





# Global, regional, and national level and trends in the burdens of suicide and income-related inequality

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"In order to be able to think, you have to risk being offensive"

1세대한

- Jordan Bernt Peterson

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## ABSTRACT

# Global, regional, and national levels and trends in income inequalities in the burden of suicide from 1990 to 2019

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**Background:** Understanding how economic and social determinants impact suicide and monitoring the trends in suicide burden over time is necessary for the development and implementation of effective policy and practices that can address social inequalities and prevent suicide at a population level. We aimed to describe the global, regional, and national levels and trends in burden of suicide and to estimate which factors are associated with burdens of suicide. We also aimed to measure how suicide death rate is disproportionately distributed by country's Gini coefficient or socio-demographic index (SDI).

**Methods:** In this secondary analysis of the Global Burden of Disease, Injuries, and Risk Factors Study (GBD) 2019, we extracted data for suicide deaths rate and its burdens (disability-adjusted life-years, years lived with disability, and years of life lost) using the GBD Results Tool. We estimated annual average percentage change (AAPC) with joinpoint regression analysis from 1990–2019, and evaluated which



were the major risk factors to suicide death rate, and measured suicide inequality across countries with different Gini coefficient or SDI.

**Results**: GBD 2019 estimated 759,028 (95% uncertainty interval, 95% UI 685,390 to 831,857) deaths globally from suicide in 2019, along with its 9.4 age-standardized death rate (ASDR) from suicide death per 100,000. In joinpoint regression analysis, the global decreasing trend in ASDR of suicide was shown with its AAPC of -1.67% (-1.85% to -1.50%, p-value < 0.001). The similar trend of decreasing was also shown in other GBD regions. However, some joinpoint periods among 21 GBD regions were not constant in decline of ASDR suicide death, rather, reversed to increase or slowed to decreasing trend, explained by economic crisis occurred within the period. Our model explained 68.1% on suicide death rate, considering economic, sociodemographic, and epidemiologic risk factors. Among these, Gini coefficient of 17.64 (p-value=0.0305), followed by SDI with its relative importance of 42.3% and regression coefficient of -3.82 (p-value=0.5555).

Higher Gini coefficient (more disproportionately income distributed) was estimated to have higher rate of suicide death (Gini coefficient > 0.6, rate ratio, RR: 1.281, 95% confidence interval, 95% CI: 1.121to 1.463, compared to lowest group). Countries in low SDI group had higher rate of suicide death (RR: 1.883, 95% CI: 1.595 to 2.223, compared to highest group). The suicide death rate was disproportionately concentrated among countries with greater income disparities (higher Gini coefficient) or with lower SDI. Inequality of suicide according to Gini coefficient or SDI increased from 1990 to 2019.



**Conclusion:** Burden of suicide has been reduced since 1990, but in certain period where economic crisis occurred it increased. Countries' income disparity and SDI are related with suicide burden. Disproportion of suicide death rate in countries with higher Gini coefficient has been greater since 1990. It is reasonable to consider the income disparities as a major component when making suicide prevention strategies for the population.

**Keywords**: Global Burden of Disease, Suicide, Income disparity, Gini coefficient, Socio-demographic Index



# I. Introduction

#### 1. Background

Suicide is a critical public health concern of global importance, with an estimated 800,000 suicide deaths per year, which is a 33% increase over two decades<sup>1</sup>. It is a major preventable cause of premature mortality worldwide, causing as many fatalities as war and homicide combined. Recognizing the importance and urgency of reducing global levels of suicide mortality, the World Health Organization (WHO) member states have committed to working toward a 10% reduction in global suicide death rates by 2030 as part of the Comprehensive Mental Health Action Plan<sup>2,3</sup>. Proposed actions include the provision of comprehensive, integrated mental health services and national suicide prevention strategies, with special attention to vulnerable populations identified as having an increased risk for suicide<sup>2,3</sup>. Suicide mortality is also one of the indicators covered in the United Nations (UN) Sustainable Development Goal (SDG) 3.4.2, which is used to measure progress toward a targeted one-third reduction in premature mortality from noncommunicable diseases through the prevention, treatment, and promotion of mental health and well-being<sup>4,5</sup>.

Suicidal behaviors show marked differences across age groups, gender, and geographic regions<sup>6-9</sup>. The causes of suicide are diverse and multifactorial<sup>6,9</sup>. Various individual-level risk factors have been reported to be associated with suicide, including previous suicide attempts, mental health problems, harmful use of alcohol,



drug use, job or financial loss, relationship breakdown, trauma or abuse, violence, conflict or disaster, and chronic pain or illness <sup>9-11</sup>. Identifying risk factors for individuals' suicide enables clinicians to assess patients and implement interventions<sup>12</sup>. Moreover, family, community, and societal levels of environmental factors have also been related to the risk of suicide<sup>7,13-20</sup>. Suicide death rates vary greatly across countries, where many country-level factors also act differently<sup>7,16-20</sup>. Understanding both individual and national levels of suicide risk factors is needed to construct effective suicide prevention programs and policies<sup>3,10,15</sup>. Socioeconomic development differs across countries, which might play an important role in the global inequality of suicide<sup>7,18,20</sup>. Understanding how societal determinants impact suicide and monitor the trends in suicide burden over time is necessary for the development and implementation of effective policies and practices that can address social inequalities and prevent suicide at population level<sup>7,18,20</sup>.

Nevertheless, suicide is still stigmatized in many countries. Thus, it is very likely that it is underreported owing to stigma, criminalization, and weak surveillance systems<sup>10</sup>. As a result, obtaining high-quality data on suicide is difficult, particularly in countries that do not have reliable vital registration data<sup>10</sup>. Using a variety of analytics and data processing, the Global Burden of Disease Study 2019 provides internationally comparable estimates of suicide mortality and the associated burden on a global scale<sup>21</sup>. In this context, this study aimed to provide a comprehensive assessment of the levels and trends in suicide burden at global and regional national levels between 1990 and 2019. The burden of suicide was assessed in terms of crude and age-standardized rates from suicide mortality, years of life lost (YLL) owing to



premature suicide mortality, years of life lived with disability (YLD) in people who attempted suicide, and disability-adjusted life-years (DALY)<sup>16,22</sup>. In addition, we assessed the association between country-level income inequality and suicide mortality by merging GBD data with the World Bank Open Data, International Labor Organization STAT, and the Standardized World Income Inequality Database<sup>23-25.</sup>



#### 2. Study objectives

The first aim of this study was to determine the suicide death rate and disease burden as YLL owing to premature suicide mortality, YLD in people who attempted suicide, and DALY of the global, regional, and national levels and trends of suicide from 1990 to 2019 by using a comprehensive approach, including a trend analysis with the data collected from GBD 2019.

Second, this study aimed to estimate possible risk factors mainly socioeconomic factors attributable to the suicide death rate.

Third, by confirming which factors have a major influence on the suicide rate of countries through the preceding analysis, we intended to analyze the extent of the disparities between the factors and suicide death rates of countries while comparing differences between 1990 and 2019.

## 영 연세대학교 YONSEI UNIVERSITY

## **II. Literature Review**

#### 1. Global Burden of Disease Study

GBD provides a tool to quantify health loss from hundreds of diseases, injuries, and risk factors, so that health systems can be improved, and disparities can be eliminated<sup>26-28</sup>. To align health systems with the populations they serve, policymakers first need to understand the true nature of their country's health challenges and how those challenges are shifting over time<sup>26-28</sup>. This means more than just estimating disease prevalence, such as the number of people with depression or diabetes in a population. GBD research incorporates both the prevalence of a given disease or risk factor and the relative harm it causes<sup>26-28</sup>. These tools allow decision-makers to compare the effects of different diseases, such as malaria versus cancer, and then use that information at home<sup>26-28</sup>. To make these results more accessible and useful, the Institute for Health Metrics and Evaluation (IHME) has distilled large amounts of complicated information into a suite of interactive data visualizations that allow people to make sense of the more than one billion data points generated<sup>26-28</sup>.

Collected and analyzed by a consortium of more than 7,000 researchers in more than 156 countries and territories, the data capture premature death and disability of more than 350 diseases and injuries in 195 countries, by age and sex, from 1990 to the present, allowing comparisons over time, across age groups, and among populations<sup>26-28</sup>. The flexible design of the GBD machinery allows for regular updates



as new data and epidemiological studies are available<sup>26-28</sup>. In this way, the tools can be used at the global, national, and local levels to understand health trends over time, just as gross domestic product data are used to monitor a country's economic activity<sup>26-28</sup>.

#### 2. Suicide

#### 1) Global and South Korea

Suicide is a serious global public health issue. Globally, approximately 800,000 people die by suicide every year<sup>1</sup>. Suicide is among the leading causes of death worldwide, with more deaths owing to suicide than malaria, human immunodeficiency virus/acquired immunodeficiency syndrome, breast cancer, or war and homicide<sup>29</sup>. More than one in every 100 deaths (1.3%) in 2019 were the result of suicide<sup>29</sup>. The reduction of suicide mortality has been prioritized by the WHO as a global target and included as an indicator in the UN SDGs under target 3.4, as well as in WHO's 13th General Program of Work 2019–2023 and in the WHO Mental Health Action Plan 2013–2020, which has been extended to 2030<sup>3,30</sup>.

In 2019, an estimated 759,028 people died owing to suicide (Appendix 1). The global age-standardized suicide rate (ASR) was 9.4/100,000 population in 2019 and varied between countries from 2 (Sao Tome and Principe) to 60.2 per 100,000 population (Greenland) (Figure 1, Appendix 2). The percentage suicide death of all deaths was 1.3% where its variation ranged from 0.4% (Syrian Arab Republic) to 7.0% (Greenland) (Figure 2, Appendix 1). Globally, the annual percentage change in the



suicide death rate from 1990 to 2019 was -0.290, ranging from -0.614 (Denmark) to 2.085 (Armenia) (Figure 3, Appendix 3).



**Figure 1. Percentage of suicide death number of all deaths, 2019** Source: Global Burden of Disease Global Burden of Disease, Injuries, and Risk Factors Study (GBD) 2019





**Figure 2.** Age-standardized suicide death rate per 100,000, both sexes, 2019 Source: Global Burden of Disease Global Burden of Disease, Injuries, and Risk Factors Study (GBD) 2019



**Figure 3.** Annual percentage change of suicide death rate from 1990 to 2019 Source: Global Burden of Disease Global Burden of Disease, Injuries, and Risk Factors Study (GBD) 2019



However, this overall decreasing trend of suicide death rate has masked increases in other countries, such as South Korea, which experienced a constant rise in suicide rates. The annual death rate in South Korea has been increasing by 1.4%, although little fluctuation appeared (Figure 4). Along with the 1997–1998 Asian financial crisis that triggered an increase in the suicide rate in South Korea, a dramatic and persistent increase in the suicide rate of older people appears to have played a major role in the recent epidemic in South Korea<sup>31,32</sup>. Since then, imbalanced economic structural reforms imposed by the International Monetary Fund (IMF), rising income inequality, and inadequate social security safety net combined with a weakening of the Confucian tradition of family-based informal care provided to aging parents) have been cited as potential causes of the suicide crisis in South Korea<sup>33,34</sup>.



Figure 4. Trend of suicide death rate per 100,000 population and number in South Korea Data: Statistics Korea, 2021



#### 2) Suicide risk factor

Suicide risk factors differ across cultures, geographic locations, and secular trends, although there are common factors, including male gender, past suicide attempts, psychiatric illness, and lower socioeconomic status<sup>1,8-10,15,35</sup>. In some ecological studies, facing an economic crisis, such as the 2008 global economic crisis, has been highly related to an increased suicide rate because of the possible consequences of resulting unemployment and decreased personal income<sup>36,37</sup>. Since the Asian financial crisis began in July 1997, the suicide rate and the prevalence of suicidal behaviors and depression rose dramatically, particularly in South Korea, along with the unemployment rate and declining household income<sup>38,39</sup>. Likewise, a nationwide economic recession is a well-known factor associated with a higher suicide rate in this population. Furthermore, other previous ecological studies support numerous possible risk factors of a country's suicide rate, such as economic, socio-demographic, and epidemiologic indicators<sup>7,18,40,41</sup>.

#### 3) Suicide prevention policies and programs

A comprehensive and coordinated response to suicide prevention is critical to ensure that the tragedy of suicide does not continue to cost lives and affect many millions through the loss of loved ones or suicide attempts<sup>2,3,10,13,15,30</sup>. The timely registration and regular monitoring of suicide form the backbone of effective national suicide prevention strategies. Doing so provides essential information for understanding the scope of the problem so that interventions can be tailored to meet the needs of specific populations and can be adjusted to trends. Unfortunately, suicide



prevention is often a low priority for governments and policy-makers<sup>10</sup>. Suicide prevention needs to be prioritized on global public health and public policy agendas, and awareness of suicide as a public health concern must be raised by using a multidimensional approach that recognizes social, psychological, and cultural impacts<sup>10</sup>. A national suicide prevention strategy is important because it indicates a government's clear commitment to prioritizing and tackling suicide, while providing leadership and guidance on key evidence-based suicide prevention interventions<sup>10</sup>.

Numerous global actions have described suicide prevention as an important priority to achieve the global target of reduced suicide rates in countries. In this regard, national responses have also appeared with comprehensive multisectoral suicide prevention strategies that are essential to achieving the target of reducing the suicide rate. In 2013, the WHO Mental Health Action Plan 2013–2020 was adopted by the World Health Assembly<sup>42</sup>. In 2015, the SDGs, which are focused on what can be achieved by 2030, were adopted by the UN General Assembly<sup>10</sup>. Far broader in scope than the Millennium Development Goals, the third goal of the SDGs is to ensure healthy lives and promote well-being for all-ages<sup>10</sup>.

With continuous efforts to upgrade suicide prevention strategies with many studies and actions, knowledge about suicidal behavior has greatly increased. It has shown the important interplay between biological, psychological, social, environmental, and cultural factors in determining suicidal behaviors<sup>10,13</sup>. Moreover, it helped capture many possible risk and protective factors for suicide in both the general population and vulnerable groups such as indigenous peoples, young pregnant



women, immigrants, prisoners, military personnel, and lesbian, gay, bisexual, transgender, and intersex persons<sup>10,13</sup>.

National suicide prevention needs to be approached strategically. It should be multisectoral, involving not only the health sector but also sectors such as education, labor, social welfare, agriculture, business, justice, law, defense, politics, and the media, while considering each country's cultural and social contexts<sup>10,13,15</sup>. In addition, it is necessary to specify clear objectives, targets, indicators, timelines, milestones, designated responsibilities, and budget allocations<sup>10,13,15,30</sup>. Thus, the government must establish a strategic and systematic approach. Since 2000, many national suicide prevention strategies have been developed, such as the national suicide prevention frameworks, national programs for specific subpopulations, and the integration of suicide prevention into national plans for mental health or other health areas<sup>43</sup>. We introduce an example of South Korea's suicide prevention policy.

The Korean government announced a comprehensive policy under the "National Suicide Prevention Five-Year Plan" in 2004. In 2008, the 2<sup>nd</sup> Suicide Prevention and Comprehensive Plan (2009–2013) was established to expand the range of stakeholders and intervention actions compared to the first plan. Unlike the first plan, which focused on mental health, the second plan covered broader efforts based on the community, including the Healthy Families Support Centers, the Youth Counseling Support Centers, Educational councils, reporters' associations, and elderly protection agencies. In 2011, the Act for Preventing Suicide and Building a Culture of Respect for Life was enacted. In early 2018, the South Korean government announced the "Third National Action Plan for Preventing Suicide." This entails



support systems for high-risk suicide groups (e.g., bereaved families, those with psychiatric or physical illnesses, the unemployed, and the poor)<sup>10,44</sup>. However, government-led mental health programs continue to suffer from various limitations<sup>10,44</sup>.



## **III. Methodology**

#### 1. Overview

The GBD study provides estimates of incidence, prevalence, mortality, YLL, YLD, and DALY of 345 diseases and injuries and 84 risk factors by age and sex on a global scale and for 204 countries and territories for the years 1990 to 2019<sup>21,26</sup>. Input data were extracted from censuses, household surveys, civil registration and vital statistics, disease registries, health service use, air pollution monitors, satellite imaging, disease notifications, and other sources<sup>21,26</sup>. Cause-specific death rates and cause fractions were calculated using the cause of death ensemble model and spatiotemporal Gaussian process regression<sup>45,46</sup>. Cause-specific deaths were adjusted to match the total all-cause deaths calculated as part of the GBD population, fertility, and mortality estimates. Deaths were multiplied by the standard life expectancy at each age to calculate the YLLs. The methods used in GBD have been described elsewhere<sup>47,49</sup>.

For this study, we used the GBD Results Tool to extract estimates and their 95% uncertainty interval (UI) for deaths, prevalence of cases, DALYs, YLD, and YLL owing to suicide. Using the International Classification of Diseases (ICD) codes, suicide mortality was defined as death caused by purposely self-inflicted poisoning or injury (ICD-10 codes X60-X64.9, X66-X84.9, Y87.0; ICD-9 codes E950-E959). In some countries, a large proportion of injury-related deaths are coded as



"underdetermined intent" for cultural, religious, or medico-legal reasons. GBD 2010 developed a method to redistribute these deaths to specific underlying causes, including suicide. Our study was performed in the following steps (Figure 5).





**Figure 5. Study flowchart** 



## 2. Data and variables

We primarily used GBD data along with other multiple data sourced from the World Bank Open Data, International Labour Organization STAT, and the Standardized World Income Inequality Database<sup>23-25</sup>. The variables used for the analysis in our study are summarized in Table 1, along with their data sources and descriptions.



Variables			Description	Source
Dependent variables (by Global, GBD super regions, 21 GBD regions, Socio- demographic Index (SDI) group, and 195 countries)		Age-standardized suicide death rate per 100,000	Number of suicides in a country in a year, divided by the its standard population and multiplied with 100,000.	
	D. su Burdens of Suicide Y Y Su	DALYs due to suicide	DALY attributed to a disease, condition or injury are calculated by combining estimates from two individual metrics: YLL due to premature mortality and YLD.	Global Burden of
		YLLs due to suicide	YLL measures the years of life lost due to premature deaths i.e. the fatal component of burden of disease. YLLs are calculated by subtracting the age at each suicide death from the expected remaining life expectancy for a person at that age. YLL represent fatal burden.	Burden of Disease, Injuries, and Risk Factors Study 2019
		YLDs due to suicide	A measure of the years of what could have been a healthy life but were instead spent in states of less than full health because non-fatal self-harm. YLD represent non-fatal burden.	-

## Table 1. Variable classification, definitions, and sources of the data



Independent variables (by 195 countries)	Economic characteristics	Gini coefficient	Gini index measures the extent to which the distribution of income (or, in some cases, consumption expenditure) among individuals or households within an economy deviates from a perfectly equal distribution. A Lorenz curve plots the cumulative percentages of total income received against the cumulative number of recipients, starting with the poorest individual or household. The Gini index measures the area between the Lorenz curve and a hypothetical line of absolute equality, expressed as a percentage of the maximum area under the line. Thus a Gini index of 0 represents perfect equality, while an index of 100 implies perfect inequality.	The Standardized World Income Inequality Database
	Socio- demographic characteristics	Socio-demographic index	A summary measure that identifies where countries or other geographic areas sit on the spectrum of development. Expressed on a scale of 0 to 1, SDI is a composite average of the rankings of the incomes per capita, average educational attainment, and fertility rates of all areas in the GBD study.	Global Burden of Disease Global Burden of Disease, Injuries, and Risk Factors Study 2019
		Population ages 65 and above (% of total population)	Population ages 65 and above as a percentage of the total population. Population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship.	World Bank Open Data
		Unemployment, total (% of total labor force)	Unemployment refers to the share of the labor force that is without work but available for and seeking employment.	International Labour Organization STAT



	Age dependency ratio (% of working-age population)	Age dependency ratio is the ratio of dependentspeople younger than 15 or older than 64to the working-age populationthose ages 15-64. Data are shown as the proportion of dependents per 100 working-age population.	World Bank Open Data
Epidemiologic characteristics	DALYs due to mental disorder	DALYs due to mental disorder are calculated by combining estimates from YLL and YLD due to schizophrenia, depressive disorders, bipolar disorder, anxiety disorder, eating disorder, and other disorders.	Global Burden of Disease Global Burden of Disease, Injuries, and Risk Factors Study 2019
	DALYs due to alcohol use disorder	DALYs due to mental disorder are calculated by combining estimates from YLL and YLD due to alcohol use disorder.	Global Burden of Disease Global Burden of Disease, Injuries, and Risk Factors Study 2019
	DALYs due to drug use disorder	DALYs due to mental disorder are calculated by combining estimates from YLL and YLD due to drug use disorder.	Global Burden of Disease Global Burden of Disease, Injuries, and Risk Factors Study 2019


# 3. Statistical analysis

### 1) Regression based multiple imputation for missing data

For the variables with missing values derived from other data sources, we implemented multiple imputations based on regression with a longitudinal setting. Multiple imputation is a robust and flexible option for handling missing data<sup>50,51</sup>. Multiple imputation fills in missing values by generating plausible numbers derived from the distributions of and relationships among observed variables in the data set<sup>50,51</sup>. Multiple imputation differs from single imputation methods because missing data are filled many times, with many different plausible values estimated for each missing value<sup>50,51</sup>. Using multiple plausible values provides a quantification of the uncertainty in estimating what the missing values might be, avoiding creating false precision (as can happen with single imputation)<sup>50,51</sup>. Multiple imputation provides accurate estimates of quantities or associations of interest, such as treatment effects in randomized trials, sample means of specific variables, correlations between two variables, as well as the related variances. In doing so, it reduces the chance of false-positive or false-negative conclusions<sup>50,51</sup>. The imputation was supported by the SAS 9.4 procedures "PROC MI" and "PROC MIANLYZE"<sup>52,53</sup>.

# 2) Descriptive analysis

To characterize the burden of suicide in the GBD regions (GBD super regions, 21 GBD regions, and SDI groups), I performed a descriptive analysis. The number of deaths by suicide, age-standardized mortality rate by suicide (ASDR) per 100,000



population, and age-standardized DALYs, YLD, and YLL by suicide per 100,000 population were compared. A list of countries and their regions is presented in Appendix 4.

### 3) Assessment of trends from 1990 to 2019

We used joinpoint regression models to describe trends in ASDR per 100,000 from 1990 to 2019 for each global and regional cluster. The joinpoint regression fits a piecewise linear regression to the natural logarithm of the standardized rates with the calendar year as the predictor variable and uses permutation tests to detect whether there are time points (joinpoints) at which trends in rates statistically significantly change in either direction or magnitude<sup>54,55</sup>. The joinpoint regression compares models by starting with no joinpoint (no joinpoints correspond to a straight line) and then testing whether more joinpoints need to be added into the model to best fit the data<sup>53</sup>. The best-fitting model was selected to report the average annual percent change (AAPC) in rates for the entire study period, and the annual percent change (APC) for each linear trend segment was detected<sup>53</sup>. The AAPC is a summary measure of the trend over a prespecified fixed interval, computed as a weighted average (mean) of the annual percentage change of each time segment from the joinpoint model, with weights equal to the length of each segment over time<sup>53</sup>.



The following model was used to estimate the APC:

 $\log Y_x = b_0 + b_1 x$ , where  $\log Y_x$  is the natural logarithm of the rate in year x. Then, the APC from year x to year x+1 is:

APC = 
$$\frac{e^{b_0+b_1(x+1)}-e^{b_0+b_1x}}{e^{b_0+b_1x}} \times 100 = (e^{b_1}-1) \times 100$$

When there are no joinpoints (i.e., no changes in trend), APC is constant, so it equals the AAPC. Otherwise, the entire period is segmented by points with a trend change. Then, AAPC is estimated as a weighted average of the estimated APC in each segment by using the segment lengths as weights. For example, if joinpoint regression identifies six joinpoints in 1990–1994, 1994–1999, 1999–2002, 2002–2005, 2005–2015 and 2015–2019, with APCs of 0.670, -1.325, -2.791, -1.432, -2.810, and -0.909, respectively, and segment widths of 4, 5, 3, 3, 10, and 4 years, respectively.

