

Supplemental Online Content

Chen S, Cao Z, Prettnner K, et al. Estimates and projections of the global economic cost of 29 cancers in 204 countries and territories from 2020 to 2050. *JAMA Oncol*. Published online February 23, 2023. doi:10.1001/jamaoncol.2022.7826

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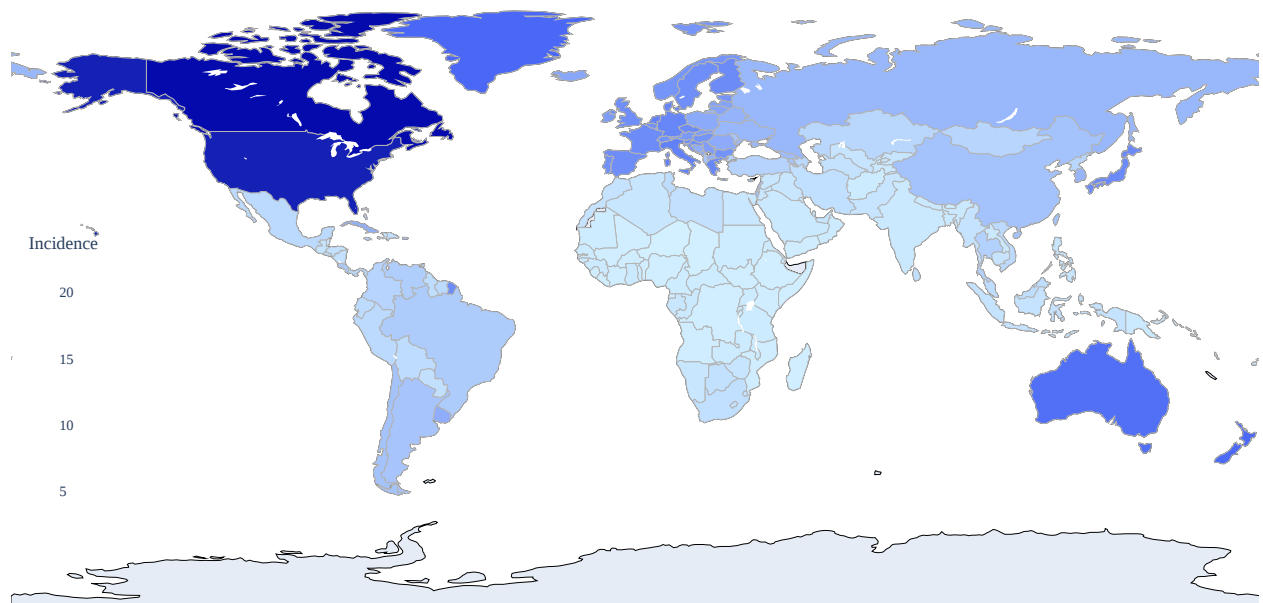
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This supplemental material has been provided by the authors to give readers additional information about their work.

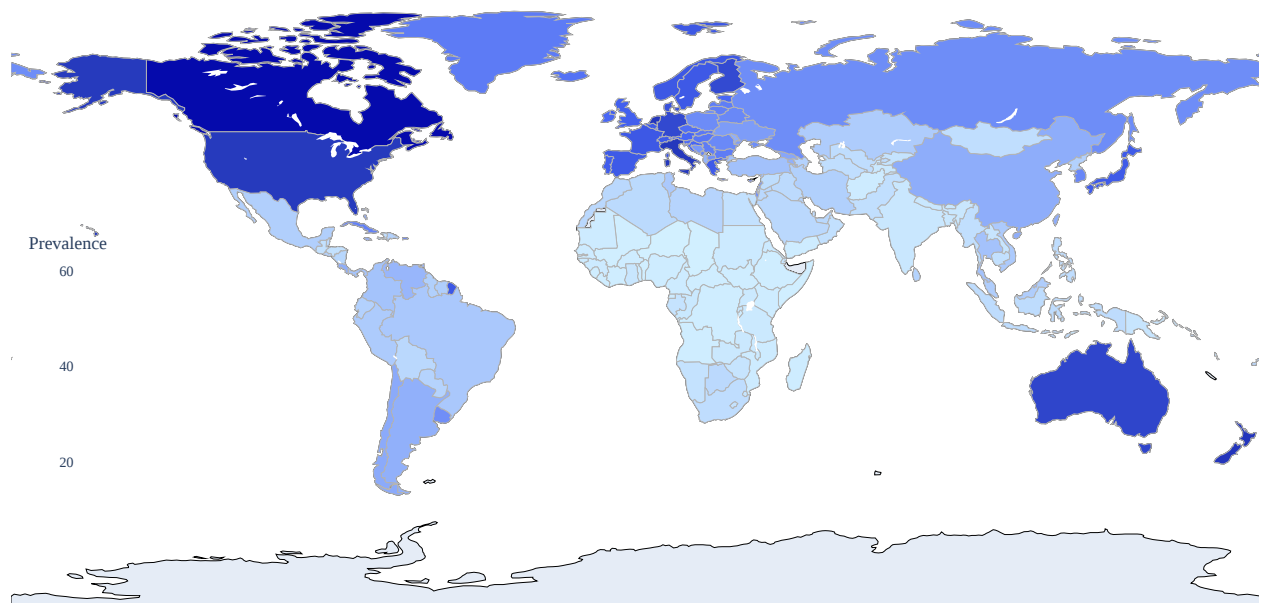
eAppendix 1. Global health burden of cancer

Figures S1–S4 show the health burden of cancer. The numbers are based on the Global Burden of Disease Study (2020).¹



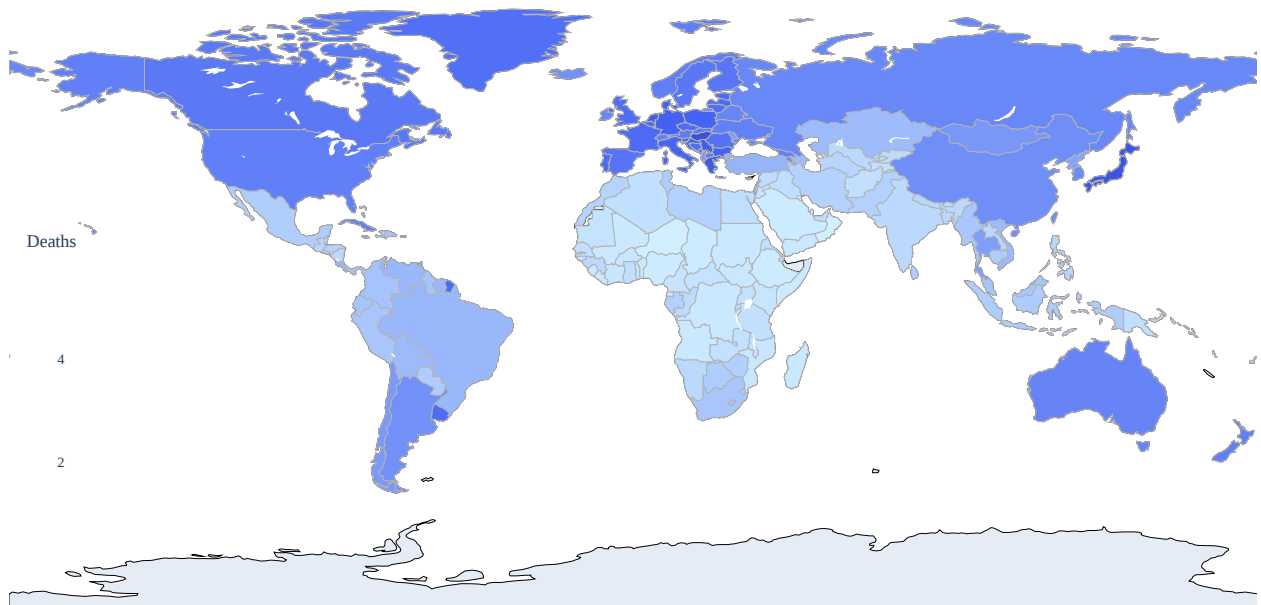
*White areas represent countries with insufficient data

eFigure 1. All-cancer incidence rate (per 1,000) in 2019



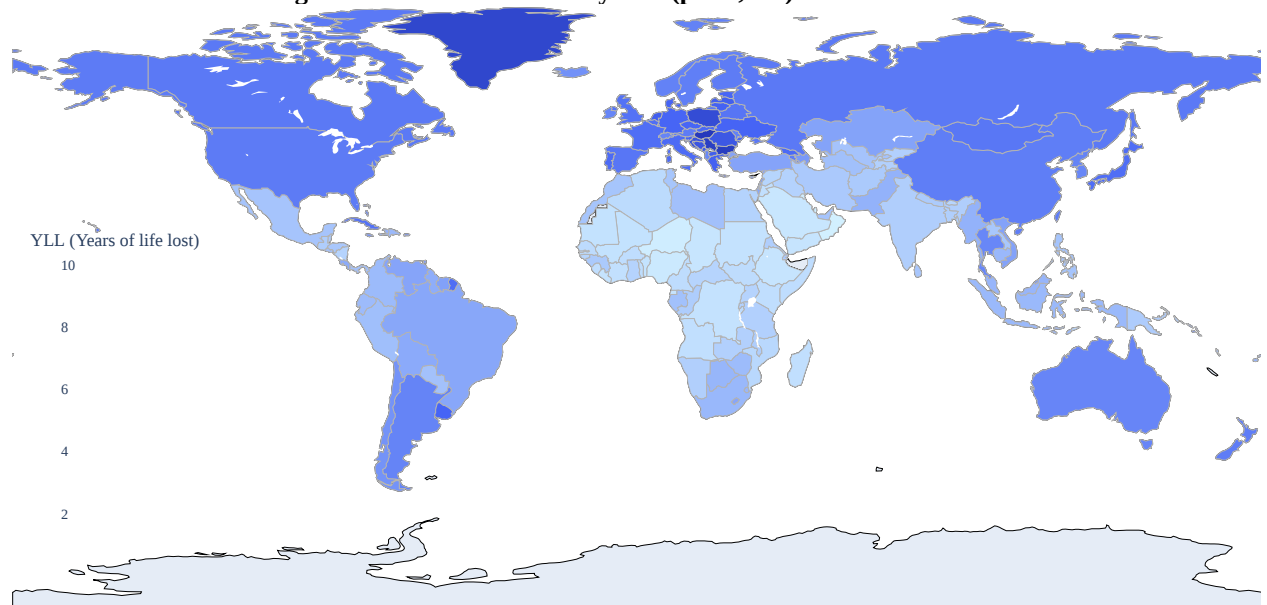
*White areas represent countries with insufficient data

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*White areas represent countries with insufficient data

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eAppendix 2. Modeling details

We aimed to quantify each type of cancer's impact on economic output through healthcare expenditures and through productivity losses due to mortality and morbidity. For each country and each cancer, we did the following analysis:

Step 1. We identified the disease burden of cancer (in terms of mortality, morbidity, and treatment costs).

Step 2. We constructed economic projections for two scenarios: a status quo scenario, in which gross domestic product (GDP) is projected to grow based on current estimates and projections of disease prevalence, and a counterfactual scenario, in which cancer prevalence is eliminated from the beginning of

the time frame. The economic projections utilize a macroeconomic production function and can be further decomposed into two parts:

- a) Projections of effective labor supply.
- b) Projections of physical capital accumulation.

Step 3. We calculated the economic loss as the discounted cumulative difference in projected annual GDP between these two scenarios by discount rate.

This detailed model description follows our previous contribution, in which we applied the framework to estimate the economic burden of noncommunicable diseases in China, Japan, and South Korea² and in the United States and European countries^{3,4} as well as the economic burden of chronic obstructive pulmonary disease and other risk factors.⁴⁻⁷

Production function

Consider an economy in which time $t = 1, 2, \dots, \infty$ evolves discretely. Building on Lucas,⁸ we considered the following production function for this economy:

$$Y_t = A_t K_t^\alpha H_t^{1-\alpha}, \quad (1)$$

where Y_t is aggregate output; A_t is the technological level at time t , which we assume evolves exogenously; K_t is the physical capital stock (i.e., machines, factory buildings, etc.); and H_t represents aggregate human capital. The parameter α is the elasticity of final output with respect to physical capital. The aggregate production function recognizes that output is not only produced with physical capital and raw labor as in the Solow framework,⁹ on which the original EPIC model is based,¹⁰ but with *effective labor*, of which health is a crucial determinant.

Physical capital evolves according to

$$K_{t+1} = (1 - \delta)K_t + Y_t - C_t - TC_t = (1 - \delta)K_t + \gamma_t Y_t, \quad (2)$$

where δ refers to the depreciation rate, γ_t refers to the saving rate, TC_t refers to the costs of ongoing treatment of cancer (or the types of cancer under consideration), and C_t refers to the amount of consumption. From Equation (2), it follows that the saving rate is defined as

$$\gamma_t = 1 - \frac{C_t + TC_t}{Y_t}. \quad (3)$$

Note that aggregate output Y_t is used for three purposes: (i) to pay treatment costs TC_t (hospitalization, medication, etc.), (ii) to consume the amount C_t , and (iii) to save.

Individuals of age-sex group (a, s) with age a and sex s are endowed with $h_t^{(a,s)}$ units of human capital and supply $\ell_t^{(a,s)}$ units of labor from age 15 up to their retirement. Children younger than 15 and retirees older than the age of R do not work. R varies by country and could correspond to a high age (e.g., some people older than 80 could also be working). In the theoretical derivations, R indicates the upper bound of the summation. In our simulations, we used labor projections data from the International Labour Organization, and positive values for the labor force exist for cohorts older than 65. We discretized age less than 65 into 13 groups every five years and discretized all ages older than 65 into 1 group. Thus, we have 28 age-sex groups marked as G . Aggregate human capital in the production function (1) is then defined as the sum over the age-sex-time-specific effective labor supply of each age-sex group:

$$H_t = \sum_{(a,s) \in G} h_t^{(a,s)} \ell_t^{(a,s)} N_t^{(a,s)}, \quad (4)$$

where $N_t^{(a,s)}$ denotes the number of individuals in age-sex group (a, s) . Note that aggregate human capital increases with the number of working-age individuals who live in the economy (i.e., with a higher $N_t = \sum_{(a,s) \in G} N_t^{(a,s)}$), with individual human capital endowment (i.e., with a higher $h_t^{(a,s)}$ for at least one group), and with labor supply (i.e., with a higher $\ell_t^{(a,s)}$ for at least one group).

We followed Mincer¹¹ and constructed the average human capital for each age-sex group with age a according to an exponential function of education and work experience:

$$h_t^{(a,s)} = \exp \left[\eta_1 (ys_t^{(a,s)}) + \eta_2 (a - ye_t^{(a,s)} - 5) + \eta_3 (a - ye_t^{(a,s)} - 5)^2 \right], \quad (5)$$

where η_1 is the semi-elasticity of human capital with respect to average years of education as given by $ye_t^{(a,s)}$, and η_2 and η_3 are the semi-elasticities of human capital with respect to the experience of the workforce $(a - ye_t^{(a,s)} - 5)$ and the experience of the workforce squared $(a - ye_t^{(a,s)} - 5)^2$, respectively. Here, we assumed a school entry age of 5 years throughout.

Impact of cancer on labor supply

Following Bloom et al.² and Chen et al.,^{3 5 6 12} the evolution of labor supply in the status quo scenario is given by

$$L_t^{(a,x)} = \ell_t^{(a,s)} N_t^{(a,s)} \text{ with } N_t^{(a,s)} = [1 - \sigma_{t-1}^{(a-1,s)}] N_{t-1}^{(a-1,s)}, \quad (6)$$

where $\sigma_t^{(a,s)}$ is the overall mortality rate of the age-sex group with age a and sex s at time t . Mortality and morbidity reduce effective labor supply. The reduction of the population size $N_t^{(a,s)}$ captures the mortality effect.

Let $\sigma_{r,t}^{(a,s)}$ denote the mortality rate of people in each age-sex group due to cancer and let $\sigma_{-r,t}^{(a,s)}$ be the overall mortality rate due to causes other than cancer. Then we have

$$(1 - \sigma_t^{(a,s)}) = (1 - \sigma_{r,t}^{(a,s)})(1 - \sigma_{-r,t}^{(a,s)}), \quad (7)$$

Next, we considered the mortality effect of cancer. In general, it reduces labor supply by reducing the population $N_t^{(a,s)}$ (through $\sigma_{r,t}^{(a,s)}$). In the counterfactual case, where cancers are eliminated from time $t = 0$ onward, the evolution of labor supply is defined similarly to Equation (6), but with a different overall mortality rate ($\sigma_{-r,t}^{(a,s)}$ instead of $\sigma_t^{(a,s)}$). For simplicity, we assumed that the number of births is the same in both cases at each point in time t .

