

# The growing trend of vascular intestinal disorder in young individuals: a 20-year analysis

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## Abstract

**Background** Vascular intestinal disorder (VID) is a condition with a low incidence, but a high mortality risk. The increasing prevalence of substance abuse and metabolic syndrome among young individuals could impact the burden of VID. This study aimed to evaluate the impact of VID on young individuals.

**Methods** Our study harnessed data from the Global Burden of Disease study, spanning 2000 to 2019. With this extensive dataset, we conducted a comprehensive analysis of the prevalence, mortality rates, and impact on disability-adjusted life years (DALYs) related to VID among young individuals aged 15 to 49 years.

**Results** Globally, there were an estimated 32,628 cases, 3869 deaths, and 201,099 million DALYs attributed to VID in young individuals. Geographically, the regions of America had the highest burden of VID in young individuals. From 2000-2019, there was an increasing prevalence in all areas, with the most pronounced change observed in Southeast Asia (annual percentage change [APC] +2.17%,  $P < 0.001$ ). Over the study period, there was a more rapid increase in prevalence in males (APC +0.82%,  $P < 0.001$ ) than in females (APC +0.59%,  $P < 0.001$ ). Rates of death and DALYs declined in most regions, except for the Eastern Mediterranean region, where there was a slight increase (APC +0.85%,  $P < 0.001$  and 0.88%,  $P < 0.001$ , respectively).

**Conclusion** Over the past decade, the burden of VID in young individuals has been increasing, particularly in Southeast Asia and the Eastern Mediterranean region, necessitating immediate and inclusive measures to tackle the rising burden.

**Keywords** Mesenteric ischemia, vascular disease, epidemiology, gastroenterology

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Conflict of Interest: None

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## Introduction

Vascular intestinal disorders (VID), encompassing conditions such as mesenteric ischemia, ischemic colitis and angiodysplasia of the intestine, can present a wide range of clinical symptoms [1]. Traditionally, these disorders were primarily associated with older individuals [2]. However, recent evidence has shown an emergence of these conditions among younger populations [3]. This shift in prevalence may be attributed to the increasing presence of cardiovascular risk factors, including metabolic syndrome, which has increased in recent decades [4-6]. Additionally, there has been a notable increase in the abuse of substances such as cocaine, another risk factor for these conditions in young individuals [7].

Despite these concerning burdens, there has been a lack of a comprehensive global perspective that outlines the epidemiology of VID in young individuals. Recognizing this knowledge gap, we conducted a study to investigate how the prevalence, mortality, and disability-adjusted life-years (DALYs) associated with VID have changed over time in young individuals, specifically from 2000-2019 [8]. Our analysis considers variations in these trends by region, sociodemographic index (SDI), and sex.

## Materials and methods

### Data source

This study relied on data from the Global Burden of Disease Study (GBD) 2019, which represents a systematic and comprehensive effort to estimate the burden of 369 diseases and 87 risk factors across 204 countries and territories [8]. Our analysis involved the utilization of annual frequencies and age-standardized rates (ASRs) to assess the prevalence, mortality, and disability-adjusted life-years (DALYs) associated with VID in individuals aged 15-49 years. We conducted this assessment over the years 2000-2019, and we further stratified the data by sex, age, region and country. The data were accessed through the GlobalHealth Data Exchange query tool, an online resource maintained by a collaborative effort involving multiple countries and overseen by the Institute for Health Metrics and Evaluation.

### Definitions and measures

VID in young individuals is defined as VID diagnosed in patients aged 15-49 years, based on the relevant International Classification of Diseases Tenth Revision (ICD-10) K52 codes. This includes: K55.0 acute vascular disorders of the intestine, K55.1 chronic vascular disorders of the intestine, K55.2 angiodysplasia of the colon, K55.3 angiodysplasia of the small intestine, K55.8 other vascular disorders of the intestine, and K55.9 vascular disorder of the intestine, unspecified [8,9].

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The main aim of this study was to assess the overall disease burden of VID in young individuals on a global scale. We categorized the data into 6 regions defined by the World Health Organization (WHO). These regions include Africa, the Eastern Mediterranean, Europe, the Americas, Southeast Asia, and the Western Pacific. We also categorized countries based on their SDI. The SDI is a composite measure that considers various factors, such as *per capita* incomes, educational attainment and fertility rates, to provide an overall ranking of countries and territories. This categorization allows us to analyze and compare the disease burden across different regions and varying levels of sociodemographic development (Supplementary Table 1). SDI is measured on a scale from 0-1, where 0 signifies the lowest level of development relevant to health, and 1 signifies the highest theoretical level of development. Using these SDI values, countries are classified into 5 categories: high, high-middle, middle, low-middle, and low SDI categories. A separate research study has provided a detailed explanation of the methodology employed to evaluate the disease burden of VID based on the GBD 2019 data [10]. To ensure the accuracy of the data, the GBD 2019 study assessed the quality of data from each country or territory on a scale ranging from 0 (indicating the lowest quality) to 5 (indicating the highest quality). The ratings for data quality related to the causes of death data from each country can be found in Supplementary Table 2. Various statistical techniques were employed to address data heterogeneity, including correction for misclassification, redistribution of garbage codes, and noise reduction algorithms [8].

The annual prevalence of VID was determined using the formula: Prevalence = Number of diagnosed cases/Population size. Here, “number of cases” refers to the count of confirmed VID diagnoses by the end of the year. The mortality rate linked to VID was calculated by dividing the number of deaths attributed to VID-related causes by the population count at the end of the year. The burden of VID in this age group was assessed in terms of DALYs, which comprise the sum of years of life lost (YLL) and years lived with disability (YLD). YLL is calculated as the number of deaths multiplied by the life expectancy at the time of death. YLD is computed as the prevalence of the disease multiplied by a disability weight, representing the severity of the disease on a scale from 0 (indicating total health) to 1 (indicating death). To ensure consistency between mortality rates and DALYs across various causes, we used DisMod-MR 2.1, a Bayesian meta-regression tool. This helped establish a reliable correlation between these 2 measures. Additionally, we conducted a subgroup analysis to explore potential differences between sexes [8].

### Statistical analysis

The reported estimates for the frequency of new cases and deaths were accompanied by 95% uncertainty intervals (UIs), representing the range between the 2.5<sup>th</sup> and 97.5<sup>th</sup> ranked values obtained from 10,000 draws originating from a posterior distribution. Age-standardized rates were computed using

the direct method, employing the GBD 2019 population estimate as a reference [8]. To assess changes in any category between 2000 and 2019, we used the following formula: (Value in 2019 - Value in 2000)/Value in 2000. When examining alterations in age-standardized rates over this timeframe, we computed the annual percentage change (APC) along with its associated 95% confidence interval (CI) using the Joinpoint regression program, version 4.6.1.0, which is maintained by the Statistical Research and Applications Branch at the National Cancer Institute in Bethesda, MD. An increasing trend was identified when both the annualized rate of change and the lower boundary of its 95%CI were positive. Conversely, a decreasing trend was determined when the annualized rate of change and the upper limit were negative.