Then, AAPC is estimated as:

$$AAPC = \left[e^{\frac{4 \times 0.670 - 5 \times 1.325 - 3 \times 2.791 - 3 \times 1.432 - 10 \times 2.810 - 4 \times 0.909}{4 + 5 + 3 + 3 + 10 + 4}} - 1\right] \times 100$$
$$= -1.675\%$$

An approximate 95% confidence interval for AAPC is:  $(AAPC_L, AAPC_U)$ , where

$$AAPC_{L} = \left[ e^{\log(AAPC+1) - 1.96\sqrt{w_{x}^{2}\alpha_{x}^{2}}} - 1 \right] \times 100 = -1.852\%$$
$$AAPC_{U} = \left[ e^{\log(AAPC+1) + 1.96\sqrt{w_{x}^{2}\alpha_{x}^{2}}} - 1 \right] \times 100 = -1.497\%$$



Joinpoint trend analysis software was used to analyze trends in agestandardized suicide burden in our study<sup>54</sup>. The software describes changes in data trends by connecting several different line segments on a log scale at "joinpoints," and can identify points where a statistically significant change over time in the linear slope of the trend has occurred<sup>56</sup>. The analysis started with the minimum number of joinpoints (e.g., 0 joinpoint, which is a straight line), and tests whether one or more joinpoints are statistically significant and should be added to the model. The statistical significance test was performed using the Monte Carlo permutation method. Furthermore, the APC was tested to determine whether it was different from the null hypothesis that the APC was zero. In the final model, each joinpoint indicated a statistically significant change in trends (increase or decrease), and each of these trends was quantitatively described by an APC. The AAPC is a weighted average of the APCs, with weights equal to the length of the joinpoint segment. To obtain a summary measure of the trend over the complete study period, AAPC and the related 95% uncertainty interval were also computed for the complete study period (1990–2019). For all analyses, a p-value < 0.05, was considered statistically significant.

# 4) Group-Based Trajectory Model (GBTM) analysis

The 30-year sequential Gini coefficient and SDI were fit into a semiparametric mixture, GBTM, using the SAS PROC TRAJ procedure in SAS 9.4<sup>57,58</sup>. GBTM was developed to identify the optimal number of distinct groups that classify individual units according to their longitudinal patterns. GBTM identified



groupings of individuals that incorporated all data points instead of a single point of time. The dependent variable in the GBTM analysis was the country's Gini coefficient and SDI of each year.

### 5) Variable validation for the analysis

Selecting appropriate variables for inclusion in a model is often considered the most important and difficult part of model building. This is the first step in selecting potential variables related to a country's suicide death rate by reviewing the existing literature on the topic. However, the data sources that compile related data for 195 GBD countries from 1990 to 2019 were limited; thus, we extracted as many potential variables as possible with a literature review. Then, we performed a dominance analysis to determine whether the extracted independent variables in the model gave a statistically significant response to the dependent variable. Dominance analysis is a method used to compare the relative importance of predictors in multiple regression<sup>59</sup>. Dominance analysis determines the dominance of one predictor over another by comparing their additional R<sup>2</sup> to the case of multiple response variables. Furthermore, we confirmed that there was no multicollinearity among the variables included in the model. We also tested whether the assumptions of normal distribution were violated.



# 6) Country's socioeconomic, demographic characteristics as factors associated with suicide death rate, DALYs, YLL, and YLD

To evaluate which country's economic, socio-demographic, and epidemiologic factors selected by preceded dominance analysis had a stronger association with suicide death rate, we employed multivariable linear regression. The following model was used to estimate the association between the dependent variable and multiple independent variables:

$$Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_k x_k + \varepsilon,$$

where Y is a continuous dependent variable,  $x_1, x_2, ..., x_k$  are the independent variables in the multivariable model,  $\beta_0$  is the y-intercept (constant term),  $\beta_k$  is the slope coefficient for each independent variable, and  $\varepsilon$  is the model's error term (also known as the residuals).

Furthermore, we developed an association analysis in a longitudinal setting with repeatedly measured countries from 1990 to 2019 by employing the generalized estimating equation (GEE) model with Poisson distribution and log link function, assuming that correlations between time points were autocorrelated. The GEE model is an extension of the quasi-likelihood approach that accounts for time variations and correlations among repeated measurements in a longitudinal setting<sup>60,61</sup>. The analysis was supported by SAS 9.4, "PROC SURVEYREG," and "PROC GENMOD"<sup>62</sup>.



## 7) Computation of inequality index measure

Distributive inequality of suicide burden across countries was measured by the slope index of inequality (SII), relative index of inequality (RII), and the health inequality concentration index, and the standard metrics of absolute and relative gradient inequality, respectively<sup>63</sup>. In the preceding regression analysis, we confirmed that income disparity (measured by the Gini coefficient) and the sociodemographic index (SDI) had a stronger association with suicide death rate and suicide-related outcomes than other variables. The Gini coefficient demonstrates the degree of inequality in the distribution of wealth or income<sup>64</sup>. It is used to estimate how far a country's wealth or income distribution deviates from an equal distribution, where it theoretically ranges from 0 (complete equality) to 1 (complete inequality). SDI was developed by GBD researchers as a composite indicator of development status strongly correlated with health outcomes, incorporating a geometric mean of 0 to 1 index of total fertility rate under the age of 25, mean years of education among those aged 15 and older, and lag distributed income per capita to create an index for each country or region<sup>65</sup>. A country with an SDI of 1 would have a theoretical maximum level.

Accordingly, we measured how the suicide death rate was disproportionately distributed by the country's Gini coefficient and SDI. For absolute measurement of the disproportion in suicide death rate by income disparities, we derived SII by regressing country-level age-standardized suicide death rates in all-age populations on each country's relative position of degree of income disparity, defined by the midpoint of the cumulative class interval of the



population ranked by the Gini coefficient. For another absolute measurement of the disproportion in suicide death rate by SDI, we derived SII by regressing countrylevel age-standardized suicide death rates in all-age populations on each country's relative socio-demographic position, defined by the midpoint of the cumulative class interval of the population ranked by SDI. Regarding SII, the slope of the regression line represents differences in a health indicator between the highest and lowest Gini coefficients or SDI in a focused population, since the respective positions of these points are assigned a score of 0 and 1.

Further calculation for relative measure by RII was obtained by the ratio of the rate at the lowest Gini coefficient or SDI to the rate at the highest Gini coefficient or SDI. With the lowest social rank as reference, an RII value greater (less) than 1 indicates that the suicide mortality rate was higher among the countries with higher (lower) Gini coefficient or SDI (more distance from 1 implies more inequality).

For another relative measurement of the disproportion, we derived a health inequality concentration index by fitting a Lorenz concentration curve to the observed cumulative relative distributions of the population ranked by the Gini coefficient or SDI and the age-standardized suicide death rates, and numerically integrating the area under the curve<sup>66</sup>. The extent of inequality measured by the concentration curve ranges from -1 to +1, which is equal to twice the area between the curve and the diagonal line. For a value of -1, the burden of suicide is concentrated in the lowest ranked segment (Gini coefficient, or SDI) of country (or vice versa for value of +1), and a value of 0 means perfect equality.



For both absolute and relative measurements, we compared them by stratifying them into the years 1990 and 2019. The analysis was supported by the Stata version 15 commands "GLCURVE" and "CONINDEX"<sup>67,68</sup>.

# 4. Ethics statement

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This study was approved by the Institutional Review Board of Yonsei University Health System (IRB number: 4-2021-1488) and adhered to the tenets of the Declaration of Helsinki.



# **IV. Results**

# 1. Overview

GBD 2019 estimated 759,028 (95% uncertainty interval, 95% UI 685,390 to 831,857) deaths globally from suicide in 2019, along with its 9.4 ASDR from suicide death per 100,000 (Table 2). Male to female ratio of suicide ASDR was 2.3 globally and it was different by regions, ranging from 1.5 in South Asia to 5.7 in Eastern Europe (Appendix 5). In joinpoint regression analysis, the global decreasing trend in ASDR of suicide was shown with its AAPC of -1.67% (-1.85% to -1.50%, p-value < 0.001). The similar trend of decreasing was also shown in other GBD super regions (Figure 6, Table 3), or most of 21 GBD regions (except High-income Asia Pacific region, AAPC=0.02%, -0.37% to 0.42, p-value=0.915; Eastern Europe, AAPC=0.27%, -1.13% to 1.69, p-value=0.706; Central Asia, AAPC=0.26%, -0.20% to 0.72, p-value=0.276), or SDI groups. However, some joinpoint periods among 21 GBD regions were not constant in decline of ASDR suicide death, rather, reversed to increase or slowed to decreasing trend (Appendix 6). These joinpoints had a common feature where economic crisis occurred within the period, which strongly supported by that economic downturns affect rises in unemployment and result in excess suicide<sup>36,38</sup>. For instance, 1997 Asian fiscal crisis hit many East/Southeast such as South Korea, Japan, Hong Kong, Taiwan, Singapore, Thailand since 1997<sup>36,38</sup>. Regarding this, there was higher increase of ASDR suicide death for the



related regions such as High-income Asia Pacific (1995-1999 APC=4.72%, p-value<0.001, Appendix 6-4) and South Asia (1995-1999 APC=1.23%, p-value=0.228, Appendix 6-17). For another instance, after the 2008 economic crisis, rates of suicide increased in the European and American countries, particularly in men<sup>36</sup>. In line with this, there was higher increase of ASDR suicide death for the regions of High-income North America (2004-2013 APC=0.76%, p-value<0.001, Appendix 6-2) and Western Europe (2006-2010 APC=-0.57%, p-value=0.096, Appendix 6-5). These were not notably different with the estimation of suicide DALYs, YLL, or YLD (Appendix 7, 8, and 9).

The suicide death rate per 100,000 in 2019 varied by country ranges from 2.01 (Sao Tome and Principe, 95% UI: 1.31 to 2.71) to 60.2 (Greenland, 47.6 to 76.2) and it estimated mean 10.2, standard deviation (SD) 7.3, median 8.2 (Appendix 2). The percentage of suicide death number of all deaths among countries in 2019 varies from 0.38% (Syrian Arab Republic) to 7.04% (Greenland), it estimated mean 1.31, SD 0.78, median 1.13. (Appendix 1). APC of suicide death rate from 1990 to 2019 shows distinctive difference by country where highest increasing in Armenia (2.085%, 1.521 to 2.647), second highest increasing in Republic of Korea (1.405%, -0.140 to 2.110), and highest decreasing in Denmark (- 0.614%, -0.644 to -0.575) (Appendix 3).



Table 2	Total number of deaths and as	a standardizad sujaida daath rata	nor 100 000 in 2010 and avora	as annual porcontage chang	to of suicido dooth rate from 1000 to 2010
I able 2.	Total number of deaths and ag	e stanuaruizeu suiciue ueath rate	; per 100 000 in 2019, and avera	ge annual percentage chang	e of suicide death rate from 1990 to 2019

		ASI	ASDR from suicide				AAPC of ASDR from suicide, 1990-2019						
Regions	Estimate		95% UI		Estimate		95% UI		Estimate		95% UI		p-value
GBD super regions													
Global	759,028	685,390	-	831,857	9.4	8.5	-	10.3	-1.67	-1.85	-	-1.50	< 0.001
Central Europe, Eastern Europe, and Central Asia	85,560	77,196	-	97,318	17.6	15.9	-	20.0	-0.39	-1.30	-	0.52	0.399
High-income	150,785	144,180	-	157,014	11.0	10.6	-	11.4	-0.62	-0.77	-	-0.47	< 0.001
Latin America and Caribbean	37,451	34,152	-	41,110	6.1	5.6	-	6.7	-0.24	-0.35	-	-0.13	< 0.001
North Africa and Middle East	25,803	21,418	-	31,528	4.3	3.6	-	5.2	-1.15	-1.23	-	-1.08	< 0.001
South Asia	223,958	189,333	-	261,538	12.5	10.5	-	14.6	-1.31	-1.78	-	-0.83	< 0.001
Southeast Asia, East Asia, and Oceania	166,322	143,575	-	194,625	6.7	5.8	-	7.8	-3.25	-3.59	-	-2.91	< 0.001
Sub-Saharan Africa	69,149	57,105	-	83,313	10.8	9.1	-	13.0	-0.79	-0.90	-	-0.67	< 0.001
											-		
21 GBD regions											-		
High-income North America	50,082	48,902	-	51,275	11.6	11.3	-	11.9	-0.17	-0.43	-	0.08	0.180
Australasia	3,410	3,253	-	3,641	10.4	10.0	-	11.1	-0.75	-1.16	-	-0.34	0.000
High-income Asia Pacific	39,837	34,419	-	42,476	15.1	13.1	-	16.0	0.02	-0.37	-	0.42	0.915
Western Europe	49,755	47,699	-	52,349	8.5	8.2	-	8.9	-1.56	-1.72	-	-1.40	< 0.001
Southern Latin America	7,702	7,351	-	8,093	10.6	10.1	-	11.1	-0.36	-0.63	-	-0.09	0.008
Eastern Europe	57,009	49,675	-	66,789	23.0	20.2	-	27.0	0.27	-1.13	-	1.69	0.706
Central Europe	17,408	15,198	-	19,916	11.5	10.1	-	13.2	-1.44	-1.83	-	-1.05	< 0.001
Central Asia	11,143	9,990	-	12,530	12.1	10.9	-	13.6	0.26	-0.20	-	0.72	0.276
Central Latin America	15,514	13,340	-	17,978	6.0	5.2	-	7.0	0.84	0.57	-	1.11	< 0.001
Andean Latin America	3,437	2,348	-	4,256	5.4	3.7	-	6.7	0.47	0.23	-	0.71	< 0.001
Caribbean	4,569	3,944	-	5,330	9.1	7.9	-	10.6	-1.20	-1.43	-	-0.96	< 0.001
Tropical Latin America	13,931	13,210	-	15,181	5.7	5.4	-	6.2	-0.74	-0.99	-	-0.50	< 0.001
East Asia	128,470	108,370	-	153,699	7.0	5.9	-	8.3	-3.65	-4.11	-	-3.19	< 0.001
Southeast Asia	37,100	30,280	-	43,725	5.4	4.4	-	6.4	-1.53	-1.80	-	-1.27	< 0.001
Oceania	753	586	-	973	6.5	5.2	-	8.3	-0.81	-0.94	-	-0.68	< 0.001
North Africa and Middle East	25.803	21.418	-	31,528	4.3	3.6	-	5.2	-1.15	-1.23	-	-1.07	< 0.001
South Asia	223,958	189,333	-	261,538	12.5	10.5	-	14.6	-1.31	-1.78	-	-0.83	< 0.001
Southern Sub-Saharan Africa	11.894	9.457	-	14.024	15.7	12.7	-	18.5	-0.92	-1.53	-	-0.30	0.003
Western Sub-Saharan A frica	23.263	18.240	-	29.872	9.3	7.4	-	11.9	-0.14	-0.26	-	-0.01	0.029
Eastern Sub-Saharan Africa	24,794	20.445	-	29.826	11.1	9.3	-	13.3	-1.13	-1.20		-1.06	< 0.001
Central Sub-Saharan Africa	9,199	6,948	-	11,979	12.5	9.8	-	15.9	-0.83	-1.04	-	-0.61	< 0.001
SDI group													
High SDI	145 220	138 398	-	151 543	11.2	10.7	-	11.6	-0.77	-0.81	-	-0.72	< 0.001
High-middle SDI	152 437	139 314	-	170 313	8.8	81	-	9.8	-2.08	-2 41	-	-1.76	< 0.001
Middle SDI	185,063	162 156	-	208 721	7.4	6.5	-	84	-2.34	-2.63	-	-2.06	< 0.001
Low-middle SDI	203 873	174 140		232 019	12.0	10.2		13.7	-1.30	-1.75		-0.84	< 0.001
Low SDI	72 105	60 143	-	87.065	9.5	7.9	-	11.4	-0.84	-0.93	-	-0.75	< 0.001
Low-middle SDI Low SDI	203,873 72,105	174,140 60,143	-	232,019 87,065	12.0 9.5	10.2 7.9	-	13.7 11.4	-1.30 -0.84	-1.75 -0.93	-	-0.84 -0.75	< 0.001 < 0.001

<sup>a</sup> Result from joinpoint regression





**Figure 6. Trends of age-standardized death rate from suicide by GBD super regions, 1990-2019** Interval plot shows the 95% uncertainty interval in each estimates.



GBD super regions	Period	Change year	APC	95% CI			AAPC		p-value		
	1990-2019						-1.675	-1.852	-	-1.497	< 0.001
	1990-1994	1994	0.670	0.259	-	1.083					0.004
	1994-1999	1999	-1.325	-1.701	-	-0.947					< 0.001
Global	1999-2002	2002	-2.791	-3.872	-	-1.698					< 0.001
	2002-2005	2005	-1.432	-2.524	-	-0.328					0.015
	2005-2015	2015	-2.810	-2.921	-	-2.700					< 0.001
	2015-2019		-0.909	-1.351	-	-0.465					0.001
	1990-2019						-0.392	-1.299	-	0.523	0.399
	1990-1994	1994	11.393	8.991	-	13.848					< 0.001
	1994-1997	1997	-3.668	-10.332	-	3.492					0.281
Central Europe, Eastern Europe, and Central Asia	1997-2000	2000	1.386	-2.841	-	5.797					0.497
	2000-2005	2005	-1.496	-2.677	-	-0.301					0.018
	2005-2011	2011	-4.561	-5.417	-	-3.697					< 0.001
	2011-2019		-1.481	-2.621	-	-0.328					0.016
	1990-2019						-0.621	-0.767	-	-0.475	< 0.001
	1990-2003	2003	-0.386	-0.442	-	-0.329					< 0.001
High-income	2003-2006	2006	-0.843	-1.767	-	0.089					0.074
6	2006-2009	2009	0.473	-0.628	-	1.587					0.381
	2009-2019		-1.184	-1.298	-	-1.071					< 0.001
	1990-2019						-0.240	-0.347	-	-0.134	< 0.001
	1990-1999	1999	0.19	0.041	-	0.339	0.210	015 17		0.121	0.015
Latin America and Caribbean	1999-2012	2012	-0.624	-0.719	-	-0.53					< 0.001
	2012-2019	2012	-0.077	-0.464	-	0.311					0.684
	1990-2019		01077	0.101		01011	-1 152	-1 228	-	-1.075	< 0.001
	1990-1995	1995	-0.454	-0.643	-	-0.264	11102	1.220		11075	< 0.001
	1995-1999	1999	-1 318	-1 706	-	-0.929					< 0.001
North Africa and Middle East	1999-2007	2007	-1 874	-1 974		-1.775					< 0.001
	2007-2012	2007	-0.642	-0.87	-	-0.412					< 0.001
	2012-2012	2012	-1.089	-1.19	-	-0.987					< 0.001
	1990-2019		11000	,		0.507	-1 310	-1 784	-	-0.834	< 0.001
	1990-1995	1995	-0.643	-1 640		0.365	1.510	1.704		0.054	0 194
	1995-1999	1999	1 225	-0.850		3 344					0.231
South Asia	1999-2012	2012	-2.165	-2 307		-1 032					< 0.001
	2012 2016	2012	2 257	5 202	-	1 270					~ 0.001
	2012-2010	2010	0.743	-5.572	-	2 100					0.522
	1000-2019		0.745	-1.045		3.190	-3 252	-3 503		-2.011	< 0.001
	1990-2019	1005	1 246	1 827		0.651	-3.232	-3.393	-	-2.911	< 0.001
	1005 1000	1775	2 744	-1.05/	-	2 620					< 0.001
Southcost Asia East Asia and One	1995-1999	1999	-3./44	-4.643	-	-2.030					< 0.001
Southeast Asia, East Asia, and Oceania	1999-2002	2002	-0.323	-8.309	-	-4.294					< 0.001
	2002-2005	2005	5.122	-2.133	-	2.209					0.989
	2005-2014	2014	-3.133	-5.500	-	-4.905					< 0.001
Cal Calance Africa	2014-2019		-1.405	-2.032	-	-0.895	0.796	0.001		0.00	< 0.001
Sub-Saharan Africa	1990-2019						-0./86	-0.904	-	-0.668	< 0.001

#### Table 3. Trends of age-standardized death rate from suicide by GBD super regions, 1990-2019



$\begin{array}{cccccccccccccccccccccccccccccccccccc$	19 0.193   84 0.228   001 <0.001   001 0.004   003 0.525
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# 2. Trends of age-standardized suicide death rate by Gini coefficient, SDI trajectory groups, 1990-2019

Result from GBTM analysis supported a 5-class model which included the following classes: 1) a highest group which was likely to remain highest Gini coefficient or SDI over time (Highest Gini coefficient: n= 6, 3.1%; Highest SDI: n=50, 25.8%), 2) a high group which was likely to remain high Gini coefficient or SDI over time (High Gini coefficient: n= 52, 26.5%; High SDI: n=42, 21.7%), 3) a middle group which was likely to remain middle Gini coefficient or SDI over time (Middle Gini coefficient: n= 72, 36.7%; Middle SDI: n=38, 19.6%), 4) a lower group which was likely to remain lower Gini coefficient or SDI over time (Lower Gini coefficient: n= 38, 19.3%; Lower SDI: n=38, 19.6%), 5) a lowest group which was likely to remain lowest Gini coefficient or SDI over time (Lowest Gini coefficient: n= 28, 14.5%; Lowest SDI: n=24, 12.4%) (Appendix 10).

In the case of the highest Gini coefficient trajectory group, the suicide rate was the highest in almost all years, and lowest Gini coefficient trajectory group followed as second highest suicide rate in almost all years. The lowest suicide rate was shown in the middle Gini coefficient trajectory group (Figure 7-A, Appendix 11). There was tendency that lower Gini coefficient trajectory group showed greater decrease in AAPC of suicide death rate (Lowest Gini coefficient trajectory group AAPC: -1.364%; Highest Gini coefficient trajectory group AAPC: -0.165%).

In the case of the Highest SDI trajectory group, it can be seen that the suicide rate is the highest in the beginning year and then reversed to a lower suicide



rate. The Lowest SDI trajectory group shows the highest suicide rate over time (Figure 7-B, Appendix 12). The highest SDI trajectory group showed greater decrease in AAPC of suicide death rate (AAPC: -1.261%)



Figure 7. Trends of age-standardized death rate from suicide by different trajectory groups of Gini coefficient regions (A), and SDI regions (B) from 1990-2019

AAPC, average annual percentage change, SDI, Socio-Demographic Index



# **3.** Economic, socio-demographic, and epidemiologic factors associated with suicide death rate

Prior to the regression analysis, we confirmed the assumption of normality in dependent variables was met (Appendix 13). Dominance analysis resulted Gini coefficient explains 44.6% of total adjusted R<sup>2</sup> of 0.6807, followed 42.3% explained by SDI (Table 4). In the analysis, regression coefficient for Gini coefficient was 17.641 (p-value: 0.0305), presenting that 17.641 increase in suicide death rate per 100,000 population for one unit change in the Gini coefficient while adjusting other independent variables with statistical significance. With regard to SDI, its regression coefficient was - 3.819 (p-value: 0.5555), presenting that 3.819 decrease in suicide death rate per 100,000 population for one unit change in the SDI while adjusting other independent variables, but statistically not significant. Proportion of elderly population (ages 65 and above) was positively associated with suicide death rate (regression coefficient: 0.279), but it was marginally significant (p-value: 0.0871) while explaining 5.7% of total model fitness. Other independent variables were not statistically significant or little explanation for the suicide death rate.



Variables	199	<b>)</b> 0	201	19		Age-standardized suicide death rate per 100,000							
variables	Mean	SD	Mean	SD	Coefficient	SE	P-value	Adjusted R-Square	Partial R-Square (%)				
Intercept					-2.301	6.991	0.7425	0.0000					
Gini coefficient	0.39	0.09	0.39	0.08	17.641	8.093	0.0305	0.3033	44.6%				
Socio-demographic index	0.48	0.19	0.63	0.18	-3.819	6.468	0.5555	0.5913	42.3%				
Population ages 65 and above (% of total population)	6.09	3.93	8.88	6.30	0.279	0.162	0.0871	0.6480	5.7%				
Mental disorder (DALY rate per 100,000)	1690.47	267.93	1675.13	274.71	-0.003	0.002	0.1378	0.6728	3.6%				
Unemployment rate	7.55	6.77	7.07	5.42	0.107	0.085	0.2083	0.6075	2.4%				
Alcohol use disorder (DALY rate per 100,000)	254.95	221.79	234.03	187.29	0.015	0.003	<.0001	0.6797	1.0%				
Age dependency ratio (% of working-age population)	72.98	20.05	177.53	174.35	0.094	0.048	0.0526	0.6094	0.3%				
Drug use disorder (DALY rate per 100,000)	133.23	82.71	58.84	16.81	0.006	0.004	0.1846	0.6807	0.1%				
Adjusted R-Square							0.6807						

Table 4. The results of multivariable regression analysis of risk factors related with suicide death rate and its relative importance



Most of economic, socio-demographic, and epidemiologic factors were associated with ASDR of suicide in the longitudinal setting, analyzed by GEE model with repeated measure (Table 5). Compared to countries where Gini coefficient lower than 0.4, those with higher Gini coefficient (more disproportionately income distributed) was estimated to have higher rate of suicide death (Gini coefficient > 0.6, rate ratio, RR: 1.281, 95% confidence interval, 95% CI: 1.121to 1.463). Compared to countries where positioned in high group of SDI, those in low SDI group had higher rate of suicide death (Low SDI, RR: 1.883, 95% CI: 1.595 to 2.223). Other sociodemographic factors (elderly population %, unemployment rate, age dependency ratio) and epidemiologic factors (DALY rate of mental disorder, alcohol use disorder, and drug use disorder) also significantly associated with most of suicide death rate.