In the counterfactual scenario, the size of the cohort with age a and sex s at time t ($\bar{N}_t^{(a,s)}$) evolves according to

$$\bar{N}_t^{(a,s)} = [1 - \sigma_{-r,t-1}^{(a-1,s)}] \bar{N}_{t-1}^{(a-1,s)}, \bar{N}_0^{(a,s)} = N_0^{(a,s)}, \bar{N}_t^{(0,s)} = N_t^{(0,s)}. \quad (8)$$

Following Bloom et al.,² the loss of labor due to mortality accumulates over the years according to

$$\bar{N}_t^{(a,s)} = \frac{N_t^{(a,s)}}{\prod_{\tau=0}^{\min\{t,a\}-1} [1 - \sigma_{r,t-1-\tau}^{(a-1-\tau,s)}]}. \quad (9)$$

The reduction of the labor participation rate $\ell_t^{(a,s)}$ captures the morbidity effect because people with an illness typically reduce their labor supply, either by reducing working hours or by leaving the workforce.

Following Bloom et al.,² the labor participation rate in the counterfactual scenario $\bar{\ell}_t^{(a,s)}$ can be calculated as

$$\bar{\ell}_t^{(a,s)} \approx \frac{\ell_t^{(a,s)}}{\prod_{\tau=0}^{\min\{t,a\}-1} [1 - p^\tau \sigma_{r,t-1-\tau}^{(a-1-\tau,s)} \xi^{(a-1-\tau,s)}]}, \quad (10)$$

where $\xi^{(a,s)}$ measures the size of the morbidity effect relative to the relevant mortality rate, and p is the probability of a patient not recovering from cancer morbidity in each year.

Because the impact of morbidity is hard to estimate directly, we first defined the relative effect for each age-sex group:

$$\xi^{(a,s)} = \frac{\text{loss of labor due to morbidity of group } (a, s)}{\text{loss of labor due to mortality of group } (a, s)}. \quad (11)$$

Next, we assumed that the following holds in any given year for each age-sex group:

$$\xi^{(a,s)} = \frac{YLD^{(a,s)}}{YLL^{(a,s)}}, \quad (12)$$

where $YLD^{(a,s)}$ represents the years lived with cancer and $YLL^{(a,s)}$ represents the years of life lost due to cancer. Notice that $\xi^{(a,s)}$ can be calculated from the corresponding DALY data reported by the Global Burden of Disease Study.¹

In sum, by reducing the prevalence of cancer, the *counterfactual scenario* is associated with an increase in labor supply as compared with the *status quo scenario*. We approximated the change in labor supply (at time t for each age-sex group) by

$$\Delta L_t^{(a,s)} \approx \ell_t^{(a,s)} N_t^{(a,s)} \sum_{\tau=0}^{\min\{t,a\}-1} \sigma_{r,t-1-\tau}^{(a-1-\tau,s)} [1 + p^\tau \xi^{(a-1-\tau,s)}]. \quad (13)$$

For the more general case of a partial reduction in the prevalence of cancer by a factor ρ , we obtained the loss of labor for each age-sex group at time t as

$$\Delta L_t^{(a,s)}(\rho) \approx \ell_t^{(a,s)} N_t^{(a,s)} \sum_{\tau=0}^{\min\{t,a\}-1} \rho \sigma_{r,t-1-\tau}^{(a-1-\tau,s)} [1 + p^\tau \xi^{(a-1-\tau,s)}]. \quad (14)$$

Bloom et al. (2020)² provides the detailed mathematical proof.

Impact of cancer on physical capital accumulation

Cancers also impede the accumulation of physical capital because savings finance part of the treatment costs. Following Bloom et al.² and Chen et al.,³ physical capital accumulation in the counterfactual scenario can be written as

$$\bar{K}_{t+1} = \bar{\gamma}_t \bar{Y}_t + (1 - \delta) \bar{K}_t, \quad (15)$$

$$\bar{\gamma}_t \bar{Y}_t = \bar{I}_t = \bar{Y}_t - \bar{C}_t = \gamma_t \bar{Y}_t + \chi T C_t, \quad (16)$$

where an overbar indicates the counterfactual scenario and where χ is the fraction of the treatment cost that is diverted to savings. The counterfactual saving rate is thus defined by

$$\bar{\gamma}_t = \frac{\gamma_t \bar{Y}_t + \chi T C_t}{\bar{Y}_t}. \quad (17)$$

For more details, see Bloom et al. (2020)² and Chen et al. (2018).³

Because cancers are assumed to be eliminated in the counterfactual scenario, the resources that were devoted to their treatment can now be used for savings or for consumption. Notice that this creates an income effect that, in reality, could affect the division of households' income between savings and consumption. For tractability, we assumed that aggregate investment consists of two parts in the counterfactual scenario: a fixed share γ_t of total output and an additional part from $T C_t$ that would otherwise have been used to pay to treat cancers:

$$\bar{I}_t = \gamma_t \bar{Y}_t + \chi T C_t, \quad (18)$$

Similarly, for the case of a partial reduction in cancer prevalence by ρ , we have

$$\bar{I}_t = \gamma_t \bar{Y}_t + \rho \chi T C_t. \quad (19)$$

The intuition is that if cancers are partially eliminated, the treatment cost that is diverted to savings should be added back proportionally.

eAppendix 3. Data description

Education

Age-specific educational attainment data are from the Barro-Lee Educational Attainment Database,¹³ which provides educational attainment data by five-year age-sex groups up to 2010. For 2010–2030, no age-specific data are available, but the database provides projections for the population aged 15–64. We approximated the age-specific estimates by assuming that educational attainment for each age-sex group grows at the same rate. Because the Barro-Lee database presents data in five-year intervals, linear interpolation was adopted to extend the estimates for each year. For 2030–2050, we projected educational attainment by assuming the same growth rate as during 2010–2030 for each age and sex group.

Mortality/morbidity

The age-sex-specific mortality and morbidity (measured in years of life lost and years of life lost to disability) of cancers up to 2019 are from the recently updated GBD estimates.¹ To extend the estimates beyond 2019, we assumed that the mortality rate of cancers grows at the same rate as during 2010–2019 for each country. Morbidity estimates were obtained similarly. If the projected mortality rate grew too large (i.e., if it more than doubled the current annual rate in 30 years), we limited the mortality rate's growth rate to 2%.

GDP projection

The GDP estimates (in constant 2017 international dollars or INT\$) up to 2020 are from the World Bank database.¹⁴ The GDP growth rates for 2021–2027 are from the International Monetary Fund's World Economic Outlook as of April 2022.¹⁵ We assumed that growth beyond 2027 will be the same as in 2015–2019.

Physical capital

For each country, the physical capital stock (in constant 2017 INT\$) was obtained from the Penn World Table projections.¹⁶

Labor participation

For each country, the labor participation rates (by five-year age-sex groups) are from the International Labour Organization database for 2010–2020.¹⁷ For estimates beyond 2020, we estimated the labor participation rates for the five-year age groups using a logistic regression.

Population

For each country, the population by five-year age group was obtained from the population dynamics database built by the Department of Economic and Social Affairs (DESA) of the United Nations.¹⁸ For those countries without five-year age group data, we used the total population from DESA to impute the economic burden.

Saving rate and health expenditure

We obtained country-specific saving rates and health expenditures from the World Bank database.¹⁹ For the projection, we assumed that the saving rate remains constant (at the average from 2010–2019), while health expenditures (as a percentage of GDP) grow at the same rate as in 2000–2019.

Parameter values and data sources

eTable 1 shows parameter values and data sources in the model, where definitions for parameters are consistent with Bloom et al. (2020)² and Chen et al. (2019).^{5 12}

eTable 1. Parameter values and data sources

Parameter	Definition	Value	Source
	Capital share	Country specific	Penn World Table ²⁰
	Depreciation rate	0.05	Grossmann et al. (2013) ²¹
	Mincer elasticity of education	0.091	Psacharopoulos and Patrinos (2018) ²²
	First-degree Mincer elasticity of experience	0.1301	Heckman et al. (2006) ²³
	Second-degree Mincer elasticity of experience	−0.0023	Heckman et al. (2006) ²³
	Fraction of treatment cost financed out of savings	Set as saving rate	World Bank (2022) ¹⁹

Treatment costs

Prior studies of cancer treatment costs for the United States and other countries have typically focused on the patient level (rather than the national level) and have been limited to patients who actively sought care.^{24–26} This makes obtaining national-level cost estimates difficult because many people with cancer are either not diagnosed or do not actively seek care. In addition, available estimates typically fail to consider comorbidities and vary substantially. In our study, total treatment costs for each cancer in the United States are based on results from Dieleman et al. (2020),²⁷ who systematically estimated national-level spending on private insurance, public insurance, and out-of-pocket payments for different conditions after considering comorbidities. Their spending estimates amounted to 4.57% of the total health expenditures in the United States that year (\$123.8 billion / \$2705.6 billion, in constant 2016 US dollars). **eTable 2** shows the treatment costs for 29 cancers in the United States.

We calculated the country-level cancer-related treatment costs for the countries with data and extrapolated costs for the countries without data, assuming that the per case treatment cost for cancer was proportional to the health expenditure per capita of the country, as previous studies have assumed.^{12 28 29} The intuition here is that health expenditure per capita could be a good metric of the cost of treating a certain disease (cancer for example) across countries. This is an approximate estimate for tractability due to lack of data. Under this assumption, share of cancer-related treatment costs out of all health expenditures (all treatment costs) can be calculated via the cancer prevalence rate. Specifically, we used the U.S. data as the base share of cancer-related treatment costs out of all health expenditures and scaled this figure by the ratio of cancer prevalence between other countries and the United States. For years after 2010, we assumed that the treatment costs of cancers grow at the same rate as per capita health expenditures for each country.

eTable 2. Treatment costs (medium, lower bound, and upper bound) and the share of all treatment cost for all 29 cancers in the United States

Disease	Treatment cost (billions of 2016 US dollars)	Treatment cost_lower (billions of 2016 US dollars)	Treatment cost_upper (billions of 2016 US dollars)	Share of all treatment cost (%)
All cancer	123.8	114.9	132.8	4.575695
Non-melanoma skin cancer	21.6	17.7	27.5	0.798344
Other neoplasms	13.2	11	15.6	0.487877
Leukemia	12	10.7	13.6	0.443525
Non-Hodgkin lymphoma	11.8	10.4	13.4	0.436133
Colon and rectum cancer	10.5	9.3	11.7	0.388084
Tracheal, bronchus, and lung cancer	7.3	6.3	8.4	0.269811
Multiple myeloma	7.1	6.1	8.5	0.262419
Brain and central nervous system cancer	6.8	6	7.6	0.251331
Prostate cancer	5.94	5.4	6.6	0.219545
Breast cancer	4.5	3.6	5.5	0.166322
Kidney cancer	3.4	2.9	3.9	0.125665
Bladder cancer	2.6	2.3	2.9	0.096097
Pancreatic cancer	2.5	2.2	2.8	0.092401
Liver cancer	1.7	1.5	2.1	0.062833
Ovarian cancer	1.6	1.3	2	0.059137
Stomach cancer	1.5	1.2	2	0.055441
Lip and oral cavity cancer	1.4	1.1	1.6	0.051745
Malignant skin melanoma	1.4	1.3	1.6	0.051745
Esophageal cancer	1.1	0.881	1.3	0.040656
Uterine cancer	1.1	0.924	1.2	0.040656
Thyroid cancer	0.891	0.764	1	0.032932
Hodgkin lymphoma	0.851	0.575	1.2	0.031453
Cervical cancer	0.81	0.653	0.97	0.029938
Larynx cancer	0.787	0.602	0.965	0.029088
Other pharynx cancer	0.685	0.497	0.794	0.025318
Testicular cancer	0.394	0.252	0.71	0.014562
Gallbladder and biliary tract cancer	0.358	0.311	0.411	0.013232
Nasopharynx cancer	0.06	0.049	0.072	0.00222

eAppendix 4. Imputation

eTable 3 describes some data lacking for 60 countries.

eTable 3. Missing data for 60 countries; the columns represent regions, country code, country name, GDP, treatment costs, education, health expenditures, labor participation rate, physical capital, population, and saving rate, respectively

Region	Code	World Bank Country	GDP	TC	EDU	HEP C	Lab	Cap	Pop	Save
East Asia & Pacific	ASM	American Samoa	X			X	X	X	X	X
	PRK	Korea, Dem. People's Rep.	X		X	X		X		X
	GUM	Guam	X			X		X		X
	KIR	Kiribati					X	X		
	MHL	Marshall Islands					X	X	X	
	FSM	Micronesia, Fed. Sts.					X	X		X
	MMR	Myanmar						X		
	NRU	Nauru					X	X	X	X
	MNP	Northern Mariana Islands	X			X	X	X	X	X
	PLW	Palau					X	X	X	X
	PNG	Papua New Guinea						X		X
	WSM	Samoa						X		X
	SLB	Solomon Islands						X		
	TWN	Taiwan (Province of China)	X			X				X
	TLS	Timor-Leste						X		
	TON	Tonga						X		
	TUV	Tuvalu					X	X	X	X
	VUT	Vanuatu						X		
Europe & Central Asia	AND	Andorra	X			X	X	X	X	X
	ROU	Romania				X				
	GRL	Greenland	X			X	X	X	X	X
	MCO	Monaco	X			X	X	X	X	X
	SMR	San Marino					X	X	X	X
	TKM	Turkmenistan								X
Latin America & Caribbean	ATG	Antigua and Barbuda					X			
	CUB	Cuba	X			X		X		X
	DMA	Dominica					X		X	
	GRD	Grenada					X			X
	GUY	Guyana						X		X
	HTI	Haiti						X		
	NIC	Nicaragua						X		
	PRI	Puerto Rico				X		X		X
	KNA	St. Kitts and Nevis					X		X	X
	LCA	St. Lucia								X
	VCT	St. Vincent and the Grenadines								X
	TTO	Trinidad and Tobago								X
	VIR	Virgin Islands (U.S.)	X			X		X		X

Region	Code	World Bank Country	GDP	TC	EDU	HEP C	Lab	Cap	Pop	Save
	VEN	Venezuela, RB	X			X				
Middle East & North Africa	DZA	Algeria						X		
	IRN	Iran, Islamic Rep.								X
	LBY	Libya						X		X
	SYR	Syrian Arab Republic	X			X				
	ARE	United Arab Emirates						X		X
	YEM	Yemen, Rep.	X			X				X
North America	BMU	Bermuda	X			X	X		X	
South Asia	AFG	Afghanistan						X		X
Sub-Saharan Africa	CAF	Central African Republic								X
	TCD	Chad								X
	GNQ	Equatorial Guinea								X
	ERI	Eritrea	X			X		X		X
	LBR	Liberia								X
	MWI	Malawi								X
	STP	Sao Tome and Principe								X
	SYC	Seychelles			X		X	X		
	SOM	Somalia				X		X		X
	SSD	South Sudan	X			X		X		
Others	COK	Cook Islands	X		X	X	X	X	X	X
	NIU	Niue	X		X	X	X	X	X	X
	PSE	Palestine	X		X	X		X		
	TKL	Tokelau	X		X	X	X	X	X	X

For the 60 countries and territories with incomplete data (mostly on education, physical capital, and the saving rate in **eTable 3**) but reliable data for GDP and DALYs, we used a linear projection to approximate the economic burden of cancer. We found that the ratio of economic burden to GDP is highly correlated to DALYs. Thus, we imputed economic burden results based on an ordinary least squares linear regression of the relationship between GDP and DALYs. For the imputation, we then used the formula

$$Y_{imputed} = \beta_0 + \beta_1 \text{DALYs}, \quad (20)$$

where β_0 and β_1 are the parameter estimates for the intercept and the slope obtained in the linear regression.

eTable 4 shows the regression coefficients with p-values. All p-values of the coefficient of DALYs are less than 0.0001. The average number of DALYs is 3,233, which means the constant value is far less than the coefficient of DALYs multiplying DALYs. Therefore, the large p-value of the coefficient of constant value is also acceptable for some cancers. To improve the fitting result, we replaced DALYs with all healthy data such as the mortality, incidence, and prevalence rates; DALYs; years of life lost to disability; and years of life lost for each cancer. Due to the multicollinearity of these IHME variables, we performed principal component analysis (PCA) and set the two main components of the PCA results as independent variables. We got a better fit for the linear regression for almost all cancers except non-melanoma skin cancer. In this paper, we used the primary results for almost all cancers except other neoplasms using PCA-refined methods (R-squared is 0.7).