## Results

### Global burden of VID in young individuals

Globally in 2019, the numbers of VID-related cases, deaths, and DALYs in patients aged 15-49 years were estimated to be 32,628 (95%UI 22,861-49,024) cases, 3,869 (95%UI 3,482-4,351) deaths, and 201,099 (95%UI 181,017-226,729) DALYs attributable to VID, respectively. In 2019, the estimated VID age-standardized prevalence rate (ASPR), age-standardized death rate (ASDR), and age-standardized DALYs (ASDALYs) in young individuals were 0.83 (95%UI 0.58-1.25), 0.1 (95%UI 0.09-0.11), and 5.11 (95%UI 4.6-5.76), respectively (Table 1). From 2000-2019, ASPR increased, with an APC of 0.71 (95%CI 0.63-0.8,  $P<0.001$ ). In contrast, ASDR (APC -0.35%, 95%CI -0.45 to -0.26%;  $P<0.001$ ) and ASDALYs (APC -0.3%, 95%CI -0.38 to -0.23%;  $P<0.001$ ) decreased (Table 1).

### The burden of VID in young individuals, by sex

In 2019, the number of VID cases in females was estimated at 14,586 (95%UI 10,193-21,879), with 1626 (95%UI 1386-1989) deaths and 85,272 (95%UI 72,406-103,940) DALYs. There were 18,042 (95%UI 12,721-27,102) cases, 2243 (95%UI 2021-2468) deaths, and 115,827 (95%UI 104,489-127,940) DALYs in males aged 15-49 (Table 1). In the given period, ASPR in females increased with an APC of 0.59% (95%CI 0.46-0.72%,  $P<0.001$ ), whereas in males the increase had an APC of 0.82% (95%CI 0.75-0.89%,  $P<0.001$ ). In males, ASDR (APC -0.53%, 95%CI -0.62 to -0.44%;  $P<0.001$ ) and ASDALYs (APC -0.44%, 95%CI -0.52 to -0.37%;  $P<0.001$ ) decreased. In females, ASDR decreased (APC -0.12%, 95%CI -0.23 to -0.02%;  $P<0.025$ ), while ASDALYs remained stable.

### The burden of VID in young individuals, according to WHO region

The frequency of prevalence, deaths, and DALYs, as well as rates (ASPR, ASDR, and ASDALYs) of VID in young

individuals categorized by WHO region, are displayed in Table 1 and Fig. 1A-F. In 2019, the Americas region had the highest VID-related ASR prevalence in young individuals (ASPR 1.22, 95%UI 0.9-1.71) and deaths (ASDR 0.19, 95%UI 0.18-0.2). This region also had the highest VID-related DALYs in young individuals (ASDALYs 9.56, 95%UI 8.91-10.29) (Fig. 1B,1D,1F). Between 2000 and 2019, ASPR increased in all regions, with the highest increase observed in Southeast Asia (APC 2.17%, 95%CI 1.86-2.48%;  $P<0.001$ ). While ASDRs remained stable in Africa, Southeast Asia and the Western Pacific, they decreased in Europe (APC -0.91%, 95%CI -1.2 to -0.62%;  $P<0.001$ ) and the region of the Americas (APC -0.27%, 95%CI -0.38 to -0.16%;  $P<0.001$ ). However, ASDRs increased in the Eastern Mediterranean region (APC 0.85%, 95%CI 0.74-0.96%;  $P<0.001$ ). Similarly, there was a decrease or stability in ASDALYs attributable to VID in young individuals, except for the Eastern Mediterranean region, where the rates increased (APC 0.88%, 95%CI 0.78-0.99%;  $P<0.001$ ).

### The burden of VID in young individuals, by SDI

The data related to VID in young individuals, including cases, deaths, and DALYs, as well as ASPR, ASDR and ASDALYs stratified by SDI, are shown in Table 1. In 2019, the highest ASRs of VID cases (ASPR 2.11, 95%UI 1.52-2.99) were observed in high SDI strata, whereas the highest rates of death (ASDR 0.13, 95%UI 0.12-0.14) and DALYs (ASDALYs 6.36, 95%UI 5.86-6.91) in young individuals were observed in high-middle SDI countries (Fig. 2A-C). From 2000-2019, ASPR increased in all SDI strata. Low-middle SDI countries experienced the highest increase in ASPR (APC 1.86%, 95%CI 1.64-2.07%;  $P<0.001$ ). ASDR decreased in low (APC -0.27%, 95%CI -0.34 to -0.2%;  $P<0.001$ ), high-middle (APC -0.97%, 95%CI -1.19 to -0.74%;  $P<0.001$ ), and high (APC -0.81, 95%CI -0.93 to -0.69%;  $P<0.001$ ) SDI strata, but increased in low-middle SDI countries (APC 0.31%, 95%CI 0.03-0.59%;  $P=0.033$ ) and middle SDI countries (APC 0.31%, 95%CI 0.15-0.46%;  $P<0.001$ ). ASDALYs decreased in low (APC -0.24%, 95%CI -0.32 to -0.16%;  $P<0.001$ ), high-middle (APC -0.94%, 95%CI -1.14 to -0.74%;  $P<0.001$ ), and high (APC -0.67%, 95%CI -0.78 to -0.57%;  $P<0.001$ ) SDI, but increased in low-middle SDI countries (APC 0.3%, 95%CI 0.08-0.53%;  $P=0.008$ ), and middle SDI strata (APC 0.27%, 95%CI 0.12-0.42%;  $P<0.001$ ; Table 1).