Table 5. Adjusted association between country-level characteristics and age-standardized suicide death rate by repeatedly measuring with generalized estimating equation (GEE) model from 1990 to 2019 estimating equation (GEE) model from 1990 to 2019.

Characteristics

Age-standardized suicide death rate per 100,000

	RR	95% (	P-value	
Gini coefficient				
< 0.40	1.000			
0.40-0.49	1.030	0.979	1.083	0.2578
0.50-0.59	1.108	1.012	1.212	0.0260
> 0.60	1.281	1.121	1.463	0.0003
Socio-demographic index				
Low SDI	1.883	1.595	2.223	<.0001
Low-middle SDI	1.448	1.254	1.671	<.0001
Middle SDI	1.183	1.057	1.324	0.0035
High-middle SDI	1.238	1.122	1.365	<.0001
High SDI	1.000			
Population ages 65 and above (% of total population)				
< 7 %	1.000			
7-13 %: aging society	0.778	0.718	0.843	<.0001
14-20 %: aged society	0.711	0.645	0.784	<.0001
≥21 %: super-aged society	0.544	0.427	0.693	<.0001
Unemployment rate				
Q1: Lowest	1.000			
Q2	1.036	0.971	1.106	0.2873
Q3	0.974	0.907	1.046	0.4704
Q4: Highest	1.077	0.996	1.166	0.0642
Age dependency ratio (% of working-age population)				
Q1: Lowest	1.000			
Q2	0.929	0.872	0.990	0.0229
Q3	1.041	0.949	1.142	0.3926
Q4: Highest	1.157	1.030	1.300	0.0139
Mental disorder DALY rate per 100,000				
Q1: Lowest	1.000			
Q2	1.027	0.929	1.137	0.6001
Q3	1.040	0.943	1.146	0.4351
Q4: Highest	1.228	1.120	1.347	<.0001
Alcohol use disorder DALY rate per 100,000				
Q1: Lowest	1.000			
Q2	0.994	0.924	1.069	0.8740
Q3	1.140	1.045	1.245	0.0033
Q4: Highest	1.089	0.996	1.190	0.0604
Drug use disorder DALY rate per 100,000				
Q1: Lowest	1.000			
Q2	0.984	0.902	1.074	0.7175
Q3	1.034	0.935	1.144	0.5129
O4: Highest	1,104	0.986	1.236	0.0854

GDP, gross domestic product; RR, rate ratio; CI, confidence interval

In the subgroup analysis, notable trend was estimated that higher SDI group had greater suicide rate when they were in high Gini coefficient group (>0.60),



although the high SDI group was not converged due to lack of observation (Low SDI, RR: 1.077, 95% CI: 0.950 to 1.221; Low-middle SDI, RR: 1.071, 95% CI: 0.933 to 1.231; Middle SDI, RR: 1.492, 95% CI: 1.121to 1.987; High-middle SDI, RR: 1.522, 95% CI: 1.340 to 1.728) (Table 6).

However, the result does not in line with other dependent variables such as suicide DALY rate, YLD rate, and YLL rate, Elderly suicide death rate, and Nonelderly suicide death rate (Appendix 15). Especially, Gini coefficient was not associated with these dependent variables (except suicide YLD rate), but lower SDI was highly associated with the higher rates of them.



		Gin coencient														
Characteristics	> 0.60						0.50-0.59						< 0.4 (reference)			
	RR		95% C	I	P-value	RR		95% C	I	P-value	RR		95% C	I	P-value	RR
Socio-demographic index																
Low SDI	1.077	0.950	-	1.221	0.2485	1.109	1.007	-	1.221	0.0351	1.077	0.973	-	1.193	0.1512	1.000
Low-middle SDI	1.071	0.933	-	1.231	0.3299	1.209	1.087	-	1.344	0.0005	1.145	1.058	-	1.239	0.0008	1.000
Middle SDI	1.492	1.121	-	1.987	0.0061	1.027	0.795	-	1.327	0.8370	0.942	0.865	-	1.026	0.1697	1.000
High-middle SDI	1.522	1.340	-	1.728	<.0001	0.923	0.796	-	1.070	0.2865	0.963	0.900	-	1.030	0.2729	1.000
High SDI			-			1.058	0.923	-	1.212	0.4212	1.025	0.939	-	1.118	0.5815	1.000

0.01

#### Table 6. Adjusted association between Gini coefficient and age-standardized suicide death rate, according to SDI groups



# 4. Income-related inequality and SDI-related inequality measures in suicide death rate

Significant absolute and relative income-related inequality existed in the burden of suicide death across the 195 countries of GBD study. The suicide death rate was disproportionately concentrated among countries with greater income disparities (Figure 8). As indicated by the SII, an excess of 6.22 ASDR of suicide per 100,000 (4.18 to 8.26) existed between countries with the lowest and highest income disparities in 1990, which increased to 6.98 ASDR of suicide per 100,000 (5.56 to 8.40) in 2019. RII measured between Gini coefficient and suicide death rate was lower than 1 in both 1990 (RII: 0.50, 0.33 to 0.68) and 2019 (RII: 0.85, 0.68 to 1.03) years, showing a persistent inequality in favor of countries with higher Gini coefficient. The relative suicide death inequality by Gini coefficient was also measured by the concentration index, where was 0.273 (standard deviation, SD: 0.105, p-value=0.018) in 1990 and 0.415 (SD: 0.077, p-value=0.018), showing a disproportionate concentration of the suicide burden among the countries with higher II-

Another significant absolute and relative socio-demographic inequality existed in the burden of suicide death across the 195 countries of GBD study. The suicide death rate was disproportionately concentrated among countries positioned with lower SDI (Figure 9). As indicated by SII, an excess of 12.83 ASDR of suicide per 100,000 (11.54 to 14.13) existed between countries with the highest and lowest SDI in 1990, which decreased to 9.44 ASDR of suicide per 100,000 (8.34 to 10.55)



in 2019. RII measured between SDI and suicide death rate was lower than 1 in both 1990 (RII: 0.85, 0.78 to 0.95) and 2019 (RII: 0.90, 0.80 to 1.02) years, showing a persistent inequality in favor of countries with lower SDI. The relative suicide death inequality by SDI was also measured by the concentration index, where was -0.543 (SD: 0.044 p-value<0.001) in 1990 and -0.537 (SD: 0.041, p-value<0.001), showing a disproportionate concentration of the suicide burden among the countries with lower SDI (Figure 10-B).

We initially hypothesized that the either economically or sociodemographically unprivileged society with more elderly population would have greater magnitude of suicide inequality, but there were not notable differences of suicide inequality with Gini coefficient or SDI among different groups of elderly population society (Appendix 16).





Figure 8. Inequality measures in income disparity and suicide, measured by slope index of inequality (SII; absolute gradient) and relative index of inequality (RII; relative gradient) scale

(A) Inequality regression curves. (B) Summary measures and 95% CIs for inequalities in income disparity and suicide death rate.



(A)



Figure 9. Inequality measures in socio-demographic index (SDI) and suicide, measured by slope index of inequality (SII; absolute gradient) and relative index of inequality (RII; relative gradient) scale

(A) Inequality regression curves. (B) Summary measures and 95% CIs for inequalities in SDI and suicide death rate.

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Incomplity matrice		1990			2019	Difforence	SD	n valuo		
inequality metrics	Index value	SD	p-value	Index value	SD	p-value	Difference	30	p-value	
(A) Concentration index value by Gini coefficient	0.273	(0.105)	0.018	0.415	(0.077)	< 0.001	0.142	(0.130)	0.014	
(B) Concentration index value by SDI	-0.543	(0.044)	< 0.001	-0.537	(0.041)	< 0.001	0.006	(0.060)	0.874	

Figure 10. Inequality measures in income disparity and suicide (A) and socio-demographic index (B), measured by concentration index (relative gradient)

# V. Discussion

# 1. Discussion of the study methods

1세대한

The major objective of our study was to investigate the influential risk factors of countries that affect suicide death rates that change over time, and to analyze the extent of the disparities between the factors and suicide death rates of countries.

Prior to investigating the major objective, we need to impute missing independent variables from numerous data sources from 1990 to 2019. We employed a regression-based multiple imputation method for multiple time points in the data.

Then, we primarily produced age-standardized suicide death rate, disease burden as YLL owing to premature suicide mortality, YLD in people who attempted suicide, and DALY at the global, regional, and national levels. We then described trends in suicide death rates from 1990 to 2019 using a comprehensive approach, including a trend analysis with the data collected from GBD 2019. Accordingly, we preliminarily verified that there has been a decreasing trend in the suicide death rate, but during some specific time points in some regions, there was a reversed increasing trend of suicide death rate. Through a literature review, we were able to understand that the reversed phenomenon of suicide rate could be owing to an economic crisis since the regions and periods overlapped. Furthermore, economic crises are known to significantly affect income disparities and socio-demographic conditions<sup>69-73</sup>. Given this, we hypothesized that income disparities and



socio-demographic factors would have played an important role in the changes in the suicide death rate in countries.

To measure how income disparities or socio-demographic factors had a correlation with suicide death rate, we first captured longitudinal patterns of the Gini coefficient and SDI, and classified them into five groups by analyzing the group-based trajectory model. By plotting the trajectory groups and suicide death rate according to each year, we once again captured some notable features that the Gini coefficient and SDI would have affected the suicide death rate.

We employed the dominance analysis to identify which risk factors had played a critical role in suicide death rate by measuring relative importance with partial  $R^2$  and measured the regression coefficient of each risk factor on suicide death rate. The GEE model was also used to analyze the associations in a longitudinal setting with repeatedly measured countries from 1990 to 2019.

While identifying the Gini coefficient and SDI as major risk factors through the preceding analysis, we intended to analyze the extent of the disparities between the factors and suicide death rates of countries with absolute and relative scales.

A list of the methodological limitations should be mentioned. First, although the Global Burden of Disease Study 2019 employs data standardization and evaluations of data quality in a sophisticated modelling framework that borrows strength across space and time, this study is limited by the gaps in data, especially among low- and middle-income countries, and variations in data quality. Second, since there are social, cultural, religious,



and sometimes legal ramifications of suicide death, the possibility of under-reporting cannot be free from real-world estimation. Indeed, some countries misclassify suicide deaths as other causes of death owing to sociocultural reasons, leading to differential misclassification<sup>74</sup>. Although the Global Burden of Disease Study method to reclassify garbage codes adjusts for some of this misclassification, this could still be a conservative estimate of the suicide mortality rate if suicide deaths are wrongly assigned to other plausible causes, such as unintentional injuries, when deaths are recorded<sup>16</sup>. Third, some issues could exist in the imputation procedure used to fill in the missing values. Some systematically missing data were treated by forcing the survey year to be a predictor, instead of using a hierarchical multiple imputation considering the multilevel structure of the data, which is given by the four independent surveys used in the imputation procedure. Fifth, since this is an ecological study, we were unable to consider individual-level factors that should be highly related to countries' suicide death rates. Therefore, we were unable to identify the interactions between individual- and regional-level factors on suicide death rate because we only used data constructed at the regional level. Consequently, we restricted the interpretation of the results from the regional perspective. Sixth, unmeasured factors remained in the analysis, such as annual budget on mental health policy of each country since the WHO has only a few years or countries of data collected; thus, it could not be imputed.

Despite these limitations, our study had several strengths. In estimating suicide death rates and their joinpoint trends by using methods that are comparable over time and



between countries for the period 1990 to 2019, this study provides comprehensive estimates of suicide death rates by region. Through this, it was possible to capture the overall or segmented trends of regions where economic crises occurred. Moreover, unlike traditional GBD studies that were limited to the measuring of descriptive results, this is a unique study that investigated possible risk factors of suicide death rate at the regional level with the strict scheme (Figure 5).



# 2. Discussion of the results

### 1) Summary of the results

GBD 2019 estimated 759,028 (95% uncertainty interval, 95% UI 685,390 to 831,857) deaths globally from suicide in 2019, along with its 9.4 age-standardized death rate (ASDR) from suicide deaths per 100,000. The suicide death rate has been decreasing since 1990 (Global AAPC: -1.67%, p-value<0.001), but at a specific time point, it increased when the economic crises occurred (1997 Asian fiscal crisis, 2008 economic crisis).

In the case of the highest Gini coefficient trajectory group, the suicide rate was the highest in almost all years, and the lowest Gini coefficient trajectory group followed the second highest suicide rate in almost all years. The lowest suicide rate was observed in the middle Gini coefficient trajectory group. The lower Gini coefficient trajectory group showed a greater decrease in AAPC of suicide death rate (lowest Gini coefficient trajectory group AAPC: -1.364%; highest Gini coefficient trajectory group AAPC: -0.165%). In the case of the Highest SDI trajectory group, it can be seen that the suicide rate is the highest in the beginning year and then reversed to a lower suicide rate. The lowest SDI trajectory group had the highest suicide rate over time. The highest SDI trajectory group showed a greater decrease in AAPC of the suicide death rate (AAPC: -1.261%).

The overall adjusted  $R^2$  of 0.6807 in the association between the risk factors and suicide death rate, the Gini coefficient explained 44.6%, and SDI explained 42.3% with a



regression coefficient of 17.641 (p = 0.0305) and -3.819 (p = 0.5555), respectively. Other remaining factors were either marginally significant or had little explanation for the suicide death rate.

Most economic, socio-demographic, and epidemiologic factors were associated with ASDR of suicide in a longitudinal setting. Those with the highest Gini coefficient group (more disproportionately income distributed) were estimated to have a higher suicide death rate (Gini coefficient > 0.6, rate ratio, RR: 1.281, 95% confidence interval, 95% CI: 1.121to 1.463) than those with the lowest Gini coefficient group. Compared to countries in the high SDI group, those in the low SDI group had a higher suicide death rate (low SDI, RR: 1.883, 95% CI: 1.595–2.223). In the subgroup analysis, it was estimated that the higher SDI group had a higher suicide rate when they were in the high Gini coefficient group (>0.60), although the high SDI group did not converge owing to a lack of observation.

The suicide death rate was disproportionately concentrated among countries positioned in greater income disparities or lower socio-demographic conditions (lower GDP per capita, lower educational attainment, and lower fertility rate). Moreover, these gaps were even greater in 2019 than in 1990.

# 2) Interpretation of the results

The global suicide death rate has continuously decreased, and numerous studies and reports support many reasons such as worldwide or nationwide suicide prevention strategies and policies<sup>9,13,16,32,75-77</sup>, improved socio-demographic factors<sup>18,41,78,79</sup>, elevated



mental health status at population level<sup>19,80-82</sup>, or prosperity of economic status<sup>81,83,84</sup>. However, these studies did not account for diverse aspects of the factors that either affect or are associated with suicide death rate in a single model, masking which factors should be considered as most important in terms of changes in suicide death rate. To reveal the major factors related to suicide death rate, we conducted a number of statistical methods from the descriptive analysis to the factor analysis.

With regard to the decreasing trend of the suicide death rate, we may assist it with possible explanations. First, we revealed that the highest Gini coefficient trajectory group showed the highest suicide rates in almost all years, followed by the lowest Gini coefficient trajectory group. However, the highest Gini coefficient trajectory group (3.1% of all countries) showed almost the same suicide rate in 2019 compared to 1990, but the lowest Gini coefficient trajectory group (36.7% of all countries) showed a further decrease in suicide rate compared to 1990, which means that a greater number of countries with lower Gini coefficients experienced a reduction in the suicide death rate. Furthermore, considering that the Gini coefficient accounts for a large proportion of suicide death rates (partial R<sup>2</sup>: 44.6%), the global reduction in suicide death rates can be partly explained. Second, we also revealed that the highest SDI trajectory group showed the highest suicide death rate in the beginning of the year and then reversed to a low suicide death rate, but the lowest SDI trajectory group had the highest suicide death rate over time. It can be inferred that the higher SDI in recent years is relatively more related to a lower suicide death rate, compared to previous years.



In addition, along with the result that SDI accounts for a large proportion of suicide rates (partial  $R^2$ : 42.3%), the global reduction in suicide death rates can be partly explained.

Income disparity, measured by the Gini coefficient, was one of the major risk factors. This finding is understandable since the event of economic recession or crisis in a country is positively associated with the suicide death rate<sup>18,36,39,69-71,85,86</sup>. To support this, those countries that experienced economic crises had temporarily or lastingly become higher in income disparity<sup>69,70</sup>.

As another major risk factor, SDI is a composite measure in a country with GDP per capita, average educational attainment, and fertility rates, which reflect the general condition of socio-demographic and socio-cultural aspects. Taken as a whole, a more stable society is more likely to have a lower rate of mental disease, which may be directly associated with the suicide death rate<sup>16,22,87-89</sup>.

Surprisingly, however, those countries positioned at a higher SDI showed an increased probability of suicide death rate when their income disparity was severe. That is, even in a country with the highest socioeconomic status, the suicide death rate can be high if the extent of internal income disparity is severe.


## 3. Implications of the study

Many studies have revealed the risk factors of individuals' suicide behaviors or bivariate associations with a country's economic or socio-demographic condition in a cross-sectional setting. However, this study gives evidence that among a country's many factors income disparity (measured by Gini coefficient) and SDI have been the strongest association with suicide death rate, and since 1990 it has been more unequally concentrated in countries with higher Gini coefficient, and lower SDI, respectively. Furthermore, it should be noted that no matter how high the socio-demographic status of a country, the suicide death rate would be higher than others if income disparity is severe.

Although suicide mortality has been reduced in recent decades, suicide remains an important preventable contributor to the global burden of disease across all regions. The study indicated that income disparity in a country is highly related to the suicide death rate, which yields insights that inform suicide prevention initiatives to add effective suicide prevention interventions to existing plans, considering the results of this study. Furthermore, this study provides important evidence that strengthening data on suicide, which is the first step in identifying suicide risk factors, detecting suicide vulnerable populations, and building successful intervention programs or policies. For future study, developed research such as inferencing causal relationships with pathways to suicide death rate considering epidemiologic, economic, and socio-demographic aspects of suicide risk factors revealed in this study. To do so, more effective strategies can be developed to reduce suicide deaths.



# **VI.** Conclusion

The burden of suicide has been reduced since 1990, but in certain periods where an economic crisis occurred, it increased. Income disparity and sociodemographic status are significantly related to suicide death rates. The disproportion of the suicide death rate in the Gini coefficient and socio-demographic index was revealed, and it has been greater since 1990. Even in countries with a higher sociodemographic status, the suicide death rate increased if income disparities were severe. It is reasonable to consider income disparities as a major component when making suicide prevention strategies at the population level.



## Abbreviations

GBD - Global Burden of Disease, Injuries, and Risk Factors Study

DALYs — Disability-Adjusted Life-Years

YLL — Years of Life Lost

YLD — Years Lived with Disability

IHME — Institute for Health Metrics and Evaluation

WHO - World Health Organization

UN — United Nations

SDG — Sustainable Development Goals

ASR — Age-standardized Suicide Rate

IMF — International Monetary Fund

UI — Uncertainty Interval

ICD — International Classification of Disease

ASDR — Age-Standardized Death Rate

AAPC — Average Annual Percent Change

APC — Annual Percent Change

GBTM — Group-Based Trajectory Model

GEE — Generalized Estimating Equation

SII — Slope Index of Inequality

RII — Relative Index of Inequality

- SD Standard Deviation
- SE Standard Error
- RR Rate Ratio



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## Appendix

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### Appendix 1. Country's suicide death percentage in 2019

Country	All-case death	Suicide death	Suicide death
Greenland	480 5	33.8	7.0%
Republic of Korea	318630.6	14575.2	4.6%
Guvana	6683.8	250.2	3.7%
Suriname	4370.6	144.9	3.3%
Sri Lanka	135633.3	4425.0	3.3%
 Nauru	66.7	2.2	3 3%
Kazakhstan	139467.3	4275.0	3.1%
Oatar	4421.5	131.4	3.0%
Guam	1127.7	31.9	2.8%
Marshall Islands	422.4	11.9	2.8%
Kiribati	1151.0	30.1	2.6%
Micronesia (Federated States of)	939.3	23.2	2.5%
Mongolia	24859.0	591.5	2.4%
Cabo Verde	3500.6	81.8	2.3%
Taiwan (Province of China)	185365.2	4298.8	2.3%
Solomon Islands	6220.8	143.8	2.3%
Vanuatu	2236.5	51.1	2.3%
United Arab Emirates	29113.0	664.1	2.3%
Lesotho	32513.8	736.2	2.3%
Northern Mariana Islands	350.5	7.9	2.2%
Lithuania	38501.4	857.3	2.2%
Russian Federation	1788286.3	39040.2	2.2%
India	9391548.6	195336.1	2.1%
Singapore	23222.0	463.5	2.0%
Slovenia	20813.2	410.0	2.0%
Uruguay	33847.3	665.9	2.0%
Ukraine	698662.8	13689.9	2.0%
Eswatini	11566.5	226.2	2.0%
Belgium	114073.5	2211.9	1.9%
Botswana	21171.8	403.2	1.9%
Zimbabwe	126522.7	2402.6	1.9%
Belarus	121776.8	2272.4	1.9%
Uzbekistan	203598.9	3792.6	1.9%
Samoa	1367.2	25.4	1.9%
France	603277.8	11013.5	1.8%
Nepal	193331.0	3528.0	1.8%
Ecuador	92531.3	1678.0	1.8%
Bahrain	4265.9	77.3	1.8%
Chile	113085.5	2006.4	1.8%
Japan	1400012.5	247/3.3	1.8%
Iceland	2113.3	37.2	1.8%
Tuvalu	107.3	1.9	1.8%
Kyrgyzstan	346/6.3	600.4	1.7%
Austria	82490.0	1417.0	1.7%
Montenegro	170852.4	2808.0	1.7%
Australia	60816.8	2898.0	1.770
Switzenand	4147.2	60.2	1.770
Cuba	4147.2	1726.2	1./%
Canada	103964.2	1/30.2	1.0%
Poland	200192.9	4070.3	1.070
Costa Rica	24415 7	388 7	1.6%
Finland	56113.3	873.2	1.6%
United States of America	2946455.8	45348.8	1.5%
South Africa	521802.4	7864.3	1.5%
New Zealand	34498.1	512.4	1.5%
	51.90.1	0.2.1	1.570



Hungary	128867.0	1002.1	1 504
Gaban	11766.0	1902.1	1.5%
Sweden	02801.2	172.2	1.5%
Arcentina	348822.6	5028.9	1.5%
Thailand	497502.4	7106.9	1.4%
I atvia	497502.4	391.6	1.470
Latvia Son Morino	2/420.7	391.0	1.470
San Marino	301.0	4.5	1.470
Cook Islands	105.4	1701.2	1.470
	128507.2	1791.3	1.470
Belize	1990.1	27.7	1.4%
Namibia	18906.9	261.3	1.4%
Norway	41385.9	561.7	1.4%
Kuwait	10012.9	135.0	1.3%
Ireland	32354.4	435.4	1.3%
Global	56526959.5	/59028.4	1.3%
Republic of Moldova	40997.9	549.4	1.3%
Maldives	1501.8	20.1	1.3%
Eritrea	43395.2	579.5	1.3%
Croatia	52311.4	694.2	1.3%
El Salvador	40198.6	531.4	1.3%
Trinidad and Tobago	11765.1	154.6	1.3%
Andorra	619.7	8.1	1.3%
Estonia	15888.7	208.1	1.3%
Turkmenistan	33620.3	440.2	1.3%
Brunei Darussalam	1880.3	24.6	1.3%
Serbia	117629.1	1535.2	1.3%
Czechia	113802.8	1479.5	1.3%
Netherlands	157008.2	2017.2	1.3%
Viet Nam	631817.6	8114.1	1.3%
Slovakia	54548.9	695.2	1.3%
Senegal	89908.6	1126.3	1.3%
Paraguay	34171.1	427.4	1.3%
Democratic People's Republic of Korea	237057.3	2954.4	1.2%
Venezuela (Bolivarian Republic of)	186929.3	2309.8	1.2%
Palau	208.7	2.6	1.2%
Nicaragua	29196.3	354.9	1.2%
Germany	959889.0	11663.5	1.2%
Denmark	55373.8	667.5	1.2%
Tokelau	11.1	0.1	1.2%
Congo	35712.8	422.9	1.2%
Pakistan	1499877.6	17688.1	1.2%
Portugal	116386.9	1357.4	1.2%
Iraq	179615.2	2075.1	1.2%
China	10653448.0	121216.6	1.1%
Israel	47925.3	545.2	1.1%
Fiji	7419.1	84.2	1.1%
Zambia	123355.0	1397.7	1.1%
Morocco	228124.4	2566.3	1.1%
Colombia	246679.1	2730.8	1.1%
Rwanda	68571.3	759.0	1.1%
Seychelles	797.2	8.8	1.1%
Togo	53555.2	590.9	1.1%
Guinea-Bissau	14816.4	163.4	1.1%
Libya	31659.7	346.7	1.1%
Cameroon	207271.2	2260.2	1.1%
Côte d'Ivoire	182432.8	1959.9	1.1%
Kenya	293887.6	3154.8	1.1%
Iran (Islamic Republic of)	391113.1	4171.7	1.1%