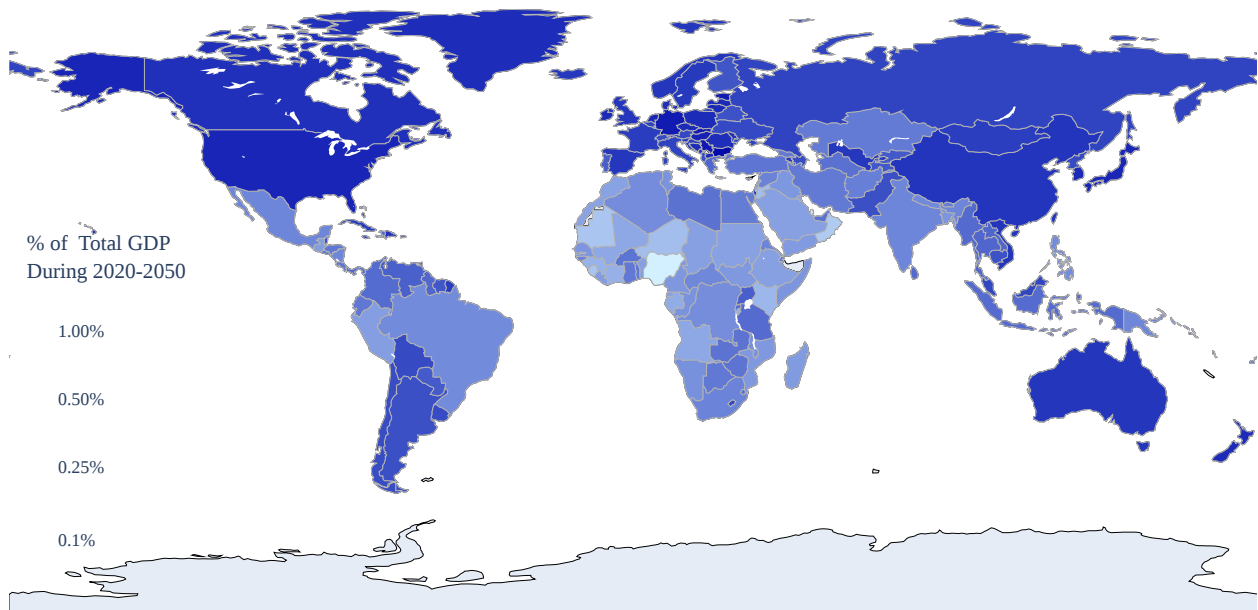
eTable 4. Estimating the relationship among percentage of economic loss, the two main PCA components of IHME data, and the indicator of high-income countries

Disease	Coefficient of constant value β_0	Coefficient of DALYs β_1	p-value	R-squared
Bladder cancer	1.24E-05	9.10E-07	0.000	0.66292636
Brain and central nervous system cancer	-7.84E-06	2.31E-06	0.000	0.71212245
Breast cancer	6.89E-05	1.29E-06	0.000	0.53856703
Cervical cancer	-4.74E-06	2.04E-06	0.000	0.82542384
Colon and rectum cancer	7.38E-05	1.04E-06	0.000	0.71032899
Esophageal cancer	2.09E-05	1.16E-06	0.000	0.72638618
Gallbladder and biliary tract cancer	3.16E-06	9.32E-07	0.000	0.80129833
Hodgkin lymphoma	5.50E-06	2.32E-06	0.000	0.68511449
Kidney cancer	1.12E-05	1.18E-06	0.000	0.76900808
Larynx cancer	3.81E-07	1.50E-06	0.000	0.77727263
Leukemia	5.39E-05	1.70E-06	0.000	0.45658393
Lip and oral cavity cancer	-6.14E-06	1.83E-06	0.000	0.75992021
Liver cancer	2.71E-06	1.45E-06	0.000	0.86422094
Malignant skin melanoma	2.32E-06	1.84E-06	0.000	0.9161329
Mesothelioma	5.28E-06	7.48E-07	0.000	0.71878609
Multiple myeloma	1.99E-06	1.41E-06	0.000	0.80181043
Nasopharynx cancer	-3.55E-06	2.43E-06	0.000	0.94475422
Non-Hodgkin lymphoma	8.68E-06	1.88E-06	0.000	0.7117133
Non-melanoma skin cancer (with no PCA)	-2.85E-05	3.60E-06	0.000	0.78063085
Other neoplasms	0.00011222	4.83E-06	0.000	0.2748814
Other pharynx cancer	-3.10E-08	1.74E-06	0.000	0.83323188
Ovarian cancer	3.30E-06	1.38E-06	0.000	0.6783696
Pancreatic cancer	2.51E-05	9.73E-07	0.000	0.71352724
Prostate cancer	6.48E-06	6.66E-07	0.000	0.61454087
Stomach cancer	4.18E-05	1.19E-06	0.000	0.67103976
Testicular cancer	1.95E-06	3.02E-06	0.000	0.81170393
Thyroid cancer	2.38E-06	1.47E-06	0.000	0.66716852
Tracheal, bronchus, and lung cancer	-2.91E-06	1.10E-06	0.000	0.67689097
Uterine cancer	1.24E-05	9.10E-07	0.000	0.66292636

We then imputed the percentage of the economic loss in total GDP using the coefficients from the regression and calculated the economic loss for the 60 countries with incomplete data as listed in **eTable 3**. The results are merged into the main paper.

eAppendix 5. Geographic distribution and discounted estimates of economic burden of cancers

eFigure 5 shows the geographical distribution of the economic burden of cancer in percentage terms.



eFigure 5. Economic cost of cancers as a percentage of total GDP in 2020–2050

Tables S5–S7 show the total discounted economic burden of cancers in 2020–2050 for each country, by World Bank region, and by World Bank income group, using discount rates of 2%, 0%, and 3%.

eTable 5. Total macroeconomic cost, economic cost as a share of GDP in 2020–2050, and per capita economic cost attributable to cancers, by World Bank region and country (in 2017 INT\$), using discount rates of 2%

Region	World Bank Country	Economic cost in millions of 2017 INT\$ (lower and upper bound)	Percentage of total GDP in 2020–2050 (lower and upper bound)	Per capita loss in 2017 INT\$ (lower and upper bound)
East Asia & Pacific	American Samoa*	112(67-180)	0.477(0.286-0.763)	2,064(1,237-3,300)
East Asia & Pacific	Australia	246,962(180,343-345,480)	0.607(0.443-0.849)	8,424(6,152-11,785)
East Asia & Pacific	Brunei Darussalam	5,442(3,184-8,684)	0.723(0.423-1.154)	11,438(6,693-18,251)
East Asia & Pacific	Cambodia	18,768(10,624-31,028)	0.466(0.264-0.770)	960(543-1,587)
East Asia & Pacific	China	6,089,513(4,116,179-8,545,632)	0.621(0.420-0.872)	4,208(2,845-5,906)
East Asia & Pacific	Fiji	991(476-1,789)	0.305(0.147-0.551)	998(479-1,802)
East Asia & Pacific	Guam*	1,084(666-1,683)	0.523(0.321-0.811)	5,892(3,619-9,144)
East Asia & Pacific	Indonesia	534,305(327,951-858,682)	0.365(0.224-0.587)	1,740(1,068-2,796)
East Asia & Pacific	Japan	967,620(838,479-1,090,630)	0.751(0.650-0.846)	8,283(7,178-9,336)
East Asia & Pacific	Kiribati*	49(28-81)	0.567(0.328-0.933)	331(191-545)
East Asia & Pacific	Korea, Dem. People's Rep.*	7,575(4,433-12,286)	0.529(0.310-0.858)	285(167-462)
East Asia & Pacific	Korea, Rep.	500,271(368,524-695,568)	0.680(0.501-0.946)	9,991(7,360-13,891)
East Asia & Pacific	Lao PDR	10,815(5,850-18,113)	0.388(0.210-0.649)	1,267(685-2,121)
East Asia & Pacific	Malaysia	175,758(83,966-318,020)	0.479(0.229-0.867)	4,731(2,260-8,560)
East Asia & Pacific	Marshall Islands*	33(18-57)	0.440(0.235-0.763)	483(258-837)
East Asia & Pacific	Micronesia, Fed. Sts.*	54(22-104)	0.515(0.206-0.986)	418(167-801)
East Asia & Pacific	Mongolia	9,191(4,830-16,562)	0.566(0.297-1.020)	2,361(1,241-4,254)

East Asia & Pacific	Myanmar*	41,063(28,515-60,299)	0.391(0.271-0.574)	691(480-1,015)
East Asia & Pacific	Nauru*	16(9-26)	0.375(0.218-0.608)	1,460(846-2,364)
East Asia & Pacific	New Zealand	57,733(42,784-78,652)	0.755(0.560-1.029)	10,938(8,106-14,901)
East Asia & Pacific	Northern Mariana Islands*	337(207-534)	0.758(0.465-1.201)	5,496(3,370-8,705)
East Asia & Pacific	Palau*	53(32-86)	0.748(0.449-1.209)	2,912(1,748-4,707)
East Asia & Pacific	Papua New Guinea*	4,102(2,458-6,680)	0.304(0.182-0.495)	354(212-576)
East Asia & Pacific	Philippines	196,048(117,732-300,613)	0.418(0.251-0.642)	1,521(913-2,332)
East Asia & Pacific	Samoa*	128(71-211)	0.324(0.180-0.533)	551(305-906)
East Asia & Pacific	Singapore	64,796(50,470-84,240)	0.348(0.271-0.452)	10,301(8,024-13,393)
East Asia & Pacific	Solomon Islands*	347(199-574)	0.638(0.365-1.055)	357(204-590)
East Asia & Pacific	Taiwan (Province of China)*	289,667(152,896-536,189)	0.708(0.374-1.310)	12,271(6,477-22,714)
East Asia & Pacific	Thailand	152,912(80,089-275,739)	0.369(0.193-0.666)	2,210(1,158-3,986)
East Asia & Pacific	Timor-Leste*	452(242-704)	0.333(0.178-0.519)	268(143-418)
East Asia & Pacific	Tonga*	102(60-168)	0.505(0.295-0.828)	849(496-1,392)
East Asia & Pacific	Tuvalu*	12(7-20)	0.452(0.259-0.758)	852(488-1,430)
East Asia & Pacific	Vanuatu*	108(59-177)	0.363(0.198-0.599)	252(138-415)
East Asia & Pacific	Vietnam	327,797(173,817-573,518)	0.651(0.345-1.139)	3,114(1,651-5,448)
Europe & Central Asia	Albania	8,768(4,484-15,429)	0.657(0.336-1.156)	3,254(1,664-5,727)
Europe & Central Asia	Andorra*	927(575-1,419)	0.778(0.483-1.191)	11,948(7,414-18,283)
Europe & Central Asia	Armenia	8,367(5,531-12,772)	0.554(0.366-0.845)	2,861(1,892-4,368)
Europe & Central Asia	Austria	62,132(48,969-80,737)	0.465(0.366-0.604)	6,783(5,346-8,814)
Europe & Central Asia	Azerbaijan	17,711(9,595-30,403)	0.469(0.254-0.805)	1,637(887-2,810)
Europe & Central Asia	Belarus	20,164(10,289-39,750)	0.481(0.246-0.949)	2,219(1,132-4,375)
Europe & Central Asia	Belgium	81,499(59,111-114,154)	0.510(0.370-0.715)	6,801(4,933-9,526)
Europe & Central Asia	Bosnia and Herzegovina	12,689(7,576-20,285)	0.766(0.458-1.225)	4,211(2,514-6,732)
Europe & Central Asia	Bulgaria	76,830(42,006-134,380)	1.416(0.774-2.477)	12,490(6,829-21,846)
Europe & Central Asia	Croatia	20,065(11,413-35,775)	0.524(0.298-0.934)	5,354(3,045-9,545)
Europe & Central Asia	Cyprus	5,108(3,583-7,310)	0.355(0.249-0.508)	3,946(2,767-5,647)
Europe & Central Asia	Czech Republic	104,503(69,200-163,335)	0.713(0.472-1.115)	9,794(6,485-15,307)
Europe & Central Asia	Denmark	62,083(44,902-87,762)	0.610(0.441-0.862)	10,249(7,413-14,488)
Europe & Central Asia	Estonia	17,844(10,318-30,196)	1.018(0.588-1.722)	14,300(8,269-24,197)
Europe & Central Asia	Finland	32,496(24,365-44,579)	0.435(0.326-0.597)	5,854(4,389-8,030)
Europe & Central Asia	France	478,125(330,702-697,800)	0.600(0.415-0.876)	7,143(4,940-10,425)
Europe & Central Asia	Georgia	6,870(4,398-10,104)	0.313(0.201-0.461)	1,824(1,167-2,682)
Europe & Central Asia	Germany	1,215,479(896,484-1,661,940)	1.014(0.748-1.386)	14,749(10,878-20,166)
Europe & Central Asia	Greece	28,944(21,728-38,561)	0.374(0.281-0.499)	2,978(2,236-3,968)

Europe & Central Asia	Greenland*	677(393-1,120)	0.784(0.455-1.297)	12,098(7,025-20,008)
Europe & Central Asia	Hungary	105,943(63,857-174,025)	0.909(0.548-1.493)	11,634(7,013-19,111)
Europe & Central Asia	Iceland	4,240(2,926-5,953)	0.608(0.420-0.854)	11,654(8,043-16,361)
Europe & Central Asia	Ireland	289,186(213,306-405,025)	0.745(0.549-1.043)	54,009(39,837-75,643)
Europe & Central Asia	Italy	302,171(254,813-353,700)	0.503(0.424-0.589)	5,216(4,399-6,106)
Europe & Central Asia	Kazakhstan	50,474(33,300-76,262)	0.304(0.201-0.460)	2,349(1,550-3,549)
Europe & Central Asia	Kyrgyz Republic	4,797(2,993-7,289)	0.419(0.262-0.637)	610(381-927)
Europe & Central Asia	Latvia	14,933(7,696-28,416)	0.761(0.392-1.449)	8,995(4,636-17,116)
Europe & Central Asia	Lithuania	28,538(18,237-44,783)	0.762(0.487-1.195)	11,924(7,620-18,712)
Europe & Central Asia	Luxembourg	7,521(5,465-10,391)	0.315(0.229-0.435)	10,517(7,642-14,531)
Europe & Central Asia	Moldova	7,448(4,800-11,024)	0.611(0.394-0.904)	1,989(1,282-2,943)
Europe & Central Asia	Monaco*	3,648(2,380-5,560)	1.328(0.867-2.025)	85,230(55,612-129,918)
Europe & Central Asia	Montenegro	4,420(2,686-6,947)	1.091(0.663-1.714)	7,191(4,370-11,301)
Europe & Central Asia	Netherlands	228,621(168,484-308,934)	0.792(0.584-1.071)	13,163(9,701-17,787)
Europe & Central Asia	North Macedonia	8,782(4,634-15,843)	0.798(0.421-1.439)	4,395(2,319-7,929)
Europe & Central Asia	Norway	58,533(51,204-67,653)	0.579(0.507-0.670)	9,667(8,456-11,173)
Europe & Central Asia	Poland	365,913(218,836-622,791)	0.744(0.445-1.266)	10,174(6,085-17,317)
Europe & Central Asia	Portugal	40,923(28,362-58,297)	0.408(0.283-0.581)	4,215(2,921-6,004)
Europe & Central Asia	Romania*	203,881(123,154-323,060)	0.901(0.544-1.427)	11,462(6,924-18,162)
Europe & Central Asia	Russian Federation	459,222(303,005-681,690)	0.499(0.329-0.741)	3,253(2,147-4,830)
Europe & Central Asia	San Marino*	488(270-850)	0.858(0.475-1.493)	14,277(7,895-24,835)
Europe & Central Asia	Serbia	51,592(28,288-93,193)	1.073(0.588-1.938)	6,489(3,558-11,722)
Europe & Central Asia	Slovak Republic	58,788(30,845-113,845)	1.012(0.531-1.959)	11,123(5,836-21,540)
Europe & Central Asia	Slovenia	15,543(8,820-28,278)	0.543(0.308-0.989)	7,675(4,355-13,963)
Europe & Central Asia	Spain	277,921(200,988-383,951)	0.522(0.378-0.721)	6,096(4,408-8,422)
Europe & Central Asia	Sweden	88,116(72,564-109,271)	0.519(0.427-0.643)	8,160(6,720-10,119)
Europe & Central Asia	Switzerland	108,345(78,021-151,404)	0.626(0.451-0.874)	11,611(8,362-16,226)
Europe & Central Asia	Tajikistan	8,285(5,057-13,323)	0.411(0.251-0.661)	649(396-1,044)
Europe & Central Asia	Turkey	328,237(198,361-532,155)	0.322(0.195-0.523)	3,590(2,169-5,820)
Europe & Central Asia	Turkmenistan*	9,551(5,447-16,092)	0.376(0.215-0.634)	1,351(770-2,276)
Europe & Central Asia	Ukraine	11,136(6,610-17,531)	0.383(0.227-0.603)	282(168-444)
Europe & Central Asia	United Kingdom	508,397(445,889-578,368)	0.610(0.535-0.693)	7,125(6,249-8,105)
Europe & Central Asia	Uzbekistan	81,388(48,664-124,419)	0.622(0.372-0.950)	2,097(1,254-3,206)
Latin America & Caribbean	Antigua and Barbuda*	309(206-448)	0.506(0.338-0.735)	2,907(1,942-4,220)