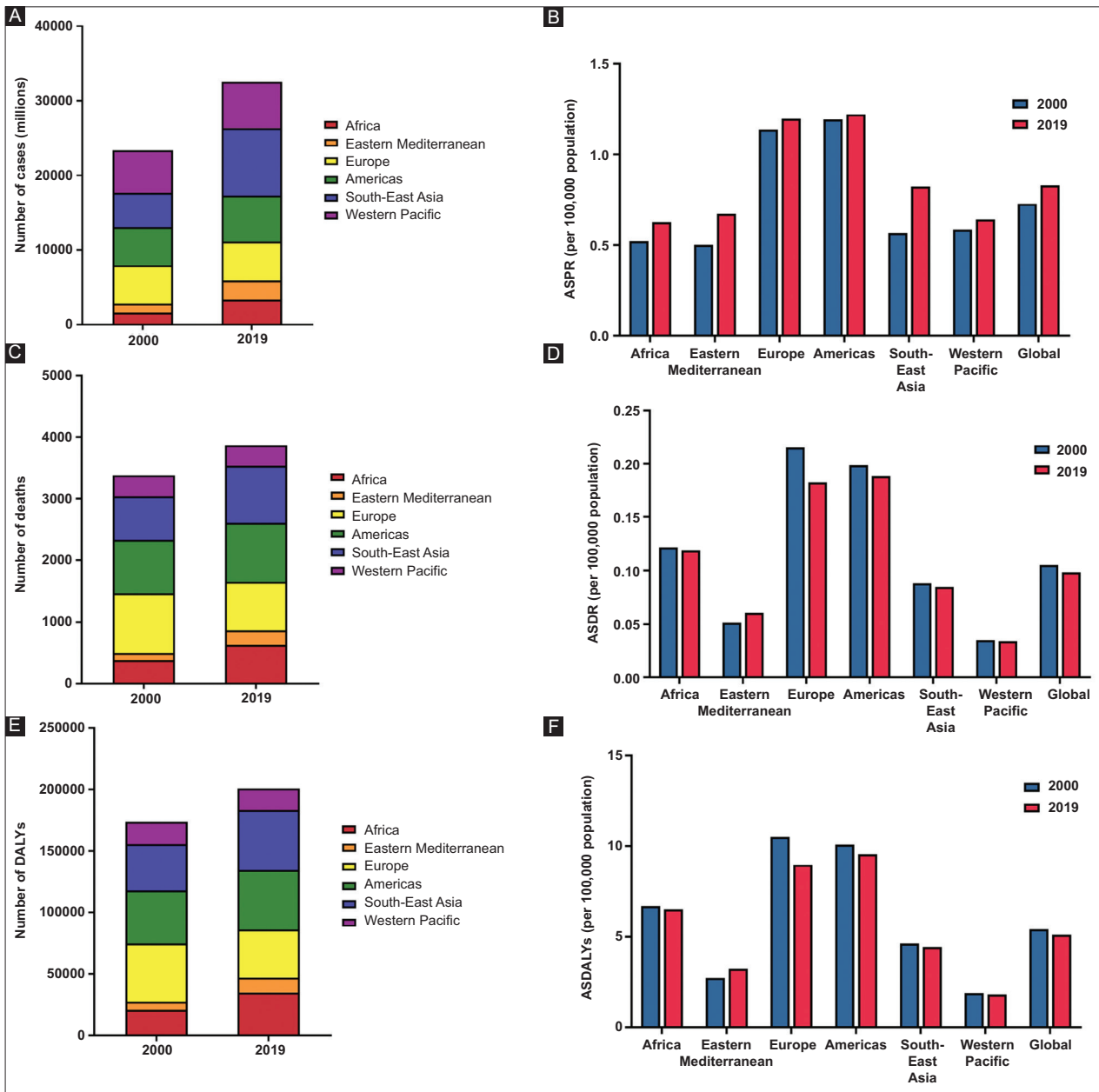
## Discussion

The present study is the first that comprehensively assesses the epidemiology of VID among young individuals over the past decades. In 2019, the global incidence of VID cases in young individuals exceeded 30,000. Our findings indicate a notably higher burden of this condition among males. Over 2 decades, we observed an upward trend in the prevalence rates of VID, coupled with an increase in mortality and disability

**Table 1** Summary of the burden of vascular Intestinal disorder in patients aged 15–49 years and temporal progression from 2000–2019

Parameter	Prevalence			Deaths			Disabilities					
	2019 Cases (95%UI)	2019 ASPR per 100,000 people (95%UI)	APC (95%UI)	P-value	2019 Deaths (95%UI)	2019 ASDR per 100,000 people (95%UI)	APC (95%UI)	P-value	2019 DALYs (95%UI)	2019 ASDALYs per 100,000 people (95%UI)	APC (95%UI)	P-value
Overall	32627.83 (22860.84 to 49024.1)	0.83 (0.58 to 1.25)	0.71 (0.63 to 0.8)	<0.001	3869.33 (3481.7 to 4351.41)	0.1 (0.09 to 0.11)	-0.35 (-0.45 to -0.26)	<0.001	201098.61 (181016.92 to 226729.44)	5.11 (4.6 to 5.76)	-0.3 (-0.38 to -0.23)	<0.001
Sex												
Female	14585.59 (10192.55 to 21878.53)	0.75 (0.52 to 1.12)	0.59 (0.46 to 0.72)	<0.001	1626.34 (1385.82 to 1989.01)	0.08 (0.07 to 0.1)	-0.12 (-0.23 to -0.02)	0.025	85271.92 (72405.61 to 103939.96)	4.38 (3.72 to 5.34)	-0.1 (-0.2 to 0)	0.052
Male	18042.23 (12720.94 to 27102.06)	0.91 (0.64 to 1.36)	0.82 (0.75 to 0.89)	<0.001	2242.99 (2020.84 to 2467.64)	0.11 (0.1 to 0.12)	-0.53 (-0.62 to -0.44)	<0.001	115826.69 (104489.44 to 127939.89)	5.82 (5.25 to 6.43)	-0.44 (-0.52 to -0.37)	<0.001
Region												
Africa	3333.37 (2192.14 to 5137.55)	0.63 (0.41 to 0.97)	1.02 (0.89 to 1.16)	<0.001	629.39 (483.04 to 780.37)	0.12 (0.09 to 0.15)	-0.07 (-0.18 to 0.04)	0.228	34631.59 (26848.54 to 43096.29)	6.52 (5.05 to 8.11)	-0.04 (-0.12 to 0.04)	0.296
Eastern Mediterranean	2387.43 (1746.63 to 4041.93)	0.67 (0.45 to 1.05)	1.61 (1.44 to 1.78)	<0.001	232.74 (169.35 to 336.26)	0.06 (0.04 to 0.09)	0.85 (0.74 to 0.96)	<0.001	12452.38 (9183.79 to 17816.04)	3.24 (2.39 to 4.63)	0.88 (0.78 to 0.99)	<0.001
Europe	5195.26 (3619.59 to 7715.73)	1.2 (0.83 to 1.78)	0.23 (0.14 to 0.32)	<0.001	790.56 (721.52 to 867.77)	0.18 (0.17 to 0.2)	-0.91 (-1.2 to -0.62)	<0.001	38965.69 (35752.95 to 42631.54)	8.98 (8.24 to 9.82)	-0.87 (-1.14 to -0.59)	<0.001
Americas	6185.07 (4534.45 to 8658.19)	1.22 (0.9 to 1.71)	0.14 (0.03 to 0.25)	0.016	951.91 (887.5 to 1020.32)	0.19 (0.18 to 0.2)	-0.27 (-0.38 to -0.16)	<0.001	48393.18 (45082.48 to 52112.17)	9.56 (8.91 to 10.29)	-0.24 (-0.34 to -0.14)	<0.001
Southeast Asia	9016.57 (6175.61 to 13875.66)	0.82 (0.56 to 1.27)	2.17 (1.86 to 2.48)	<0.001	929.56 (661.74 to 1278.87)	0.08 (0.06 to 0.12)	-0.19 (-0.53 to 0.15)	0.279	48729.24 (34857.42 to 65771.39)	4.45 (3.18 to 6)	-0.19 (-0.5 to 0.12)	0.222
Western Pacific	6249.29 (4285.06 to 9595.49)	0.64 (0.44 to 0.99)	0.5 (0.33 to 0.67)	<0.001	329.14 (274.08 to 373.21)	0.03 (0.03 to 0.04)	-0.06 (-0.27 to 0.16)	0.615	17612.41 (15022 to 19971.21)	1.81 (1.54 to 2.05)	-0.19 (-0.43 to 0.05)	0.116
Sociodemographic Index (SDI)												
Low SDI	3131.21 (2110.15 to 4817.85)	0.58 (0.39 to 0.89)	1.43 (1.27 to 1.6)	<0.001	559.53 (436 to 735.02)	0.1 (0.08 to 0.14)	-0.27 (-0.34 to -0.2)	<0.001	30074.37 (23416.67 to 39048.58)	5.57 (4.33 to 7.23)	-0.24 (-0.32 to -0.16)	<0.001
Low-middle SDI	6630.88 (4575.28 to 10262.95)	0.71 (0.49 to 1.1)	1.86 (1.64 to 2.07)	<0.001	944.75 (735.53 to 1237.8)	0.1 (0.08 to 0.13)	0.31 (0.03 to 0.59)	0.033	49585.92 (39099.6 to 64200.67)	5.31 (4.19 to 6.88)	0.3 (0.08 to 0.53)	0.008
Middle SDI	7471.29 (5077.94 to 11646.27)	0.59 (0.4 to 0.92)	1.51 (1.28 to 1.73)	<0.001	885.05 (809.8 to 968.22)	0.07 (0.06 to 0.08)	0.31 (0.15 to 0.46)	<0.001	45959.46 (42035.62 to 50415.19)	3.65 (3.33 to 4)	0.27 (0.12 to 0.42)	<0.001
High-middle SDI	5463.38 (3787.68 to 8238.24)	0.75 (0.52 to 1.13)	0.18 (0.12 to 0.24)	<0.001	936.67 (862.64 to 1021.34)	0.13 (0.12 to 0.14)	-0.97 (-1.19 to -0.74)	<0.001	46335.66 (42678.89 to 50361.32)	6.36 (5.86 to 6.91)	-0.94 (-1.14 to -0.74)	<0.001
High SDI	9917.46 (7119.85 to 14047.41)	2.11 (1.52 to 2.99)	0.5 (0.47 to 0.53)	<0.001	541.27 (515.75 to 567.08)	0.12 (0.11 to 0.12)	-0.81 (-0.93 to -0.69)	<0.001	29039.13 (27227.45 to 31302.02)	6.18 (5.79 to 6.66)	-0.67 (-0.78 to -0.57)	<0.001