Democratic Republic of the Congo	564090.7	5979.5	1.1%
Mexico	738424.8	7805.3	1.1%
Mauritius	10713.4	113.1	1.1%
Angola	184933.8	1927.6	1.0%
Monaco	523.8	5.4	1.0%
Malawi	116671.4	1208.7	1.0%
Niue	19.9	0.2	1.0%
American Samoa	383.1	4.0	1.0%
Armenia	27978.1	287.2	1.0%
Malaysia	175875.8	1802.9	1.0%
Haiti	99707.8	1016.9	1.0%
Equatorial Guinea	7618.3	77.2	1.0%
Ethionia	559996.8	5655.0	1.0%
Panama	19797.6	199.4	1.0%
Guatemala	94820.6	953.1	1.0%
Sudan	202165.4	2029.4	1.0%
Ghana	202103.4	2025.4	1.0%
Dikouti	7575.5	2005.5	1.0%
Diliouu Delivie (Diversional State of)	75010.0	74.7	1.0%
	73910.0	742.8	1.0%
Bosnia and Herzegovina	3/424.0	365.7	1.0%
Lao People's Democratic Republic	44456.8	429.7	1.0%
Bhutan	4252.4	41.0	1.0%
Saint Lucia	1406.1	13.5	1.0%
Burundi	83466.3	799.7	1.0%
Brazil	1411015.8	13503.2	1.0%
Tajikistan	48702.9	464.0	1.0%
Gambia	13505.1	128.7	1.0%
Dominican Republic	70544.7	671.4	1.0%
Oman	12374.2	117.6	1.0%
Madagascar	164160.9	1521.9	0.9%
Mozambique	264784.2	2440.3	0.9%
Central African Republic	67754.8	619.5	0.9%
United Republic of Tanzania	354351.0	3231.3	0.9%
United Kingdom	621814.6	5617.9	0.9%
Yemen	174541.9	1560.2	0.9%
Uganda	242798.5	2166.6	0.9%
North Macedonia	24046.6	211.1	0.9%
Spain	428576.8	3759.4	0.9%
Bulgaria	124225.9	1086.8	0.9%
Liberia	29749.8	258.8	0.9%
Bangladesh	849560.6	7365.2	0.9%
Romania	262810.9	2181.6	0.8%
Comoros	5006.8	40.9	0.8%
Timor-Leste	7756.2	62.9	0.8%
Iordan	32264.9	260.2	0.8%
Saint Vincent and the Grenadines	1026.0	8.2	0.8%
Ponin	02065.2	742.2	0.8%
Commo	93003.2	742.2	0.8%
De deire Free	8/0/.4 201812.6	1545.2	0.8%
Burkina Faso	201813.0	1545.2	0.8%
Puerto Rico	32906.0	249.0	0.8%
Algeria	201111.0	1515.5	0.8%
ratesune	16608.1	124.4	0.7%
Mauritania	20981.1	155.0	0.7%
Tonga	658.0	4.8	0.7%
Somalia	184230.9	1324.7	0.7%
Philippines	638800.8	4568.6	0.7%
Cambodia	110850.8	785.4	0.7%
Guinea	114264.9	805.0	0.7%



Sierra Leone	70113.9	491.4	0.7%
United States Virgin Islands	1279.0	8.8	0.7%
Italy	642341.6	4315.4	0.7%
Albania	22670.5	152.1	0.7%
Peru	152432.5	1016.3	0.7%
Afghanistan	251417.8	1613.2	0.6%
Malta	3780.3	24.1	0.6%
Chad	156649.1	996.0	0.6%
Georgia	49418.4	313.2	0.6%
Grenada	818.5	5.2	0.6%
Tunisia	67618.3	410.2	0.6%
South Sudan	72739.1	418.9	0.6%
Turkey	454742.1	2585.5	0.6%
Egypt	561555.8	3105.3	0.6%
Lebanon	33858.1	176.2	0.5%
Dominica	735.0	3.8	0.5%
Azerbaijan	75128.8	379.3	0.5%
Nigeria	1593180.0	7969.6	0.5%
Bermuda	579.6	2.9	0.5%
Barbados	3093.2	14.9	0.5%
Niger	202621.3	971.6	0.5%
Mali	201432.9	946.8	0.5%
Myanmar	420932.1	1956.1	0.5%
Honduras	52569.3	240.7	0.5%
Jamaica	19657.7	89.1	0.5%
Antigua and Barbuda	609.9	2.7	0.4%
Indonesia	1705894.7	7657.7	0.4%
Saint Kitts and Nevis	499.7	2.2	0.4%
Bahamas	2731.4	11.7	0.4%
Papua New Guinea	69785.0	289.4	0.4%
Sao Tome and Principe	1010.8	4.1	0.4%
Greece	128668.6	499.8	0.4%
Syrian Arab Republic	84425.0	319.7	0.4%
Mean	551325.2	7403.5	1.3%
Standard deviation	4062847.1	55309.1	0.8%
Median	54548.9	591.5	1.1%
Interquartile range	175352.3	1936.8	0.7%



#### Appendix 2. Country's age-standardized death rate of suicide per 100,000 in 2019

Country	Annual % change of suicide death rate from 1990 to 2019	95% uncertainty interval lower	95% uncertainty interval upper
Armenia	2 085	1 521	2 647
Republic of Korea	1.405	-0.140	2.110
Jamaica	1.202	0.667	1.852
Lesotho	1 194	0.442	2.062
Paraguay	1.149	0.424	1.889
Mexico	0.976	0.669	1.303
Ecuador	0.966	0.099	1.662
Saudi Arabia	0.955	0.296	2.146
Taiwan (Province of China)	0.947	0.502	1.520
Eswatini	0.843	0.173	1.708
Belize	0.688	0.389	1.040
Uruguay	0.686	0.568	0.829
Uzbekistan	0.645	0.362	0.956
Zimbabwe	0.617	0.199	1.212
Cabo Verde	0.614	0.270	1.156
Dominican Republic	0.609	0.139	1.141
Costa Rica	0.517	0.171	0.970
Georgia	0.501	0.232	0.795
Albania	0.482	-0.010	1.027
Venezuela (Bolivarian Republic of)	0.469	0.101	0.914
Sao Tome and Principe	0.410	-0.038	1.265
Antigua and Barbuda	0.393	0.140	0.702
Djibouti	0.392	-0.085	1.100
Botswana	0.386	-0.136	1.169
Ukraine	0.385	0.149	0.655
Togo	0.369	-0.007	0.846
Argentina	0.339	0.252	0.427
Gambia	0.331	-0.090	0.939
Saint Vincent and the Grenadines	0.321	0.105	0.585
Colombia	0.314	-0.001	0.695
Libya	0.313	-0.025	0.856
Dominica	0.303	-0.007	0.696
Guyana	0.297	-0.041	0.692
Kenya	0.277	0.020	0.585
Ghana	0.274	-0.086	0.712
Kuwait	0.271	0.031	0.561
Saint Lucia	0.244	0.039	0.482
Pakistan	0.232	-0.047	0.566
Azerbaijan	0.208	-0.177	0.635
United States Virgin Islands	0.205	-0.103	0.583
Mozambique	0.201	-0.135	0.644
Turkmenistan	0.199	-0.043	0.504
Cameroon	0.195	-0.150	0.627
Brunei Darussalam	0.187	-0.194	0.535
Mongolia	0.186	-0.114	0.600
United Arab Emirates	0.183	-0.246	0.830
Guam	0.182	-0.076	0.465
Bahamas	0.176	-0.065	0.493
Tonga	0.175	-0.137	0.630
Montenegro	0.147	-0.098	0.477
Greece	0.145	0.060	0.246
Yemen	0.140	-0.291	0.896



Suriname	0.133	-0.100	0.502
Iraq	0.132	-0.217	0.700
American Samoa	0.131	-0.173	0.573
Eritrea	0.128	-0.224	0.763
Namibia	0.126	-0.261	0.750
Kazakhstan	0.126	-0.035	0.323
Vanuatu	0.116	-0.247	0.667
Guinea	0.116	-0.164	0.468
Romania	0.103	-0.098	0.328
Northern Mariana Islands	0.102	-0.242	0.648
Nicaragua	0.093	-0.158	0.411
Comoros	0.083	-0.293	1.680
Tunisia	0.082	-0.254	0.484
Panama	0.076	-0.206	0.407
Belarus	0.070	-0.174	0.401
Sierra Leone	0.070	-0.251	0.517
Bosnia and Herzegovina	0.068	-0.252	0.391
Solomon Islands	0.059	-0.195	0.387
Souchelles	0.051	-0.121	0.262
Zambia	0.043	0.228	0.202
Zantola Wat Nam	0.043	-0.238	0.383
	0.039	-0.275	0.449
Senegai	0.035	-0.267	0.424
United States of America	0.032	0.010	0.056
Marshall Islands	0.030	-0.229	0.344
Malaysia	0.029	-0.214	0.307
Barbados	0.028	-0.164	0.248
Chad	0.028	-0.246	0.361
North Macedonia	0.028	-0.208	0.315
Malta	0.022	-0.097	0.149
Bolivia (Plurinational State of)	0.019	-0.313	0.461
Côte d'Ivoire	0.009	-0.298	0.376
Benin	0.009	-0.279	0.387
Japan	0.007	-0.034	0.044
Micronesia (Federated States of)	0.006	-0.367	0.389
Brazil	0.003	-0.058	0.098
San Marino	-0.004	-0.369	0.517
Tajikistan	-0.005	-0.202	0.238
Bahrain	-0.013	-0.387	0.379
Peru	-0.022	-0.390	0.412
Uganda	-0.024	-0.296	0.365
Syrian Arab Republic	-0.025	-0.316	0.488
Lithuania	-0.027	-0.213	0.187
Morocco	-0.032	-0.310	0.411
Nauru	-0.033	-0.253	0.242
Papua New Guinea	-0.041	-0.286	0.302
Guatemala	-0.045	-0.281	0.251
Guinea-Bissau	-0.054	-0.297	0.293
Cyprus	-0.059	-0.346	0.224
Poland	-0.059	-0.230	0.169
Palau	-0.068	-0.353	0.331
Netherlands	-0.068	-0.123	-0.013
Burkina Faso	-0.070	-0.289	0.201
Grenada	-0.072	-0.215	0.091
Democratic Republic of the Congo	-0.092	-0.339	0.232
Somalia	-0.093	-0.333	0.249
Niger	-0.098	-0.349	0.266
Bhutan	-0.099	-0.424	0.443
Monaco	-0.102	-0.344	0.215



Fiji	-0.103	-0.344	0.216
Egypt	-0.104	-0.341	0.194
Spain	-0.105	-0.163	-0.040
Palestine	-0.107	-0.353	0.288
Andorra	-0.111	-0.400	0.301
Belgium	-0.116	-0.162	-0.061
Malawi	-0.127	-0.351	0.165
Lebanon	-0.133	-0.372	0.199
Russian Federation	-0.134	-0.273	0.027
Ireland	-0.138	-0.220	-0.024
Canada	-0.142	-0.190	-0.093
Liberia	-0.145	-0.414	0.201
Republic of Moldova	-0.146	-0.265	-0.004
Haiti	-0.149	-0.365	0.112
Australia	-0.151	-0.198	-0.093
Central African Republic	-0.155	-0.381	0.171
Nepal	-0.156	-0.420	0.215
Cambodia	-0.160	-0.412	0.139
South Sudan	-0.160	-0.400	0.241
Samoa	-0.161	-0.479	0.262
Indonesia	-0.161	-0.344	0.085
United Republic of Tanzania	-0.168	-0.380	0.120
Philippines	-0.175	-0.362	0.090
Oatar	-0.176	-0.432	0.177
Democratic People's Republic of Korea	-0.177	-0.440	0.198
New Zealand	-0.177	-0.233	-0.107
Thailand	-0.182	-0.414	0.128
Niue	-0.183	-0.442	0.120
Tuyahı	-0.184	-0.415	0.146
Trinidad and Tobago	-0.196	-0.412	0.059
Gabon	-0.200	-0.443	0.131
Sudan	-0.200	-0.485	0.180
Kiribati	-0.202	-0.390	0.042
Tekeley	0.202	-0.550	0.042
Iron (Iclomic Bonublic of)	-0.203	-0.478	0.170
Cook Islands	-0.204	-0.230	-0.009
Italy	0.213	0.251	0.114
Mali	-0.213	-0.231	-0.170
India	-0.214	-0.410	0.051
El Salvadar	-0.220	-0.342	-0.003
El Salvador	-0.221	-0.428	0.022
Fortugar	-0.221	-0.282	-0.137
Israel	-0.221	-0.275	-0.166
South Africa	-0.226	-0.347	-0.078
Nigeria	-0.227	-0.463	0.077
United Kingdom	-0.230	-0.254	-0.193
Oman	-0.236	-0.469	0.316
Bulgaria	-0.239	-0.401	-0.055
Serbia	-0.248	-0.412	-0.052
Saint Kitts and Nevis	-0.257	-0.511	0.007
Madagascar	-0.263	-0.458	-0.045
Germany	-0.264	-0.308	-0.216
Cuba	-0.269	-0.408	-0.102
Timor-Leste	-0.287	-0.606	0.154
Global	-0.290	-0.350	-0.218
Slovakia	-0.291	-0.474	-0.065
Iceland	-0.294	-0.365	-0.214
Maldives	-0.294	-0.502	0.047
Bermuda	-0.301	-0.435	-0.131



Interquartile range	0.368		
Standard deviation Median	0.383		
Mean	0.003		
Denmark	-0.614	-0.644	-0.575
Ethiopia	-0.540	-0.667	-0.341
Bangladesh	-0.537	-0.662	-0.315
China	-0.530	-0.630	-0.371
Equatorial Guinea	-0.528	-0.731	-0.177
Hungary	-0.518	-0.607	-0.415
Finland	-0.515	-0.547	-0.479
Switzerland	-0.498	-0.535	-0.451
Sri Lanka	-0.487	-0.625	-0.315
Estonia	-0.475	-0.600	-0.340
Myanmar	-0.456	-0.647	-0.152
Singapore	-0.453	-0.490	-0.408
Lao People's Democratic Republic	-0.446	-0.642	-0.203
Luxembourg	-0.439	-0.511	-0.352
Chile	-0.427	-0.466	-0.376
Rwanda	-0.413	-0.591	-0.161
Slovenia	-0.400	-0.593	-0.165
Burundi	-0.393	-0.573	-0.110
Norway	-0.393	-0.431	-0.341
Sweden	-0.392	-0.420	-0.361
Czechia	-0.384	-0.498	-0.248
Turkey	-0.378	-0.538	-0.132
France	-0.364	-0.404	-0.309
Greenland	-0.358	-0.524	-0.124
Congo	-0.350	-0 571	-0.006
Croatia	-0.350	-0.494	-0.166
Algeria	-0.335	-0.532	-0.291
Latvia	-0.351	-0.438	-0.109
Mauritania	-0.323	-0.348	-0.010
Angola	-0.321	-0.548	0.004
Jordan	-0.316	-0.4/5	-0.091
Mauritius	-0.316	-0.450	-0.149
Kyrgyzstan	-0.315	-0.40/	-0.203
Honduras	-0.312	-0.519	-0.009
Afghanistan	-0.309	-0.494	-0.001



#### Appendix 3. Country's age-standardized death rate of suicide per 100,000 in 2019

Country	Suicide death rate per 100,000	95% uncertainty interval lower	95% uncertainty interval upper
Greenland	60.2	47.6	76.2
Lesotho	35.2	16.1	53.4
Guyana	32.5	25.0	41.8
Ukraine	31.1	25.9	37.0
Lithuania	30.7	24.8	37.4
Republic of Korea	27.3	16.8	30.8
Russian Federation	26.6	22.1	33.0
Kiribati	25.4	19.7	32.1
Suriname	25.2	20.4	30.9
Belarus	23.9	18.5	31.5
Kazakhstan	23.2	19.9	27.6
Micronesia (Federated States of)	22.7	14.2	30.8
Solomon Islands	21.9	11.6	30.3
Marshall Islands	20.9	14.4	27.9
Nauru	20.6	13.2	27.6
Latvia	20.4	16.6	25.4
Sri Lanka	20.2	14.8	27.0
Eswatini	19.8	11.9	29.3
Slovenia	19.8	15.2	26.0
Hungary	19.7	16.1	24.0
Japan	19.4	18.2	20.2
Uruguay	19.4	18.2	20.8
Belgium	19.4	18.3	20.6
Montenegro	18.8	14.7	24.4
Guam	18.7	14.7	22.4
Northern Mariana Islands	18.5	14.1	23.7
Taiwan (Province of China)	18.2	14.2	23.5
Serbia	17.6	13.6	22.2
Mongolia	17.5	13.2	23.2
Vanuatu	17.4	11.0	24.0
Botswana	17.2	10.8	25.6
Poland	17.1	14.0	21.2
France	16.6	15.5	18.0
Croatia	16.3	12.8	20.6
Zimbabwe	16.0	10.9	21.1
Tuvalu	16.0	11.0	21.7
Austria	15.9	15.0	17.0
Estonia	15.9	12.0	20.1
Finland	15.8	14.9	16.8
Bulgaria	15./	12.4	19.5
	15.3	12.3	18.8
Cake Verde	14.9	12.9	17.5
Cabo verde	14.5	11.0	18.4
Palau	14.5	11.0	18.4
Falau South Africa	14.5	10.5	18.5
India	14.1	11.4	17.1
Czashia	14.0	11.0	17.0
United States of America	13.9	13.5	14.1
Germany	13.0	13.5	14.1
Sweden	13./	12.9	14.0
Switzerland	13.4	12.8	14.0
Cook Islands	13.5	0.2	14.0
Canada	12.0	5.2 12.2	17.0
San Marino	12.9	12.2 & 1	15.5
Slovakia	12.0	0.1	17.0
Portugal	12.0	7. <del>4</del> 11 8	10.5
Nine	12.7	25	17.0
	12.5	0.5	17.2

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Samoa	12.0	7.8	16.5
Australia	11.8	11.2	12.6
Netherlands	11.8	11.1	12.5
Central African Republic	11.7	7.9	16.8
Nepal	11.6	8.1	15.0
Denmark	11.5	10.6	12.6
New Zealand	11.4	10.8	12.2
Romania	11.3	9.3	13.6
Democratic People's Republic of Korea	11.3	8.4	16.3
Uzbekistan	11.3	9.3	13.3
Luxembourg	11.2	9,9	12.8
Argentina	11.1	10.5	11.8
Trinidad and Tobago	11.1	82	14.7
Bosnia and Herzegovina	11.1	7.9	14.2
Chile	11.0	10.4	11.2
Namihia	10.9	7.2	16.2
Jealand	10.9	7.2	11.0
Numero	10.8	9.9	11.9
Norway	10.5	9.9	11.5
Thailand	10.1	/.4	13.6
Gabon	9.8	6.7	13.9
Global	9.8	8.9	10.8
North Macedonia	9.8	7.5	12.4
Andorra	9.8	7.2	12.9
Ecuador	9.5	6.0	12.5
Armenia	9.5	8.0	11.2
Tokelau	9.4	6.2	13.0
Fiji	9.2	7.0	11.8
Kyrgyzstan	9.2	8.0	10.6
Ireland	8.9	8.1	10.0
Mauritius	8.9	7.1	10.8
Turkmenistan	8.7	7.0	10.8
Eritrea	8.6	5.6	12.5
Seychelles	8.6	7.0	10.6
Guinea-Bissau	8.6	6.1	11.5
Georgia	8.5	7.2	10.0
China	8 5	7.1	10.2
El Salvador	8.5	62	11.2
United States Virgin Islands	8.5	6.5	10.6
Viet Nem	8.4	5.0	11.0
United Kingdom	8.4	5. <del>7</del> 9.1	11.0
Marana kingdom	8.4	8.1	0./
	8.3	5.8	10.9
	8.2	0.4	10.5
venezuela (Bolivarian Republic of)	8.2	6.1	10.7
Haiti	8.2	5.7	11.1
Singapore	8.2	7.6	8.8
Spain	8.2	7.7	8.7
Congo	8.0	5.7	11.2
Pakistan	7.9	4.6	12.5
Cameroon	7.8	5.4	10.7
Saint Lucia	7.7	6.5	9.0
Zambia	7.7	5.6	10.2
Côte d'Ivoire	7.5	5.2	10.4
Togo	7.5	5.3	9.8
Senegal	7.4	5.3	9.8
Saint Vincent and the Grenadines	7.3	6.2	8.4
United Arab Emirates	7.2	4.7	10.2
Italy	7.2	6.8	7.5
Morocco	7.1	4.2	11.1
American Samoa	7.1	5.4	95
Puerto Rico	71	5.4	9.0
Democratic Republic of the Congo	6.8	5.0	0.2
Burkina Faco	0.0	5.0	9.3
Baliza	0.0	5.0	0.0
Durandi	0.0	5.0	/.8
Melawi	0.7	5.0	9.5
191010 99 1	0.0	4.7	0.0



Ghana	6.5	4.9	8.0
Somalia	6.5	4.0	10.
Angola	6.4	4.7	8.
Guinea	64	13	8
Juniea 7	0.4	4.5	o.
Kenya	6.3	4.9	8.
Aexico	6.2	5.3	7.
Brazil	6.2	5.9	6.
Djibouti	6.2	3.7	10.
Bolivia (Plurinational State of)	6.2	4.1	8.
Dominican Republic	62	4.4	8
	0.2	4.1	0.
araguay	6.2	4.1	8.
Chad	6.1	4.1	8.
Lao People's Democratic Republic	6.0	4.1	8.
Rwanda	6.0	4.2	8.
Sierra Leone	5.9	4.0	8.
Benin	5.9	4.2	8.
grad	5.0	5.5	6.
Stael	5.9	5.5	0
Aalaysia	5.8	4.4	7.
Jambia	5.7	3.7	8.
Comoros	5.7	3.6	8.
Colombia	5.7	4.4	7.
Madagascar	5.7	4.2	7
Inited Republic of Tanzania	57	4.2	7.
anne Republic of Tanzama	5.1	7.2	1.
Brunel Darussalam	5.0	4.2	0.
Albania	5.6	3.6	7.
Dominica	5.5	4.1	6.
Malta	5.5	4.9	6.
Nicaragua	5.5	4.2	7.
Faustorial Guines	5.4	3.3	8
Aquatoriai Guinea	5.4	3.5	
Shutan	5.4	3.7	/.
Liberia	5.4	3.5	7.5
Guatemala	5.4	4.2	6.
Bahrain	5.4	3.8	7.0
Jganda	5.3	4.0	6.
thionia	53	4.2	6
ibua	5.1	2.9	7
noya	5.1	5.8	7.
yprus	5.1	3.8	5.
Frenada	5.0	4.3	5.
Saudi Arabia	5.0	3.6	6.
Barbados	5.0	4.1	6.
Sudan	5.0	3.1	7.
Jaman	5.0	3.2	7
	5.0	5.2	/.
ran (Islamic Republic of)	4.9	4.2	5.
raq	4.9	3.6	6.
Fajikistan	4.9	3.7	6.
Greece	4.8	4.5	5.
Panama	4.8	3.6	6
	47	2.5	0. 5
	+./	5.5	5.
I imor-Leste	4.7	2.4	6.
Fonga	4.7	3.5	6.
Bangladesh	4.6	3.6	5.
Datar	4.6	3.3	6.
- South Sudan	4 5	3.0	6
Domessido	4.5	2.0	0.
Jermuda	4.5	5.8	5.
Malı	4.3	2.9	6.
C. L Tota .	4.2	3.1	6.
Argnanistan			(
Viger	4.2	2.8	0.
Argnanistan Niger Philippines	4.2 4.1	2.8 3.0	5.
Argnanistan Viger Philippines Maldives	4.2 4.1	2.8 3.0 3.2	5
Argnanistan Viger Philippines Maldives	4.2 4.1 4.0	2.8 3.0 3.2	5.
Argnanistan Viger Philippines Maldives Mauritania	4.2 4.1 4.0 3.9	2.8 3.0 3.2 2.5	6. 5. 6.
Argnanistan Niger Philippines Maldives Vauritania Saint Kitts and Nevis	4.2 4.1 4.0 3.9 3.8	2.8 3.0 3.2 2.5 2.5	6. 5. 6. 5.
Argnanistan Niger Philippines Maldives Mauritania 3aint Kitts and Nevis Nigeria	4.2 4.1 4.0 3.9 3.8 3.7	2.8 3.0 3.2 2.5 2.5 2.5 2.4	6. 5. 5. 6. 5. 5.
Argnanistan Niger Philippines Valdives Vauritania Saint Kitts and Nevis Vigeria Vigeria	4.2 4.1 4.0 3.9 3.8 3.7 3.7	2.8 3.0 3.2 2.5 2.5 2.4 2.6	6. 5. 6. 5. 5. 4.
Argnanistan Niger Philippines Valdives Vauritania Saint Kitts and Nevis Nigeria Azerbaijan Aleeria	4.2 4.1 4.0 3.9 3.8 3.7 3.7 3.7	2.8 3.0 3.2 2.5 2.5 2.4 2.6 2.6	6. 5. 6. 5. 5. 4.