Latin America & Caribbean	Argentina	106,110(75,871-147,935)	0.463(0.331-0.645)	2,101(1,502-2,930)
Latin America & Caribbean	Bahamas, The	2,149(1,284-3,401)	0.659(0.394-1.042)	4,931(2,947-7,805)
Latin America & Caribbean	Barbados	750(453-1,173)	0.778(0.470-1.217)	2,619(1,582-4,095)
Latin America & Caribbean	Belize	324(216-462)	0.479(0.319-0.682)	658(438-936)
Latin America & Caribbean	Bolivia	16,525(8,819-27,574)	0.493(0.263-0.823)	1,189(635-1,985)
Latin America & Caribbean	Brazil	191,810(162,924-228,415)	0.263(0.223-0.313)	853(724-1,016)
Latin America & Caribbean	Chile	61,411(44,458-84,818)	0.449(0.325-0.621)	3,102(2,246-4,284)
Latin America & Caribbean	Colombia	91,451(47,597-165,683)	0.388(0.202-0.702)	1,691(880-3,063)
Latin America & Caribbean	Costa Rica	19,560(10,655-33,160)	0.530(0.288-0.898)	3,531(1,923-5,986)
Latin America & Caribbean	Cuba*	38,006(22,126-60,900)	0.775(0.451-1.242)	3,488(2,031-5,589)
Latin America & Caribbean	Dominica*	155(97-244)	0.747(0.464-1.174)	2,145(1,334-3,372)
Latin America & Caribbean	Dominican Republic	63,255(27,352-121,097)	0.660(0.285-1.263)	5,263(2,276-10,075)
Latin America & Caribbean	Ecuador	13,837(8,479-22,469)	0.287(0.176-0.467)	668(410-1,085)
Latin America & Caribbean	El Salvador	6,082(2,845-11,226)	0.373(0.174-0.688)	893(417-1,648)
Latin America & Caribbean	Grenada*	351(246-493)	0.629(0.440-0.884)	3,039(2,126-4,267)
Latin America & Caribbean	Guatemala	11,518(7,549-17,380)	0.213(0.139-0.321)	509(333-767)
Latin America & Caribbean	Guyana*	6,883(3,837-11,659)	0.423(0.236-0.716)	8,374(4,669-14,185)
Latin America & Caribbean	Haiti*	3,562(1,873-6,284)	0.408(0.214-0.720)	268(141-473)
Latin America & Caribbean	Honduras	6,308(3,126-11,444)	0.322(0.160-0.584)	524(260-950)
Latin America & Caribbean	Jamaica	4,166(2,138-7,155)	0.610(0.313-1.047)	1,378(707-2,367)
Latin America & Caribbean	Mexico	177,506(123,243-244,700)	0.269(0.187-0.371)	1,229(853-1,694)
Latin America & Caribbean	Nicaragua*	3,053(1,840-4,902)	0.276(0.166-0.444)	398(240-638)
Latin America & Caribbean	Panama	16,287(9,488-27,485)	0.358(0.208-0.604)	3,158(1,840-5,329)
Latin America & Caribbean	Paraguay	12,681(6,571-22,284)	0.411(0.213-0.722)	1,540(798-2,706)
Latin America & Caribbean	Peru	31,572(17,701-57,072)	0.247(0.138-0.446)	850(477-1,537)
Latin America & Caribbean	Puerto Rico*	10,983(6,164-19,271)	0.494(0.277-0.866)	3,994(2,242-7,009)
Latin America & Caribbean	St. Kitts and Nevis*	224(135-346)	0.586(0.352-0.904)	4,015(2,412-6,188)
Latin America & Caribbean	St. Lucia*	415(287-589)	0.670(0.463-0.950)	2,224(1,536-3,151)
Latin America & Caribbean	St. Vincent and the Grenadines*	297(211-410)	0.700(0.498-0.966)	2,648(1,883-3,657)
Latin America & Caribbean	Suriname	861(474-1,409)	0.435(0.239-0.712)	1,337(735-2,188)
Latin America & Caribbean	Trinidad and Tobago*	3,307(1,689-6,178)	0.459(0.235-0.858)	2,372(1,212-4,431)
Latin America & Caribbean	Uruguay	9,666(6,900-13,431)	0.465(0.332-0.646)	2,696(1,924-3,746)
Latin America & Caribbean	Venezuela, RB*	47,548(23,121-88,472)	0.494(0.240-0.919)	1,393(677-2,592)
Latin America & Caribbean	Virgin Islands (U.S.)*	1,157(735-1,811)	0.835(0.530-1.307)	11,939(7,580-18,685)

Middle East & North Africa	Algeria*	32,632(19,385-52,876)	0.236(0.140-0.382)	617(367-1,000)
Middle East & North Africa	Bahrain	3,118(2,184-4,617)	0.135(0.094-0.200)	1,500(1,050-2,221)
Middle East & North Africa	Djibouti	1,019(478-1,992)	0.325(0.153-0.636)	878(412-1,717)
Middle East & North Africa	Egypt, Arab Rep.	178,444(91,029-339,758)	0.303(0.155-0.577)	1,364(696-2,597)
Middle East & North Africa	Iran, Islamic Rep.*	109,969(81,492-135,232)	0.346(0.256-0.425)	1,157(857-1,422)
Middle East & North Africa	Iraq	31,280(20,617-47,774)	0.223(0.147-0.341)	564(372-862)
Middle East & North Africa	Israel	84,137(60,088-118,060)	0.590(0.421-0.827)	7,888(5,633-11,068)
Middle East & North Africa	Jordan	5,211(3,076-8,633)	0.164(0.097-0.272)	459(271-760)
Middle East & North Africa	Kuwait	9,273(7,233-12,314)	0.188(0.146-0.249)	1,885(1,470-2,503)
Middle East & North Africa	Lebanon	1,014(554-1,742)	0.228(0.125-0.391)	159(87-272)
Middle East & North Africa	Libya*	36,565(20,018-63,480)	0.357(0.195-0.620)	4,669(2,556-8,106)
Middle East & North Africa	Malta	7,040(5,141-9,655)	0.650(0.474-0.891)	15,942(11,642-21,863)
Middle East & North Africa	Morocco	18,427(11,219-30,636)	0.205(0.125-0.341)	437(266-726)
Middle East & North Africa	Oman	6,459(3,244-13,031)	0.137(0.069-0.277)	1,052(528-2,123)
Middle East & North Africa	Qatar	7,024(5,025-10,542)	0.097(0.070-0.146)	2,038(1,458-3,058)
Middle East & North Africa	Saudi Arabia	94,838(64,221-145,289)	0.199(0.135-0.305)	2,338(1,583-3,581)
Middle East & North Africa	Syrian Arab Republic*	5,251(3,075-8,635)	0.292(0.171-0.480)	191(112-314)
Middle East & North Africa	Tunisia	7,747(4,929-12,063)	0.233(0.148-0.363)	596(379-929)
Middle East & North Africa	United Arab Emirates*	81,578(38,143-151,669)	0.381(0.178-0.708)	7,766(3,631-14,439)
Middle East & North Africa	Yemen, Rep.*	5,998(3,453-9,784)	0.228(0.131-0.371)	152(88-248)
North America	Bermuda*	1,216(800-1,832)	0.649(0.427-0.979)	20,732(13,643-31,240)
North America	Canada	363,048(263,104-507,966)	0.703(0.510-0.984)	8,638(6,260-12,085)
North America	United States	5,253,166(4,654,137-6,079,225)	0.845(0.749-0.978)	14,703(13,026-17,015)
South Asia	Afghanistan*	5,261(3,007-8,686)	0.294(0.168-0.486)	101(57-166)
South Asia	Bangladesh	132,218(63,277-261,535)	0.242(0.116-0.479)	725(347-1,435)
South Asia	Bhutan	1,160(511-2,232)	0.309(0.136-0.595)	1,354(597-2,605)
South Asia	India	1,420,619(931,130-2,045,243)	0.282(0.185-0.406)	924(606-1,330)
South Asia	Maldives	637(381-1,019)	0.192(0.115-0.307)	1,166(698-1,865)
South Asia	Nepal	14,409(7,580-25,467)	0.271(0.143-0.480)	429(225-757)
South Asia	Pakistan	210,793(123,644-342,220)	0.481(0.282-0.780)	748(439-1,215)
South Asia	Sri Lanka	36,204(15,823-75,118)	0.371(0.162-0.770)	1,648(720-3,419)
Sub-Saharan Africa	Angola	10,264(5,445-17,350)	0.207(0.110-0.350)	193(103-327)
Sub-Saharan Africa	Benin	4,656(2,495-7,997)	0.225(0.121-0.387)	261(140-448)
Sub-Saharan Africa	Botswana	3,687(2,327-5,876)	0.300(0.189-0.478)	1,246(786-1,985)
Sub-Saharan Africa	Burkina Faso	7,429(4,255-12,164)	0.315(0.180-0.515)	236(135-386)
Sub-Saharan Africa	Burundi	474(256-825)	0.186(0.101-0.324)	26(14-45)

Sub-Saharan Africa	Cabo Verde	475(256-827)	0.378(0.203-0.657)	758(407-1,318)
Sub-Saharan Africa	Cameroon	10,148(5,191-18,457)	0.242(0.124-0.441)	267(137-485)
Sub-Saharan Africa	Central African Republic*	448(250-774)	0.249(0.139-0.430)	68(38-118)
Sub-Saharan Africa	Chad*	1,361(802-2,140)	0.207(0.122-0.326)	55(32-86)
Sub-Saharan Africa	Comoros	317(149-573)	0.342(0.160-0.617)	272(127-491)
Sub-Saharan Africa	Congo, Dem. Rep.	12,810(6,818-22,470)	0.262(0.139-0.459)	92(49-162)
Sub-Saharan Africa	Congo, Rep.	905(462-1,611)	0.260(0.133-0.462)	114(58-202)
Sub-Saharan Africa	Côte d'Ivoire	17,149(9,250-29,122)	0.193(0.104-0.328)	450(242-763)
Sub-Saharan Africa	Equatorial Guinea*	685(384-1,171)	0.217(0.122-0.372)	325(182-555)
Sub-Saharan Africa	Eritrea*	1,043(599-1,723)	0.300(0.172-0.496)	222(127-366)
Sub-Saharan Africa	Eswatini	980(510-1,748)	0.331(0.172-0.591)	694(361-1,237)
Sub-Saharan Africa	Ethiopia	46,943(27,412-77,960)	0.219(0.128-0.364)	293(171-487)
Sub-Saharan Africa	Gabon	1,942(1,072-3,364)	0.189(0.104-0.327)	645(356-1,118)
Sub-Saharan Africa	Gambia, The	800(380-1,445)	0.319(0.152-0.577)	222(105-401)
Sub-Saharan Africa	Ghana	34,505(17,572-60,301)	0.416(0.212-0.728)	833(424-1,456)
Sub-Saharan Africa	Guinea	8,611(4,182-15,456)	0.383(0.186-0.687)	446(217-801)
Sub-Saharan Africa	Guinea-Bissau	496(275-851)	0.300(0.166-0.514)	181(100-311)
Sub-Saharan Africa	Kenya	19,428(11,760-32,191)	0.175(0.106-0.290)	267(161-442)
Sub-Saharan Africa	Lesotho	601(283-1,120)	0.507(0.239-0.945)	249(117-464)
Sub-Saharan Africa	Liberia*	437(237-729)	0.207(0.112-0.345)	61(33-102)
Sub-Saharan Africa	Madagascar	3,654(1,887-6,382)	0.234(0.121-0.409)	91(47-158)
Sub-Saharan Africa	Malawi*	2,738(1,475-4,753)	0.231(0.124-0.401)	97(52-168)
Sub-Saharan Africa	Mali	4,338(2,074-7,952)	0.209(0.100-0.383)	139(66-255)
Sub-Saharan Africa	Mauritania	1,585(738-3,027)	0.149(0.070-0.285)	235(110-449)
Sub-Saharan Africa	Mauritius	2,703(1,812-3,959)	0.326(0.218-0.477)	2,161(1,449-3,165)
Sub-Saharan Africa	Mozambique	4,270(2,354-7,391)	0.234(0.129-0.404)	90(50-156)
Sub-Saharan Africa	Namibia	1,460(739-2,757)	0.253(0.128-0.478)	448(227-847)
Sub-Saharan Africa	Niger	2,828(1,551-4,803)	0.159(0.087-0.270)	66(36-113)
Sub-Saharan Africa	Nigeria	32,591(20,060-52,037)	0.108(0.067-0.173)	109(67-175)
Sub-Saharan Africa	Rwanda	6,517(3,322-11,654)	0.361(0.184-0.645)	363(185-649)
Sub-Saharan Africa	Sao Tome and Principe*	103(57-176)	0.314(0.172-0.533)	344(188-585)
Sub-Saharan Africa	Senegal	7,972(4,221-13,292)	0.245(0.130-0.409)	325(172-543)
Sub-Saharan Africa	Seychelles*	698(429-1,095)	0.699(0.430-1.098)	6,769(4,166-10,627)
Sub-Saharan Africa	Sierra Leone	558(297-971)	0.152(0.081-0.264)	53(28-93)
Sub-Saharan Africa	Somalia*	1,620(906-2,713)	0.228(0.127-0.382)	66(37-110)
Sub-Saharan Africa	South Africa	52,947(39,768-73,882)	0.269(0.202-0.375)	775(582-1,081)
Sub-Saharan Africa	South Sudan*	1,711(993-2,858)	0.239(0.139-0.399)	111(64-186)
Sub-Saharan Africa	Sudan	11,292(5,965-19,925)	0.215(0.113-0.379)	183(96-322)

Sub-Saharan Africa	Tanzania	33,373(16,974-60,647)	0.363(0.185-0.659)	363(185-660)
Sub-Saharan Africa	Togo	3,013(1,587-5,203)	0.332(0.175-0.573)	258(136-445)
Sub-Saharan Africa	Uganda	20,067(10,003-36,630)	0.381(0.190-0.696)	299(149-546)
Sub-Saharan Africa	Zambia	7,636(3,921-13,647)	0.348(0.179-0.622)	272(140-486)
Sub-Saharan Africa	Zimbabwe	4,995(2,666-8,802)	0.340(0.181-0.599)	259(138-457)
Others	Cook Islands*	57(34-90)	0.534(0.317-0.841)	3,289(1,954-5,183)
Others	Niue*	2(1-3)	0.557(0.335-0.887)	1,179(710-1,876)
Others	Palestine*	2,960(1,897-4,318)	0.319(0.204-0.466)	425(272-620)
Others	Tokelau*	1(1-2)	0.415(0.234-0.694)	777(438-1,300)

Please note that results for countries marked with an asterisk in column 2 are imputed due to missing data.

eTable 6. Total macroeconomic burden attributable to cancers in 2020–2050 using a discount rate of 0% for 204 countries, by World Bank region (in 2017 INT\$)