APC, annual percentage change; ASDALYs, age-standardized disability-adjusted life-years; ASDR, age-standardized death rates; ASPR, age-standardized prevalence rate; CI, confidence interval; UI, uncertainty interval

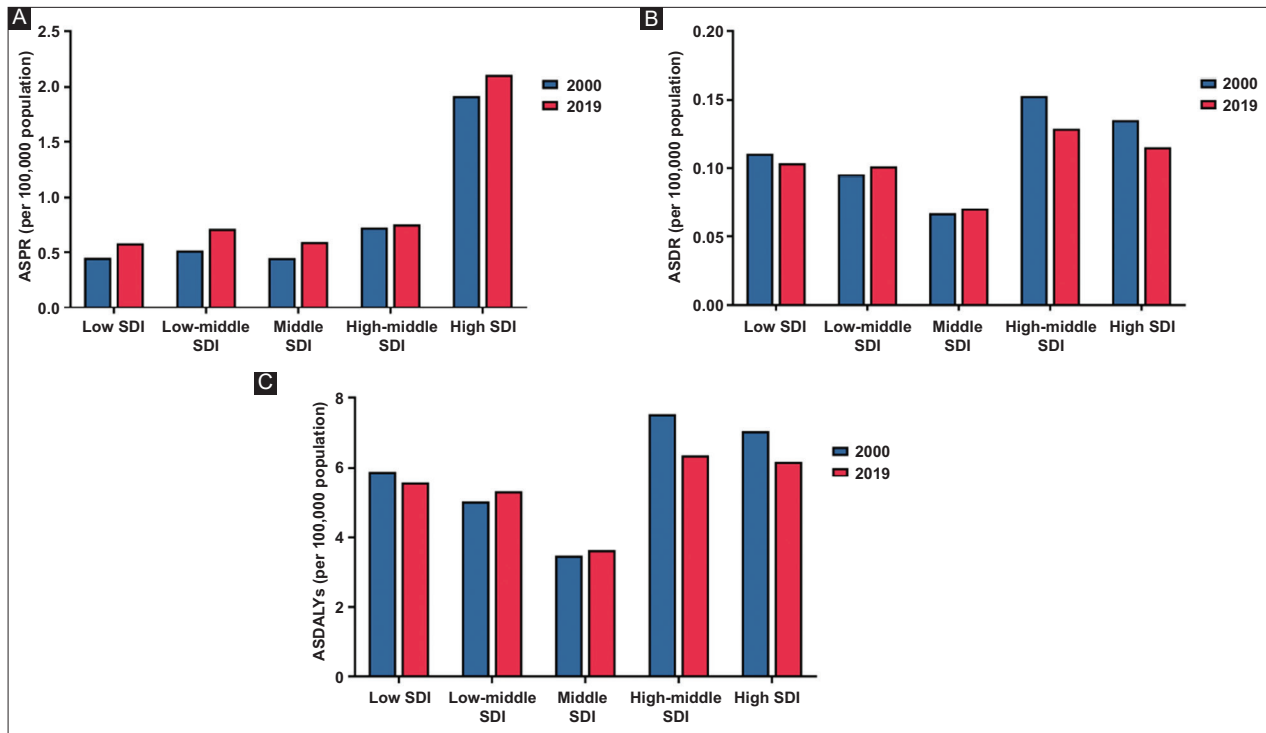


**Figure 1** (A) The number of cases of vascular intestinal disorder (VID) in patients aged 15-49 years: cases in 2000 and 2019, stratified by World Health Organization (WHO) region. (B) Age-standardized prevalence rates attributable to VID in patients aged 15-49 in 2000 and 2019, stratified by WHO region. (C) The number of VID-related deaths in patients aged 15-49 in 2000 and 2019, stratified by the WHO region. (D) Age-standardized death rates attributable to VID in patients aged 15-49 in 2000 and 2019, stratified by WHO region. (E) The number of VID-related disabilities in patients aged 15-49 in 2000 and 2019, stratified by WHO region. (F) Age-standardized disability-adjusted life-years attributable to VID in patients aged 15-49 in 2000 and 2019, stratified by WHO region  
 ASPR, age standardized prevalence rate; ASDR, age standardized death rate; ASDALYs, age standardized disability adjusted life years; DALYs, disability adjusted life years

rates, particularly prominent in the Eastern Mediterranean region.

