 0.3)	0.18(-0.16 to 0.53)	-1.22(-1.5 to -0.94)	-0.07(-0.07 to -0.07)
Lesotho	1.08(0.34 to 2.37)	3.18(1.08 to 7.95)	3.76(-8.72 to 16.25)	3.51(3.28 to 3.74)	0.66(0.65 to 0.66)
Liberia	5.03(2.39 to 8.18)	3.54(2.12 to 5.37)	4.02(-5.99 to 14.03)	-1.16(-1.45 to -0.87)	0.52(0.51 to 0.52)
Libya	0.42(0.23 to 0.69)	0.61(0.38 to 0.98)	0.92(-0.43 to 2.27)	1.2(0.9 to 1.51)	1.40(1.39 to 1.41)
Lithuania	0.71(0.53 to 0.9)	1.35(1.05 to 1.71)	1.44(-3.51 to 6.38)	2.23(1 to 3.47)	0.14(0.12 to 0.16)
Luxembourg	1.41(1.13 to 1.7)	1.58(1.2 to 1.98)	0.82(-2.04 to 3.68)	0.32(-0.55 to 1.19)	-2.25(-2.27 to -2.23)
Madagascar	0.63(0.33 to 1.14)	0.49(0.26 to 0.91)	0.45(-0.16 to 1.06)	-0.78(-1.11 to -0.45)	-0.16(-0.16 to -0.16)

Location	ASMR (95% UI)			AAPC (95% CI)	
	1990	2021	2050	1990-2021	2022-2050
Malawi	0.72(0.41 to 1.15)	1.03(0.67 to 1.58)	0.84(-1.42 to 3.1)	1.13(0.85 to 1.42)	-0.59(-0.60 to -0.58)
Malaysia	0.62(0.39 to 0.94)	0.81(0.52 to 1.26)	0.63(-0.43 to 1.7)	0.87(0.26 to 1.49)	-0.83(-0.84 to -0.82)
Maldives	1.46(0.92 to 2.18)	1.03(0.63 to 1.49)	0.75(-0.21 to 1.72)	-1.15(-1.48 to -0.81)	-0.99(-1.02 to -0.96)
Mali	4.09(2.66 to 5.89)	4.27(2.81 to 6.66)	3.2(-2.42 to 8.81)	0.12(-0.05 to 0.28)	-0.92(-0.93 to -0.91)
Malta	0.61(0.44 to 0.81)	1.02(0.74 to 1.36)	1.18(-0.66 to 3.02)	1.57(1.11 to 2.03)	0.51(0.50 to 0.51)
Marshall Islands	0.37(0.19 to 0.72)	0.47(0.24 to 0.9)	0.48(-0.26 to 1.23)	0.79(0.44 to 1.15)	0.25(0.25 to 0.26)
Mauritania	5.58(1.15 to 11.51)	2.94(1.38 to 4.9)	4.86(-2.96 to 12.67)	-2.06(-2.26 to -1.86)	1.79(1.79 to 1.80)
Mauritius	0.87(0.62 to 1.18)	0.15(0.11 to 0.21)	0.27(-9.55 to 10.09)	-5.25(-8.99 to -1.35)	2.03(2.01 to 2.04)
Mexico	0.46(0.4 to 0.53)	0.8(0.65 to 0.96)	1.7(-0.88 to 4.28)	1.84(0.99 to 2.69)	2.70(2.69 to 2.72)
Micronesia (Federated States of)	0.61(0.33 to 1.05)	0.6(0.33 to 1.13)	0.39(-0.2 to 0.97)	-0.13(-0.34 to 0.08)	-1.34(-1.34 to -1.34)
Monaco	1.19(0.75 to 1.71)	2.62(1.69 to 3.97)	2.39(-4.89 to 9.67)	2.59(2.44 to 2.75)	-0.29(-0.30 to -0.29)
Mongolia	11(6.57 to 17.54)	18.12(12.22 to 27.05)	12.51(-28.34 to 53.36)	1.58(0.95 to 2.22)	-1.22(-1.22 to -1.21)
Montenegro	2.02(1.36 to 2.89)	2.51(1.67 to 3.54)	1.48(-0.78 to 3.74)	0.76(0.29 to 1.23)	-1.79(-1.81 to -1.78)
Morocco	0.04(0.02 to 0.07)	0.05(0.03 to 0.09)	0.28(-0.55 to 1.11)	0.81(0.62 to 1.01)	6.99(6.98 to 6.99)
Mozambique	3.56(1.94 to 5.97)	4.79(2.3 to 10.42)	2.78(-2.23 to 7.79)	0.94(0.79 to 1.09)	-1.76(-1.77 to -1.75)
Myanmar	0.47(0.22 to 0.99)	0.55(0.27 to 1.18)	0.76(-0.34 to 1.86)	0.49(0.37 to 0.6)	1.20(1.20 to 1.20)
Namibia	0.38(0.17 to 0.79)	0.73(0.48 to 1.06)	0.73(-1.37 to 2.83)	2.21(1.8 to 2.62)	-0.01(-0.01 to -0.01)
Nauru	0.86(0.54 to 1.29)	0.73(0.43 to 1.22)	1.19(-1.44 to 3.81)	-0.56(-0.85 to -0.28)	1.77(1.76 to 1.77)