Tunisia	3.5	2.4	5.0
Lebanon	3.4	2.2	5.1
Turkey	3.2	2.5	4.4
Jamaica	3.2	2.5	4.0
Egypt	3.1	2.0	5.0
Bahamas	3.1	2.5	3.9
Antigua and Barbuda	3.1	2.6	3.7
Kuwait	3.0	2.5	3.7
Peru	3.0	2.1	4.0
Indonesia	3.0	2.3	3.7
Papua New Guinea	2.9	2.1	4.6
Oman	2.6	2.0	3.9
Palestine	2.5	1.5	3.0
Honduras	2.5	1.7	4.3
Jordan	2.2	1.8	2.8
Syrian Arab Republic	2.2	1.6	3.0
Sao Tome and Principe	2.0	1.3	2.7
Mean	10.2		
Standard deviation	7.3		
Median	8.2		
Interquartile range	7.9		



Appendix 4. List of 195 countries and territories by the sources of data utilized in this study, and their corresponding 3 letter country codes

Super_Region(GBD)	21 GBD regions (GBD)	Country Name(GBD)	Region (World Bank)	Country Name (World Bank)	Region (WHO)	Country Name (WHO)	Country Code
High-income	High-income North America	Canada	North America	Canada	Americas	Canada	CAN
High-income	High-income North America	USA	North America	United States	Americas	United States of America	USA
High-income	Australasia	Australia	East Asia & Pacific	Australia	Western Pacific	Australia	AUS
High-income	Australasia	New Zealand	East Asia & Pacific	New Zealand	Western Pacific	New Zealand	NZL
High-income	High-income Asia Pacific	Brunei	East Asia & Pacific	Brunei Darussalam	Western Pacific	Brunei Darussalam	BRN
High-income	High-income Asia Pacific	Japan	East Asia & Pacific	Japan	Western Pacific	Japan	JPN
High-income	High-income Asia Pacific	Singapore	East Asia & Pacific	Singapore	Western Pacific	Singapore	SGP
High-income	High-income Asia Pacific	South Korea	East Asia & Pacific	Korea, Rep.	Western Pacific	Republic of Korea	KOR
High-income	Western Europe	Andorra	Europe & Central Asia	Andorra		-	AND
High-income	Western Europe	Austria	Europe & Central Asia	Austria	Europe	Austria	AUT
High-income	Western Europe	Belgium	Europe & Central Asia	Belgium	Europe	Belgium	BEL
High-income	Western Europe	Cyprus	Europe & Central Asia	Cyprus	Europe	Cyprus	CYP
High-income	Western Europe	Denmark	Europe & Central Asia	Denmark	Europe	Denmark	DNK
High-income	Western Europe	Finland	Europe & Central Asia	Finland	Europe	Finland	FIN
High-income	Western Europe	France	Europe & Central Asia	France	Europe	France	FRA
High-income	Western Europe	Germany	Europe & Central Asia	Germany	Europe	Germany	DEU
High-income	Western Europe	Greece	Europe & Central Asia	Greece	Europe	Greece	GRC
High-income	Western Europe	Greenland	Europe & Central Asia	Greenland		-	GRL
High-income	Western Europe	Iceland	Europe & Central Asia	Iceland	Europe	Iceland	ISL
High-income	Western Europe	Ireland	Europe & Central Asia	Ireland	Europe	Ireland	IRL
High-income	Western Europe	Israel	Middle East & North Africa	Israel	Europe	Israel	ISR
High-income	Western Europe	Italy	Europe & Central Asia	Italy	Europe	Italy	ITA
High-income	Western Europe	Luxembourg	Europe & Central Asia	Luxembourg	Europe	Luxembourg	LUX
High-income	Western Europe	Malta	Middle East & North Africa	Malta	Europe	Malta	MLT
High-income	Western Europe	Netherlands	Europe & Central Asia	Netherlands	Europe	Netherlands	NLD
High-income	Western Europe	Norway	Europe & Central Asia	Norway	Europe	Norway	NOR
High-income	Western Europe	Portugal	Europe & Central Asia	Portugal	Europe	Portugal	PRT
High-income	Western Europe	Spain	Europe & Central Asia	Spain	Europe	Spain	ESP
High-income	Western Europe	Sweden	Europe & Central Asia	Sweden	Europe	Sweden	SWE
High-income	Western Europe	Switzerland	Europe & Central Asia	Switzerland	Europe	Switzerland	CHE
High-income	Western Europe	United Kingdom	Europe & Central Asia	United Kingdom	Europe	United Kingdom of Great Britain and Northern Ireland	GBR
High-income	Southern Latin America	Argentina	Latin America & Caribbean	Argentina	Americas	Argentina	ARG
High-income	Southern Latin America	Chile	Latin America & Caribbean	Chile	Americas	Chile	CHL
High-income	Southern Latin America	Uruguay	Latin America & Caribbean	Uruguay	Americas	Uruguay	URY
Central Europe, Eastern Europe, and Central Asia	Eastern Europe	Belarus	Europe & Central Asia	Belarus	Europe	Belarus	BLR
Central Europe, Eastern Europe, and Central Asia	Eastern Europe	Estonia	Europe & Central Asia	Estonia	Europe	Estonia	EST
Central Europe, Eastern Europe, and Central Asia	Eastern Europe	Latvia	Europe & Central Asia	Latvia	Europe	Latvia	LVA
Central Europe, Eastern Europe, and Central Asia		Lithuania	Europe & Central Asia	Lithuania	Europe	Lithuania	LTU
			F		<b>F</b>	D IF CM II	1001



Central Europe, Eastern Europe, and Central Asia	Eastern Europe	Russia	Europe & Central Asia	Russian Federation	Europe	Russian Federation	RUS
Central Europe, Eastern Europe, and Central Asia	Eastern Europe	Ukraine	Europe & Central Asia	Ukraine	Europe	Ukraine	UKR
Central Europe, Eastern Europe, and Central Asia	Central Europe	Albania	Europe & Central Asia	Albania	Europe	Albania	ALB
Central Europe, Eastern Europe, and Central Asia	Central Europe	Bosnia and Herzegovina	Europe & Central Asia	Bosnia and Herzegovina	Europe	Bosnia and Herzegovina	BIH
Central Europe, Eastern Europe, and Central Asia	Central Europe	Bulgaria	Europe & Central Asia	Bulgaria	Europe	Bulgaria	BGR
Central Europe, Eastern Europe, and Central Asia	Central Europe	Croatia	Europe & Central Asia	Croatia	Europe	Croatia	HRV
Central Europe, Eastern Europe, and Central Asia	Central Europe	Czech Republic	Europe & Central Asia	Czech Republic	Europe	Czechia	CZE
Central Europe, Eastern Europe, and Central Asia	Central Europe	Hungary	Europe & Central Asia	Hungary	Europe	Hungary	HUN
Central Europe, Eastern Europe, and Central Asia	Central Europe	Macedonia	Europe & Central Asia	North Macedonia	Europe	The former Yugoslav Republic of Macedonia	MKD
Central Europe, Eastern Europe, and Central Asia	Central Europe	Montenegro	Europe & Central Asia	Montenegro	Europe	Montenegro	MNE
Central Europe, Eastern Europe, and Central Asia	Central Europe	Poland	Europe & Central Asia	Poland	Europe	Poland	POL
Central Europe, Eastern Europe, and Central Asia	Central Europe	Romania	Europe & Central Asia	Romania	Europe	Romania	ROU
Central Europe, Eastern Europe, and Central Asia	Central Europe	Serbia	Europe & Central Asia	Serbia	Europe	Serbia	SRB
Central Europe, Eastern Europe, and Central Asia	Central Europe	Slovakia	Europe & Central Asia	Slovak Republic	Europe	Slovakia	SVK
Central Europe, Eastern Europe, and Central Asia	Central Europe	Slovenia	Europe & Central Asia	Slovenia	Europe	Slovenia	SVN
Central Europe, Eastern Europe, and Central Asia	Central Asia	Armenia	Europe & Central Asia	Armenia	Europe	Armenia	ARM
Central Europe, Eastern Europe, and Central Asia	Central Asia	Azerbaijan	Europe & Central Asia	Azerbaijan	Europe	Azerbaijan	AZE
Central Europe, Eastern Europe, and Central Asia	Central Asia	Georgia	Europe & Central Asia	Georgia	Europe	Georgia	GEO
Central Europe, Eastern Europe, and Central Asia	Central Asia	Kazakhstan	Europe & Central Asia	Kazakhstan	Europe	Kazakhstan	KAZ
Central Europe, Eastern Europe, and Central Asia	Central Asia	Kyrgyzstan	Europe & Central Asia	Kyrgyz Republic	Europe	Kyrgyzstan	KGZ
Central Europe, Eastern Europe, and Central Asia	Central Asia	Mongolia	East Asia & Pacific	Mongolia	Western Pacific	Mongolia	MNG
Central Europe, Eastern Europe, and Central Asia	Central Asia	Tajikistan	Europe & Central Asia	Tajikistan	Europe	Tajikistan	TJK
Central Europe, Eastern Europe, and Central Asia	Central Asia	Turkmenistan	Europe & Central Asia	Turkmenistan	Europe	Turkmenistan	TKM
Central Europe, Eastern Europe, and Central Asia	Central Asia	Uzbekistan	Europe & Central Asia	Uzbekistan	Europe	Uzbekistan	UZB
Latin America and Caribbean	Central Latin America	Colombia	Latin America & Caribbean	Colombia	Americas	Colombia	COL
Latin America and Caribbean	Central Latin America	Costa Rica	Latin America & Caribbean	Costa Rica	Americas	Costa Rica	CRI
Latin America and Caribbean	Central Latin America	El Salvador	Latin America & Caribbean	El Salvador	Americas	El Salvador	SLV
Latin America and Caribbean	Central Latin America	Guatemala	Latin America & Caribbean	Guatemala	Americas	Guatemala	GTM
Latin America and Caribbean	Central Latin America	Honduras	Latin America & Caribbean	Honduras	Americas	Honduras	HND
Latin America and Caribbean	Central Latin America	Mexico	Latin America & Caribbean	Mexico	Americas	Mexico	MEX
Latin America and Caribbean	Central Latin America	Nicaragua	Latin America & Caribbean	Nicaragua	Americas	Nicaragua	NIC
Latin America and Caribbean	Central Latin America	Panama	Latin America & Caribbean	Panama	Americas	Panama	PAN
Latin America and Caribbean	Central Latin America	Venezuela	Latin America & Caribbean	Venezuela, RB	Americas	Venezuela (Bolivarian Republic of)	VEN
Latin America and Caribbean	Andean Latin America	Bolivia	Latin America & Caribbean	Bolivia	Americas	Bolivia (Plurinational State of)	BOL
Latin America and Caribbean	Andean Latin America	Ecuador	Latin America & Caribbean	Ecuador	Americas	Ecuador	ECU
Latin America and Caribbean	Andean Latin America	Peru	Latin America & Caribbean	Peru	Americas	Peru	PER
Latin America and Caribbean	Caribbean	Antigua and Barbuda	Latin America & Caribbean	Antigua and Barbuda	Americas	Antigua and Barbuda	ATG
Latin America and Caribbean	Caribbean	The Bahamas	Latin America & Caribbean	Bahamas, The	Americas	Bahamas	BHS
Latin America and Caribbean	Caribbean	Barbados	Latin America & Caribbean	Barbados	Americas	Barbados	BRB
Latin America and Caribbean	Caribbean	Belize	Latin America & Caribbean	Belize	Americas	Belize	BLZ
Latin America and Caribbean	Caribbean	Bermuda	North America	Bermuda			BMU



Latin America and Caribbean	Caribbean	Cuba	Latin America & Caribbean	Cuba	Americas	Cuba	CUB
Latin America and Caribbean	Caribbean	Dominica	Latin America & Caribbean	Dominica	-	-	DMA
Latin America and Caribbean	Caribbean	Dominican Republic	Latin America & Caribbean	Dominican Republic	Americas	Dominican Republic	DOM
Latin America and Caribbean	Caribbean	Grenada	Latin America & Caribbean	Grenada	Americas	Grenada	GRD
Latin America and Caribbean	Caribbean	Guyana	Latin America & Caribbean	Guyana	Americas	Guyana	GUY
Latin America and Caribbean	Caribbean	Haiti	Latin America & Caribbean	Haiti	Americas	Haiti	HTI
Latin America and Caribbean	Caribbean	Jamaica	Latin America & Caribbean	Jamaica	Americas	Jamaica	JAM
Latin America and Caribbean	Caribbean	Puerto Rico	Latin America & Caribbean	Puerto Rico	-	-	PRI
Latin America and Caribbean	Caribbean	Saint Lucia	Latin America & Caribbean	St. Lucia	Americas	Saint Lucia	LCA
Latin America and Caribbean	Caribbean	Saint Vincent and the Grenadines	Latin America & Caribbean	St. Vincent and the Grenadines	Americas	Saint Vincent and the Grenadines	VCT
Latin America and Caribbean	Caribbean	Suriname	Latin America & Caribbean	Suriname	Americas	Suriname	SUR
Latin America and Caribbean	Caribbean	Trinidad and Tobago	Latin America & Caribbean	Trinidad and Tobago	Americas	Trinidad and Tobago	TTO
Latin America and Caribbean	Caribbean	Virgin Islands	Latin America & Caribbean	Virgin Islands (U.S.)	-	-	VIR
Latin America and Caribbean	Tropical Latin America	Brazil	Latin America & Caribbean	Brazil	Americas	Brazil	BRA
Latin America and Caribbean	Tropical Latin America	Paraguay	Latin America & Caribbean	Paraguay	Americas	Paraguay	PRY
Southeast Asia, East Asia, and Oceania	East Asia	China	East Asia & Pacific	China	Western Pacific	China	CHN
Southeast Asia, East Asia, and Oceania	East Asia	North Korea	East Asia & Pacific	Korea, Dem. People's Rep.	South-East Asia	Democratic People's Republic of Korea	PRK
Southeast Asia, East Asia, and Oceania	East Asia	Taiwan (province of China)	-	-	-	-	-
Southeast Asia, East Asia, and Oceania	Southeast Asia	Cambodia	East Asia & Pacific	Cambodia	Western Pacific	Cambodia	KHM
Southeast Asia, East Asia, and Oceania	Southeast Asia	Indonesia	East Asia & Pacific	Indonesia	South-East Asia	Indonesia	IDN
Southeast Asia, East Asia, and Oceania	Southeast Asia	Laos	East Asia & Pacific	Lao PDR	Western Pacific	Lao People's Democratic Republic	LAO
Southeast Asia, East Asia, and Oceania	Southeast Asia	Malaysia	East Asia & Pacific	Malaysia	Western Pacific	Malaysia	MYS
Southeast Asia, East Asia, and Oceania	Southeast Asia	Maldives	South Asia	Maldives	South-East Asia	Maldives	MDV
Southeast Asia, East Asia, and Oceania	Southeast Asia	Mauritius	Sub-Saharan Africa	Mauritius	Africa	Mauritius	MUS
Southeast Asia, East Asia, and Oceania	Southeast Asia	Myanmar	East Asia & Pacific	Myanmar	South-East Asia	Myanmar	MMR
Southeast Asia, East Asia, and Oceania	Southeast Asia	Philippines	East Asia & Pacific	Philippines	Western Pacific	Philippines	PHL
Southeast Asia, East Asia, and Oceania	Southeast Asia	Sri Lanka	South Asia	Sri Lanka	South-East Asia	Sri Lanka	LKA
Southeast Asia, East Asia, and Oceania	Southeast Asia	Seychelles	Sub-Saharan Africa	Seychelles	Africa	Seychelles	SYC
Southeast Asia, East Asia, and Oceania	Southeast Asia	Thailand	East Asia & Pacific	Thailand	South-East Asia	Thailand	THA
Southeast Asia, East Asia, and Oceania	Southeast Asia	Timor-Leste	East Asia & Pacific	Timor-Leste	South-East Asia	Timor-Leste	TLS
Southeast Asia, East Asia, and Oceania	Southeast Asia	Vietnam	East Asia & Pacific	Vietnam	Western Pacific	Vict Nam	VNM
Southeast Asia, East Asia, and Oceania	Oceania	American Samoa	East Asia & Pacific	American Samoa	-	-	ASM
Southeast Asia, East Asia, and Oceania	Oceania	Federated States of Micronesia	East Asia & Pacific	Micronesia, Fed. Sts.	Western Pacific	Micronesia (Federated States of)	FSM
Southeast Asia, East Asia, and Oceania	Oceania	Fiji	East Asia & Pacific	Fiji	Western Pacific	Fiji	FЛ
Southeast Asia, East Asia, and Oceania	Oceania	Guam	East Asia & Pacific	Guam	-	-	GUM
Southeast Asia, East Asia, and Oceania	Oceania	Kiribati	East Asia & Pacific	Kiribati	Western Pacific	Kiribati	KIR
Southeast Asia, East Asia, and Oceania	Oceania	Marshall Islands	East Asia & Pacific	Marshall Islands	-	-	MHL
Southeast Asia, East Asia, and Oceania	Oceania	Northern Mariana Islands	East Asia & Pacific	Northern Mariana Islands	-	-	MNP
Southeast Asia, East Asia, and Oceania	Oceania	Papua New Guinea	East Asia & Pacific	Papua New Guinea	Western Pacific	Papua New Guinea	PNG
Southeast Asia, East Asia, and Oceania	Oceania	Samoa	East Asia & Pacific	Samoa	Western Pacific	Samoa	WSM
Southeast Asia, East Asia, and Oceania	Oceania	Solomon Islands	East Asia & Pacific	Solomon Islands	Western Pacific	Solomon Islands	SLB



Southeast Asia, East Asia, and Oceania	Oceania	Tonga	East Asia & Pacific	Tonga	Western Pacific	Tonga	TON
Southeast Asia, East Asia, and Oceania	Oceania	Vanuatu	East Asia & Pacific	Vanuatu	Western Pacific	Vanuatu	VUT
North Africa and Middle East	North Africa and Middle East	Afghanistan	South Asia	Afghanistan	Eastern Mediterranean	Afghanistan	AFG
North Africa and Middle East	North Africa and Middle East	Algeria	Middle East & North Africa	Algeria	Africa	Algeria	DZA
North Africa and Middle East	North Africa and Middle East	Bahrain	Middle East & North Africa	Bahrain	Eastern Mediterranean	Bahrain	BHR
North Africa and Middle East	North Africa and Middle East	Egypt	Middle East & North Africa	Egypt, Arab Rep.	Eastern Mediterranean	Egypt	EGY
North Africa and Middle East	North Africa and Middle East	Iran	Middle East & North Africa	Iran, Islamic Rep.	Eastern Mediterranean	Iran (Islamic Republic of)	IRN
North Africa and Middle East	North Africa and Middle East	Iraq	Middle East & North Africa	Iraq	Eastern Mediterranean	Iraq	IRQ
North Africa and Middle East	North Africa and Middle East	Jordan	Middle East & North Africa	Jordan	Eastern Mediterranean	Jordan	JOR
North Africa and Middle East	North Africa and Middle East	Kuwait	Middle East & North Africa	Kuwait	Eastern Mediterranean	Kuwait	KWT
North Africa and Middle East	North Africa and Middle East	Lebanon	Middle East & North Africa	Lebanon	Eastern Mediterranean	Lebanon	LBN
North Africa and Middle East	North Africa and Middle East	Libya	Middle East & North Africa	Libya	Eastern Mediterranean	Libya	LBY
North Africa and Middle East	North Africa and Middle East	Morocco	Middle East & North Africa	Morocco	Eastern Mediterranean	Morocco	MAR
North Africa and Middle East	North Africa and Middle East	Oman	Middle East & North Africa	Oman	Eastern Mediterranean	Oman	OMN
North Africa and Middle East	North Africa and Middle East	Palestine	-	-	-	-	-
North Africa and Middle East	North Africa and Middle East	Qatar	Middle East & North Africa	Qatar	Eastern Mediterranean	Qatar	QAT
North Africa and Middle East	North Africa and Middle East	Saudi Arabia	Middle East & North Africa	Saudi Arabia	Eastern Mediterranean	Saudi Arabia	SAU
North Africa and Middle East	North Africa and Middle East	Sudan	Sub-Saharan Africa	Sudan	Eastern Mediterranean	Sudan	SDN
North Africa and Middle East	North Africa and Middle East	Syria	Middle East & North Africa	Syrian Arab Republic	Eastern Mediterranean	Syrian Arab Republic	SYR
North Africa and Middle East	North Africa and Middle East	Tunisia	Middle East & North Africa	Tunisia	Eastern Mediterranean	Tunisia	TUN
North Africa and Middle East	North Africa and Middle East	Turkey	Europe & Central Asia	Turkey	Europe	Turkey	TUR
North Africa and Middle East	North Africa and Middle East	United Arab Emirates	Middle East & North Africa	United Arab Emirates	Eastern Mediterranean	United Arab Emirates	ARE
North Africa and Middle East	North Africa and Middle East	Yemen	Middle East & North Africa	Yemen, Rep.	Eastern Mediterranean	Yemen	YEM
South Asia	South Asia	Bangladesh	South Asia	Bangladesh	South-East Asia	Bangladesh	BGD
South Asia	South Asia	Bhutan	South Asia	Bhutan	South-East Asia	Bhutan	BTN
South Asia	South Asia	India	South Asia	India	South-East Asia	India	IND
South Asia	South Asia	Nepal	South Asia	Nepal	South-East Asia	Nepal	NPL
South Asia	South Asia	Pakistan	South Asia	Pakistan	Eastern Mediterranean	Pakistan	PAK
Sub-Saharan Africa	Southern Sub-Saharan Africa	Botswana	Sub-Saharan Africa	Botswana	Africa	Botswana	BWA
Sub-Saharan Africa	Southern Sub-Saharan Africa	Swatini	Sub-Saharan Africa	Eswatini	Africa	Eswatini	SWZ
Sub-Saharan Africa	Southern Sub-Saharan Africa	Lesotho	Sub-Saharan Africa	Lesotho	Africa	Lesotho	LSO
Sub-Saharan Africa	Southern Sub-Saharan Africa	Namibia	Sub-Saharan Africa	Namibia	Africa	Namibia	NAM
Sub-Saharan Africa	Southern Sub-Saharan Africa	South Africa	Sub-Saharan Africa	South Africa	Africa	South Africa	ZAF
Sub-Saharan Africa	Southern Sub-Saharan Africa	Swaziland	Sub-Saharan Africa	Eswatini	Africa	Eswatini	SWZ
Sub-Saharan Africa	Southern Sub-Saharan Africa	Zimbabwe	Sub-Saharan Africa	Zimbabwe	Africa	Zimbabwe	ZWE
Sub-Saharan Africa	Western Sub-Saharan Africa	Benin	Sub-Saharan Africa	Benin	Africa	Benin	BEN
Sub-Saharan Africa	Western Sub-Saharan Africa	Burkina Faso	Sub-Saharan Africa	Burkina Faso	Africa	Burkina Faso	BFA
Sub-Saharan Africa	Western Sub-Saharan Africa	Cameroon	Sub-Saharan Africa	Cameroon	Africa	Cameroon	CMR
Sub-Saharan Africa	Western Sub-Saharan Africa	Cape Verde	Sub-Saharan Africa	Cabo Verde	Africa	Cabo Verde	CPV
Sub-Saharan Africa	Western Sub-Saharan Africa	Chad	Sub-Saharan Africa	Chad	Africa	Chad	TCD
Sub-Saharan Africa	Western Sub-Saharan Africa	Côte d'Ivoire	Sub-Saharan Africa	Côte d'Ivoire	Africa	Côte d'Ivoire	CIV