Consistent with earlier investigations, our study uncovered a comparatively lower disease burden associated with VID in young individuals, compared to the broader population and the elderly demographic [9]. Nonetheless, it is imperative not to underestimate the significance of VID in young

individuals. Given its high mortality rate, prompt and accurate diagnosis and timely therapeutic interventions stand as critical cornerstones in addressing this condition [11]. Moreover, it is worth noting that, while some risk factors for VID overlap with those observed in older individuals, such as atherosclerotic risk factors, there are unique contributors in the younger demographic [6]. For instance, autoimmune



**Figure 2** (A) Age-standardized prevalence rates attributable to vascular intestinal disorder (VID) in patients aged 15-49 in 2000 and 2019, stratified by Sociodemographic Index (SDI). (B) Age-standardized death rates attributable to VID in patients aged 15-49 in 2000 and 2019, stratified by SDI. (C) Age-standardized disability-adjusted life years attributable to VID in patients aged 15-49 in 2000 and 2019, stratified by SDI. ASPR, age standardized prevalence rate; ASDR, age standardized death rate; ASDALYs, age standardized disability adjusted life years; SDI, sociodemographic index

diseases such as systemic lupus erythematosus heighten the risk of mesenteric ischemia, a subtype of VID [12,13]. In terms of sex, our study found that the burden of VID in males was lower than in females, which was consistent with previous study conducted in the older population using the same database [9,14]. However, previous cohort studies reported that the burden was higher in females compared to males; this could be due to differences in the methodologies used in the 2 studies [15,17]. Importantly, these studies were conducted in the general population, which patients with VID tend to be middle-aged or older individuals, rather than young individuals [16]. Therefore, it is plausible to consider VID in young individuals as a potentially distinct entity, albeit sharing some etiological factors with older individuals. This area remains relatively unexplored, warranting further research to elucidate the precise distinctions and commonalities between these populations.

In addition to the noted increase in the age-adjusted prevalence rate of VID in young individuals, a simultaneous decrease in age-adjusted death and DALY rates was observed. This trend held true across most regions, except for the Eastern Mediterranean region, where rising mortality and DALYs rates were observed. Regarding pathophysiology, regardless of etiology, VID arises from an imbalance between the oxygenation supply and demand of the intestine, and the etiology includes blood loss, thromboembolism, hypercoagulable state, substance use (such as cocaine-

induced vasoconstriction), and atherosclerotic risk factors [1,18,19]. Therefore, the upsurge in prevalence can be partially attributed to shifts in the landscape of metabolic risk factors and changing demographics, such as the increasing prevalence of obesity among young populations over the past few decades [19,20]. Nevertheless, the heterogeneity of the ICD-10 code in this umbrella term makes it difficult to quantify the exact root cause. However, it is important to note that the pathophysiology of VID is heterogeneous, varying between conditions such as mesenteric ischemia and angiodysplasia of the colon. Despite some shared pathophysiological aspects, there are also non-overlapping features. A notable limitation is that GBD 2019 combines these conditions into a single category, potentially masking crucial distinctions between them. To address this knowledge gap, there is a clear need for more extensive cohort studies that can provide more accurate and granular epidemiological and pathophysiological data. Such research endeavors are crucial to unravelling the complexities of VID in young individuals and developing targeted interventions for specific subtypes.

Our study has illuminated significant regional disparities in the burden of VID among young individuals. The Americas have emerged as the region with the highest burden of this condition, while Southeast Asia has experienced the most substantial increase in its prevalence. Notably, mortality and DALY rates have generally declined across regions, except for an observed increase in the Eastern

Mediterranean region. These variations may be attributed to differences in healthcare infrastructure and detection systems for this condition, and an increased prevalence of metabolic syndrome in these regions [21]. However, it is essential to underscore the heterogeneous nature of the etiology of VID, even when classified under the same ICD-10 code. The underlying pathophysiology can vary significantly and may include factors such as vasculitis, hypercoagulable states, trauma, atherosclerosis and aneurysms. Further comprehensive research is needed to better understand these distinct entities and their respective contributions to the overall burden. Further studies, including the next cycle of GBD that provided more granularity of the individual cause under the umbrella term of VID, could be highly beneficial and help strategize further trajectories in the field. Moreover, while the increasing burden of VID in the Americas deserves attention, we must not let it overshadow the declining trends observed in other regions. It is crucial to acknowledge the methodological approach of the GBD study, which estimates mortality and morbidity due to a single cause of disease. In the case of VID, it is often a consequence of other underlying diseases rather than a primary cause.

Therefore, there is an immediate and critical need for the development of policies and strategies to mitigate the burden of VID among young individuals, especially in regions where the burden is high and increasing. These efforts should consider the multifaceted nature of the condition and the specific risk factors contributing to its occurrence.

There are a few limitations in our research that need to be mentioned. Firstly, our study critically relies on estimates sourced from the GBD study, and consequently, it inherits any inherent constraints associated with these estimates. The precision of GBD estimates is intrinsically tied to the quality and comprehensiveness of each country's vital registration systems. In regions with deficient data sources, GBD estimates predominantly hinge on modeling methodologies, predictive variables, historical trends or extrapolations from neighboring geographic areas. Secondly, the elusive nature of VID, characterized by diagnostic challenges, may introduce an element of underestimation in portraying its genuine burden. Thirdly, it is essential to acknowledge that the GBD estimation methods, predominantly grounded in ICD-10, can potentially introduce an inherent underestimation of the actual disease burden. Lastly, our descriptive study possesses limitations regarding granularity. Specifically, it lacks detailed insights into various risk factors that could differentiate conditions like angiodysplasia from mesenteric ischemia. Such differentiations are pivotal for comprehensively understanding the burden associated with these distinct disorders [22].

In summary, the prevalence of VID amongst young individuals witnessed a significant surge from 2000 to 2019, with a more pronounced burden in males. Nearly every nation had a marked increase in VID prevalence over 2 decades. This rise should trigger significant alarm, and the development of strategies to deal with the possible risk factors.

## Summary Box

### What is already known:

- Vascular intestinal disorder (VID) is a condition with high mortality and morbidity
- VID commonly occurs in older individuals, but little is known about the epidemiology of this condition in young individuals

### What the new findings are:

- Prevalence rates of young individuals living with VID are increasing globally
- Mortality rates declined globally over the period 2000-2019, but increased in people living in the Eastern Mediterranean region
- Young males have a higher prevalence compared to young females