Location	ASMR (95% UI)			AAPC (95% CI)	
	1990	2021	2050	1990-2021	2022-2050
Nepal	0.38(0.23 to 0.58)	0.83(0.48 to 1.31)	2.36(-2.76 to 7.47)	2.6(2.4 to 2.79)	3.72(3.71 to 3.73)
Netherlands	0.51(0.4 to 0.62)	1.07(0.85 to 1.35)	0.96(-0.65 to 2.56)	2.37(1.36 to 3.4)	-0.42(-0.44 to -0.40)
New Zealand	0.85(0.74 to 0.97)	1.47(1.26 to 1.69)	1.88(-0.36 to 4.13)	1.7(0.77 to 2.65)	0.93(0.92 to 0.93)
Nicaragua	0.71(0.48 to 1.03)	0.81(0.54 to 1.19)	1.05(-1.41 to 3.51)	0.35(-0.66 to 1.37)	0.93(0.92 to 0.94)
Niger	3.16(1.4 to 5.82)	1.5(0.92 to 2.64)	0.91(-0.19 to 2.01)	-2.39(-2.61 to -2.17)	-1.62(-1.63 to -1.61)
Nigeria	0.92(0.41 to 1.73)	0.9(0.63 to 1.26)	0.83(-0.37 to 2.04)	-0.1(-0.37 to 0.17)	-0.18(-0.18 to -0.17)
Niue	0.56(0.32 to 0.9)	0.75(0.44 to 1.3)	0.62(-0.88 to 2.13)	0.95(0.85 to 1.04)	0.51(0.51 to 0.51)
North Macedonia	3.87(2.73 to 5.09)	3.33(2.28 to 4.49)	3.89(-4.1 to 11.89)	-0.47(-0.89 to -0.04)	0.49(0.46 to 0.52)
Northern Mariana Islands	0.58(0.37 to 0.86)	0.87(0.54 to 1.36)	0.55(-0.18 to 1.28)	1.17(0.34 to 2)	-1.39(-1.46 to -1.32)
Norway	0.46(0.41 to 0.53)	1.11(0.99 to 1.26)	1.45(-5.7 to 8.59)	2.88(2.03 to 3.74)	0.86(0.85 to 0.86)
Oman	0.3(0.17 to 0.54)	0.38(0.23 to 0.58)	0.09(-0.19 to 0.38)	0.67(0.32 to 1.01)	-4.55(-4.57 to -4.53)
Pakistan	0.48(0.34 to 0.64)	0.57(0.41 to 0.78)	0.47(-0.11 to 1.06)	0.62(0.47 to 0.77)	-0.56(-0.56 to -0.56)
Palau	1.02(0.6 to 1.7)	1.11(0.68 to 1.69)	0.9(-0.68 to 2.49)	0.18(-0.31 to 0.66)	-0.57(-0.58 to -0.56)
Palestine	0.73(0.43 to 1.18)	0.62(0.39 to 0.97)	0.55(-0.18 to 1.27)	-0.51(-0.9 to -0.12)	-0.36(-0.37 to -0.35)
Panama	1.11(0.82 to 1.43)	1.01(0.69 to 1.36)	2.61(-5.64 to 10.87)	-0.4(-1.47 to 0.69)	3.42(3.41 to 3.43)
Papua New Guinea	0.46(0.2 to 1.23)	0.31(0.12 to 0.9)	0.26(-0.11 to 0.62)	-1.25(-1.38 to -1.11)	-0.39(-0.41 to -0.38)
Paraguay	0.8(0.58 to 1.07)	1.1(0.73 to 1.63)	1.25(-2.1 to 4.59)	1.14(0.56 to 1.72)	0.41(0.41 to 0.41)
Peru	0.54(0.34 to 0.75)	0.76(0.48 to 1.14)	2.3(-2.15 to 6.75)	1.28(-0.06 to 2.64)	3.99(3.99 to 4.00)