Region	World Bank Country	Economic cost in millions of 2017 INT\$ (lower and upper bound)	Percentage of total GDP in 2020–2050 (lower and upper bound)	Per capita loss in 2017 INT\$ (lower and upper bound)
East Asia & Pacific	American Samoa*	169(100-271)	0.512(0.305-0.825)	3,097(1,843-4,985)
East Asia & Pacific	Australia	368,716(268,232-518,662)	0.654(0.476-0.920)	12,577(9,150-17,692)
East Asia & Pacific	Brunei Darussalam	8,055(4,683-12,912)	0.793(0.461-1.272)	16,930(9,843-27,138)
East Asia & Pacific	Cambodia	29,466(16,645-48,777)	0.495(0.280-0.819)	1,507(851-2,494)
East Asia & Pacific	China	9,189,816(6,169,449-12,962,148)	0.664(0.446-0.936)	6,351(4,264-8,958)
East Asia & Pacific	Fiji	1,480(704-2,689)	0.325(0.155-0.591)	1,491(709-2,709)
East Asia & Pacific	Guam*	1,626(992-2,540)	0.561(0.343-0.877)	8,837(5,392-13,805)
East Asia & Pacific	Indonesia	825,326(504,478-1,332,219)	0.392(0.240-0.633)	2,688(1,643-4,338)
East Asia & Pacific	Japan	1,412,600(1,221,883-1,594,886)	0.811(0.702-0.916)	12,092(10,460-13,652)
East Asia & Pacific	Kiribati*	73(42-121)	0.608(0.350-1.008)	493(284-817)
East Asia & Pacific	Korea, Dem. People's Rep.*	11,348(6,602-18,528)	0.567(0.330-0.926)	427(248-697)
East Asia & Pacific	Korea, Rep.	749,966(551,151-1,047,478)	0.733(0.539-1.024)	14,977(11,007-20,918)
East Asia & Pacific	Lao PDR	16,836(9,109-28,194)	0.413(0.224-0.692)	1,972(1,067-3,302)
East Asia & Pacific	Malaysia	272,750(128,795-496,536)	0.518(0.245-0.944)	7,341(3,467-13,365)
East Asia & Pacific	Marshall Islands*	49(26-86)	0.472(0.251-0.824)	724(385-1,264)
East Asia & Pacific	Micronesia, Fed. Sts.*	80(32-154)	0.553(0.220-1.067)	615(244-1,187)
East Asia & Pacific	Mongolia	13,915(7,276-25,213)	0.599(0.313-1.085)	3,574(1,869-6,476)
East Asia & Pacific	Myanmar*	64,359(44,518-94,892)	0.420(0.291-0.620)	1,083(749-1,597)
East Asia & Pacific	Nauru*	23(14-38)	0.403(0.233-0.656)	2,142(1,235-3,487)
East Asia & Pacific	New Zealand	86,626(63,949-118,615)	0.808(0.596-1.106)	16,412(12,116-22,472)
East Asia & Pacific	Northern Mariana Islands*	506(308-807)	0.814(0.496-1.299)	8,244(5,020-13,157)
East Asia & Pacific	Palau*	77(46-126)	0.801(0.477-1.305)	4,240(2,527-6,909)
East Asia & Pacific	Papua New Guinea*	6,232(3,714-10,193)	0.327(0.195-0.534)	537(320-879)
East Asia & Pacific	Philippines	308,797(184,026-475,714)	0.449(0.267-0.691)	2,395(1,427-3,690)

East Asia & Pacific	Samoa*	193(106-318)	0.349(0.192-0.576)	829(457-1,368)
East Asia & Pacific	Singapore	97,583(75,890-127,181)	0.374(0.291-0.488)	15,514(12,065-20,220)
East Asia & Pacific	Solomon Islands*	525(298-874)	0.688(0.390-1.145)	540(306-899)
East Asia & Pacific	Taiwan (Province of China)*	434,627(227,833-811,039)	0.760(0.399-1.419)	18,412(9,652-34,357)
East Asia & Pacific	Thailand	231,311(120,247-420,575)	0.398(0.207-0.723)	3,344(1,738-6,079)
East Asia & Pacific	Timor-Leste*	658(350-1,030)	0.358(0.190-0.560)	391(208-611)
East Asia & Pacific	Tonga*	152(88-251)	0.543(0.316-0.895)	1,262(734-2,081)
East Asia & Pacific	Tuvalu*	19(11-31)	0.485(0.276-0.819)	1,339(762-2,260)
East Asia & Pacific	Vanuatu*	162(88-269)	0.389(0.212-0.646)	380(207-630)
East Asia & Pacific	Vietnam	511,329(269,347-899,423)	0.687(0.362-1.209)	4,857(2,558-8,543)
Europe & Central Asia	Albania	13,380(6,780-23,697)	0.716(0.363-1.269)	4,966(2,516-8,795)
Europe & Central Asia	Andorra*	1,394(860-2,148)	0.838(0.517-1.291)	17,964(11,081-27,690)
Europe & Central Asia	Armenia	12,625(8,304-19,391)	0.584(0.384-0.896)	4,318(2,840-6,632)
Europe & Central Asia	Austria	91,628(72,216-119,246)	0.499(0.394-0.650)	10,003(7,884-13,018)
Europe & Central Asia	Azerbaijan	25,469(13,687-44,052)	0.500(0.269-0.864)	2,354(1,265-4,072)
Europe & Central Asia	Belarus	28,651(14,367-57,594)	0.512(0.257-1.029)	3,153(1,581-6,339)
Europe & Central Asia	Belgium	119,634(86,441-168,513)	0.547(0.395-0.771)	9,983(7,213-14,062)
Europe & Central Asia	Bosnia and Herzegovina	19,093(11,323-30,715)	0.824(0.489-1.325)	6,337(3,758-10,194)
Europe & Central Asia	Bulgaria	117,289(63,421-207,156)	1.543(0.834-2.726)	19,067(10,310-33,676)
Europe & Central Asia	Croatia	29,533(16,658-53,314)	0.551(0.311-0.994)	7,880(4,444-14,225)
Europe & Central Asia	Cyprus	7,930(5,571-11,352)	0.383(0.269-0.548)	6,126(4,303-8,769)
Europe & Central Asia	Czech Republic	158,586(104,701-249,469)	0.767(0.506-1.206)	14,862(9,812-23,379)
Europe & Central Asia	Denmark	91,309(65,874-129,833)	0.648(0.468-0.922)	15,074(10,875-21,433)
Europe & Central Asia	Estonia	27,226(15,624-46,447)	1.100(0.631-1.876)	21,817(12,520-37,221)
Europe & Central Asia	Finland	48,007(35,954-66,098)	0.470(0.352-0.647)	8,648(6,477-11,906)
Europe & Central Asia	France	703,849(483,962-1,035,372)	0.646(0.444-0.950)	10,515(7,230-15,468)
Europe & Central Asia	Georgia	10,463(6,666-15,454)	0.335(0.214-0.495)	2,777(1,770-4,102)
Europe & Central Asia	Germany	1,811,781(1,329,802-2,493,186)	1.105(0.811-1.520)	21,985(16,136-30,253)
Europe & Central Asia	Greece	42,109(31,539-56,286)	0.402(0.301-0.538)	4,333(3,245-5,792)
Europe & Central Asia	Greenland*	1,016(586-1,694)	0.842(0.486-1.404)	18,145(10,464-30,251)
Europe & Central Asia	Hungary	159,092(94,986-263,872)	0.963(0.575-1.597)	17,471(10,431-28,978)
Europe & Central Asia	Iceland	6,418(4,416-9,037)	0.648(0.446-0.913)	17,640(12,136-24,838)
Europe & Central Asia	Ireland	463,209(341,570-650,138)	0.784(0.578-1.100)	86,509(63,792-121,420)
Europe & Central Asia	Italy	443,111(373,120-519,697)	0.544(0.458-0.638)	7,649(6,441-8,972)
Europe & Central Asia	Kazakhstan	74,272(48,680-113,068)	0.321(0.210-0.488)	3,456(2,265-5,262)

Europe & Central Asia	Kyrgyz Republic	7,357(4,559-11,245)	0.453(0.281-0.692)	935(580-1,430)
Europe & Central Asia	Latvia	22,462(11,438-43,321)	0.818(0.416-1.577)	13,530(6,890-26,094)
Europe & Central Asia	Lithuania	43,089(27,400-68,085)	0.819(0.521-1.294)	18,004(11,449-28,448)
Europe & Central Asia	Luxembourg	11,112(8,053-15,405)	0.334(0.242-0.464)	15,539(11,261-21,543)
Europe & Central Asia	Moldova	11,215(7,176-16,705)	0.653(0.418-0.973)	2,995(1,916-4,460)
Europe & Central Asia	Monaco*	5,492(3,556-8,449)	1.432(0.927-2.202)	128,325(83,083-197,409)
Europe & Central Asia	Montenegro	6,749(4,075-10,667)	1.176(0.710-1.859)	10,979(6,628-17,352)
Europe & Central Asia	Netherlands	339,278(249,059-460,841)	0.852(0.626-1.158)	19,535(14,340-26,534)
Europe & Central Asia	North Macedonia	13,096(6,819-23,934)	0.852(0.444-1.557)	6,554(3,413-11,979)
Europe & Central Asia	Norway	85,511(74,803-98,965)	0.620(0.542-0.717)	14,122(12,354-16,344)
Europe & Central Asia	Poland	556,598(329,092-959,719)	0.794(0.470-1.370)	15,476(9,151-26,685)
Europe & Central Asia	Portugal	60,021(41,461-85,936)	0.432(0.298-0.618)	6,182(4,270-8,851)
Europe & Central Asia	Romania*	313,444(187,968-500,868)	0.969(0.581-1.548)	17,622(10,568-28,159)
Europe & Central Asia	Russian Federation	659,930(430,858-990,590)	0.532(0.347-0.798)	4,675(3,053-7,018)
Europe & Central Asia	San Marino*	721(396-1,264)	0.926(0.509-1.624)	21,072(11,582-36,950)
Europe & Central Asia	Serbia	77,895(42,253-142,398)	1.154(0.626-2.109)	9,798(5,315-17,911)
Europe & Central Asia	Slovak Republic	90,082(46,776-176,707)	1.106(0.574-2.169)	17,044(8,850-33,433)
Europe & Central Asia	Slovenia	23,075(13,014-42,468)	0.573(0.323-1.055)	11,394(6,426-20,969)
Europe & Central Asia	Spain	414,060(298,846-574,309)	0.559(0.404-0.776)	9,082(6,555-12,597)
Europe & Central Asia	Sweden	131,077(107,879-162,843)	0.556(0.458-0.691)	12,139(9,990-15,080)
Europe & Central Asia	Switzerland	159,103(114,033-223,727)	0.670(0.480-0.942)	17,051(12,221-23,977)
Europe & Central Asia	Tajikistan	13,137(8,017-21,146)	0.443(0.270-0.712)	1,029(628-1,657)
Europe & Central Asia	Turkey	499,577(299,685-816,137)	0.346(0.207-0.565)	5,464(3,278-8,926)
Europe & Central Asia	Turkmenistan*	13,893(7,891-23,516)	0.404(0.229-0.684)	1,965(1,116-3,326)
Europe & Central Asia	Ukraine	14,744(8,599-23,468)	0.447(0.261-0.712)	374(218-595)
Europe & Central Asia	United Kingdom	755,204(661,571-860,416)	0.658(0.577-0.750)	10,584(9,271-12,058)
Europe & Central Asia	Uzbekistan	126,298(74,924-194,097)	0.664(0.394-1.021)	3,254(1,931-5,001)
Latin America & Caribbean	Antigua and Barbuda*	476(316-695)	0.545(0.362-0.796)	4,478(2,973-6,537)
Latin America & Caribbean	Argentina	154,798(110,064-217,155)	0.505(0.359-0.708)	3,065(2,180-4,300)
Latin America & Caribbean	Bahamas, The	3,160(1,872-5,037)	0.710(0.421-1.131)	7,252(4,297-11,559)
Latin America & Caribbean	Barbados	1,097(657-1,730)	0.840(0.503-1.324)	3,831(2,294-6,040)
Latin America & Caribbean	Belize	484(321-690)	0.520(0.346-0.743)	980(651-1,399)
Latin America & Caribbean	Bolivia	25,101(13,347-41,979)	0.529(0.281-0.885)	1,807(961-3,022)
Latin America & Caribbean	Brazil	276,052(233,914-329,771)	0.284(0.241-0.339)	1,227(1,040-1,466)

Latin America & Caribbean	Chile	92,127(66,430-127,809)	0.490(0.353-0.680)	4,653(3,355-6,456)
Latin America & Caribbean	Colombia	137,538(70,615-251,995)	0.420(0.215-0.769)	2,542(1,305-4,658)
Latin America & Caribbean	Costa Rica	29,847(16,102-50,950)	0.575(0.310-0.982)	5,388(2,907-9,197)
Latin America & Caribbean	Cuba*	57,111(33,023-92,231)	0.834(0.482-1.346)	5,241(3,031-8,465)
Latin America & Caribbean	Dominica*	228(141-361)	0.805(0.498-1.274)	3,145(1,945-4,978)
Latin America & Caribbean	Dominican Republic	99,313(42,515-191,026)	0.710(0.304-1.366)	8,263(3,537-15,893)
Latin America & Caribbean	Ecuador	20,385(12,436-33,312)	0.313(0.191-0.512)	985(601-1,609)
Latin America & Caribbean	El Salvador	9,153(4,207-17,064)	0.405(0.186-0.756)	1,343(617-2,504)
Latin America & Caribbean	Grenada*	535(372-755)	0.678(0.472-0.958)	4,626(3,219-6,535)
Latin America & Caribbean	Guatemala	17,518(11,443-26,548)	0.230(0.150-0.349)	773(505-1,172)
Latin America & Caribbean	Guyana*	10,587(5,873-18,036)	0.455(0.252-0.774)	12,881(7,146-21,945)
Latin America & Caribbean	Haiti*	5,222(2,732-9,262)	0.440(0.230-0.780)	393(206-698)
Latin America & Caribbean	Honduras	9,653(4,780-17,539)	0.349(0.173-0.633)	801(397-1,456)
Latin America & Caribbean	Jamaica	6,202(3,141-10,740)	0.668(0.338-1.157)	2,052(1,039-3,553)
Latin America & Caribbean	Mexico	267,951(184,773-370,906)	0.296(0.204-0.409)	1,855(1,279-2,568)
Latin America & Caribbean	Nicaragua*	4,490(2,697-7,229)	0.297(0.178-0.478)	585(351-941)
Latin America & Caribbean	Panama	25,184(14,572-42,798)	0.386(0.224-0.656)	4,883(2,825-8,298)
Latin America & Caribbean	Paraguay	19,303(9,899-34,170)	0.448(0.229-0.792)	2,344(1,202-4,149)
Latin America & Caribbean	Peru	47,892(26,689-87,353)	0.267(0.149-0.487)	1,290(719-2,353)
Latin America & Caribbean	Puerto Rico*	15,451(8,625-27,290)	0.532(0.297-0.940)	5,619(3,137-9,925)
Latin America & Caribbean	St. Kitts and Nevis*	335(200-520)	0.631(0.377-0.979)	6,003(3,584-9,311)
Latin America & Caribbean	St. Lucia*	616(423-878)	0.722(0.496-1.029)	3,299(2,266-4,702)
Latin America & Caribbean	St. Vincent and the Grenadines*	443(313-616)	0.754(0.534-1.048)	3,957(2,799-5,496)
Latin America & Caribbean	Suriname	1,257(685-2,067)	0.475(0.259-0.781)	1,951(1,064-3,209)
Latin America & Caribbean	Trinidad and Tobago*	4,670(2,373-8,783)	0.494(0.251-0.930)	3,349(1,702-6,299)
Latin America & Caribbean	Uruguay	14,103(10,025-19,689)	0.499(0.355-0.697)	3,933(2,796-5,491)
Latin America & Caribbean	Venezuela, RB*	71,498(34,608-133,895)	0.531(0.257-0.995)	2,095(1,014-3,923)
Latin America & Caribbean	Virgin Islands (U.S.)*	1,741(1,098-2,746)	0.899(0.567-1.418)	17,960(11,331-28,331)
Middle East & North Africa	Algeria*	48,166(28,513-78,232)	0.253(0.150-0.410)	911(539-1,480)
Middle East & North Africa	Bahrain	4,789(3,357-7,094)	0.148(0.104-0.220)	2,303(1,615-3,412)
Middle East & North Africa	Djibouti	1,585(743-3,103)	0.343(0.161-0.672)	1,366(641-2,675)
Middle East & North Africa	Egypt, Arab Rep.	276,814(140,183-530,657)	0.328(0.166-0.628)	2,116(1,072-4,057)
Middle East & North Africa	Iran, Islamic Rep.*	161,206(118,789-198,603)	0.371(0.274-0.458)	1,696(1,249-2,089)
Middle East & North Africa	Iraq	48,557(31,909-74,334)	0.242(0.159-0.370)	876(575-1,341)