	Sub-Saharan Africa	Western Sub-Saharan Africa	The Gambia	Sub-Saharan Africa	Gambia, The	Africa	Gambia	GMB
	Sub-Saharan Africa	Western Sub-Saharan Africa	Ghana	Sub-Saharan Africa	Ghana	Africa	Ghana	GHA
	Sub-Saharan Africa	Western Sub-Saharan Africa	Guinea	Sub-Saharan Africa	Guinea	Africa	Guinea	GIN
	Sub-Saharan Africa	Western Sub-Saharan Africa	Guinea-Bissau	Sub-Saharan Africa	Guinea-Bissau	Africa	Guinea-Bissau	GNB
	Sub-Saharan Africa	Western Sub-Saharan Africa	Liberia	Sub-Saharan Africa	Liberia	Africa	Liberia	LBR
	Sub-Saharan Africa	Western Sub-Saharan Africa	Mali	Sub-Saharan Africa	Mali	Africa	Mali	MLI
	Sub-Saharan Africa	Western Sub-Saharan Africa	Mauritania	Sub-Saharan Africa	Mauritania	Africa	Mauritania	MRT
	Sub-Saharan Africa	Western Sub-Saharan Africa	Niger	Sub-Saharan Africa	Niger	Africa	Niger	NER
	Sub-Saharan Africa	Western Sub-Saharan Africa	Nigeria	Sub-Saharan Africa	Nigeria	Africa	Nigeria	NGA
	Sub-Saharan Africa	Western Sub-Saharan Africa	São Tomé and Príncipe	Sub-Saharan Africa	São Tomé and Principe	Africa	Sao Tome and Principe	STP
	Sub-Saharan Africa	Western Sub-Saharan Africa	Senegal	Sub-Saharan Africa	Senegal	Africa	Senegal	SEN
	Sub-Saharan Africa	Western Sub-Saharan Africa	Sierra Leone	Sub-Saharan Africa	Sierra Leone	Africa	Sierra Leone	SLE
	Sub-Saharan Africa	Western Sub-Saharan Africa	Togo	Sub-Saharan Africa	Togo	Africa	Togo	TGO
	Sub-Saharan Africa	Eastern Sub-Saharan Africa	Burundi	Sub-Saharan Africa	Burundi	Africa	Burundi	BDI
	Sub-Saharan Africa	Eastern Sub-Saharan Africa	Comoros	Sub-Saharan Africa	Comoros	Africa	Comoros	COM
	Sub-Saharan Africa	Eastern Sub-Saharan Africa	Djibouti	Middle East & North Africa	Djibouti	Eastern Mediterranean	Djibouti	DJI
	Sub-Saharan Africa	Eastern Sub-Saharan Africa	Eritrea	Sub-Saharan Africa	Eritrea	Africa	Eritrea	ERI
	Sub-Saharan Africa	Eastern Sub-Saharan Africa	Ethiopia	Sub-Saharan Africa	Ethiopia	Africa	Ethiopia	ETH
	Sub-Saharan Africa	Eastern Sub-Saharan Africa	Kenya	Sub-Saharan Africa	Kenya	Africa	Kenya	KEN
	Sub-Saharan Africa	Eastern Sub-Saharan Africa	Madagascar	Sub-Saharan Africa	Madagascar	Africa	Madagascar	MDG
	Sub-Saharan Africa	Eastern Sub-Saharan Africa	Malawi	Sub-Saharan Africa	Malawi	Africa	Malawi	MWI
	Sub-Saharan Africa	Eastern Sub-Saharan Africa	Mozambique	Sub-Saharan Africa	Mozambique	Africa	Mozambique	MOZ
	Sub-Saharan Africa	Eastern Sub-Saharan Africa	Rwanda	Sub-Saharan Africa	Rwanda	Africa	Rwanda	RWA
	Sub-Saharan Africa	Eastern Sub-Saharan Africa	Somalia	Sub-Saharan Africa	Somalia	Eastern Mediterranean	Somalia	SOM
	Sub-Saharan Africa	Eastern Sub-Saharan Africa	South Sudan	Sub-Saharan Africa	South Sudan	Africa	South Sudan	SSD
	Sub-Saharan Africa	Eastern Sub-Saharan Africa	Tanzania	Sub-Saharan Africa	Tanzania	Africa	United Republic of Tanzania	TZA
	Sub-Saharan Africa	Eastern Sub-Saharan Africa	Uganda	Sub-Saharan Africa	Uganda	Africa	Uganda	UGA
	Sub-Saharan Africa	Eastern Sub-Saharan Africa	Zambia	Sub-Saharan Africa	Zambia	Africa	Zambia	ZMB
	Sub-Saharan Africa	Central Sub-Saharan Africa	Angola	Sub-Saharan Africa	Angola	Africa	Angola	AGO
	Sub-Saharan Africa	Central Sub-Saharan Africa	Central African Republic	Sub-Saharan Africa	Central African Republic	Africa	Central African Republic	CAF
	Sub-Saharan Africa	Central Sub-Saharan Africa	Congo (Brazzaville)	Sub-Saharan Africa	Congo, Dem. Rep.	Africa	Democratic Republic of the Congo	COD
	Sub-Saharan Africa	Central Sub-Saharan Africa	Democratic Republic of the Congo	Sub-Saharan Africa	Congo, Rep.	Africa	Congo	COG
	Sub-Saharan Africa	Central Sub-Saharan Africa	Equatorial Guinea	Sub-Saharan Africa	Equatorial Guinea	Africa	Equatorial Guinea	GNQ
_	Sub-Saharan Africa	Central Sub-Saharan Africa	Gabon	Sub-Saharan Africa	Gabon	Africa	Gabon	GAB

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#### ASDR from suicide (95% UI) Regions Men Women Total Male/female ratio GBD super regions Global 10.3 13.3 11.3 -14.7 5.7 5.1 -6.4 9.4 8.5 -2.3 Central Europe, Eastern Europe, and Central Asia 30.5 27.1 35.1 6.0 5.4 6.8 17.6 15.9 20.0 5.1 ---High-income 16.8 16.1 17.5 5.4 5.2 -5.5 11.0 10.6 11.4 3.1 --Latin America and Caribbean 10.2 9.2 11.2 2.4 2.1 -2.7 6.1 5.6 6.7 4.2 North Africa and Middle East 4.7 -7.5 4.3 5.2 2.3 5.9 2.6 2.1 -3.0 3.6 -1.5 South Asia 14.8 18.0 10.2 8.2 -12.5 12.5 10.5 14.6 10.6 Southeast Asia, East Asia, and Oceania 9.1 7.4 11.3 4.5 3.7 -5.3 6.7 5.8 7.8 2.0 . Sub-Saharan Africa 17.6 14.1 -21.8 4.9 4.1 -5.7 10.8 9.1 -13.0 3.6 21 GBD regions High-income North America 18.1 17.5 18.5 5.5 5.3 -5.6 11.6 11.3 11.9 3.3 Australasia 16.3 15.4 17.6 4.8 4.6 5.2 10.4 10.0 11.1 3.4 2.5 High-income Asia Pacific 21.5 17.5 23.1 8.7 8.3 -9.0 15.1 13.1 16.0 Western Europe 13.2 12.7 -13.9 4.0 3.8 -4.2 8.5 8.2 -8.9 3.3 Southern Latin America 17.8 16.9 18.9 4.0 3.7 -4.2 10.6 10.1 11.1 4.5 Eastern Europe 41.1 35.2 48.9 7.2 8.5 20.2 27.0 5.7 -6.1 -23.0 -Central Europe 19.8 17.1 22.7 3.8 3.3 -4.4 11.5 10.1 13.2 5.2 Central Asia 4.8 -6.2 12.1 10.9 13.6 3.6 19.5 17.6 -21.9 5.5 -Central Latin America 10.3 8.7 12.0 2.1 1.7 -2.4 6.0 5.2 7.0 5.0 --Andean Latin America 8.3 4.8 -10.4 2.6 2.1 -3.2 5.4 3.7 -6.7 3.1 Caribbean 14.4 12.3 17.0 4.2 3.5 -5.0 9.1 7.9 -10.6 3.4 Tropical Latin America 9.5 8.9 10.4 2.3 2.1 -2.5 5.7 5.4 6.2 4.2 . -East Asia 9.0 7.1 -11.7 5.1 4.1 -6.3 7.0 5.9 -8.3 1.8 Southeast Asia 8.6 6.7 10.2 2.4 2.0 -2.8 5.4 4.4 -6.4 3.5 Oceania 10.0 7.6 13.0 3.0 2.4 -3.7 6.5 5.2 -8.3 3.3 . North Africa and Middle East 4.7 -7.5 4.3 5.2 2.3 5.9 2.6 2.1 -3.0 3.6 -South Asia 14.8 10.6 18.0 10.2 8.2 -12.5 12.5 10.5 -14.6 1.5 Southern Sub-Saharan Africa 26.9 20.7 32.1 5.8 4.8 6.8 15.7 12.7 -18.5 4.7 -

#### Appendix 5. Age-standardized death rate (ASDR) per 100 000 from suicide in both genders and combined with its ratio, 2019



Western Sub-Saharan Africa	14.7	11.4 -	19.6	4.4	3.4 -	5.5	9.3	7.4 -	11.9	3.3
Eastern Sub-Saharan Africa	17.6	14.2 -	22.1	5.2	4.5 -	5.9	11.1	9.3 -	13.3	3.4
Central Sub-Saharan Africa	21.2	16.4 -	27.7	5.3	4.1 -	6.7	12.5	9.8 -	15.9	4.0



Global	Period	Change year	APC	95%	% CI	AAPC	95%	% CI	p-value
Both	1990-2019					-1.675	-1.852	-1.497	< 0.001
	1990-1994	1994	0.670	0.259	1.083				0.004
	1994-1999	1999	-1.325	-1.701	-0.947				< 0.001
	1999-2002	2002	-2.791	-3.872	-1.698				< 0.001
	2002-2005	2005	-1.432	-2.524	-0.328				0.015
	2005-2015	2015	-2.810	-2.921	-2.700				< 0.001
	2015-2019		-0.909	-1.351	-0.465				0.001
Men	1990-2019					-1.271	-1.404	-1.137	< 0.001
	1990-1994	1994	1.680	1.038	2.327				< 0.001
	1994-2005	2005	-1.276	-1.407	-1.145				< 0.001
	2005-2015	2015	-2.555	-2.713	-2.396				< 0.001
	2015-2019		-0.933	-1.557	-0.306				0.006
Women	1990-2019					-2.451	-2.814	-2.086	< 0.001
	1990-1994	1994	-0.753	-1.714	0.217				0.117
	1994-1999	1999	-1.812	-2.609	-1.009				< 0.001
	1999-2002	2002	-5.147	-7.294	-2.950				< 0.001
	2002-2005	2005	-1.832	-3.934	0.317				0.088
	2005-2015	2015	-3.390	-3.578	-3.201				< 0.001
	2015-2019		-0.970	-1.995	0.066				0.064

#### Appendix 6-1 ~ 6.21. Trends in age-standardized death rate of suicide by both sex and combined by global and GBD 21 regions.







AAPC = annual average percent change; 95% CI = 95% confidence interval



High-income North America	Period	Change year	APC	95	% CI	AAPC	95%	6 CI	p-value
Both	1990-2019					-0.174	-0.429	0.081	0.18
	1990-1995	1995	-0.232	-0.512	0.048				0.097
	1995-1999	1999	-2.013	-2.612	-1.41				< 0.001
	1999-2004	2004	0.042	-0.393	0.479				0.839
	2004-2013*	2013	0.755	0.582	0.929				< 0.001
	2013-2016	2016	1.687	-0.399	3.817				0.105
	2016-2019		-2.556	-3.711	-1.387				< 0.001
Men	1990-2019					-0.391	-0.641	-0.14	0.002
	1990-1995	1995	-0.091	-0.363	0.181				0.483
	1995-1999	1999	-2.385	-3.002	-1.764				< 0.001
	1999-2004	2004	-0.394	-0.816	0.029				0.065
	2004-2013*	2013	0.478	0.311	0.645				< 0.001
	2013-2016	2016	1.448	-0.585	3.523				0.149
	2016-2019		-2.588	-3.734	-1.427				< 0.001
Women	1990-2019					0.331	0.136	0.525	0.001
	1990-1999	1999	-1.114	-1.231	-0.997				< 0.001
	1999-2013	2013	1.417	1.338	1.496				< 0.001
	2013-2016*	2016	2.475	0.845	4.132				0.005
	2016-2019		-2.43	-3.484	-1.365				< 0.001

Appendix 6-2. Trends in age-standardized death rate of suicide in High-income North America by both sex and combined

AAPC = annual average percent change; 95% CI = 95% confidence interval

\* The economic crisis occurred within these period in the countries in high-income North America region









Australasia	Period	Change year	APC	95	% CI	AAPC	95%	% CI	p-value
Both	1990-2019					-0.751	-1.159	-0.342	< 0.001
	1990-1993	1993	-0.287	-1.638	1.084				0.657
	1993-1998	1998	1.658	0.818	2.505				0.001
	1998-2001	2001	-4.293	-6.767	-1.753				0.003
	2001-2005	2005	-2.785	-4.033	-1.522				< 0.001
	2005-2015	2015	0.235	-0.025	0.495				0.073
	2015-2019		-1.762	-3.373	-0.123				0.037
Men	1990-2019					-0.679	-0.907	-0.449	< 0.001
	1990-1998	1998	1.16	0.741	1.581				< 0.001
	1998-2004	2004	-4.051	-4.876	-3.218				< 0.001
	2004-2019		-0.277	-0.509	-0.045				0.022
Women	1990-2019					-0.423	-0.792	-0.051	0.026
	1990-1994	1994	-1.089	-1.919	-0.252				0.015
	1994-1997	1997	2.665	0.017	5.384				0.049
	1997-2005	2005	-1.8	-2.144	-1.454				< 0.001
	2005-2010	2010	1.519	0.667	2.378				0.002
	2010-2015	2015	0.59	-0.248	1.434				0.153
	2015-2019		-2.892	-4.111	-1.658				< 0.001

#### Appendix 6-3. Trends in age-standardized death rate of suicide in Australasia by both sex and combined

AAPC = annual average percent change; 95% CI = 95% confidence interval









High-income Asia Pacific	Period	Change year	APC	95% CI		AAPC	95% CI		p-value
Both	1990-2019					0.022	-0.371	0.416	0.914
	1990-1995	1995	-0.23	-1.245	0.796				0.635
	1995-1999*	1999	4.716	3.362	6.088				< 0.001
	1999-2004	2004	1.632	1.124	2.143				< 0.001
	2004-2010	2010	0.324	-0.284	0.935				0.271
	2010-2019	2017	-3.833	-4.409	-3.253				< 0.001
	2017-2019		0.332	-3.712	4.547				0.864
Men	1990-2019					0.176	-0.242	0.597	0.410
	1990-1995	1995	0.415	-0.693	1.536				0.434
	1995-1999*	1999	5.832	4.431	7.251				< 0.001
	1999-2004	2004	1.571	1.046	2.098				< 0.001
	2004-2010	2010	-0.24	-0.877	0.401				0.432
	2010-2017	2017	-3.703	-4.331	-3.072				< 0.001
	2017-2019		0.214	-4.103	4.725				0.918
Women	1990-2019					-0.509	-0.85	-0.168	0.003
	1990-1994	1994	-2.627	-3.578	-1.666				< 0.001
	1994-2009*	2009	1.829	1.681	1.977				< 0.001
	2009-2017	2017	-3.677	-4.132	-3.221				< 0.001
	2017-2019		-0.684	-4.979	3.805				0.749

#### Appendix 6-4. Trends in age-standardized death rate of suicide in High-income Asia Pacific by both sex and combined

AAPC = annual average percent change; 95% CI = 95% confidence interval

\* The economic crisis occurred within these period in the countries in high-income Asia Pacific region.









Western Europe	Period	Change year	APC	95	% CI	AAPC	95%	6 CI	p-value
Both	1990-2019					-1.561	-1.724	-1.398	< 0.001
	1990-1996	1996	-1.327	-1.515	-1.139				< 0.001
	1996-2006	2006	-2.412	-2.517	-2.307				< 0.001
	2006-2010*	2010	-0.570	-1.247	0.113				0.096
	2010-2014	2014	-1.805	-2.548	-1.056				< 0.001
	2014-2019		-0.722	-1.271	-0.170				0.014
Men	1990-2019					-1.471	-1.681	-1.259	< 0.001
	1990-1995	1995	-0.830	-1.086	-0.573				< 0.001
	1995-2002	2002	-2.148	-2.337	-1.958				< 0.001
	2002-2006	2006	-2.712	-3.276	-2.145				< 0.001
	2006-2009*	2009	-0.110	-1.332	1.128				0.850
	2009-2016	2016	-1.600	-1.859	-1.340				< 0.001
	2016-2019		-0.326	-1.832	1.202				0.650
Women	1990-2019					-2.028	-2.083	-1.974	< 0.001
	1990-2006	2006	-2.693	-2.746	-2.639				< 0.001
	2006-2019*		-1.204	-1.315	-1.094				< 0.001

Appendix 6-5. Trends in age-standardized death rate of suicide in Western Europe by both sex and combined







AAPC = annual average percent change; 95% CI = 95% confidence interval

\* The economic crisis occurred within these period in the countries in Western Europe region.



Eastern Europe	Period	Change year	APC	95%	6 CI	AAPC	95%	CI	p-value
Both	1990-2019					0.271	-1.129	1.691	0.706
	1990-1994	1994	16.533	12.348	20.873				< 0.001
	1994-1997	1997	-5.071	-14.444	5.33				0.299
	1997-2000	2000	2.387	-4.453	9.716				0.474
	2000-2005	2005	-1.861	-3.591	-0.099				0.04
	2005-2012	2012	-5.098	-6.038	-4.148				< 0.001
	2012-2019		0.171	-2.175	2.573				0.879
Men	1990-2019					0.34	-1.078	1.777	0.64
	1990-1994	1994	17.268	13.084	21.607				< 0.001
	1994-1997	1997	-4.95	-14.505	5.672				0.319
	1997-2000	2000	2.733	-3.882	9.802				0.397
	2000-2005	2005	-1.981	-3.834	-0.092				0.041
	2005-2012	2012	-5.288	-6.263	-4.303				< 0.001
	2012-2019		0.185	-2.283	2.715				0.875
Women	1990-2019					-0.554	-1.533	0.434	0.271
	1990-1994	1994	10.725	7.492	14.055				< 0.001
	1994-1997	1997	-4.553	-11.748	3.228				0.226
	1997-2004	2004	-0.657	-1.643	0.338				0.18
	2004-2012	2012	-3.882	-4.65	-3.107				< 0.001
	2012-2019		-0.939	-2.816	0.974				0.311

Appendix 6-6. Trends in age-standardized death rate of suicide in Eastern Europe by both sex and combined

AAPC = annual average percent change; 95% CI = 95% confidence interval








Central Europe	Period	Change year	APC	95	% CI	AAPC	95%	% CI	p-value
Both	1990-2019					-1.442	-1.833	-1.048	< 0.001
	1990-1997	1997	-0.296	-0.589	-0.002				0.048
	1997-2003	2003	-1.878	-2.319	-1.434				< 0.001
	2003-2009	2009	-1.192	-1.626	-0.756				< 0.001
	2009-2016	2016	-2.74	-3.09	-2.389				< 0.001
	2016-2019		-0.67	-4.389	3.193				0.714
Men	1990-2019					-1.214	-1.594	-0.833	< 0.001
	1990-1992	1992	1.151	-1.027	3.376				0.277
	1992-1997	1997	-0.161	-0.846	0.529				0.622
	1997-2004	2004	-1.42	-1.733	-1.105				< 0.001
	2004-2009	2009	-0.894	-1.493	-0.29				0.007
	2009-2016	2016	-2.802	-3.142	-2.461				< 0.001
	2016-2019		-0.837	-4.099	2.535				0.596
Women	1990-2019					-2.516	-2.734	-2.297	< 0.001
	1990-1996	1996	-1.609	-2.015	-1.201				< 0.001
	1996-2013	2013	-3.056	-3.139	-2.974				< 0.001
	2013-2019		-1.88	-2.895	-0.855				0.001

#### Appendix 6-7. Trends in age-standardized death rate of suicide in Central Europe by both sex and combined









Central Asia	Period	Change year	APC	95	% CI	AAPC	95%	6 CI	p-value
Both	1990-2019					0.256	-0.204	0.718	0.276
	1990-1995	1995	5.365	4.523	6.213				< 0.001
	1995-2006	2006	0.985	0.696	1.275				< 0.001
	2006-2009	2009	-4.348	-8.272	-0.257				0.039
	2009-2019	2019	-1.603	-2.033	-1.172				< 0.001
Men	1990-2019					0.193	-0.277	0.666	0.422
	1990-1992	1992	4.444	1.794	7.162				0.002
	1992-1995	1995	7.850	4.629	11.171				< 0.001
	1995-2006	2006	0.859	0.628	1.091				< 0.001
	2006-2009	2009	-5.171	-8.130	-2.118				0.003
	2009-2019	2019	-1.907	-2.243	-1.570				< 0.001
Women	1990-2019					0.159	-0.285	0.605	0.484
	1990-1994	1994	2.397	1.534	3.267				< 0.001
	1994-1999	1999	-0.965	-1.895	-0.025				0.045
	1999-2006	2006	2.115	1.64	2.592				< 0.001
	2006-2009	2009	-2.297	-5.453	0.964				0.150
	2009-2013	2013	0.459	-0.947	1.884				0.495
	2013-2019		-1.576	-2.451	-0.693				0.002

#### Appendix 6-8. Trends in age-standardized death rate of suicide in Central Asia by both sex and combined









Central Latin America	Period	Change year	APC	959	% CI	AAPC	95%	% CI	p-value
Both	1990-2019					0.839	0.573	1.107	< 0.001
	1990-1995	1995	3.257	2.861	3.655				< 0.001
	1995-2002	2002	1.52	1.265	1.776				< 0.001
	2002-2006	2006	-1.5	-2.261	-0.733				0.001
	2006-2009	2009	0.411	-1.084	1.929				0.564
	2009-2012	2012	-1.31	-2.897	0.302				0.102
	2012-2019		0.922	0.439	1.407				0.001
Men	1990-2019					0.783	0.456	1.112	< 0.001
	1990-1995	1995	3.553	3.076	4.032				< 0.001
	1995-2002	2002	1.428	1.124	1.733				< 0.001
	2002-2006	2006	-1.592	-2.496	-0.679				0.002
	2006-2009	2009	0.35	-1.542	2.279				0.698
	2009-2012	2012	-1.535	-3.49	0.459				0.119
	2012-2019		0.754	0.179	1.332				0.014
Women	1990-2019					0.922	0.256	1.592	0.007
	1990-2002	2002	2.252	2.046	2.459				< 0.001
	2002-2012	2012	-0.356	-0.658	-0.053				0.024
	2012-2015	2015	2.644	-1.208	6.646				0.17
	2015-2019		-1.09	-5.097	3.086				0.586

#### Appendix 6-9. Trends in age-standardized death rate of suicide in Central Latin America by both sex and combined









Andean Latin America	Period	Change year	APC	95	% CI	AAPC		95% CI		p-value
Both	1990-2019					0.471	0.231	0.712	3.846	< 0.001
	1990-1995	1995	2.425	1.904	2.948					< 0.001
	1995-2001	2001	0.513	0.074	0.954					0.025
	2001-2010	2010	1.276	1.005	1.547					< 0.001
	2010-2015	2015	-2.5	-3.357	-1.637					< 0.001
	2015-2019		-0.04	-1.091	1.021					0.937
Men	1990-2019					0.758	0.495	1.022	5.663	< 0.001
	1990-1999	1999	1.736	1.568	1.904					< 0.001
	1999-2007	2007	1.183	0.932	1.434					< 0.001
	2007-2010	2010	2.392	0.288	4.54					0.028
	2010-2015	2015	-2.255	-2.928	-1.578					< 0.001
	2015-2019		0.33	-0.473	1.14					0.397
Women	1990-2019					-0.339	-0.687	0.01	-1.904	0.057
	1990-1994	1994	5.319	3.755	6.906					< 0.001
	1994-2001	2001	-1.227	-2.01	-0.437					0.004
	2001-2009	2009	0.702	0.076	1.332					0.03
	2009-2019		-2.717	-3.208	-2.224					< 0.001