Location	ASMR (95% UI)			AAPC (95% CI)	
	1990	2021	2050	1990-2021	2022-2050
Philippines	1.52(1 to 2.1)	1.58(1.21 to 1.98)	1.27(-0.25 to 2.78)	0.17(-0.06 to 0.4)	-0.79(-0.80 to -0.78)
Poland	0.21(0.18 to 0.23)	0.79(0.69 to 0.89)	0.72(-4.93 to 6.37)	4.3(3.3 to 5.31)	-0.30(-0.30 to -0.29)
Portugal	0.82(0.64 to 1.01)	2.01(1.58 to 2.49)	1.06(-2.33 to 4.44)	2.95(2.29 to 3.61)	-2.28(-2.33 to -2.22)
Puerto Rico	0.87(0.64 to 1.16)	0.97(0.68 to 1.29)	2.52(-2.86 to 7.9)	0.49(-0.96 to 1.95)	3.39(3.39 to 3.39)
Qatar	1.2(0.74 to 1.96)	1.63(0.94 to 2.59)	3.12(-8.48 to 14.71)	0.83(-0.44 to 2.12)	2.78(2.71 to 2.86)
South Korea	4.58(2.88 to 6.64)	2.44(1.61 to 3.52)	1.91(-0.86 to 4.67)	-2.02(-2.23 to -1.81)	-0.78(-0.81 to -0.76)
Republic of Moldova	1.2(0.95 to 1.46)	1.12(0.88 to 1.4)	1.82(-41.54 to 45.18)	-0.48(-2.33 to 1.4)	1.70(1.70 to 1.71)
Romania	0.53(0.39 to 0.66)	1.34(1.03 to 1.67)	1.2(-1.32 to 3.73)	3.08(2.06 to 4.11)	-0.40(-0.44 to -0.36)
Russian Federation	0.58(0.52 to 0.65)	0.97(0.86 to 1.11)	1.18(-6.02 to 8.38)	1.61(0.22 to 3.01)	0.66(0.65 to 0.68)
Rwanda	1.69(1.01 to 2.71)	1(0.57 to 1.57)	1.56(-6.26 to 9.37)	-1.83(-2.22 to -1.44)	1.63(1.62 to 1.63)
Saint Kitts and Nevis	1.09(0.8 to 1.45)	1.12(0.78 to 1.47)	3.82(-18.32 to 25.96)	0.46(-1.37 to 2.33)	4.13(4.12 to 4.14)
Saint Lucia	0.88(0.65 to 1.16)	0.61(0.44 to 0.8)	1.04(-1.31 to 3.4)	-1.25(-1.96 to -0.54)	2.02(2.02 to 2.02)
Saint Vincent and the Grenadines	1.07(0.78 to 1.4)	1.06(0.79 to 1.33)	1.37(-3.67 to 6.41)	-0.14(-1.09 to 0.82)	0.94(0.93 to 0.95)
Samoa	0.71(0.43 to 1.1)	0.62(0.38 to 0.99)	0.39(-0.36 to 1.14)	-0.46(-0.79 to -0.13)	-1.23(-1.24 to -1.22)
San Marino	0.78(0.55 to 1.07)	0.92(0.53 to 1.4)	0.65(-0.52 to 1.82)	0.55(0.46 to 0.64)	-1.18(-1.18 to -1.18)
Sao Tome and Principe	0.52(0.34 to 0.77)	0.5(0.28 to 0.89)	0.34(-0.31 to 0.99)	-0.23(-0.78 to 0.33)	-1.32(-1.33 to -1.32)
Saudi Arabia	0.38(0.2 to 0.68)	0.35(0.21 to 0.58)	0.34(-0.35 to 1.02)	-0.26(-0.58 to 0.07)	-0.15(-0.17 to -0.13)
Senegal	2.1(1.18 to 3.18)	1.41(0.89 to 2.12)	1.06(-0.64 to 2.77)	-1.32(-1.97 to -0.67)	-0.91(-0.91 to -0.90)