Middle East & North Africa	Israel	127,157(90,374-179,396)	0.631(0.448-0.890)	11,921(8,472-16,818)
Middle East & North Africa	Jordan	7,749(4,544-12,934)	0.177(0.104-0.296)	682(400-1,138)
Middle East & North Africa	Kuwait	13,821(10,789-18,358)	0.208(0.162-0.276)	2,810(2,193-3,732)
Middle East & North Africa	Lebanon	1,366(738-2,368)	0.260(0.141-0.451)	213(115-370)
Middle East & North Africa	Libya*	62,604(34,108-109,289)	0.384(0.209-0.670)	7,994(4,355-13,956)
Middle East & North Africa	Malta	11,085(8,078-15,239)	0.694(0.506-0.954)	25,103(18,294-34,509)
Middle East & North Africa	Morocco	27,802(16,944-46,282)	0.221(0.135-0.368)	659(402-1,097)
Middle East & North Africa	Oman	9,652(4,815-19,669)	0.149(0.074-0.303)	1,572(784-3,204)
Middle East & North Africa	Qatar	10,550(7,534-15,890)	0.107(0.076-0.160)	3,060(2,185-4,610)
Middle East & North Africa	Saudi Arabia	142,904(96,671-219,452)	0.219(0.148-0.336)	3,522(2,383-5,409)
Middle East & North Africa	Syrian Arab Republic*	7,913(4,619-13,057)	0.315(0.184-0.519)	287(168-474)
Middle East & North Africa	Tunisia	11,520(7,347-17,930)	0.253(0.162-0.394)	887(566-1,380)
Middle East & North Africa	United Arab Emirates*	122,914(57,200-229,699)	0.410(0.191-0.766)	11,702(5,446-21,868)
Middle East & North Africa	Yemen, Rep.*	8,998(5,163-14,707)	0.244(0.140-0.399)	228(131-373)
North America	Bermuda*	1,829(1,197-2,775)	0.699(0.458-1.061)	31,188(20,405-47,315)
North America	Canada	538,023(388,202-757,460)	0.759(0.548-1.069)	12,801(9,236-18,021)
North America	United States	7,784,167(6,886,149-9,028,381)	0.906(0.802-1.051)	21,787(19,273-25,269)
South Asia	Afghanistan*	7,713(4,394-12,773)	0.317(0.181-0.525)	147(84-244)
South Asia	Bangladesh	206,721(98,430-410,685)	0.255(0.121-0.506)	1,134(540-2,253)
South Asia	Bhutan	1,809(795-3,487)	0.333(0.146-0.641)	2,111(927-4,070)
South Asia	India	2,217,555(1,444,655-3,206,137)	0.299(0.195-0.433)	1,442(940-2,086)
South Asia	Maldives	1,007(603-1,611)	0.207(0.124-0.331)	1,844(1,103-2,950)
South Asia	Nepal	22,384(11,759-39,641)	0.291(0.153-0.515)	666(350-1,179)
South Asia	Pakistan	321,654(187,921-524,010)	0.513(0.300-0.836)	1,142(667-1,860)
South Asia	Sri Lanka	54,571(23,458-114,693)	0.397(0.171-0.834)	2,484(1,068-5,220)
Sub-Saharan Africa	Angola	14,631(7,731-24,784)	0.222(0.117-0.376)	276(146-467)
Sub-Saharan Africa	Benin	7,117(3,803-12,251)	0.239(0.128-0.412)	399(213-686)
Sub-Saharan Africa	Botswana	5,576(3,528-8,883)	0.325(0.206-0.518)	1,883(1,192-3,000)
Sub-Saharan Africa	Burkina Faso	11,600(6,638-19,016)	0.338(0.194-0.555)	368(211-604)
Sub-Saharan Africa	Burundi	687(372-1,198)	0.200(0.108-0.349)	38(20-66)
Sub-Saharan Africa	Cabo Verde	721(386-1,257)	0.404(0.216-0.704)	1,148(615-2,004)
Sub-Saharan Africa	Cameroon	15,485(7,896-28,267)	0.260(0.132-0.474)	407(208-743)
Sub-Saharan Africa	Central African Republic*	680(380-1,180)	0.267(0.149-0.462)	103(58-179)
Sub-Saharan Africa	Chad*	1,959(1,151-3,081)	0.222(0.130-0.349)	79(46-124)
Sub-Saharan Africa	Comoros	481(224-870)	0.370(0.173-0.670)	412(192-746)
Sub-Saharan Africa	Congo, Dem. Rep.	19,520(10,387-34,236)	0.278(0.148-0.487)	140(75-246)

Sub-Saharan Africa	Congo, Rep.	1,219(620-2,175)	0.276(0.140-0.493)	153(78-273)
Sub-Saharan Africa	Côte d'Ivoire	26,950(14,517-45,823)	0.205(0.110-0.348)	706(381-1,201)
Sub-Saharan Africa	Equatorial Guinea*	891(498-1,526)	0.233(0.130-0.399)	422(236-723)
Sub-Saharan Africa	Eritrea*	1,564(894-2,593)	0.322(0.184-0.534)	332(190-551)
Sub-Saharan Africa	Eswatini	1,431(753-2,541)	0.352(0.185-0.624)	1,014(533-1,799)
Sub-Saharan Africa	Ethiopia	74,687(43,466-124,249)	0.231(0.134-0.383)	466(271-776)
Sub-Saharan Africa	Gabon	2,900(1,600-5,031)	0.204(0.112-0.354)	964(532-1,672)
Sub-Saharan Africa	Gambia, The	1,235(585-2,234)	0.343(0.162-0.620)	343(162-620)
Sub-Saharan Africa	Ghana	53,088(26,872-93,154)	0.444(0.225-0.778)	1,282(649-2,249)
Sub-Saharan Africa	Guinea	13,527(6,538-24,343)	0.406(0.196-0.731)	701(339-1,262)
Sub-Saharan Africa	Guinea-Bissau	755(418-1,296)	0.318(0.176-0.546)	276(153-473)
Sub-Saharan Africa	Kenya	29,781(17,932-49,603)	0.187(0.113-0.312)	409(246-681)
Sub-Saharan Africa	Lesotho	871(410-1,629)	0.551(0.259-1.031)	361(170-675)
Sub-Saharan Africa	Liberia*	631(341-1,056)	0.221(0.119-0.370)	89(48-148)
Sub-Saharan Africa	Madagascar	5,533(2,848-9,686)	0.251(0.129-0.439)	137(71-241)
Sub-Saharan Africa	Malawi*	4,154(2,232-7,228)	0.247(0.133-0.430)	147(79-256)
Sub-Saharan Africa	Mali	6,658(3,163-12,253)	0.222(0.105-0.408)	213(101-393)
Sub-Saharan Africa	Mauritania	2,423(1,122-4,650)	0.159(0.074-0.306)	360(167-690)
Sub-Saharan Africa	Mauritius	4,152(2,776-6,100)	0.355(0.238-0.522)	3,319(2,219-4,876)
Sub-Saharan Africa	Mozambique	6,608(3,635-11,471)	0.253(0.139-0.439)	140(77-242)
Sub-Saharan Africa	Namibia	2,146(1,079-4,084)	0.275(0.138-0.524)	659(331-1,254)
Sub-Saharan Africa	Niger	4,437(2,425-7,549)	0.171(0.093-0.291)	104(57-177)
Sub-Saharan Africa	Nigeria	46,414(28,537-74,290)	0.113(0.069-0.181)	156(96-249)
Sub-Saharan Africa	Rwanda	10,215(5,190-18,304)	0.381(0.193-0.682)	569(289-1,019)
Sub-Saharan Africa	Sao Tome and Principe*	156(85-266)	0.336(0.183-0.575)	518(282-886)
Sub-Saharan Africa	Senegal	12,560(6,626-20,968)	0.264(0.139-0.441)	513(270-856)
Sub-Saharan Africa	Seychelles*	1,071(655-1,693)	0.753(0.461-1.190)	10,395(6,359-16,431)
Sub-Saharan Africa	Sierra Leone	810(430-1,413)	0.164(0.087-0.286)	77(41-135)
Sub-Saharan Africa	Somalia*	2,452(1,368-4,111)	0.244(0.136-0.410)	99(55-167)
Sub-Saharan Africa	South Africa	76,737(57,953-107,141)	0.288(0.217-0.402)	1,123(848-1,568)
Sub-Saharan Africa	South Sudan*	2,568(1,487-4,294)	0.257(0.149-0.429)	167(97-279)
Sub-Saharan Africa	Sudan	16,736(8,834-29,550)	0.232(0.123-0.410)	271(143-478)
Sub-Saharan Africa	Tanzania	52,077(26,373-94,919)	0.385(0.195-0.701)	567(287-1,033)
Sub-Saharan Africa	Togo	4,592(2,412-7,948)	0.350(0.184-0.605)	393(206-680)
Sub-Saharan Africa	Uganda	31,064(15,375-57,016)	0.406(0.201-0.745)	463(229-849)
Sub-Saharan Africa	Zambia	11,400(5,822-20,473)	0.371(0.189-0.666)	406(207-729)
Sub-Saharan Africa	Zimbabwe	7,303(3,886-12,928)	0.364(0.194-0.644)	379(202-671)
Others	Cook Islands*	86(51-136)	0.573(0.338-0.909)	4,929(2,908-7,822)
Others	Niue*	3(2-5)	0.598(0.358-0.959)	1,769(1,058-2,835)

Others	Palestine*	4,446(2,836-6,509)	0.343(0.219-0.502)	638(407-934)
Others	Tokelau*	2(1-3)	0.445(0.249-0.749)	1,165(653-1,961)

Please note that results for countries marked with an asterisk in column 2 are imputed due to missing data.

eTable 7. Total macroeconomic burden attributable to cancers in 2020–2050 using a discount rate of 3% for 204 countries, by World Bank region (in 2017 INT\$)

Region	World Bank Country	Economic cost in millions of 2017 INT\$ (lower and upper bound)	Percentage of total GDP in 2020–2050 (lower and upper bound)	Per capita loss in 2017 INT\$ (lower and upper bound)
East Asia & Pacific	American Samoa*	92(55-147)	0.459(0.276-0.731)	1,695(1,019-2,701)
East Asia & Pacific	Australia	203,325(148,778-283,598)	0.582(0.426-0.812)	6,936(5,075-9,674)
East Asia & Pacific	Brunei Darussalam	4,500(2,643-7,164)	0.688(0.404-1.095)	9,459(5,554-15,057)
East Asia & Pacific	Cambodia	15,032(8,520-24,835)	0.450(0.255-0.743)	769(436-1,270)
East Asia & Pacific	China	4,983,836(3,381,179-6,974,828)	0.598(0.406-0.838)	3,444(2,337-4,820)
East Asia & Pacific	Fiji	816(394-1,468)	0.295(0.142-0.530)	822(396-1,478)
East Asia & Pacific	Guam*	890(549-1,377)	0.503(0.310-0.777)	4,840(2,983-7,484)
East Asia & Pacific	Indonesia	431,819(265,647-692,304)	0.351(0.216-0.563)	1,406(865-2,255)
East Asia & Pacific	Japan	806,176(699,214-907,865)	0.719(0.624-0.810)	6,901(5,985-7,771)
East Asia & Pacific	Kiribati*	40(23-66)	0.545(0.316-0.894)	272(158-447)
East Asia & Pacific	Korea, Dem. People's Rep.*	6,226(3,656-10,062)	0.509(0.299-0.822)	234(138-378)
East Asia & Pacific	Korea, Rep.	410,919(303,081-569,958)	0.653(0.481-0.905)	8,206(6,053-11,382)
East Asia & Pacific	Lao PDR	8,705(4,708-14,580)	0.374(0.202-0.626)	1,020(551-1,708)
East Asia & Pacific	Malaysia	141,683(68,123-255,494)	0.459(0.221-0.827)	3,813(1,834-6,877)
East Asia & Pacific	Marshall Islands*	27(14-47)	0.423(0.227-0.731)	397(213-686)
East Asia & Pacific	Micronesia, Fed. Sts.*	45(18-86)	0.495(0.199-0.944)	347(139-662)
East Asia & Pacific	Mongolia	7,509(3,957-13,490)	0.548(0.289-0.985)	1,929(1,016-3,465)
East Asia & Pacific	Myanmar*	32,976(22,948-48,316)	0.375(0.261-0.549)	555(386-813)
East Asia & Pacific	Nauru*	13(8-21)	0.361(0.210-0.582)	1,212(705-1,957)
East Asia & Pacific	New Zealand	47,411(35,207-64,414)	0.728(0.540-0.989)	8,982(6,670-12,204)
East Asia & Pacific	Northern Mariana Islands*	277(170-437)	0.729(0.449-1.150)	4,514(2,779-7,120)
East Asia & Pacific	Palau*	44(27-71)	0.719(0.434-1.158)	2,428(1,463-3,908)
East Asia & Pacific	Papua New Guinea*	3,347(2,011-5,438)	0.292(0.176-0.475)	289(173-469)
East Asia & Pacific	Philippines	156,740(94,527-239,713)	0.402(0.242-0.615)	1,216(733-1,859)
East Asia & Pacific	Samoa*	105(58-172)	0.312(0.173-0.511)	452(251-742)
East Asia & Pacific	Singapore	53,095(41,390-68,936)	0.334(0.260-0.433)	8,441(6,580-10,960)
East Asia & Pacific	Solomon Islands*	284(163-468)	0.613(0.352-1.008)	292(168-481)
East Asia & Pacific	Taiwan (Province of China)*	237,914(126,042-438,462)	0.680(0.360-1.254)	10,079(5,339-18,574)
East Asia & Pacific	Thailand	125,013(65,742-224,418)	0.354(0.186-0.636)	1,807(950-3,244)
East Asia & Pacific	Timor-Leste*	376(202-585)	0.320(0.171-0.498)	223(120-347)
East Asia & Pacific	Tonga*	84(50-138)	0.485(0.284-0.792)	701(411-1,145)
East Asia & Pacific	Tuvalu*	9(5-16)	0.434(0.249-0.726)	683(393-1,143)

East Asia & Pacific	Vanuatu*	88(48-145)	0.349(0.191-0.574)	206(113-339)
East Asia & Pacific	Vietnam	263,476(140,221-459,619)	0.631(0.336-1.100)	2,503(1,332-4,366)
Europe & Central Asia	Albania	7,135(3,668-12,513)	0.626(0.322-1.098)	2,648(1,361-4,644)
Europe & Central Asia	Andorra*	761(473-1,159)	0.747(0.465-1.139)	9,802(6,102-14,940)
Europe & Central Asia	Armenia	6,849(4,541-10,420)	0.537(0.356-0.817)	2,343(1,553-3,564)
Europe & Central Asia	Austria	51,494(40,583-66,859)	0.447(0.352-0.580)	5,621(4,430-7,299)
Europe & Central Asia	Azerbaijan	14,871(8,091-25,428)	0.453(0.246-0.774)	1,374(748-2,350)
Europe & Central Asia	Belarus	17,039(8,773-33,251)	0.465(0.240-0.908)	1,875(966-3,659)
Europe & Central Asia	Belgium	67,713(49,211-94,563)	0.491(0.357-0.686)	5,650(4,106-7,891)
Europe & Central Asia	Bosnia and Herzegovina	10,405(6,235-16,577)	0.736(0.441-1.173)	3,453(2,069-5,502)
Europe & Central Asia	Bulgaria	62,490(34,372-108,718)	1.350(0.742-2.348)	10,159(5,588-17,674)
Europe & Central Asia	Croatia	16,648(9,513-29,486)	0.510(0.291-0.902)	4,442(2,538-7,867)
Europe & Central Asia	Cyprus	4,119(2,886-5,893)	0.340(0.238-0.486)	3,182(2,229-4,552)
Europe & Central Asia	Czech Republic	85,285(56,567-132,827)	0.685(0.454-1.067)	7,992(5,301-12,448)
Europe & Central Asia	Denmark	51,534(37,322-72,625)	0.590(0.427-0.831)	8,507(6,161-11,989)
Europe & Central Asia	Estonia	14,521(8,431-24,463)	0.974(0.566-1.642)	11,636(6,756-19,603)
Europe & Central Asia	Finland	26,908(20,187-36,842)	0.418(0.313-0.572)	4,847(3,636-6,637)
Europe & Central Asia	France	396,669(275,220-576,502)	0.576(0.400-0.837)	5,926(4,112-8,613)
Europe & Central Asia	Georgia	5,595(3,592-8,210)	0.302(0.194-0.443)	1,485(953-2,179)
Europe & Central Asia	Germany	1,001,705(740,720-1,364,974)	0.967(0.715-1.318)	12,155(8,988-16,563)
Europe & Central Asia	Greece	24,161(18,159-32,131)	0.360(0.270-0.478)	2,486(1,869-3,306)
Europe & Central Asia	Greenland*	556(324-916)	0.754(0.439-1.241)	9,938(5,792-16,364)
Europe & Central Asia	Hungary	86,952(52,679-142,084)	0.879(0.533-1.436)	9,549(5,785-15,603)
Europe & Central Asia	Iceland	3,466(2,396-4,859)	0.587(0.406-0.823)	9,527(6,586-13,353)
Europe & Central Asia	Ireland	229,062(168,987-320,431)	0.723(0.533-1.011)	42,780(31,560-59,844)
Europe & Central Asia	Italy	251,184(211,981-293,712)	0.482(0.407-0.563)	4,336(3,659-5,070)
Europe & Central Asia	Kazakhstan	41,871(27,722-63,009)	0.295(0.196-0.445)	1,948(1,290-2,932)
Europe & Central Asia	Kyrgyz Republic	3,893(2,438-5,896)	0.402(0.252-0.608)	495(310-750)
Europe & Central Asia	Latvia	12,246(6,353-23,133)	0.732(0.379-1.382)	7,377(3,827-13,934)
Europe & Central Asia	Lithuania	23,354(14,964-36,512)	0.731(0.469-1.143)	9,758(6,253-15,256)
Europe & Central Asia	Luxembourg	6,227(4,531-8,588)	0.304(0.222-0.420)	8,708(6,336-12,009)
Europe & Central Asia	Moldova	6,103(3,949-9,003)	0.589(0.381-0.868)	1,630(1,054-2,404)
Europe & Central Asia	Monaco*	2,991(1,960-4,536)	1.275(0.835-1.933)	69,886(45,790-105,993)
Europe & Central Asia	Montenegro	3,595(2,193-5,633)	1.046(0.638-1.638)	5,849(3,567-9,164)