Appendix 6-10. Trends in age-standardized death rate of suicide in Andean Latin America by both sex and combined











Caribbean	Period	Change year	APC	959	% CI	AAPC	959	% CI	p-value
Both	1990-2019					-1.196	-1.432	-0.959	< 0.001
	1990-1993	1993	0.461	-0.396	1.325				0.272
	1993-1999	1999	-2.236	-2.606	-1.865				< 0.001
	1999-2002	2002	-4.46	-6.173	-2.717				< 0.001
	2002-2011	2011	-0.94	-1.203	-0.676				< 0.001
	2011-2019		-0.063	-0.445	0.322				0.734
Men	1990-2019					-0.748	-0.998	-0.498	< 0.001
	1990-1994	1994	0.548	-0.092	1.192				0.089
	1994-1999	1999	-1.236	-1.837	-0.632				0.001
	1999-2002	2002	-3.917	-5.71	-2.09				< 0.001
	2002-2011	2011	-0.623	-0.889	-0.357				< 0.001
	2011-2019		-0.016	-0.389	0.358				0.930
Women	1990-2019					-2.327	-2.543	-2.111	< 0.001
	1990-1993	1993	-0.364	-1.326	0.608				0.442
	1993-2003	2003	-4.953	-5.169	-4.737				< 0.001
	2003-2010	2010	-1.787	-2.39	-1.18				< 0.001
	2010-2019		-0.419	-0.844	0.008				0.054

#### Appendix 6-11. Trends in age-standardized death rate of suicide in Caribbean by both sex and combined









Tropical Latin America	Period	Change year	APC	95%	% CI	AAPC	95%	CI	p-value
Both	1990-2019					-0.743	-0.987	-0.498	< 0.001
	1990-1996	1996	-1.577	-1.897	-1.255				< 0.001
	1996-1999	1999	0.637	-0.875	2.172				0.387
	1999-2010	2010	-0.730	-0.864	-0.596				< 0.001
	2010-2016	2016	-0.104	-0.508	0.301				0.593
	2016-2019		-1.752	-3.439	-0.035				0.046
Men	1990-2019					-0.599	-0.815	-0.383	< 0.001
	1990-1996	1996	-1.456	-1.838	-1.071				< 0.001
	1996-1999	1999	0.718	-1.038	2.505				0.405
	1999-2006	2006	-0.884	-1.301	-0.466				< 0.001
	2006-2019		-0.350	-0.490	-0.210				< 0.001
Women	1990-2019					-0.981	-1.353	-0.609	< 0.001
	1990-1996	1996	-1.798	-2.368	-1.225				< 0.001
	1996-2006	2006	0.005	-0.283	0.294				0.970
	2006-2009	2009	-2.569	-5.115	0.047				0.054
	2009-2016	2016	-0.001	-0.505	0.506				0.997
	2016-2019		-3.263	-5.349	-1.131				0.005

#### Appendix 6-12. Trends in age-standardized death rate of suicide in Tropical Latin America by both sex and combined









East Asia	Period	Change year	APC	95	% CI	AAPC	959	% CI	p-value
Both	1990-2019					-3.653	-4.113	-3.191	< 0.001
	1990-1995	1995	-1.529	-2.339	-0.711				0.001
	1995-1999	1999	-4.123	-5.625	-2.598				< 0.001
	1999-2002	2002	-6.878	-9.527	-4.151				< 0.001
	2002-2005	2005	0.565	-2.301	3.515				0.681
	2005-2014	2014	-5.787	-6.095	-5.478				< 0.001
	2014-2019		-1.988	-2.821	-1.148				< 0.001
Men	1990-2019					-2.751	-3.279	-2.221	< 0.001
	1990-1998	1998	-2.013	-2.517	-1.506				< 0.001
	1998-2001	2001	-5.451	-9.096	-1.661				0.008
	2001-2004	2004	1.214	-2.11	4.65				0.455
	2004-2015	2015	-4.194	-4.455	-3.932				< 0.001
	2015-2019		-1.071	-2.32	0.194				0.091
Women	1990-2019					-4.729	-5.319	-4.135	< 0.001
	1990-1995	1995	-1.429	-2.601	-0.243				0.022
	1995-1999	1999	-4.816	-6.597	-3.002				< 0.001
	1999-2002	2002	-10.188	-13.382	-6.876				< 0.001
	2002-2005	2005	0.423	-3.107	4.081				0.803
	2005-2015	2015	-7.209	-7.516	-6.9				< 0.001
	2015-2019		-1.919	-3.763	-0.039				0.046

Appendix 6-13. Trends in age-standardized death rate of suicide in East Asia by both sex and combined









Southeast Asia	Period	Change year	APC	95%	% CI	AAPC	95%	% CI	p-value
Both	1990-2019					-1.535	-1.797	-1.272	< 0.001
	1990-1993		-0.593	-1.447	0.268				0.160
	1993-1996		1.827	0.116	3.568				0.038
	1996-1999		-2.695	-4.429	-0.929				0.006
	1999-2006		-3.555	-3.827	-3.281				< 0.001
	2006-2013		-2.024	-2.293	-1.754				< 0.001
	2013-2019		-0.110	-0.424	0.205				0.463
Men	1990-2019					-1.233	-1.490	-0.975	< 0.001
	1990-1993	1993	-0.101	-1.159	0.969				0.844
	1993-1996	1996	2.452	0.287	4.665				0.029
	1996-2007	2007	-3.043	-3.199	-2.886				< 0.001
	2007-2013	2013	-1.563	-2.006	-1.119				< 0.001
	2013-2019		0.084	-0.285	0.454				0.638
Women	1990-2019					-2.472	-2.779	-2.164	< 0.001
	1990-1993	1993	-1.886	-2.887	-0.873				0.001
	1993-1996	1996	0.002	-1.847	1.886				0.998
	1996-1999	1999	-1.618	-3.705	0.514				0.124
	1999-2005	2005	-4.944	-5.343	-4.543				< 0.001
	2005-2013	2013	-3.052	-3.310	-2.794				< 0.001
	2013-2019		-1.121	-1.595	-0.645				< 0.001

Appendix 6-14. Trends in age-standardized death rate of suicide in Southeast Asia by both sex and combined









Oceania	Period	Change year	APC	95	5% CI	AAPC	959	% CI	p-value
Both	1990-2019					-0.807	-0.936	-0.677	< 0.001
	1990-1992	1992	0.149	-1.154	1.469				0.814
	1992-2000	2000	-0.851	-1.017	-0.684				< 0.001
	2000-2004	2004	-1.535	-2.176	-0.890				< 0.001
	2004-2019		-0.715	-0.774	-0.656				< 0.001
Men	1990-2019					-0.719	-0.910	-0.527	< 0.001
	1990-1992	1992	0.444	-1.135	2.047				0.565
	1992-2000	2000	-0.722	-0.922	-0.521				< 0.001
	2000-2003	2003	-1.661	-3.183	-0.115				0.037
	2003-2019		-0.684	-0.747	-0.621				< 0.001
Women	1990-2019					-1.067	-1.193	-0.941	< 0.001
	1990-2002	2002	-1.047	-1.125	-0.969				< 0.001
	2002-2006	2006	-2.114	-2.792	-1.432				< 0.001
	2006-2011	2011	-0.501	-0.946	-0.055				0.030
	2011-2019		-0.924	-1.100	-0.747				< 0.001

#### Appendix 6-15. Trends in age-standardized death rate of suicide in Oceania by both sex and combined









North Africa and Middle East	Period	Change year	APC	95%	% CI	AAPC	95%	% CI	p-value
Both	1990-2019					-1.150	-1.226	-1.073	< 0.001
	1990-1995	1995	-0.450	-0.639	-0.261				< 0.001
	1995-1999	1999	-1.313	-1.700	-0.925				< 0.001
	1999-2007	2007	-1.876	-1.976	-1.777				< 0.001
	2007-2012	2012	-0.642	-0.870	-0.413				< 0.001
	2012-2019		-1.081	-1.183	-0.980				< 0.001
Men	1990-2019					-0.926	-0.977	-0.874	< 0.001
	1990-1995	1995	-0.436	-0.621	-0.250				< 0.001
	1995-2007	2007	-1.485	-1.533	-1.437				< 0.001
	2007-2012	2012	-0.208	-0.413	-0.003				0.047
	2012-2019		-0.823	-0.908	-0.738				< 0.001
Women	1990-2019					-1.710	-1.825	-1.596	< 0.001
	1990-1997	1997	-0.573	-0.746	-0.400				< 0.001
	1997-2002	2002	-1.956	-2.374	-1.537				< 0.001
	2002-2007	2007	-2.888	-3.332	-2.443				< 0.001
	2007-2019		-1.774	-1.882	-1.666				< 0.001

Appendix 6-16. Trends in age-standardized death rate of suicide in North Africa and Middle East by both sex and combined











South Asia	Period	Change year	APC	95%	6 CI	AAPC	95%	% CI	p-value
Both	1990-2019					-1.310	-1.783	-0.835	< 0.001
	1990-1995	1995	-0.643	-1.639	0.362				0.193
	1995-1999*	1999	1.230	-0.842	3.346				0.228
	1999-2012	2012	-2.166	-2.398	-1.933				< 0.001
	2012-2016	2016	-3.353	-5.385	-1.278				0.004
	2016-2019		0.737	-1.647	3.180				0.525
Men	1990-2019					-0.843	-1.444	-0.239	0.006
	1990-1996	1996	0.259	-0.483	1.006				0.465
	1996-1999*	1999	2.576	-1.306	6.611				0.178
	1999-2004	2004	-1.624	-2.721	-0.515				0.008
	2004-2007	2007	-0.130	-3.820	3.702				0.942
	2007-2016	2016	-2.828	-3.253	-2.402				< 0.001
	2016-2019		0.222	-2.090	2.589				0.840
Women	1990-2019					-1.761	-2.482	-1.035	< 0.001
	1990-2000*	2000	-0.475	-0.942	-0.006				0.047
	2000-2004	2004	-4.570	-7.302	-1.757				0.003
	2004-2017	2017	-2.386	-2.715	-2.056				< 0.001
	2017-2019		1.683	-7.317	11.558				0.710

#### Appendix 6-17. Trends in age-standardized death rate of suicide in South Asia by both sex and combined

AAPC = annual average percent change; 95% CI = 95% confidence interval

\* The economic crisis occurred within these period in the countries in South Asia region









Southern Sub-Saharan Africa	Period	Change year	APC	95%	% CI	AAPC	959	% CI	p-value
Both	1990-2019					-0.918	-1.528	-0.304	0.003
	1990-1995	1995	-0.611	-1.859	0.652				0.319
	1995-1998	1998	3.976	-1.301	9.536				0.132
	1998-2005	2005	0.445	-0.349	1.246				0.253
	2005-2012	2012	-4.281	-5.083	-3.472				< 0.001
	2012-2019		-1.117	-1.831	-0.398				0.005
Men	1990-2019					-0.566	-1.052	-0.078	0.023
	1990-1994	1994	0.657	-1.170	2.518				0.460
	1994-1998	1998	4.505	1.923	7.153				0.002
	1998-2006	2006	-0.418	-1.007	0.175				0.154
	2006-2012	2012	-4.369	-5.345	-3.383				< 0.001
	2012-2019		-0.934	-1.595	-0.267				0.009
Women	1990-2019					-2.174	-3.073	-1.266	< 0.001
	1990-1992	1992	0.355	-7.922	9.376				0.932
	1992-1996	1996	-7.233	-11.286	-2.995				0.002
	1996-2003	2003	4.145	2.453	5.866				< 0.001
	2003-2019		-3.851	-4.354	-3.346				< 0.001

#### Appendix 6-18. Trends in age-standardized death rate of suicide in Southern Sub-Saharan Africa by both sex and combined









Western Sub-Saharan Africa	Period	Change year	APC	9	5% C	CI	AAPC	9	05% (	CI	p-value
Both	1990-2019						-0.137	-0.259	-	-0.014	0.029
	1990-1996	1996	0.612	0.486	-	0.739					< 0.001
	1996-1999	1999	1.237	0.499	-	1.981					0.003
	1999-2002	2002	0.642	-0.059	-	1.348					0.07
	2002-2008	2008	-0.366	-0.521	-	-0.21					< 0.001
	2008-2011	2011	0.05	-0.64	-	0.743					0.879
	2011-2019		-1.389	-1.466	-	-1.312					< 0.001
Men	1990-2019						0.105	-0.037	-	0.248	0.148
	1990-1996	1996	0.725	0.574	-	0.877					< 0.001
	1996-1999	1999	1.492	0.637	-	2.354					0.002
	1999-2002	2002	0.704	-0.129	-	1.544					0.091
	2002-2008	2008	-0.017	-0.201	-	0.167					0.843
	2008-2011	2011	0.526	-0.261	-	1.32					0.173
	2011-2019		-1.157	-1.242	-	-1.07					< 0.001
Women	1990-2019						-0.580	-0.678	-	-0.481	< 0.001
	1990-1995	1995	-0.007	-0.167	-	0.155					0.931
	1995-2002	2002	0.272	0.156	-	0.388					< 0.001
	2002-2005	2005	-0.666	-1.274	-	-0.054					0.035
	2005-2008	2008	-1.504	-2.142	-	-0.862					< 0.001
	2008-2013	2013	-0.719	-0.915	-	-0.523					< 0.001
	2013-2019		-1 418	-1 534	-	-1 302					< 0.001

Appendix 6-19. Trends in age-standardized death rate of suicide in Western Sub-Saharan Africa by both sex and combined









Eastern Sub-Saharan Africa	Period	Change year	APC	959	% CI	AAPC	959	% CI	p-value
Both	1990-2019					-1.131	-1.2	-1.062	< 0.001
	1990-1998	1998	-0.261	-0.368	-0.154				< 0.001
	1998-2005	2005	-1.509	-1.668	-1.35				< 0.001
	2005-2015	2015	-1.709	-1.799	-1.619				< 0.001
	2015-2019		-0.748	-1.082	-0.413				< 0.001
Men	1990-2019					-0.897	-0.992	-0.801	< 0.001
	1990-1998	1998	0.04	-0.074	0.154				0.473
	1998-2011	2011	-1.215	-1.276	-1.153				< 0.001
	2011-2015	2015	-1.886	-2.453	-1.315				< 0.001
	2015-2019	2019	-0.733	-1.087	-0.378				< 0.001
Women	1990-2019					-1.565	-1.689	-1.44	< 0.001
	1990-1998	1998	-0.859	-1.004	-0.715				< 0.001
	1998-2004	2004	-1.999	-2.264	-1.734				< 0.001
	2004-2007	2007	-2.899	-3.877	-1.912				< 0.001
	2007-2014	2014	-2.06	-2.211	-1.909				< 0.001
	2014-2019	2019	-0.661	-0.886	-0.435				< 0.001

#### Appendix 6-20. Trends in age-standardized death rate of suicide in Eastern Sub-Saharan Africa by both sex and combined









Southern Latin America	Period	Change year	APC	959	% CI	AAPC	95%	6 CI	p-value
Both	1990-2019					-0.361	-0.628	-0.094	0.008
	1990-1998	1998	0.922	0.720	1.125				< 0.001
	1998-2002	2002	-0.535	-1.431	0.370				0.227
	2002-2005	2005	-3.175	-4.758	-1.567				0.001
	2005-2008	2008	0.979	-0.783	2.771				0.258
	2008-2019		-0.810	-0.960	-0.659				< 0.001
Men	1990-2019					-0.397	-0.660	-0.133	0.003
	1990-1998	1998	1.171	0.974	1.368				< 0.001
	1998-2002	2002	-0.702	-1.579	0.183				0.112
	2002-2005	2005	-3.651	-5.258	-2.018				< 0.001
	2005-2008	2008	0.876	-0.806	2.588				0.288
	2008-2019		-0.859	-1.011	-0.706				< 0.001
Women	1990-2019					-0.434	-0.673	-0.194	< 0.001
	1990-1994	1994	-0.983	-1.586	-0.376				0.003
	1994-1998	1998	0.518	-0.461	1.507				0.279
	1998-2006	2006	-0.622	-0.881	-0.362				< 0.001
	2006-2009	2009	0.616	-1.138	2.400				0.470
	2009-2019		-0.755	-0.937	-0.573				< 0.001

Appendix 6-21. Trends in age-standardized death rate of suicide in Southern Latin America by both sex and combined

AAPC = annual average percent change; 95% CI = 95% confidence interval







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#### Appendix 7. Estimated total number of suicide DALYs (per 100,000) in 2019 and average annual percentage change in age-standardized DALY rates over 1990-2019 by region among males and females.

M CBB B		N CD 11 V. (078						ASR	of DALY (9	5% UI)								1000 201	0.0050/ III)	
21 GBD Region		No. 01 DAL18 (957	~ UI)			Men			Wome	n			Total			Male/female ratio	Average a	inuai percentage chi	nge, 1990-201	(95% 01)
Global	34,123,584	30,800,472	-	37,498,986	577.0	492.9	643.4	273.7	244.7		306.3	424.7	383.2	-	466.9	2.1	-0.03	-0.12		0.07
High-income North America	2,116,559	2,067,196		2,167,817	827.5	802.6	849.6	270.6	261.1		279.8	547.7	533.6	-	561.1	3.1	-0.11	-0.13		-0.08
Australasia	156,176	149,139	-	165,739	801.0	759.4	864.9	255.2	239.2		274.7	525.3	501.8	-	557.4	3.1	-0.15	-0.19		-0.09
High-income Asia Pacific	1,427,942	1,241,837	-	1,511,767	927.9	772.1	994.1	399.3	385.1		413.9	667.8	588.1	-	704.1	2.3	0.02	-0.23		0.11
Western Europe	1,829,624	1,763,811	-	1,921,064	566.0	546.0	597.8	178.2	171.3		186.0	372.2	359.8	-	390.7	3.2	-0.28	-0.31		-0.24
Southern Latin America	367,274	348,863	-	387,521	852.0	799.2	909.7	209.9	195.6		224.4	525.0	497.6	-	555.2	4.1	0.18	0.10		0.26
Eastern Europe	2,504,362	2,195,491	-	2,920,489	1,940.1	1,665.3	2,296.0	338.9	286.4		401.0	******	980.5	-	******	5.7	-0.09	-0.15		0.00
Central Europe	666,985	583,284		761,567	854.5	739.0	975.1	162.4	140.3		187.8	508.3	444.0	-	578.1	5.3	-0.24	-0.30		-0.17
Central Asia	570,061	512,731		637,912	906.5	818.7	1,024.2	288.9	254.5		327.3	590.8	530.9	-	662.0	3.1	0.58	0.46		0.73
Andean Latin America	178,135	124,455		220,163	398.6	228.6	503.2	146.7	118.9		180.3	271.5	189.6	-	336.0	2.7	1.22	0.48		1.69
Caribbean	191,220	164,512		224,643	580.8	488.8	698.5	202.2	168.0		243.4	386.6	332.1	-	454.9	2.9	-0.15	-0.22		-0.07
Central Latin America	797,103	688,147	-	919,752	502.5	428.8	583.6	116.3	97.9		136.5	303.2	261.8	-	349.9	4.3	0.74	0.60		0.89
Tropical Latin America	649,446	614,435	-	706,932	435.2	409.2	480.8	109.7	103.1		120.4	268.4	254.2	-	292.2	4.0	0.25	0.16		0.37
East Asia	4,428,870	3,749,472	-	5,345,921	326.2	256.8	422.3	182.0	146.2	-	223.2	254.3	216.0	-	306.5	1.8	-0.53	-0.61	-	-0.37
Southeast Asia	1,755,967	1,442,480	-	2,058,564	386.7	307.8	461.9	106.8	90.6		121.8	246.0	202.0	-	288.0	3.6	0.00	-0.14		0.14
Oceania	41,073	32,094		53,584	487.7	366.8	648.6	142.6	116.6		175.6	318.6	249.7	-	410.2	3.4	-0.10	-0.21		0.01
North Africa and Middle East	1,337,127	1,112,707	-	1,641,577	279.2	224.6	351.5	132.7	110.0	-	158.6	209.2	173.7	-	256.0	2.1	0.43	0.26	-	0.69
South Asia	12,003,561	10,263,007	-	13,868,081	704.8	517.0	855.9	555.0	457.2		668.9	630.2	538.6	-	727.4	1.3	0.35	0.18		0.55
Southern sub-Saharan Africa	587,561	459,806	-	695,244	1,223.1	927.1	1,463.0	249.2	201.6	-	304.1	721.3	571.4		848.7	4.9	-0.06	-0.21		0.09
Western sub-Saharan Africa	1,004,395	779,683	-	1,281,829	497.3	383.6	658.9	144.0	109.7	-	183.5	312.7	245.5		401.3	3.5	0.91	0.55		1.35
Eastern sub-Saharan Africa	1,098,579	884,236	-	1,322,729	592.2	464.5	738.7	176.1	149.6	-	204.2	377.4	312.3		453.9	3.4	0.93	0.59		1.37
Central sub-Saharan Africa	411,564	311,446	-	545,830	725.7	546.5	973.0	184.8	143.8	-	230.9	442.9	337.5	-	574.8	3.9	0.99	0.56		1.54



#### Appendix 8. Total number of years of life lost (YLL) and age standardized rate (ASR) of YLL per 100 000 from suicide in 2019, and total percent change in ASMR from suicide 1990 to 2019, for all regions

11 CBB B 1											ASR of '	YLL (95% UI)						Avera	age annua	d percent	age
21 GBD Region		No. 01 YLL (95%	(UI)			Men				Women	1			Total			Male/female ratio	chang	e, 1990-20	119 (95%	ŪŊ
Global	33,187,013	29,985,593		36,481,241	568.0	483.5		634.3	259.9	231.2		293.6	413.3	373.2		454.7	2.2	0.1 5	0.0 5	-	0.2 7
High-income North America	2,056,075	2,008,733		2,104,226	815.4	791.3		836.9	256.1	248.0		263.7	534.4	521.4		547.0	3.2	0.0 1	0.0 3	-	0.0 1
Australasia	150,129	143,515		159,992	786.2	744.1		849.9	236.9	221.8		254.1	508.7	485.5		541.3	3.3	0.0 2	0.0 3		0.0 9
High-income Asia Pacific	1,377,436	1,194,315	-	1,461,439	912.3	756.2	-	978.0	379.1	365.6		392.1	650.0	570.4		685.4	2.4	0.1 4	0.1 5	-	0.2 3
Western Europe	1,766,947	1,704,385		1,854,795	556.0	535.3		586.9	168.0	161.9	-	174.9	362.1	349.8	-	380.2	3.3	0.1 6	0.2 0	-	0.1 2
Southern Latin America	355,491	336,910		376,251	836.0	785.2		892.6	194.3	181.5	-	208.5	509.1	481.7		540.2	4.3	0.3 5	0.2 7	-	0.4 4
Eastern Europe	2,435,178	2,123,714	-	2,856,210	1,907.8	1,634.2	-	2,268.5	319.9	269.1		382.4	1,092.2	954.5		1,277.0	6.0	0.0 7	0.1 2	-	0.0 1
Central Europe	646,852	563,908		741,654	839.0	723.0		962.9	152.4	130.8		177.9	495.6	430.8		565.9	5.5	0.1 7	0.2 2	-	0.0 9
Central Asia	553,146	494,603		622,696	888.8	800.5		1,006.9	270.2	237.9		308.6	572.7	512.7		644.1	3.3	0.7 8	0.6 4	-	0.9 7
Andean Latin America	175,054	120,770		217,249	394.6	225.1		499.7	141.0	113.1	-	173.9	266.6	183.7	-	331.5	2.8	1.9 6	0.9 7	-	2.6
Caribbean	188,332	161,736		221,620	576.0	483.3		692.8	195.6	161.4		237.5	380.9	326.8		448.8	2.9	0.0 4	0.1 1		0.0 4
Central Latin America	788,287	678,691		911,960	499.2	426.7		579.8	112.8	93.8		132.5	299.8	258.1		346.9	4.4	1.1 3	0.9 9	-	1.2 8
Tropical Latin America	645,590	610,663		703,286	433.4	407.6		479.3	108.2	101.5		119.0	266.9	252.6		290.6	4.0	0.5 5	0.4 4	-	0.7 0
East Asia	4,349,178	3,671,402		5,281,512	322.5	253.6		417.8	177.2	141.0		217.8	250.0	211.9		302.8	1.8	0.4 1	0.5 0		0.2 1
Southeast Asia	1,709,310	1,389,605		2,006,219	379.6	300.9		455.1	100.6	84.3		115.8	239.4	195.1		280.4	3.8	0.2 1	0.0 5	-	0.3 8
Oceania	39,870	30,857		52,578	476.6	356.7		638.9	132.8	107.6		163.9	308.1	240.0		397.8	3.6	0.0 6	0.1 9		0.0 8
North Africa and Middle East	1,296,644	1,071,973		1,592,704	273.3	219.5		346.2	124.6	102.2		150.1	202.3	167.0		247.6	2.2	0.8 8	0.7 0		1.2 1
South Asia	11,584,493	9,816,079		13,452,503	691.8	502.4		843.7	519.5	425.7		632.6	606.0	513.1		704.6	1.3	0.6 8	0.4 8	-	0.9 2
Southern sub-Saharan Africa	583,723	456,884		691,478	1,216.8	920.4		1,458.1	245.0	198.0		299.7	716.1	567.4		843.6	5.0	0.0	0.1		0.1 5
Western sub-Saharan Africa	996,779	772,200		1,275,353	494.6	381.1		655.0	141.8	107.6		180.9	310.2	242.8		398.7	3.5	1.0 9	0.6 8		1.5 8
Eastern sub-Saharan Africa	1,085,050	872,119		1,308,233	587.1	459.4		734.4	171.1	144.3		199.0	372.4	307.3		449.5	3.4	1.2 3	0.8 3	-	1.7 2
Central sub-Saharan Africa	403,450	303,708	-	538,305	715.7	536.2		962.9	176.2	134.9		221.4	433.6	327.2		566.2	4.1	1.2 9	0.7 9	-	1.9 3