Location	ASMR (95% UI)			AAPC (95% CI)	
	1990	2021	2050	1990-2021	2022-2050
Serbia	1.54(1.01 to 2.18)	1.65(1.11 to 2.36)	1.75(-1.52 to 5.01)	0.27(0.02 to 0.52)	0.26(0.24 to 0.27)
Seychelles	1.76(1.19 to 2.54)	1.03(0.69 to 1.46)	1.11(-2.2 to 4.41)	-1.74(-2.09 to -1.38)	0.24(0.23 to 0.25)
Sierra Leone	4(1.39 to 7.29)	1.75(1.06 to 2.67)	1.27(-0.98 to 3.53)	-2.64(-2.81 to -2.47)	-0.91(-0.93 to -0.89)
Singapore	0.55(0.36 to 0.83)	0.41(0.26 to 0.63)	0.06(-0.04 to 0.15)	-0.95(-1.84 to -0.06)	-6.44(-6.47 to -6.40)
Slovakia	2.42(1.78 to 3.27)	1.73(1.19 to 2.42)	1.92(-1.67 to 5.51)	-1.06(-1.49 to -0.63)	0.36(0.35 to 0.36)
Slovenia	1.74(1.35 to 2.16)	1.87(1.38 to 2.45)	0.92(-5.87 to 7.72)	0.17(-1.17 to 1.53)	-2.48(-2.51 to -2.44)
Solomon Islands	0.73(0.23 to 1.83)	0.55(0.32 to 0.99)	0.32(-0.26 to 0.9)	-0.91(-1.17 to -0.64)	-1.68(-1.68 to -1.67)
Somalia	1.63(0.57 to 3.17)	1.29(0.52 to 2.67)	0.94(-0.23 to 2.1)	-0.73(-0.88 to -0.59)	-0.90(-0.91 to -0.89)
South Africa	1.03(0.56 to 1.82)	1.51(1.22 to 1.84)	1.72(-4.71 to 8.16)	1.24(0.68 to 1.79)	0.50(0.47 to 0.54)
South Sudan	0.94(0.47 to 1.54)	1.14(0.65 to 1.84)	1.71(-0.67 to 4.09)	0.61(0.25 to 0.96)	1.49(1.49 to 1.49)
Spain	1.3(0.98 to 1.67)	1.6(1.14 to 2.16)	1(-0.95 to 2.94)	0.65(0.25 to 1.06)	-1.70(-1.74 to -1.66)
Sri Lanka	0.4(0.27 to 0.58)	0.34(0.19 to 0.52)	0.19(-0.31 to 0.68)	-0.5(-1.23 to 0.24)	-1.67(-1.69 to -1.66)
Sudan	0.58(0.26 to 1.15)	0.45(0.25 to 0.74)	0.63(-0.47 to 1.72)	-0.87(-1.04 to -0.69)	1.18(1.17 to 1.18)
Suriname	0.73(0.5 to 1.01)	0.85(0.54 to 1.25)	1.31(-0.5 to 3.12)	0.6(-0.27 to 1.48)	1.51(1.51 to 1.51)
Sweden	1.02(0.89 to 1.16)	1.22(1.01 to 1.44)	1.15(-19.15 to 21.45)	0.53(-1.48 to 2.58)	-0.25(-0.27 to -0.23)
Switzerland	1.79(1.41 to 2.21)	1.49(1.12 to 1.93)	0.42(-0.25 to 1.08)	-0.7(-1.58 to 0.19)	-4.33(-4.37 to -4.30)
Syrian Arab Republic	0.61(0.34 to 1)	0.45(0.27 to 0.72)	0.25(-0.53 to 1.02)	-0.92(-1.44 to -0.4)	-2.11(-2.14 to -2.09)
Taiwan (Province of China)	0.57(0.39 to 0.82)	0.64(0.43 to 0.94)	0.27(-7.64 to 8.17)	0.37(-2.16 to 2.96)	-3.01(-3.04 to -2.98)