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## Supplementary material

**Supplementary Table 1** Sociodemographic Index values for all estimated GBD 2019 locations, 2010-2019

Location	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Global	0.607	0.612	0.616	0.621	0.626	0.631	0.635	0.641	0.647	0.651
Central Europe, eastern Europe, and central Asia	0.732	0.735	0.738	0.742	0.745	0.748	0.751	0.754	0.758	0.76
Central Asia	0.622	0.627	0.632	0.637	0.642	0.647	0.651	0.655	0.659	0.663
Armenia	0.658	0.662	0.666	0.67	0.673	0.676	0.679	0.682	0.686	0.689
Azerbaijan	0.637	0.645	0.652	0.658	0.664	0.669	0.673	0.677	0.68	0.683
Georgia	0.665	0.668	0.672	0.676	0.68	0.684	0.688	0.693	0.697	0.702
Kazakhstan	0.688	0.692	0.696	0.7	0.704	0.708	0.712	0.716	0.72	0.723
Kyrgyzstan	0.56	0.563	0.565	0.569	0.574	0.578	0.583	0.588	0.592	0.596
Mongolia	0.566	0.57	0.575	0.579	0.584	0.588	0.592	0.597	0.601	0.606
Tajikistan	0.495	0.5	0.505	0.511	0.516	0.521	0.526	0.531	0.535	0.539
Turkmenistan	0.616	0.622	0.628	0.635	0.642	0.648	0.654	0.66	0.666	0.67
Uzbekistan	0.578	0.584	0.59	0.597	0.603	0.609	0.616	0.622	0.627	0.631
Central Europe	0.756	0.76	0.764	0.768	0.771	0.775	0.778	0.781	0.785	0.788
Albania	0.636	0.64	0.645	0.651	0.658	0.664	0.669	0.674	0.678	0.681
Bosnia and Herzegovina	0.682	0.686	0.691	0.695	0.698	0.702	0.706	0.71	0.714	0.718
Bulgaria	0.733	0.737	0.74	0.743	0.746	0.75	0.752	0.755	0.76	0.764
Croatia	0.763	0.767	0.77	0.774	0.777	0.781	0.784	0.788	0.791	0.794
Czech Republic	0.813	0.816	0.818	0.819	0.82	0.82	0.82	0.822	0.825	0.828
Hungary	0.772	0.773	0.774	0.774	0.775	0.778	0.781	0.784	0.788	0.791
Montenegro	0.754	0.759	0.764	0.768	0.773	0.777	0.78	0.784	0.788	0.791
North Macedonia	0.709	0.713	0.717	0.722	0.726	0.73	0.734	0.738	0.741	0.744
Poland	0.763	0.77	0.775	0.78	0.784	0.788	0.791	0.795	0.798	0.802
Romania	0.726	0.729	0.734	0.74	0.741	0.744	0.747	0.752	0.756	0.76
Serbia	0.729	0.735	0.739	0.744	0.748	0.753	0.756	0.76	0.763	0.767
Slovakia	0.789	0.794	0.798	0.801	0.803	0.803	0.804	0.805	0.808	0.812
Slovenia	0.822	0.824	0.825	0.827	0.829	0.831	0.833	0.835	0.838	0.84
Eastern Europe	0.762	0.765	0.768	0.772	0.777	0.781	0.785	0.788	0.791	0.793
Belarus	0.703	0.709	0.713	0.719	0.725	0.73	0.734	0.738	0.742	0.745
Estonia	0.798	0.804	0.809	0.813	0.817	0.821	0.825	0.829	0.833	0.835
Latvia	0.797	0.798	0.801	0.803	0.804	0.805	0.809	0.813	0.817	0.82
Lithuania	0.797	0.801	0.808	0.813	0.817	0.822	0.829	0.835	0.839	0.843
Moldova	0.644	0.651	0.658	0.665	0.672	0.677	0.683	0.688	0.693	0.696
Russia	0.775	0.777	0.779	0.784	0.788	0.793	0.797	0.801	0.803	0.805
Ukraine	0.713	0.718	0.721	0.725	0.727	0.729	0.73	0.732	0.734	0.736
High income	0.82	0.823	0.826	0.829	0.832	0.835	0.839	0.842	0.845	0.847
Australasia	0.81	0.812	0.816	0.821	0.825	0.828	0.832	0.835	0.837	0.84
Australia	0.809	0.812	0.815	0.82	0.824	0.828	0.832	0.834	0.837	0.839
New Zealand	0.809	0.812	0.816	0.821	0.825	0.828	0.832	0.835	0.838	0.84
High-income Asia Pacific	0.847	0.85	0.853	0.856	0.859	0.862	0.865	0.868	0.871	0.873

(Contd...)

Supplementary Table 1 (Continued)

Location	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Brunei	0.789	0.793	0.797	0.801	0.806	0.809	0.813	0.817	0.82	0.823
Japan	0.848	0.85	0.853	0.855	0.857	0.86	0.862	0.865	0.867	0.87
Aichi	0.859	0.861	0.864	0.866	0.869	0.871	0.874	0.876	0.879	0.881
Akita	0.806	0.808	0.811	0.813	0.816	0.819	0.822	0.824	0.827	0.83
Aomori	0.8	0.803	0.806	0.809	0.811	0.814	0.817	0.82	0.823	0.826
Chiba	0.842	0.844	0.846	0.848	0.85	0.852	0.855	0.857	0.859	0.861
Ehime	0.818	0.82	0.822	0.824	0.827	0.83	0.833	0.836	0.838	0.841
Fukui	0.833	0.836	0.838	0.84	0.842	0.844	0.846	0.849	0.851	0.854
Fukuoka	0.837	0.84	0.842	0.844	0.846	0.848	0.85	0.853	0.855	0.858
Fukushima	0.812	0.814	0.816	0.818	0.821	0.823	0.826	0.83	0.833	0.836
Gifu	0.831	0.833	0.836	0.838	0.84	0.842	0.845	0.847	0.849	0.852
Gunma	0.833	0.836	0.838	0.841	0.844	0.847	0.85	0.852	0.855	0.858
Hiroshima	0.843	0.846	0.849	0.851	0.854	0.857	0.859	0.862	0.865	0.868
Hokkaidō	0.823	0.825	0.827	0.829	0.831	0.833	0.836	0.838	0.841	0.843
Hyōgo	0.845	0.848	0.85	0.852	0.854	0.857	0.859	0.862	0.864	0.866
Ibaraki	0.834	0.837	0.839	0.842	0.844	0.847	0.85	0.852	0.855	0.858
Ishikawa	0.835	0.837	0.839	0.841	0.843	0.846	0.848	0.851	0.854	0.856
Iwate	0.803	0.806	0.808	0.811	0.814	0.818	0.821	0.824	0.828	0.831
Kagawa	0.831	0.834	0.837	0.839	0.842	0.844	0.847	0.85	0.853	0.855
Kagoshima	0.806	0.808	0.811	0.813	0.816	0.819	0.822	0.825	0.828	0.831
Kanagawa	0.867	0.869	0.87	0.872	0.873	0.875	0.877	0.878	0.88	0.882
Kōchi	0.807	0.81	0.812	0.815	0.817	0.82	0.823	0.826	0.829	0.832
Kumamoto	0.808	0.811	0.813	0.816	0.819	0.822	0.825	0.828	0.831	0.834
Kyōto	0.855	0.857	0.859	0.861	0.863	0.865	0.868	0.87	0.872	0.875
Mie	0.832	0.835	0.838	0.841	0.844	0.847	0.85	0.853	0.856	0.859
Miyagi	0.831	0.834	0.837	0.839	0.842	0.845	0.848	0.851	0.854	0.857
Miyazaki	0.799	0.802	0.805	0.807	0.81	0.814	0.817	0.82	0.823	0.826
Nagano	0.835	0.837	0.839	0.841	0.843	0.845	0.848	0.851	0.853	0.856
Nagasaki	0.801	0.804	0.807	0.81	0.813	0.815	0.818	0.821	0.824	0.827
Nara	0.834	0.836	0.837	0.839	0.841	0.843	0.845	0.847	0.849	0.851
Niigata	0.821	0.823	0.826	0.829	0.832	0.834	0.837	0.84	0.842	0.845
Ōita	0.825	0.827	0.83	0.832	0.834	0.836	0.839	0.841	0.844	0.847
Okayama	0.838	0.841	0.843	0.845	0.848	0.85	0.853	0.855	0.858	0.861
Okinawa	0.795	0.798	0.8	0.802	0.804	0.807	0.81	0.813	0.816	0.819
Ōsaka	0.856	0.858	0.86	0.862	0.864	0.866	0.869	0.871	0.873	0.875
Saga	0.812	0.814	0.816	0.818	0.82	0.822	0.825	0.828	0.831	0.834
Saitama	0.837	0.839	0.841	0.843	0.845	0.847	0.849	0.851	0.854	0.856
Shiga	0.853	0.855	0.858	0.86	0.862	0.864	0.867	0.869	0.872	0.874
Shimane	0.809	0.812	0.815	0.818	0.821	0.824	0.827	0.83	0.833	0.836
Shizuoka	0.84	0.843	0.845	0.848	0.851	0.853	0.856	0.858	0.861	0.864
Tochigi	0.834	0.836	0.839	0.841	0.844	0.847	0.851	0.854	0.857	0.859
Tokushima	0.828	0.831	0.833	0.836	0.839	0.842	0.845	0.848	0.851	0.854

(Contd...)