Central Saharan Africa sub-

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#### ASR of YLD (95% UI) Average annual percentage change, 1990-2019 (95% UI) 21 GBD Region No. of YLD (95% UI) Male /female ratio Total Men Women Global 0. 936,571 661.751 1.258.405 9.0 6.3 12.0 13.9 9.7 18.6 11.4 8.1 15.3 0.6 33 36 High-income North 0. 00 0. 03 60,484 42,167 82,558 12.1 8.3 16.4 14.5 10.1 19.8 13.3 9.2 18.3 0.8 America Australasia 0. 6,047 4,115 8,231 14.8 10.0 20.2 18.3 12.6 25.1 16.6 11.4 22.7 0.8 02 High-income Asia Pacific 0. 27 0. 22 50,507 15.5 10.6 21.3 20.2 13.9 27.8 17.9 12.3 24.5 0.8 35,006 68,838 0. 24 Western Europe 0. 22 7.1 62.678 43,176 86,311 10.0 6.9 13.8 10.3 14.0 10.1 7.0 14.0 1.0 Southern Latin America 0. 02 0. 08 11.782 8,173 15,871 16.0 11.0 21.7 15.6 10.8 21.6 15.8 10.9 21.3 1.0 Eastern Europe 0. 22 0. 27 69 184 47 196 93 898 32.3 22.0 44.1 19.0 12.9 26.2 25.0 17.0 34.2 17 Central Europe 0. 20,133 13,960 27,426 15.5 10.6 21.2 10.0 6.9 13.8 12.7 8.7 17.2 1.5 Central Asia 16,915 11,773 22,892 17.6 12.3 23.9 18.7 12.9 25.2 18.1 12.6 24.4 0.9 14 09 Andean America Lati 0. 4.0 0.7 3.081 2.134 4.144 4.1 2.8 5.4 5.8 7.8 4.9 3.4 6.6 08 17 Caribbean 0. 2,888 2,043 3,820 4.8 3.4 6.4 6.7 4.7 8.9 5.8 4.1 7.6 0.7 41 Central America Latin 0. 06 0. 02 2.3 2.5 3.4 4.7 0.9 8,816 6,176 11,942 3.3 4.4 3.6 4.9 2.4 Tropical America Latin 0. 15 3,856 2,725 5,229 1.7 1.2 2.3 1.4 1.0 1.9 1.6 1.1 2.1 1.2 East Asia 0. 60 3.7 2.6 3.4 4.3 3.0 5.8 0.8 0. 57 79,692 55,956 108,314 5.0 4.8 6.6 Southeast Asia 0. 43 46 656 32 589 62 987 71 5.0 96 6.2 4.3 8.4 6.6 4.6 9.0 1.1 0. Oceania 1.202 843 1.622 11.1 7.8 14.7 9.9 6.9 13.2 10.5 7.3 14.0 1.1 15 19 North Africa and Middle East 0. 0. 40,483 28,381 54,781 5.8 4.1 7.9 8.1 5.6 10.9 6.9 4.9 9.3 0.7 25 31 South Asia 0. 40 17.3 35.5 24.2 17.0 32.8 0.4 419,068 294,020 572,166 13.0 9.2 24.8 48.4 Southern sub 0. 21 Saharan Afric 3,839 2,637 5,254 6.4 4.4 8.6 4.2 2.9 5.7 5.2 3.6 1.5 Western sub 0. 09 0. 05 Saharan Africa 7 616 5,302 10 335 27 19 37 2.3 1.6 3.0 2.5 17 3.3 1.2 Eastern 0. 24 0. 21 13,529 9,546 17.896 5.1 3.6 6.7 5.0 3.5 6.6 5.0 3.6 6.6 1.0 Saharan Africa

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Appendix 9. Total number of years of healthy life lost due to disability (YLD) and age standardized rate (ASR) of YLL per 100 000 from suicide in 2019, and total percent change in ASMR from suicide 1990 to 2019, for all region

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11.4

9.3

6.7

12.3

13.1





Appendix 10. Trajectory groups of Gini coefficient regions (A) and SDI regions (B): a group-based semiparametric mixture model in every year.

The solid lines represent estimated values, and the dimmed lines represent 95% confidence intervals



Gini coefficient trajectory groups	Period	Change year	APC	95% CI	AAPC	95% CI	p-value
	1990-2019				-0.165	-0.2780.052	0.004
	1990-1993	1993	2.139	1.765 - 2.514			< 0.001
II's base	1993-1999	1999	3.208	2.988 - 3.429			< 0.001
Hignest	1999-2003	2003	1.194	0.569 - 1.824			0.001
	2003-2012	2012	-2.72	-2.8692.57			< 0.001
	2012-2019		-1.421	-1.6061.236			< 0.001
	1990-2019				-0.324	-0.3490.300	< 0.001
High	1990-1999	1999	0.483	0.414 - 0.553			< 0.001
	1999-2019		-0.686	-0.7060.665			< 0.001
	1990-2019				-0.676	-0.7410.611	< 0.001
	1990-1995	1995	0.183	0.082 - 0.284			0.002
	1995-1999	1999	-0.682	-0.9050.458			< 0.001
Middle	1999-2004	2004	-1.378	-1.5171.238			< 0.001
	2004-2013	2013	-0.852	-0.9030.802			< 0.001
	2013-2016	2016	-0.192	-0.667 - 0.285			0.399
	2016-2019		-0.873	-1.1090.636			< 0.001
	1990-2019				-1.049	-1.1770.921	< 0.001
Law	1990-1994	1994	3.694	2.895 - 4.499			< 0.001
Low	1994-2006	2006	-1.605	-1.7661.444			< 0.001
	2006-2019		-1.955	-2.0681.841			< 0.001
	1990-2019	, ,			-1.364	-1.4271.301	< 0.001
	1990-1995	1995	0.042	-0.15 - 0.235			0.650
Lowest	1995-2006	2006	-1.269	-1.3481.19			< 0.001
	2006-2014	2014	-2.597	-2.7252.47			< 0.001
	2014-2019		-0.982	-1.1860.777			< 0.001

### Appendix 11. Trends of age-standardized death rate from suicide by Gini coefficient trajectory groups, 1990-2019



SDI trajectory groups	Period	Change year	APC	9	95% (	CI	AAPC		95% C	I	p-value
	1990-2019						-1.261	-1.385	-	-1.137	< 0.001
	1990-1994	1994	1.169	0.664	-	1.676					< 0.001
Highest	1994-2007	2007	-1.582	-1.682	-	-1.483					< 0.001
	2007-2017	2017	-1.922	-2.058	-	-1.786					< 0.001
	2017-2019		-0.647	-1.996	-	0.720					0.332
	1990-2019			•			-0.830	-0.932	-	-0.727	< 0.001
	1990-1996	1996	1.915	1.629	-	2.202					< 0.001
High	1996-2006	2006	-1.453	-1.597	-	-1.308					< 0.001
	2006-2013	2013	-2.379	-2.63	-	-2.128					< 0.001
	2013-2019		-0.674	-0.906	-	-0.44					< 0.001
	1990-2019						-0.415	-0.522	-	-0.307	< 0.001
	1990-1993	1993	1.280	0.857	-	1.705					< 0.001
	1993-1998	1998	0.380	0.116	-	0.644					0.008
Middle	1998-2003	2003	-0.371	-0.643	-	-0.098					0.012
	2003-2013	2013	-1.072	-1.152	-	-0.993					< 0.001
	2013-2017	2017	-0.485	-0.92	-	-0.049					0.032
	2017-2019		-1.573	-2.413	-	-0.726					0.002
	1990-2019						-0.498	-0.53	-	-0.467	< 0.001
	1990-1994	1994	0.487	0.374	-	0.599					< 0.001
Low	1994-2000	2000	-0.079	-0.163	-	0.005					0.065
	2000-2014	2014	-0.786	-0.811	-	-0.76					< 0.001
	2014-2019		-0.977	-1.101	-	-0.853					< 0.001
	1990-2019						-0.420	-0.452	-	-0.387	0.004
Lowest	1990-1998	1998	0.295	0.224	-	0.366					< 0.001
Lowest	1998-2004	2004	-0.558	-0.685	-	-0.431					< 0.001
	2004-2019		-0.743	-0.765	-	-0.721					< 0.001

 Appendix 12. Trends of age-standardized death rate from suicide by SDI trajectory groups, 1990-2019

 SDI trajectory groups
 Period
 Change year
 APC
 95% CI



#### Appendix 13. The results of normality test for the age standardized suicide mortality, DALY, YLL, and YLD rate





Characteristics	N	%	Age-standardized suicid 100,000	e death rate per
			Mean	SD
Gini coefficient				
< 0.40	25	12.9	9.9	4.5
0.40-0.49	65	33.5	9.5	7.4
0.50-0.59	70	36.1	10.4	7.6
> 0.60	34	17.5	12.0	5.3
Socio-demographic index				
Low SDI	38	19.6	10.9	3.8
Low-middle SDI	39	20.1	11.8	9.0
Middle SDI	39	20.1	8.1	5.1
High-middle SDI	39	20.1	9.7	9.1
High SDI	39	20.1	10.5	5.0
Population ages 65 and above (% of total population)				
< 7 % (reference)	98	50.5	10.1	6.7
7-13 %: aging society	44	22.7	8.6	5.5
14-20 %: aged society	45	23.2	12.2	8.1
≥21 %: super-aged society	7	3.6	9.1	4.0
Unemployment rate				
Q1: Lowest (<3.48%)	49	25.3	9.2	4.5
Q2 (3.48-5.59%)	47	24.2	11.0	5.2
Q3 (5.59-9.20%)	47	24.2	9.4	5.6
Q4: Highest (>9.20%)	51	26.3	11.1	10.2
Age dependency ratio (% of working-age population)				
Q1: Highest (>68.70%)	49	25.3	7.4	4.8
Q2 (54.80-68.70%)	50	25.8	10.7	6.1
Q3 (48.85-54.80%)	49	25.3	11.5	9.5
Q4: Lowest (<48.85%)	46	23.7	11.3	5.0
Mental disorder DALY rate per 100,000				
Q1: Highest (>1854.7)	49	25.3	11.2	6.5
Q2 (1658.8-1854.7)	48	24.7	10.5	5.5
Q3 (1409.9-1658.8)	48	24.7	9.5	6.5
Q4: Lowest (<1409.9)	49	25.3	9.6	8.5
Alcohol use disorder DALY rate per 100,000				
Q1: Highest (>296.7)	52	26.8	7.4	4.7
Q2 (186.8-296.7)	46	23.7	10.1	5.7
Q3 (104.9-186.8)	48	24.7	11.5	6.8
Q4: Lowest (<104.9)	48	24.7	12.0	8.8
Drug use disorder DALY rate per 100,000				
Q1: Highest (>189.7)	49	25.3	9.8	3.8
Q2 (127.8-189.7)	48	24.7	8.9	6.7
Q3 (96.9-127.8)	48	24.7	10.1	7.1
Q4: Lowest (<96.9)	49	25.3	12.0	8.6

SD, standard deviation; DALY, disability-adjusted life-years



Characteristics	DALYs rate per 100,000		YLD	rate per 100	0,000		YLI	rate per 100	),000		Elderly suicio	le death rate pe	r 100,000			Non-eld death rat	erly suicide e per 100,00(	0		
	RR	95%	сі	P-value	RR	95%	6 CI	P-value	RR	95%	6 CI	P-value	RR	95%	сі	P-value	RR	95%	% CI	P-value
Gini coefficient																				
< 0.40	1.000				1.000				1.000				1.000				1.000			
0.40-0.49	1.002	0.883	1.137	0.978	0.816	0.689	0.967	0.019	1.006	0.887	1.141	0.922	1.146	0.996	1.319	0.058	0.973	0.851	1.112	0.685
0.50-0.59	1.075	0.905	1.276	0.411	0.688	0.543	0.872	0.002	1.083	0.912	1.286	0.363	1.187	0.979	1.440	0.081	1.043	0.874	1.245	0.639
> 0.60	1.071	0.716	1.602	0.738	0.481	0.308	0.749	0.001	1.083	0.723	1.622	0.698	1.280	0.944	1.736	0.112	1.057	0.671	1.665	0.810
Socio-demographic index																				
Low SDI	1.768	1.208	2.587	0.003	1.499	1.014	2.217	0.042	1.774	1.209	2.602	0.003	1.490	0.993	2.235	0.054	1.659	1.136	2.424	0.009
Low-middle SDI	1.368	0.955	1.962	0.088	1.394	0.966	2.012	0.076	1.368	0.953	1.964	0.090	0.979	0.714	1.342	0.893	1.325	0.930	1.887	0.120
Middle SDI	1.006	0.726	1.393	0.973	0.997	0.748	1.330	0.985	1.006	0.725	1.396	0.971	0.732	0.536	0.999	0.050	0.975	0.708	1.342	0.876
High-middle SDI	1.114	0.754	1.644	0.588	1.027	0.774	1.361	0.855	1.116	0.754	1.653	0.584	0.846	0.638	1.123	0.247	1.102	0.752	1.616	0.618
High SDI	1.000				1.000				1.000				1.000				1.000			
Population ages 65 and above (% of total population)																				
< 7 %	1.000				1.000				1.000				1.000				1.000			
7-13 %: aging society	0.954	0.777	1.170	0.649	0.925	0.760	1.127	0.440	0.954	0.777	1.172	0.656	1.075	0.882	1.311	0.475	1.010	0.817	1.248	0.928
14-20 %: aged society	1.021	0.769	1.355	0.888	0.960	0.759	1.215	0.736	1.022	0.768	1.360	0.880	1.277	0.994	1.640	0.056	1.149	0.869	1.519	0.329
≥21 %: super-aged society	1.320	0.736	2.367	0.352	1.040	0.661	1.636	0.866	1.326	0.737	2.385	0.346	1.488	0.992	2.231	0.055	1.529	0.895	2.613	0.120
Unemployment rate																				
Q1: Lowest	1.000				1.000				1.000				1.000				1.000			
Q2	1.065	0.926	1.226	0.379	1.061	0.891	1.264	0.507	1.065	0.926	1.226	0.379	1.086	0.946	1.248	0.243	1.053	0.910	1.218	0.487
Q3	1.052	0.892	1.241	0.544	1.010	0.856	1.192	0.903	1.053	0.893	1.243	0.539	1.069	0.903	1.266	0.439	1.050	0.887	1.242	0.573
Q4: Highest	1.222	1.032	1.446	0.020	1.037	0.884	1.218	0.655	1.226	1.034	1.453	0.019	1.144	0.943	1.389	0.173	1.237	1.044	1.465	0.014
Age dependency ratio (% of working-age population)																				
Q1: Lowest	1.000				1.000				1.000				1.000				1.000			
Q2	0.866	0.763	0.982	0.025	0.908	0.798	1.034	0.144	0.865	0.762	0.981	0.024	0.790	0.684	0.914	0.002	0.840	0.743	0.951	0.006
Q3	0.990	0.799	1.226	0.926	0.962	0.766	1.210	0.743	0.991	0.800	1.228	0.933	0.831	0.682	1.013	0.067	0.944	0.760	1.172	0.602
Q4: Highest	0.971	0.749	1.259	0.826	0.657	0.468	0.922	0.015	0.978	0.754	1.269	0.869	1.228	0.953	1.581	0.112	0.857	0.648	1.134	0.279
Mental disorder DALY rate per 100,000																				
Q1: Lowest	1.000				1.000				1.000				1.000				1.000			
Q2	1.008	0.767	1.325	0.956	0.912	0.717	1.161	0.455	1.010	0.767	1.330	0.944	1.007	0.802	1.265	0.949	1.032	0.772	1.378	0.834

#### Appendix 15. Adjusted association between country's characteristics and DALY rate of suicide, YLD rate of suicide, elderly suicide rate, and non-elderly suicide rate, by repeatedly measuring with generalized estimating equation (GEE) model from 1990 to 2019.



Q3	0.968	0.725	1.294	0.828	0.814	0.634	1.044	0.104	0.972	0.726	1.301	0.847	1.158	0.921	1.457	0.210	0.984	0.723	1.338	0.916
Q4: Highest	1.371	1.030	1.826	0.031	1.426	1.118	1.819	0.004	1.370	1.027	1.827	0.033	1.219	0.935	1.589	0.144	1.402	1.045	1.881	0.024
Alcohol use disorder DALY rate per 100,000																				
Q1: Lowest	1.000				1.000				1.000				1.000				1.000			
Q2	1.247	0.996	1.560	0.054	1.233	0.952	1.597	0.112	1.247	0.996	1.561	0.054	1.244	1.043	1.483	0.015	1.213	0.954	1.544	0.115
Q3	1.551	1.234	1.950	0.000	1.360	1.040	1.779	0.025	1.555	1.237	1.957	0.000	1.758	1.445	2.140	<.0001	1.516	1.191	1.930	0.001
Q4: Highest	1.870	1.452	2.409	<.0001	1.603	1.259	2.041	0.000	1.876	1.455	2.420	<.0001	1.559	1.243	1.956	0.000	1.944	1.500	2.520	<.0001
Drug use disorder DALY rate per 100,000																				
Q1: Lowest	1.000				1.000				1.000				1.000				1.000			
Q2	1.386	1.108	1.732	0.004	1.482	1.121	1.959	0.006	1.384	1.106	1.731	0.005	0.879	0.688	1.123	0.303	1.479	1.164	1.878	0.001
Q3	1.544	1.215	1.961	0.000	1.548	1.184	2.024	0.001	1.544	1.213	1.965	0.000	0.944	0.699	1.274	0.706	1.626	1.275	2.072	<.0001
Q4: Highest	2.087	1.597	2.729	<.0001	2.016	1.490	2.728	<.0001	2.089	1.596	2.735	<.0001	0.996	0.723	1.372	0.980	2.233	1.686	2.955	<.0001

DALYs, disability-adjusted life-years; YLD, years lived with disability; YLL, years of life lost due to premature mortality; SDI, socio-demographic index; GDP, gross domestic product; RP, rate ratio; CI, confidence interval





				Population ages (	55 and above (% of tot	al population)				
Inequality metrics		< 7 %		7-	13 %: aging society		≥13 %: age	d society and super-age	d society	<i>p-value</i> for difference
	Index value	Robust std. error	p-value	Index value	Robust std. error	p-value	Index value	Robust std. error	p-value	
(A) Concentration index value by Gini coefficient	0.140	(0.104)	0.209	-0.011	(0.093)	0.907	0.236	(0.093)	0.028	0.046
(B) Concentration index value by SDI	-0.395	(0.081)	0.001	-0.165	(0.077)	0.052	-0.354	(0.067)	< 0.001	0.034

Appendix 16. Inequality measures in income disparity and suicide by elderly population society groups, measured by concentration index (relative gradient)



국문요약

## 자살 세계질병부담 연구

### : 1990-2019 년도 경향성과 소득불평등에 따른 자살률 불균형

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서론: 효과적인 자살 예방 정책을 개발하고 시행하기 위해 자살률의 추세와 경제적, 사회인구학적 결정요인을 파악하는 것이 중요하다. 따라서 자살 부담의 세계적, 지역적, 국가적 수준과 추세를 확인하고 어떤 요인이 자살 부담과 관련이 있는지 파악하는 것을 목표로 했다. 나아가 자살 사망률이 국가의 Gini 계수 또는 사회인구학적 지수(Socio-demographic Index, SDI)에 의해 불균형하게 분포되는 정도를 측정하는 것을 목표로 했다.

연구방법: 2019 년 세계질병부담연구(Global Burden of Disease study, GBD study) 데이터를 활용하여 자살 부담의 척도로 연령-성별 표준화 자살사망률, 장애보정생존년수(Disability-Adjusted Life Years, DALY), 장애생존년수 (Years Lived with Disability, YLD), 수명손실년수(Years of Life Lost, YLL)에 대한 데이터를 추출했다. Joinpoint 회귀 분석을 통해 1990-2019 년의 연간 평균 백분율 변화(Annual average percentage change, AAPC)를 추정했다. 또한 자살 부담과 관련된 요인을 파악하고, Gini 계수 또는 SDI 에 따른 국가 간에 자살 불평등을 측정했다.

**연구결과:** 2019 년 전세계적으로 자살로 인한 사망은 759,028 명(95% Uncertainty Interval, 95% UI 685,390-831,857)이었고 인구 10 만명당



자살로 인한 사망률 9.4 명이었다. Joinpoint 회귀 분석을 통해 전세계적으로 자살률이 감소하는 추세를 보였고(AAPC -1.67%, -1.85%~-1.50%, p-value < 0.001), 이러한 추세는 다른 GBD 지역에서도 나타났다. 그러나 GBD 의 특정 지역에서의 경제불황 시기에는 자살률의 감소가 일정하지 않고 오히려 증가 추세로 반전되거나 둔화된 감소추세를 보였다(High-income Asia Pacific APC=4.72%, p- value < 0.001; South Asia 1995-1999 APC = 1.23%, pvalue = 0.228; High-income North America 2004-2013 APC=0.76%, pvalue < 0.001; Western Europe 2006–2010 APC = -0.57%, p-value = 0.096). 이 연구에서 활용된 경제적, 인구사회학적, 그리고 역학적 요인들이 자살사망률에 대해 갖는 모델 적합도는 68.1%였다. 그 중에 Gini 계수가 갖는 상대적 중요도는 44.6% 였으며 회귀계수는 17.641(p-value = 0.0305) 였고, SDI 가 갖는 상대적 중요도는 42.3% 였으며 회귀계수는 -3.819(p-value = (0.5555)였다. Gini 계수가 높을수록(소득이 불균형하게 분포될수록) 자살 사망률이 높은 것으로 측정되었다(Gini 계수 > 0.6, Rate Ratio, RR: 1.281, 95% Confidence Interval, 95% CI: 1.121- 1.463). 하위 SDI 그룹의 국가들은 자살 사망률이 높았다(Low SDI, RR: 1.883, 95% CI: 1.595~2.223), 자살사망률은 Gini 계수가 더 높거나 SDI 가 낮은 국가들에 불균형적으로 집중되었다. Gini 계수와 SDI 에 따른 자살의 불규형 크기는 1990 년부터 2019 년 사이 더 증가했다.

결론: 자살에 대한 부담은 1990 년 이후 감소했지만, 경제 위기가 발생한 특정 기간의 특정 지역에서는 증가했다. 국가들의 경제적(특히 소득 격차)과 사회 인구학적 요인은 자살 부담과 관련이 있다. Gini 계수가 높거나, SDI 가 낮은 나라들에서 자살 사망률이 집중되는 불균형성은 1990 년 이후로 더 커졌다. 따라서, 국가 혹은 세계적 차원에서의 자살 예방 전략을 세울 때 경제적 격차와 사회인구학적 측면을 고려하는 것이 타당하다.