Location	ASMR (95% UI)			AAPC (95% CI)	
	1990	2021	2050	1990-2021	2022-2050
Tajikistan	1.07(0.63 to 1.81)	0.96(0.51 to 1.54)	0.58(-0.35 to 1.51)	-0.34(-0.73 to 0.04)	-1.86(-1.86 to -1.85)
Thailand	3.98(2.67 to 5.66)	3.3(2.2 to 4.74)	4.21(-8.84 to 17.26)	-0.61(-0.97 to -0.25)	0.85(0.84 to 0.86)
Timor-Leste	0.57(0.34 to 0.94)	0.56(0.32 to 1.05)	0.75(-0.36 to 1.87)	-0.07(-0.28 to 0.14)	1.09(1.09 to 1.10)
Togo	1.59(0.98 to 2.6)	1.3(0.74 to 2.26)	1.16(-0.69 to 3)	-0.69(-0.89 to -0.49)	-0.35(-0.35 to -0.34)
Tokelau	0.44(0.22 to 0.86)	0.62(0.34 to 1.06)	1.14(-1.45 to 3.73)	1.03(0.7 to 1.35)	2.68(2.67 to 2.69)
Tonga	2.45(1.45 to 4.01)	2.54(1.5 to 4.02)	1.89(-3.56 to 7.33)	0.11(-0.47 to 0.68)	-1.00(-1.00 to -1.00)
Trinidad and Tobago	0.69(0.51 to 0.91)	0.68(0.45 to 0.95)	1.09(-1.38 to 3.57)	-0.13(-1.69 to 1.45)	1.69(1.68 to 1.70)
Tunisia	0.21(0.13 to 0.33)	0.28(0.16 to 0.44)	0.5(-0.15 to 1.16)	0.88(0.63 to 1.14)	2.08(2.07 to 2.08)
Turkey	1.17(0.8 to 1.62)	1.37(0.91 to 1.97)	1.47(-7.85 to 10.78)	0.06(-0.21 to 0.32)	-0.68(-0.70 to -0.67)
Turkmenistan	0.5(0.29 to 0.89)	0.58(0.33 to 0.97)	0.58(-0.2 to 1.35)	0.5(-0.85 to 1.86)	0.18(0.18 to 0.19)
Tuvalu	0.43(0.27 to 0.66)	0.44(0.29 to 0.66)	0.36(-0.5 to 1.22)	0.39(0.2 to 0.58)	0.07(0.07 to 0.07)
Uganda	2.07(1.34 to 3)	1.95(1.27 to 2.97)	2.28(-1.23 to 5.79)	-0.2(-0.35 to -0.05)	0.66(0.65 to 0.67)
Ukraine	0.55(0.44 to 0.66)	0.45(0.31 to 0.63)	0.45(-2.83 to 3.72)	-0.61(-2.86 to 1.68)	0.04(0.03 to 0.05)
United Arab Emirates	1.04(0.59 to 1.69)	1.33(0.78 to 2.05)	3.65(-6.32 to 13.62)	0.75(0.2 to 1.31)	3.58(3.42 to 3.74)
United Kingdom	0.68(0.6 to 0.76)	1.93(1.71 to 2.19)	2.68(-3.37 to 8.72)	3.31(2.59 to 4.05)	1.12(1.12 to 1.12)
United Republic of Tanzania	1.33(0.85 to 1.98)	1.01(0.61 to 1.64)	1.27(-0.56 to 3.1)	-0.89(-1.01 to -0.78)	0.89(0.88 to 0.89)
United States of America	0.58(0.53 to 0.65)	1.26(1.11 to 1.43)	1.3(-0.28 to 2.89)	2.56(2.09 to 3.02)	-0.02(-0.04 to -0.01)
United States Virgin Islands	0.58(0.38 to 0.86)	0.95(0.58 to 1.48)	1.04(-1.47 to 3.56)	1.63(1.29 to 1.96)	0.44(0.43 to 0.44)

Location	ASMR (95% UI)			AAPC (95% CI)	
	1990	2021	2050	1990-2021	2022-2050
Uruguay	0.28(0.2 to 0.37)	0.74(0.52 to 1.02)	1.34(-1.76 to 4.44)	3.11(1.98 to 4.25)	2.19(2.18 to 2.19)
Uzbekistan	0.66(0.44 to 1.01)	1.03(0.65 to 1.56)	0.82(-0.84 to 2.48)	1.55(1.1 to 2.01)	-0.87(-0.94 to -0.81)
Vanuatu	0.54(0.29 to 1.15)	0.52(0.28 to 0.92)	0.49(-0.34 to 1.31)	-0.18(-0.68 to 0.32)	0.00(0.00 to 0.01)
Venezuela (Bolivarian Republic of)	1.82(1.37 to 2.27)	0.72(0.49 to 1.02)	5.52(-92.83 to 103.87)	-3.22(-4.56 to -1.86)	7.34(7.30 to 7.37)
Viet Nam	2.56(1.64 to 3.92)	3.47(2.17 to 5.42)	3.46(-0.87 to 7.8)	0.98(0.82 to 1.13)	-0.03(-0.03 to -0.02)
Yemen	0.24(0.08 to 0.5)	0.16(0.08 to 0.3)	0.19(-0.12 to 0.51)	-1.31(-1.47 to -1.15)	0.92(0.91 to 0.94)
Zambia	2.12(1.41 to 3.08)	1.07(0.45 to 2.62)	1.16(-3.15 to 5.48)	-2.21(-2.73 to -1.68)	0.51(0.50 to 0.51)
Zimbabwe	2.12(1.1 to 3.55)	2.28(1.32 to 3.63)	2.03(-3.34 to 7.4)	0.23(-0.2 to 0.67)	-0.23(-0.24 to -0.22)

ASMR: Age-standardized mortality rate; LCA: liver cancer due to alcohol use; AAPC: average annual percentage change; UI: uncertainty interval; CI: confidence interval.