Europe & Central Asia	Netherlands	188,851(139,462-254,495)	0.761(0.562-1.025)	10,873(8,030-14,653)
Europe & Central Asia	North Macedonia	7,235(3,845-12,961)	0.769(0.409-1.377)	3,621(1,924-6,487)
Europe & Central Asia	Norway	48,746(42,641-56,302)	0.558(0.488-0.645)	8,050(7,042-9,298)
Europe & Central Asia	Poland	298,210(179,459-503,967)	0.716(0.431-1.210)	8,292(4,990-14,013)
Europe & Central Asia	Portugal	34,018(23,619-48,330)	0.395(0.274-0.561)	3,504(2,433-4,978)
Europe & Central Asia	Romania*	165,381(100,287-260,851)	0.865(0.525-1.364)	9,298(5,638-14,665)
Europe & Central Asia	Russian Federation	385,763(255,948-569,310)	0.482(0.320-0.711)	2,733(1,813-4,033)
Europe & Central Asia	San Marino*	405(224-701)	0.824(0.457-1.426)	11,827(6,561-20,484)
Europe & Central Asia	Serbia	42,219(23,283-75,768)	1.030(0.568-1.849)	5,310(2,929-9,530)
Europe & Central Asia	Slovak Republic	47,724(25,182-91,769)	0.963(0.508-1.852)	9,029(4,764-17,363)
Europe & Central Asia	Slovenia	12,835(7,308-23,206)	0.527(0.300-0.953)	6,338(3,609-11,459)
Europe & Central Asia	Spain	229,061(165,837-315,770)	0.502(0.364-0.693)	5,024(3,637-6,926)
Europe & Central Asia	Sweden	72,688(59,876-90,054)	0.499(0.411-0.618)	6,731(5,545-8,340)
Europe & Central Asia	Switzerland	89,999(64,971-125,353)	0.603(0.435-0.839)	9,645(6,963-13,434)
Europe & Central Asia	Tajikistan	6,600(4,029-10,608)	0.394(0.240-0.633)	517(316-831)
Europe & Central Asia	Turkey	267,438(162,262-431,791)	0.310(0.188-0.501)	2,925(1,775-4,722)
Europe & Central Asia	Turkmenistan*	7,967(4,554-13,390)	0.362(0.207-0.608)	1,127(644-1,894)
Europe & Central Asia	Ukraine	9,803(5,870-15,348)	0.356(0.213-0.558)	248(149-389)
Europe & Central Asia	United Kingdom	419,778(368,396-477,176)	0.584(0.513-0.664)	5,883(5,163-6,687)
Europe & Central Asia	Uzbekistan	65,611(39,401-100,008)	0.599(0.359-0.912)	1,691(1,015-2,577)
Latin America & Caribbean	Antigua and Barbuda*	250(168-362)	0.486(0.326-0.703)	2,355(1,578-3,409)
Latin America & Caribbean	Argentina	88,425(63,411-122,880)	0.442(0.317-0.614)	1,751(1,256-2,433)
Latin America & Caribbean	Bahamas, The	1,783(1,071-2,812)	0.632(0.380-0.997)	4,093(2,457-6,454)
Latin America & Caribbean	Barbados	624(379-972)	0.747(0.453-1.163)	2,180(1,322-3,394)
Latin America & Caribbean	Belize	267(179-380)	0.458(0.306-0.650)	542(362-770)
Latin America & Caribbean	Bolivia	13,481(7,209-22,466)	0.474(0.253-0.790)	970(519-1,617)
Latin America & Caribbean	Brazil	160,989(136,916-191,400)	0.252(0.214-0.299)	716(609-851)
Latin America & Caribbean	Chile	50,429(36,585-69,484)	0.429(0.311-0.591)	2,547(1,848-3,510)
Latin America & Caribbean	Colombia	74,992(39,317-135,039)	0.371(0.194-0.668)	1,386(727-2,496)
Latin America & Caribbean	Costa Rica	15,915(8,715-26,879)	0.506(0.277-0.854)	2,873(1,573-4,852)
Latin America & Caribbean	Cuba*	31,192(18,226-49,770)	0.744(0.435-1.188)	2,863(1,673-4,568)
Latin America & Caribbean	Dominica*	129(81-202)	0.717(0.447-1.123)	1,782(1,111-2,791)
Latin America & Caribbean	Dominican Republic	50,668(22,032-96,744)	0.632(0.275-1.208)	4,215(1,833-8,049)
Latin America & Caribbean	Ecuador	11,470(7,046-18,565)	0.274(0.168-0.444)	554(340-897)

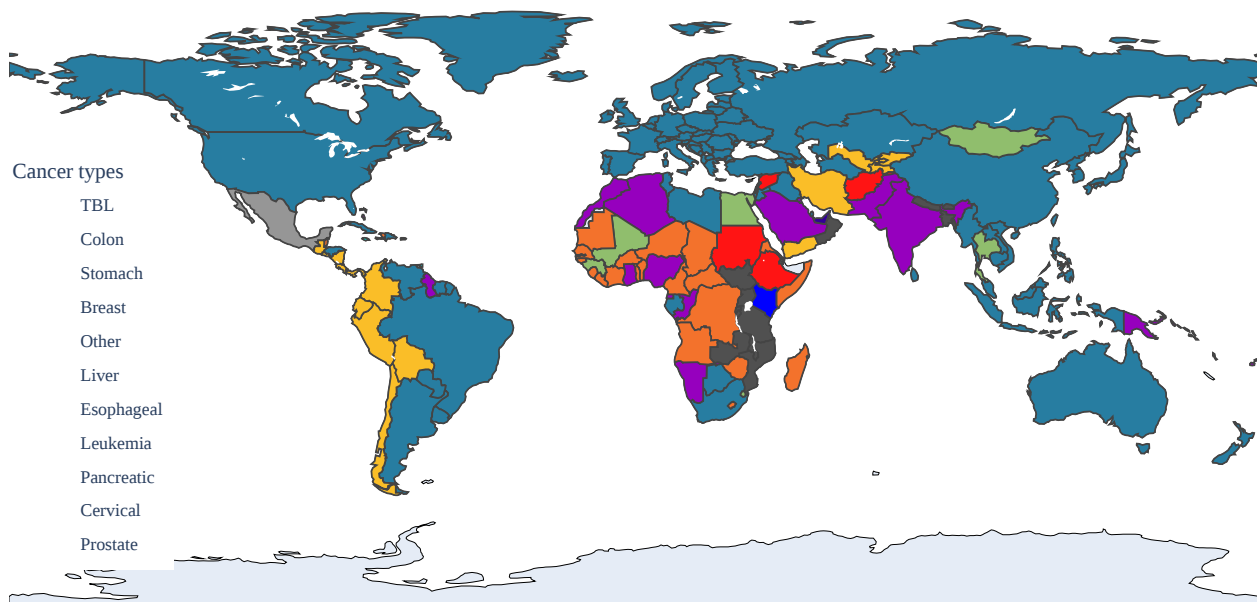
Latin America & Caribbean	El Salvador	4,987(2,354-9,155)	0.356(0.168-0.654)	732(346-1,344)
Latin America & Caribbean	Grenada*	286(201-401)	0.604(0.424-0.846)	2,477(1,739-3,468)
Latin America & Caribbean	Guatemala	9,389(6,164-14,133)	0.204(0.134-0.307)	415(272-624)
Latin America & Caribbean	Guyana*	5,574(3,116-9,412)	0.406(0.227-0.685)	6,782(3,791-11,452)
Latin America & Caribbean	Haiti*	2,960(1,560-5,207)	0.391(0.206-0.689)	223(118-392)
Latin America & Caribbean	Honduras	5,125(2,541-9,291)	0.308(0.153-0.559)	426(211-771)
Latin America & Caribbean	Jamaica	3,435(1,776-5,874)	0.581(0.300-0.993)	1,137(587-1,943)
Latin America & Caribbean	Mexico	145,278(101,237-199,825)	0.256(0.178-0.352)	1,006(701-1,384)
Latin America & Caribbean	Nicaragua*	2,532(1,529-4,060)	0.265(0.160-0.426)	330(199-529)
Latin America & Caribbean	Panama	13,155(7,691-22,113)	0.343(0.200-0.576)	2,551(1,491-4,288)
Latin America & Caribbean	Paraguay	10,331(5,383-18,083)	0.392(0.204-0.686)	1,254(654-2,196)
Latin America & Caribbean	Peru	25,769(14,495-46,355)	0.236(0.133-0.424)	694(390-1,249)
Latin America & Caribbean	Puerto Rico*	9,314(5,241-16,283)	0.474(0.267-0.828)	3,387(1,906-5,922)
Latin America & Caribbean	St. Kitts and Nevis*	184(111-283)	0.563(0.339-0.865)	3,303(1,991-5,074)
Latin America & Caribbean	St. Lucia*	343(238-485)	0.643(0.446-0.908)	1,837(1,273-2,594)
Latin America & Caribbean	St. Vincent and the Grenadines*	244(174-336)	0.671(0.479-0.924)	2,180(1,554-3,000)
Latin America & Caribbean	Suriname	718(397-1,172)	0.415(0.229-0.677)	1,114(616-1,819)
Latin America & Caribbean	Trinidad and Tobago*	2,799(1,433-5,209)	0.441(0.226-0.820)	2,007(1,028-3,736)
Latin America & Caribbean	Uruguay	8,056(5,763-11,166)	0.447(0.320-0.619)	2,247(1,607-3,114)
Latin America & Caribbean	Venezuela, RB*	39,006(19,012-72,329)	0.474(0.231-0.879)	1,143(557-2,119)
Latin America & Caribbean	Virgin Islands (U.S.)*	949(605-1,479)	0.802(0.511-1.249)	9,794(6,239-15,261)
Middle East & North Africa	Algeria*	27,016(16,079-43,722)	0.226(0.135-0.366)	511(304-827)
Middle East & North Africa	Bahrain	2,528(1,770-3,742)	0.128(0.089-0.189)	1,216(851-1,800)
Middle East & North Africa	Djibouti	820(385-1,602)	0.315(0.148-0.616)	707(332-1,381)
Middle East & North Africa	Egypt, Arab Rep.	143,860(73,679-272,886)	0.290(0.149-0.551)	1,100(563-2,086)
Middle East & North Africa	Iran, Islamic Rep.*	91,367(67,921-112,229)	0.332(0.247-0.408)	961(714-1,180)
Middle East & North Africa	Iraq	25,211(16,644-38,457)	0.213(0.141-0.325)	455(300-694)
Middle East & North Africa	Israel	68,810(49,270-96,272)	0.568(0.407-0.795)	6,451(4,619-9,025)
Middle East & North Africa	Jordan	4,299(2,546-7,095)	0.158(0.093-0.260)	378(224-624)
Middle East & North Africa	Kuwait	7,637(5,955-10,140)	0.178(0.138-0.236)	1,552(1,211-2,061)
Middle East & North Africa	Lebanon	884(486-1,511)	0.213(0.117-0.365)	138(76-236)
Middle East & North Africa	Libya*	27,948(15,339-48,377)	0.343(0.188-0.594)	3,569(1,959-6,178)
Middle East & North Africa	Malta	5,629(4,116-7,710)	0.625(0.457-0.856)	12,748(9,320-17,460)
Middle East & North Africa	Morocco	15,086(9,180-25,064)	0.197(0.120-0.327)	358(218-594)

Middle East & North Africa	Oman	5,313(2,679-10,663)	0.131(0.066-0.263)	866(436-1,737)
Middle East & North Africa	Qatar	5,762(4,126-8,632)	0.092(0.066-0.139)	1,672(1,197-2,504)
Middle East & North Africa	Saudi Arabia	77,667(52,623-118,829)	0.189(0.128-0.289)	1,914(1,297-2,929)
Middle East & North Africa	Syrian Arab Republic*	4,302(2,523-7,061)	0.280(0.164-0.459)	156(92-257)
Middle East & North Africa	Tunisia	6,391(4,061-9,954)	0.223(0.142-0.347)	492(313-766)
Middle East & North Africa	United Arab Emirates*	66,840(31,327-123,930)	0.366(0.171-0.678)	6,363(2,982-11,798)
Middle East & North Africa	Yemen, Rep.*	4,924(2,840-8,025)	0.219(0.126-0.356)	125(72-204)
North America	Bermuda*	997(658-1,497)	0.623(0.412-0.936)	17,004(11,225-25,528)
North America	Canada	300,106(217,991-418,527)	0.674(0.490-0.941)	7,140(5,186-9,958)
North America	United States	4,342,885(3,850,681-5,019,885)	0.813(0.721-0.940)	12,155(10,777-14,050)
South Asia	Afghanistan*	4,375(2,504-7,210)	0.282(0.162-0.465)	84(48-138)
South Asia	Bangladesh	106,149(50,945-209,462)	0.235(0.113-0.464)	582(279-1,149)
South Asia	Bhutan	933(412-1,792)	0.297(0.131-0.570)	1,089(481-2,092)
South Asia	India	1,141,492(750,688-1,639,549)	0.273(0.179-0.392)	743(488-1,066)
South Asia	Maldives	508(304-813)	0.183(0.110-0.293)	930(557-1,488)
South Asia	Nepal	11,611(6,113-20,499)	0.261(0.137-0.460)	345(182-610)
South Asia	Pakistan	171,513(100,823-277,925)	0.463(0.272-0.750)	609(358-987)
South Asia	Sri Lanka	29,655(13,078-61,101)	0.357(0.157-0.736)	1,350(595-2,781)
Sub-Saharan Africa	Angola	8,658(4,603-14,619)	0.200(0.106-0.337)	163(87-275)
Sub-Saharan Africa	Benin	3,785(2,032-6,493)	0.218(0.117-0.373)	212(114-364)
Sub-Saharan Africa	Botswana	3,014(1,899-4,804)	0.287(0.181-0.457)	1,018(641-1,623)
Sub-Saharan Africa	Burkina Faso	5,970(3,421-9,768)	0.302(0.173-0.494)	190(109-310)
Sub-Saharan Africa	Burundi	396(214-690)	0.179(0.097-0.311)	22(12-38)
Sub-Saharan Africa	Cabo Verde	388(209-674)	0.364(0.196-0.632)	619(333-1,074)
Sub-Saharan Africa	Cameroon	8,257(4,231-14,988)	0.233(0.119-0.423)	217(111-394)
Sub-Saharan Africa	Central African Republic*	365(205-630)	0.239(0.134-0.413)	55(31-96)
Sub-Saharan Africa	Chad*	1,140(672-1,793)	0.199(0.117-0.313)	46(27-72)
Sub-Saharan Africa	Comoros	259(122-468)	0.327(0.153-0.589)	222(104-401)
Sub-Saharan Africa	Congo, Dem. Rep.	10,431(5,553-18,298)	0.253(0.135-0.444)	75(40-132)
Sub-Saharan Africa	Congo, Rep.	786(401-1,396)	0.252(0.129-0.447)	99(50-175)
Sub-Saharan Africa	Côte d'Ivoire	13,732(7,412-23,302)	0.187(0.101-0.317)	360(194-611)
Sub-Saharan Africa	Equatorial Guinea*	602(338-1,029)	0.209(0.117-0.357)	286(160-488)
Sub-Saharan Africa	Eritrea*	856(493-1,412)	0.289(0.166-0.476)	182(105-300)
Sub-Saharan Africa	Eswatini	816(422-1,459)	0.321(0.166-0.573)	578(299-1,033)
Sub-Saharan Africa	Ethiopia	37,327(21,838-61,930)	0.213(0.124-0.353)	233(136-387)
Sub-Saharan Africa	Gabon	1,598(883-2,766)	0.181(0.100-0.314)	531(293-919)
Sub-Saharan Africa	Gambia, The	647(308-1,167)	0.307(0.146-0.554)	179(85-324)