Supplementary Table 1 (Continued)

Location	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Tōkyō	0.913	0.915	0.917	0.918	0.92	0.921	0.923	0.924	0.925	0.927
Tottori	0.815	0.816	0.818	0.82	0.822	0.825	0.827	0.83	0.833	0.835
Toyama	0.842	0.844	0.846	0.848	0.85	0.853	0.855	0.858	0.861	0.863
Wakayama	0.819	0.822	0.825	0.828	0.832	0.835	0.838	0.842	0.845	0.848
Yamagata	0.81	0.813	0.816	0.818	0.821	0.824	0.827	0.83	0.833	0.835
Yamaguchi	0.83	0.833	0.836	0.839	0.841	0.844	0.847	0.849	0.852	0.855
Yamanashi	0.836	0.839	0.841	0.843	0.846	0.848	0.851	0.853	0.856	0.858
South Korea	0.842	0.846	0.851	0.855	0.859	0.863	0.867	0.871	0.875	0.878
Singapore	0.835	0.839	0.843	0.847	0.85	0.852	0.855	0.858	0.86	0.861
High-income North America	0.834	0.837	0.841	0.844	0.847	0.85	0.854	0.857	0.859	0.86
Canada	0.851	0.853	0.856	0.859	0.861	0.864	0.867	0.869	0.871	0.873
Greenland	0.728	0.734	0.737	0.74	0.743	0.747	0.751	0.756	0.759	0.761
USA	0.832	0.835	0.839	0.842	0.845	0.849	0.853	0.856	0.858	0.859
Alabama	0.801	0.805	0.809	0.811	0.812	0.814	0.816	0.818	0.819	0.819
Alaska	0.817	0.821	0.826	0.83	0.834	0.839	0.844	0.848	0.85	0.851
Arizona	0.81	0.814	0.818	0.822	0.825	0.829	0.834	0.838	0.84	0.842
Arkansas	0.783	0.787	0.79	0.794	0.796	0.799	0.803	0.807	0.809	0.811
California	0.838	0.841	0.845	0.848	0.852	0.856	0.861	0.865	0.868	0.87
Colorado	0.847	0.851	0.855	0.859	0.863	0.867	0.871	0.874	0.876	0.877
Connecticut	0.881	0.884	0.887	0.89	0.893	0.896	0.899	0.901	0.902	0.902
Delaware	0.843	0.847	0.85	0.852	0.854	0.857	0.859	0.861	0.862	0.863
Washington, DC	0.876	0.877	0.879	0.88	0.881	0.883	0.884	0.886	0.886	0.886
Florida	0.832	0.836	0.839	0.842	0.844	0.846	0.85	0.852	0.854	0.856
Georgia	0.812	0.817	0.821	0.825	0.828	0.832	0.835	0.838	0.84	0.841
Hawaii	0.836	0.84	0.843	0.847	0.85	0.853	0.856	0.858	0.859	0.86
Idaho	0.807	0.81	0.813	0.815	0.817	0.82	0.823	0.825	0.827	0.827
Illinois	0.848	0.851	0.854	0.858	0.86	0.863	0.867	0.869	0.871	0.872
Indiana	0.812	0.816	0.819	0.823	0.826	0.829	0.833	0.835	0.837	0.838
Iowa	0.833	0.836	0.84	0.843	0.847	0.851	0.856	0.859	0.862	0.864
Kansas	0.822	0.826	0.83	0.835	0.84	0.845	0.85	0.854	0.857	0.858
Kentucky	0.79	0.794	0.797	0.8	0.803	0.806	0.81	0.812	0.814	0.815
Louisiana	0.794	0.798	0.801	0.805	0.808	0.812	0.817	0.82	0.822	0.823
Maine	0.84	0.842	0.845	0.848	0.85	0.853	0.856	0.858	0.86	0.862
Maryland	0.867	0.87	0.873	0.876	0.878	0.881	0.884	0.885	0.886	0.887
Massachusetts	0.889	0.892	0.894	0.897	0.899	0.902	0.904	0.906	0.907	0.907
Michigan	0.836	0.838	0.84	0.843	0.845	0.849	0.854	0.858	0.861	0.863
Minnesota	0.86	0.863	0.866	0.87	0.873	0.876	0.879	0.882	0.884	0.886
Mississippi	0.774	0.779	0.784	0.789	0.792	0.796	0.8	0.803	0.804	0.805
Missouri	0.818	0.821	0.825	0.828	0.831	0.834	0.838	0.841	0.843	0.844
Montana	0.823	0.826	0.829	0.833	0.837	0.842	0.847	0.851	0.854	0.856
Nebraska	0.833	0.836	0.84	0.845	0.849	0.853	0.857	0.86	0.862	0.862

(Contd...)