Supplementary Table 3. Bayesian spatiotemporal model results in 1990-2021 and 2022-2050

	1990-2021		2022-2050	
	Regression coefficient Mean \pm SD	95% credible interval	Regression coefficient Mean\pmSD	95% credible interval
Gaussian Residuals	4.83e-3 \pm 5.51e-3	(0.0012, 0.020)	0.03 \pm 0.02	(0.01, 0.11)
Intercept	1.50 \pm 0.06	(1.38, 1.61)	1.46 \pm 0.12	(1.22, 1.69)
Spatial effect (ICAR; spatially structured)	4.22 \pm 0.81	(2.92, 6.12)	4.16e-4 \pm 6.13e-4	(8.81e-5, 8.66e-3)
Spatial effect (IID; spatially unstructured)	0.41 \pm 0.19	(0.19, 0.97)	2.16 \pm 0.25	(1.74, 2.72)
Temporal effect (RW2; temporally structured)	2.12e-5 \pm 1.19e-5	(8.71e-6, 7.50e-5)	1.68e-5 \pm 8.80e-6	(7.37e-6, 6.04e-5)
Temporal effect (IID; temporally unstructured)	2.80e-5 \pm 1.67e-5	(1.14e-5, 1.36e-4)	2.34e-5 \pm 1.62e-5	(8.30e-6, 9.70e-5)
Spatial temporal effect (IID)	0.12 \pm 0.01	(0.11, 0.15)	0.03 \pm 0.02	(0.01, 0.10)

SD: Standard deviation; ICAR: intrinsic conditional auto-regressive; IID: independent and identically distributed; RW2: second-order random walk.

Supplementary Table 4. The results of frontier analysis based on the SDI and age-standardized mortality rate for liver cancer due to alcohol use in 2050

Location	2050 SDI	Frontier line	Effective difference
Afghanistan	0.55	0.30	0.30
Albania	0.78	0.22	3.25
Algeria	0.84	0.19	0.38
American Samoa	0.80	0.20	0.51
Andorra	0.95	0.10	2.17
Angola	0.63	0.23	1.15
Antigua and Barb.	0.85	0.19	3.90
Argentina	0.85	0.19	0.03
Armenia	0.82	0.19	2.01
Australia	0.94	0.11	3.06
Austria	0.94	0.11	2.21
Azerbaijan	0.76	0.23	1.80
Bahamas	0.92	0.12	1.28
Bahrain	0.91	0.12	1.07
Bangladesh	0.78	0.22	0.31
Barbados	0.82	0.20	1.45
Belarus	0.93	0.10	1.10
Belgium	0.94	0.10	0.70
Belize	0.71	0.23	0.55
Benin	0.57	0.23	1.04
Bermuda	0.88	0.19	0.30
Bhutan	0.61	0.23	0.68
Bolivia	0.76	0.23	1.18
Bosnia and Herz.	0.84	0.19	2.64
Botswana	0.74	0.23	0.82
Brazil	0.78	0.22	0.05
Brunei	0.89	0.14	0.62

Location	2050 SDI	Frontier line	Effective difference
Bulgaria	0.90	0.14	2.49
Burkina Faso	0.46	0.58	2.20
Burundi	0.37	0.50	0.00
Cote d'Ivoire	0.57	0.23	0.24
Cabo Verde	0.73	0.23	3.38
Cambodia	0.64	0.23	2.43
Cameroon	0.72	0.22	1.92
Canada	0.95	0.11	2.86
Central African Re	0.40	0.53	0.04
Chad	0.37	0.69	1.01
Chile	0.93	0.10	2.18
China	0.97	0.10	0.30
Colombia	0.77	0.22	0.82
Comoros	0.59	0.23	0.60
Cook Is.	0.95	0.10	3.79
Costa Rica	0.89	0.14	2.85
Croatia	0.90	0.14	0.57
Cuba	0.77	0.22	0.31
Cyprus	0.93	0.10	0.46
Czechia	0.91	0.14	0.69
North Korea	0.63	0.22	0.10
Democratic Repub	0.51	0.43	0.10
Denmark	0.99	0.11	0.32
Djibouti	0.69	0.23	0.52
Dominica	0.84	0.19	0.88
Dominican Rep.	0.75	0.22	0.81
Ecuador	0.80	0.20	0.55
Egypt	0.79	0.20	2.55
El Salvador	0.74	0.23	0.68