Sub-Saharan Africa	Ghana	27,949(14,280-48,735)	0.402(0.205-0.701)	675(345-1,177)
Sub-Saharan Africa	Guinea	6,898(3,358-12,362)	0.370(0.180-0.664)	358(174-641)
Sub-Saharan Africa	Guinea-Bissau	405(224-693)	0.290(0.161-0.497)	148(82-253)
Sub-Saharan Africa	Kenya	15,769(9,573-26,054)	0.169(0.103-0.279)	216(131-358)
Sub-Saharan Africa	Lesotho	502(237-935)	0.484(0.229-0.903)	208(98-388)
Sub-Saharan Africa	Liberia*	365(198-609)	0.199(0.108-0.332)	51(28-86)
Sub-Saharan Africa	Madagascar	2,986(1,545-5,209)	0.226(0.117-0.394)	74(38-129)
Sub-Saharan Africa	Malawi*	2,234(1,205-3,875)	0.222(0.120-0.385)	79(43-137)
Sub-Saharan Africa	Mali	3,520(1,689-6,437)	0.202(0.097-0.369)	113(54-206)
Sub-Saharan Africa	Mauritania	1,288(602-2,453)	0.144(0.067-0.274)	191(89-364)
Sub-Saharan Africa	Mauritius	2,192(1,472-3,205)	0.310(0.208-0.454)	1,752(1,177-2,562)
Sub-Saharan Africa	Mozambique	3,447(1,903-5,957)	0.224(0.123-0.386)	73(40-126)
Sub-Saharan Africa	Namibia	1,212(616-2,279)	0.242(0.123-0.455)	372(189-700)
Sub-Saharan Africa	Niger	2,266(1,244-3,845)	0.152(0.084-0.259)	53(29-90)
Sub-Saharan Africa	Nigeria	27,515(16,945-43,876)	0.106(0.065-0.168)	92(57-147)
Sub-Saharan Africa	Rwanda	5,225(2,668-9,333)	0.349(0.178-0.624)	291(149-520)
Sub-Saharan Africa	Sao Tome and Principe*	85(46-144)	0.302(0.165-0.512)	282(154-478)
Sub-Saharan Africa	Senegal	6,373(3,381-10,618)	0.235(0.125-0.392)	260(138-433)
Sub-Saharan Africa	Seychelles*	566(349-885)	0.671(0.414-1.050)	5,493(3,391-8,591)
Sub-Saharan Africa	Sierra Leone	466(248-810)	0.146(0.078-0.253)	44(24-77)
Sub-Saharan Africa	Somalia*	1,324(741-2,216)	0.219(0.123-0.367)	54(30-90)
Sub-Saharan Africa	South Africa	44,282(33,166-61,771)	0.259(0.194-0.362)	648(485-904)
Sub-Saharan Africa	South Sudan*	1,405(817-2,345)	0.230(0.133-0.383)	91(53-152)
Sub-Saharan Africa	Sudan	9,332(4,932-16,460)	0.206(0.109-0.363)	151(80-266)
Sub-Saharan Africa	Tanzania	26,824(13,676-48,664)	0.351(0.179-0.636)	292(149-530)
Sub-Saharan Africa	Togo	2,453(1,294-4,231)	0.322(0.170-0.556)	210(111-362)
Sub-Saharan Africa	Uganda	16,201(8,108-29,482)	0.368(0.184-0.670)	241(121-439)
Sub-Saharan Africa	Zambia	6,288(3,238-11,206)	0.336(0.173-0.599)	224(115-399)
Sub-Saharan Africa	Zimbabwe	4,159(2,224-7,310)	0.327(0.175-0.575)	216(115-379)
Others	Cook Islands*	47(28-74)	0.513(0.306-0.806)	2,703(1,611-4,243)
Others	Niue*	2(1-3)	0.535(0.324-0.849)	968(585-1,535)
Others	Palestine*	2,429(1,560-3,536)	0.306(0.197-0.446)	349(224-507)
Others	Tokelau*	1(1-2)	0.399(0.226-0.665)	638(361-1,064)

Please note that results for countries marked with an asterisk in column 2 are imputed due to missing data.

eFigure 6 illustrates the distribution of cancer types responsible for the most DALYs.



eFigure 6. Cancer type responsible for the most DALYs in 2019 for each country (TBL = tracheal, bronchus, and lung)

eTables 8–9 illustrate the distribution of macroeconomic burden of cancers by World Bank region and income group with discount rates of 0% and 3%.

eTable 8. Total macroeconomic cost, economic cost as a share of total GDP in 2020–2050, and per capita economic cost attributable to cancer mortality and morbidity, by World Bank region, by World Bank income group, and globally with discount rate of 0%

Region/income group	Economic cost in billions of 2017 INT\$ (lower and upper bound)	Percentage of total GDP in 2020–2050 (lower and upper bound)	Per capita loss in 2017 INT\$ (lower and upper bound)
By World Bank region			
East Asia & Pacific	14,645(9,881-21,053)	0.634(0.428-0.911)	5,951(4,015-8,554)
Europe & Central Asia	8,961(6,307-12,944)	0.675(0.475-0.975)	9,630(6,778-13,910)
Latin America & Caribbean	1,432(931-2,184)	0.380(0.247-0.580)	1,994(1,297-3,041)
Middle East & North Africa	1,107(672-1,806)	0.312(0.189-0.508)	1,971(1,197-3,215)
North America	8,324(7,276-9,789)	0.895(0.782-1.052)	20,842(18,217-24,510)
South Asia	2,833(1,772-4,313)	0.311(0.195-0.474)	1,342(840-2,043)
Sub-Saharan Africa	600(342-1,011)	0.251(0.143-0.423)	366(208-616)
By income group			
High income	18,964(15,113-24,582)	0.770(0.614-0.998)	15,307(12,199-19,842)
Low income	259(141-444)	0.278(0.152-0.477)	269(147-462)
Lower-middle income	5,629(3,397-8,925)	0.348(0.210-0.551)	1,430(863-2,267)
Upper-middle income	12,979(8,496-19,013)	0.574(0.376-0.841)	4,898(3,206-7,175)
Total	37,908(27,185-53,106)	0.588(0.422-0.823)	4,293(3,079-6,014)

eTable 9. Total macroeconomic cost, economic cost as a share of total GDP in 2020–2050, and per capita economic cost attributable to cancer mortality and morbidity, by World Bank region, by World Bank income group, and globally with discount rate of 3%

Region/income group	Economic cost in billions of 2017 INT\$ (lower and upper bound)	Percentage of total GDP in 2020–2050 (lower and upper bound)	Per capita loss in 2017 INT\$ (lower and upper bound)
By World Bank region			
East Asia & Pacific	7,943(5,419-11,309)	0.572(0.390-0.814)	3,227(2,202-4,595)
Europe & Central Asia	4,938(3,505-7,049)	0.602(0.428-0.860)	5,306(3,767-7,575)
Latin America & Caribbean	791(522-1,191)	0.333(0.220-0.501)	1,102(727-1,658)
Middle East & North Africa	592(364-956)	0.275(0.169-0.443)	1,054(647-1,702)
North America	4,644(4,069-5,440)	0.802(0.703-0.940)	11,628(10,189-13,621)
South Asia	1,466(925-2,218)	0.284(0.179-0.430)	695(438-1,051)
Sub-Saharan Africa	323(185-540)	0.227(0.130-0.379)	196(113-329)
By income group			
High income	10,524(8,430-13,531)	0.688(0.551-0.884)	8,494(6,805-10,922)
Low income	135(74-232)	0.252(0.139-0.432)	141(77-241)
Lower-middle income	2,935(1,787-4,621)	0.315(0.192-0.495)	745(454-1,174)
Upper-middle income	7,064(4,679-10,245)	0.514(0.341-0.746)	2,666(1,766-3,866)

eAppendix 6. Differences in macroeconomic loss and lifetime disease burden

eTable 10 illustrates the differences in economic costs across regions or income groups that also differ in terms of GDP, population, and DALYs.

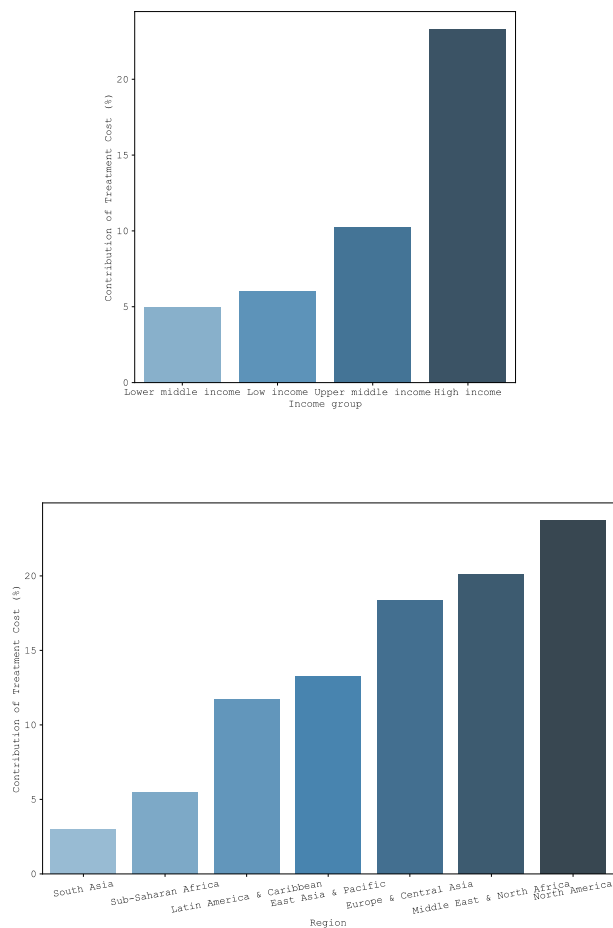
eTable 10. Comparison of macroeconomic loss and lifetime disease burden by World Bank region and country income group

Region/income group	Economic cost in billions of 2017 INT\$ (global %)	DALYs in millions in 2020 (global %)	DALYs in millions in 2050 (global %)	Annual GDP in billions of 2017 INT\$ in 2020–2050 (global %)	Annual POP in millions in 2020–2050 (global %)
By World Bank region					
East Asia & Pacific	9,704(38.48%)	99(39.13%)	112(30.90%)	52,763(35.70%)	2,461(27.87%)
Europe & Central Asia	5,993(23.76%)	49(19.35%)	49(13.57%)	30,825(20.86%)	930(10.54%)
Latin America & Caribbean	960(3.81%)	19(7.73%)	31(8.42%)	8,869(6.00%)	718(8.13%)
Middle East & North Africa	727(2.88%)	9(3.43%)	20(5.55%)	8,163(5.52%)	562(6.36%)
North America	5,616(22.27%)	19(7.43%)	22(5.99%)	21,720(14.70%)	399(4.52%)
South Asia	1,821(7.22%)	40(15.91%)	85(23.25%)	19,983(13.52%)	2,111(23.90%)
Sub-Saharan Africa	395(1.57%)	18(6.99%)	45(12.22%)	5,420(3.67%)	1,642(18.59%)
By World Bank income group					
High income	12,746(50.54%)	63(25.13%)	65(17.79%)	57,446(38.87%)	1,238(14.03%)
Low income	168(0.66%)	11(4.40%)	28(7.77%)	2,068(1.40%)	962(10.90%)
Lower-middle income	3,636(14.42%)	73(29.05%)	154(42.32%)	35,950(24.32%)	3,938(44.59%)
Upper-middle income	8,619(34.18%)	104(41.04%)	115(31.54%)	51,967(35.16%)	2,650(30.01%)
Sum	25,219(100.00%)	252(100.00%)	364(100.00%)	147,771(99.98%)	8,830(99.99%)

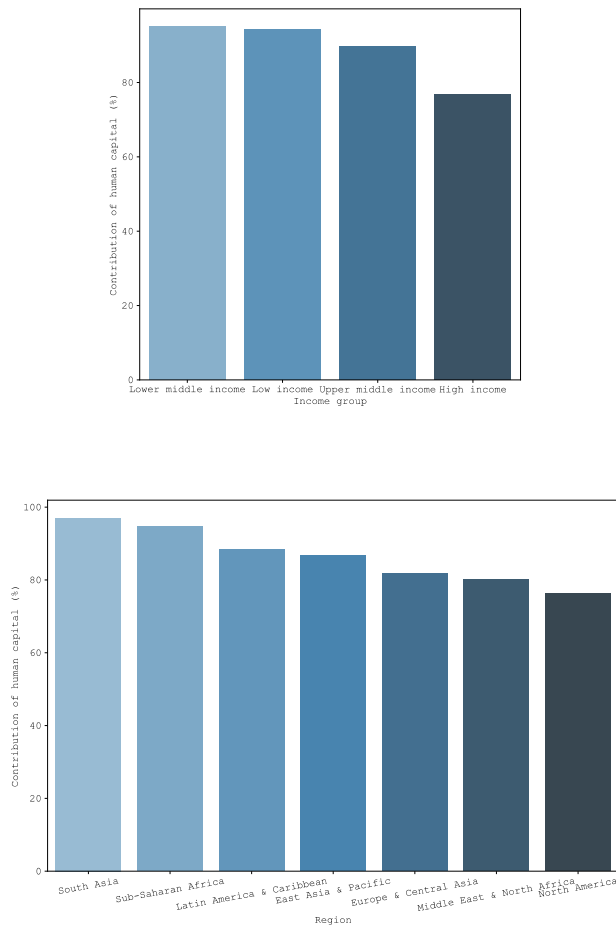
Please note that each country is classified into World Bank regions as in **eTable 5**. The seven World Bank regions do not include Cook Islands, Niue, Palestine, and Tokelau.

eAppendix 7. Contribution of treatment costs and human capital

eFigure 7 shows the contribution of treatment costs to the total macroeconomic burden of cancers by country income group and by World Bank region. eFigure 8 shows the contribution of human capital to the total macroeconomic burden of cancers by country income group and by World Bank region.



eFigure 7. Contribution of treatment costs to the total economic cost of cancers by country income group and World Bank region



eFigure 8. Contribution of human capital to the total economic cost of cancers by country income group and World Bank region

eAppendix 8. Strengths and limitations

Our model has several strengths and limitations, as summarized in **eTable 11**. First, we had to rely on imputations to calculate cancer-related health expenditures, which are based on data for the United States and then projected to other countries. This can either underestimate or overestimate the country-specific treatment costs for cancers. We also made assumptions about projections for labor participation rate, mortality, and morbidity data. This also may either underestimate or overestimate the results in some countries. Second, we had to impute the economic burden of cancers for 60 out of 204 countries and territories; however, this does not compromise our results, given that the 144 countries for which we had complete data account for 92.7% of the global population. Third, we did not account for changes in labor force participation of family members of people with cancer requiring informal care. With respect to this limitation, our findings should provide the lower bound of the economic cost of cancers. Finally, we did not consider unemployment, nor did we include an explicit treatment of price movements and endogenous savings in the framework.

Our analysis uses a simulation model grounded in dynamic macroeconomic theory to advance understanding of the global macroeconomic cost of cancers in several important ways. First, the calculations are based on recently developed methods and rely on the best available global data, including data from the recently updated Global Burden of Disease Study 2019, the Barro-Lee education database, the World Bank, and the International Labour Organization. Second, this study is the first to account for cancer's influence on

economic growth through a morbidity effect for 204 countries and territories in the world. Third, our framework is the first to consider productivity loss among people with different education and experience levels—the lack of which is a key limitation of previous studies. Fourth, our work shows the causal relationship between cancers and GDP. It avoids issues of reverse causality because we did not estimate the relationship but rather constructed it from our simulated production function. Fifth, we provided a detailed, step-by-step description of our methods and the data sources and specific parameters we used in our analysis in the SI Appendix. Sixth, we included sensitivity analyses to account for underlying uncertainty by adjusting the mortality and morbidity data based on upper and lower bounds of the GBD data.

eTable 11. Strengths and limitations of our model

	Strengths	Limitations
Data	Rich global data from GBD, Barro-Lee education database, World Bank, and International Labour Organization	Robustness of the extrapolation of cancer-related health expenditures; assumptions on the projections for labor participation rate, mortality, and morbidity data
Coverage	29 cancers and 204 countries	Missing data for 60 countries accounting for 7.3% of the total population
Modeling	Reproducible methods with mathematical description and sensitivity analyses that show the causal relationship between cancers and GDP; full consideration of morbidity effects and productivity loss among people with different education and experience levels; consideration of the effects of treatment costs on capital accumulation	Not accounting for reductions in the labor force participation of family members due to informal care for cancer; not accounting for unemployment; not accounting for behavioral responses; not including the explicit modeling of market price movements and endogenous savings

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