Location	2050 SDI	Frontier line	Effective difference
Eq. Guinea	0.82	0.19	3.00
Eritrea	0.54	0.33	0.30
Estonia	0.93	0.11	0.42
Eswatini	0.65	0.23	3.20
Ethiopia	0.49	0.55	0.22
Fiji	0.79	0.20	0.45
Finland	0.95	0.10	0.70
France	0.92	0.12	0.96
Gabon	0.86	0.19	1.95
Gambia	0.58	0.23	7.33
Georgia	0.86	0.19	0.41
Germany	0.97	0.11	1.13
Ghana	0.78	0.22	1.20
Greece	0.87	0.19	1.23
Greenland	0.84	0.19	1.57
Grenada	0.82	0.19	1.72
Guam	0.90	0.14	1.17
Guatemala	0.74	0.23	1.14
Guinea	0.55	0.30	0.87
Guinea-Bissau	0.53	0.33	1.55
Guyana	0.83	0.19	0.48
Haiti	0.50	0.39	0.00
Honduras	0.66	0.23	0.54
Hungary	0.91	0.12	0.10
Iceland	0.98	0.11	4.66
India	0.78	0.22	0.70
Indonesia	0.83	0.19	0.39
Iran	0.87	0.19	0.12
Iraq	0.93	0.10	0.64

Location	2050 SDI	Frontier line	Effective difference
Ireland	0.91	0.12	0.76
Israel	0.91	0.12	0.43
Italy	0.89	0.15	0.68
Jamaica	0.79	0.22	0.23
Japan	0.95	0.11	0.83
Jordan	0.88	0.11	0.00
Kazakhstan	0.82	0.19	1.20
Kenya	0.77	0.22	0.82
Kiribati	0.63	0.23	0.18
Kuwait	0.89	0.13	0.02
Kyrgyzstan	0.75	0.22	0.09
Laos	0.63	0.23	1.65
Latvia	0.97	0.10	1.97
Lebanon	0.79	0.18	0.00
Lesotho	0.66	0.23	3.53
Liberia	0.47	0.58	3.44
Libya	0.89	0.15	0.77
Lithuania	0.92	0.12	1.32
Luxembourg	0.94	0.11	0.72
Madagascar	0.64	0.23	0.22
Malawi	0.63	0.23	0.61
Malaysia	0.88	0.19	0.45
Maldives	0.73	0.23	0.53
Mali	0.46	0.58	2.62
Malta	0.90	0.14	1.04
Marshall Is.	0.73	0.23	0.26
Mauritania	0.72	0.23	4.63
Mauritius	0.88	0.19	0.09
Mexico	0.81	0.20	1.50

Location	2050 SDI	Frontier line	Effective difference
Micronesia	0.69	0.23	0.16
Moldova	0.90	0.14	1.68
Monaco	0.95	0.10	2.29
Mongolia	0.72	0.23	12.29
Montenegro	0.88	0.19	1.30
Morocco	0.79	0.20	0.08
Mozambique	0.55	0.30	2.48
Myanmar	0.58	0.23	0.53
N. Mariana Is.	0.91	0.14	0.41
Namibia	0.76	0.23	0.50
Nauru	0.79	0.20	0.99
Nepal	0.62	0.23	2.13
Netherlands	0.96	0.10	0.85
New Zealand	0.94	0.10	1.78
Nicaragua	0.63	0.23	0.82
Niger	0.28	0.91	0.00
Nigeria	0.71	0.23	0.61
Niue	0.83	0.19	0.43
North Macedonia	0.87	0.19	3.71
Norway	0.96	0.11	1.34
Oman	0.92	0.08	0.01
Pakistan	0.69	0.23	0.24
Palau	0.78	0.22	0.68
Palestine	0.84	0.19	0.35
Panama	0.97	0.10	2.51
Papua New Guine	0.51	0.26	0.00
Paraguay	0.79	0.22	1.02
Peru	0.76	0.22	2.08
Philippines	0.88	0.19	1.08

Location	2050 SDI	Frontier line	Effective difference
Poland	0.94	0.10	0.62
Portugal	0.83	0.19	0.86
Puerto Rico	0.98	0.11	2.41
Qatar	0.98	0.10	3.01
South Korea	0.98	0.10	1.80
Republic of the Co	0.72	0.22	1.41
Romania	0.91	0.12	1.08
Russia	0.94	0.11	1.08
Rwanda	0.67	0.23	1.33
S.Sudan	0.32	1.04	0.67
Saint Kitts and Ne	0.87	0.19	3.63
Saint Lucia	0.77	0.22	0.82
Samoa	0.69	0.23	0.16
San Marino	0.92	0.10	0.54
Sao Tome and Pri	0.65	0.23	0.12
Saudi Arabia	0.95	0.11	0.23
Senegal	0.62	0.23	0.83
Serbia	0.91	0.14	1.61
Seychelles	0.87	0.19	0.92
Sierra Leone	0.56	0.23	1.05
Singapore	0.91	0.06	0.00
Slovakia	0.89	0.15	1.77
Slovenia	0.90	0.14	0.78
Solomon Is.	0.54	0.28	0.04
Somalia	0.12	0.94	0.00
South Africa	0.74	0.23	1.50
Spain	0.85	0.19	0.80
Sri Lanka	0.87	0.18	0.00
St. Vin. and Gren.	0.79	0.22	1.15

Location	2050 SDI	Frontier line	Effective difference
Sudan	0.79	0.22	0.40
Suriname	0.72	0.23	1.09
Sweden	0.96	0.10	1.05
Switzerland	0.99	0.11	0.31
Syria	0.81	0.19	0.05
Tajikistan	0.67	0.23	0.35
Tanzania	0.70	0.22	1.05
Thailand	0.79	0.22	3.99
Timor-Leste	0.51	0.44	0.31
Togo	0.62	0.23	0.93
Tonga	0.78	0.22	1.67
Trinidad and Toba	0.84	0.20	0.90
Tunisia	0.82	0.19	0.31
Turkey	0.91	0.12	0.24
Turkmenistan	0.79	0.20	1.27
Tuvalu	0.72	0.23	0.35
U.S. Virgin Is.	0.89	0.14	0.91
Uganda	0.68	0.23	2.05
Ukraine	0.85	0.19	0.25
United Arab Emira	0.94	0.11	3.54
United Kingdom	0.96	0.10	2.58
United States	0.95	0.11	1.19
Uruguay	0.85	0.19	1.15
Uzbekistan	0.81	0.20	0.62
Vanuatu	0.59	0.23	0.26
Venezuela	0.58	0.23	5.29
Vietnam	0.80	0.19	3.27
Yemen	0.56	0.19	0.00
Zambia	0.62	0.23	0.93

Location	2050 SDI	Frontier line	Effective difference
Zimbabwe	0.47	0.59	1.45

SDI: Sociodemographic index.

Supplementary Table 5. Contributions of population growth, age structure, and epidemiological changes to the increase in deaths from LCA worldwide and in six WHO regions, 1990-2021, 2022-2050

Sex	Location	1990-2021			2022-2050		
		(change percent contribution, %)			(change percent contribution, %)		
		Age structure	Population growth	Epidemiologic changes	Age structure	Population growth	Epidemiologic changes
Total	Global	0.42	0.38	0.2	0.62	0.17	0.21
	South-East Asia region	0.33	0.27	0.39	0.67	0.19	0.14
	Region of the Americas	0.51	0.13	0.36	0.91	-0.17	0.27
	European region	0.83	0.28	-0.11	0.67	-0.04	0.37
	Western Pacific region	0.03	1.24	-0.27	0.39	0.54	0.07
	African region	0.21	0.61	0.18	0.5	0.37	0.13
	Eastern Mediterranean region	0.42	0.38	0.2	0.62	0.17	0.21
	Global	0.47	0.43	0.1	0.73	0.29	-0.02
Male	South-East Asia region	0.39	0.37	0.23	0.6	0.15	0.25
	Region of the Americas	0.34	0.26	0.39	0.66	0.18	0.16
	European region	0.62	0.13	0.25	1.08	-0.15	0.06
	Western Pacific region	0.85	0.27	-0.12	0.68	-0.05	0.37
	African region	-0.04	1.31	-0.28	0.38	0.5	0.12
	Eastern Mediterranean region	0.18	0.58	0.24	0.46	0.32	0.21
Female	Global	0.46	0.48	0.06	1.39	0.52	-0.91

South-East Asia region	0.45	0.38	0.17	0.66	0.18	0.16
Region of the Americas	0.35	0.32	0.33	0.57	0.15	0.28
European region	0.61	0.17	0.22	1.14	-0.24	0.09
Western Pacific region	0.84	0.28	-0.12	1.69	-0.07	-0.62
African region	0.06	1.07	-0.13	0.49	0.63	-0.12
Eastern Mediterranean region	0.28	0.71	0.01	0.98	0.7	-0.68

LCA: Liver cancer due to alcohol use; WHO: World Health Organization.