**Supplementary Table 1** (Continued)

Location	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Nevada	0.822	0.825	0.827	0.829	0.829	0.83	0.832	0.834	0.834	0.835
New Hampshire	0.874	0.877	0.88	0.883	0.886	0.89	0.893	0.895	0.897	0.898
New Jersey	0.872	0.875	0.878	0.88	0.883	0.886	0.888	0.89	0.892	0.892
New Mexico	0.793	0.798	0.803	0.807	0.811	0.815	0.819	0.823	0.825	0.826
New York	0.863	0.866	0.869	0.872	0.875	0.878	0.881	0.883	0.884	0.884
North Carolina	0.813	0.817	0.822	0.826	0.829	0.832	0.835	0.836	0.837	0.838
North Dakota	0.832	0.835	0.84	0.846	0.853	0.861	0.868	0.873	0.876	0.876
Ohio	0.823	0.826	0.829	0.832	0.835	0.838	0.841	0.843	0.845	0.846
Oklahoma	0.793	0.797	0.801	0.805	0.808	0.813	0.818	0.823	0.826	0.827
Oregon	0.838	0.842	0.845	0.848	0.852	0.856	0.86	0.864	0.866	0.868
Pennsylvania	0.846	0.849	0.852	0.855	0.857	0.861	0.864	0.866	0.868	0.87
Rhode Island	0.86	0.863	0.866	0.869	0.872	0.875	0.877	0.879	0.881	0.882
South Carolina	0.807	0.811	0.816	0.82	0.823	0.826	0.828	0.83	0.831	0.832
South Dakota	0.817	0.82	0.824	0.828	0.833	0.838	0.843	0.847	0.849	0.85
Tennessee	0.795	0.8	0.805	0.81	0.815	0.82	0.823	0.826	0.827	0.827
Texas	0.794	0.799	0.803	0.808	0.812	0.818	0.824	0.83	0.833	0.835
Utah	0.818	0.822	0.827	0.831	0.834	0.839	0.843	0.847	0.849	0.851
Vermont	0.864	0.866	0.869	0.872	0.875	0.879	0.883	0.885	0.887	0.889
Virginia	0.854	0.858	0.861	0.864	0.867	0.869	0.872	0.874	0.876	0.877
Washington	0.85	0.853	0.856	0.86	0.863	0.866	0.87	0.873	0.875	0.876
West Virginia	0.783	0.786	0.789	0.793	0.797	0.802	0.806	0.809	0.811	0.812
Wisconsin	0.844	0.848	0.851	0.855	0.858	0.861	0.864	0.866	0.868	0.869
Wyoming	0.829	0.833	0.837	0.84	0.843	0.847	0.85	0.853	0.855	0.856
Southern Latin America	0.676	0.681	0.686	0.689	0.692	0.701	0.71	0.716	0.719	0.721
Argentina	0.665	0.67	0.674	0.677	0.679	0.687	0.696	0.702	0.706	0.708
Chile	0.706	0.712	0.719	0.724	0.728	0.738	0.747	0.753	0.756	0.759
Uruguay	0.653	0.658	0.663	0.668	0.673	0.678	0.684	0.688	0.693	0.697
Western Europe	0.817	0.821	0.824	0.827	0.83	0.832	0.835	0.838	0.841	0.843
Andorra	0.876	0.879	0.881	0.883	0.885	0.887	0.889	0.891	0.892	0.894
Austria	0.826	0.83	0.833	0.835	0.838	0.839	0.841	0.844	0.847	0.849
Belgium	0.82	0.824	0.829	0.834	0.837	0.841	0.843	0.846	0.849	0.851
Cyprus	0.82	0.824	0.827	0.829	0.831	0.832	0.834	0.836	0.838	0.841
Denmark	0.87	0.873	0.875	0.878	0.88	0.882	0.884	0.886	0.888	0.89
Finland	0.828	0.831	0.834	0.837	0.84	0.844	0.848	0.851	0.853	0.856
France	0.806	0.809	0.812	0.815	0.819	0.822	0.826	0.829	0.832	0.834
Germany	0.878	0.881	0.883	0.886	0.888	0.89	0.892	0.894	0.896	0.898
Greece	0.779	0.782	0.785	0.786	0.786	0.787	0.788	0.79	0.792	0.794
Iceland	0.846	0.847	0.847	0.848	0.85	0.854	0.858	0.863	0.866	0.869
Ireland	0.831	0.835	0.839	0.842	0.845	0.85	0.854	0.859	0.864	0.867
Israel	0.781	0.784	0.787	0.79	0.792	0.794	0.796	0.798	0.8	0.803
Italy	0.78	0.782	0.784	0.787	0.789	0.791	0.794	0.796	0.798	0.801
Luxembourg	0.872	0.874	0.877	0.88	0.883	0.886	0.889	0.892	0.894	0.895

(Contd...)

Supplementary Table 1 (Continued)

Location	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Malta	0.764	0.768	0.772	0.775	0.779	0.784	0.788	0.793	0.797	0.801
Monaco	0.886	0.888	0.89	0.892	0.893	0.895	0.897	0.899	0.901	0.902
The Netherlands	0.861	0.864	0.866	0.869	0.871	0.874	0.876	0.878	0.881	0.883
Norway	0.885	0.889	0.893	0.896	0.9	0.903	0.907	0.91	0.912	0.913
Portugal	0.709	0.714	0.718	0.722	0.726	0.729	0.732	0.736	0.739	0.743
San Marino	0.872	0.874	0.876	0.877	0.879	0.881	0.882	0.882	0.883	0.884
Spain	0.743	0.746	0.749	0.752	0.754	0.756	0.759	0.761	0.764	0.767
Sweden	0.849	0.852	0.855	0.858	0.86	0.863	0.865	0.868	0.87	0.872
Stockholm	0.886	0.889	0.891	0.893	0.895	0.897	0.899	0.901	0.903	0.904
Sweden except Stockholm	0.838	0.841	0.844	0.846	0.849	0.851	0.853	0.856	0.858	0.86
Switzerland	0.912	0.914	0.917	0.919	0.921	0.922	0.924	0.926	0.928	0.929
United Kingdom	0.816	0.82	0.825	0.83	0.834	0.837	0.839	0.842	0.845	0.847
England	0.82	0.823	0.828	0.833	0.837	0.84	0.842	0.845	0.848	0.85
East Midlands	0.796	0.8	0.804	0.809	0.813	0.816	0.819	0.821	0.824	0.826
Derby	0.805	0.809	0.814	0.821	0.825	0.829	0.832	0.835	0.838	0.841
Derbyshire	0.779	0.783	0.789	0.795	0.799	0.803	0.806	0.809	0.811	0.814
Leicester	0.797	0.801	0.805	0.809	0.812	0.815	0.817	0.819	0.821	0.823
Leicestershire	0.819	0.822	0.826	0.83	0.833	0.835	0.838	0.84	0.842	0.845
Lincolnshire	0.777	0.781	0.786	0.791	0.795	0.799	0.802	0.804	0.807	0.81
Northamptonshire	0.795	0.799	0.804	0.81	0.814	0.817	0.82	0.822	0.825	0.827
Nottingham	0.828	0.832	0.836	0.84	0.842	0.844	0.846	0.848	0.85	0.852
Nottinghamshire	0.781	0.784	0.789	0.794	0.797	0.8	0.803	0.806	0.809	0.811
Rutland	0.821	0.824	0.827	0.831	0.834	0.836	0.838	0.84	0.842	0.844
East of England	0.814	0.817	0.822	0.827	0.83	0.833	0.836	0.839	0.841	0.844
Bedford	0.818	0.821	0.825	0.83	0.834	0.836	0.839	0.842	0.844	0.847
Cambridgeshire	0.851	0.854	0.858	0.862	0.865	0.868	0.87	0.872	0.875	0.877
Central Bedfordshire	0.811	0.815	0.819	0.824	0.827	0.83	0.833	0.836	0.839	0.841
Essex	0.805	0.809	0.813	0.817	0.821	0.823	0.825	0.828	0.83	0.833
Hertfordshire	0.851	0.854	0.857	0.862	0.865	0.867	0.87	0.872	0.875	0.877
Luton	0.803	0.807	0.812	0.817	0.82	0.823	0.825	0.828	0.83	0.832
Norfolk	0.793	0.796	0.801	0.806	0.81	0.813	0.815	0.818	0.821	0.823
Peterborough	0.78	0.785	0.791	0.798	0.802	0.806	0.809	0.813	0.816	0.818
Southend-on-Sea	0.783	0.787	0.792	0.797	0.8	0.803	0.805	0.807	0.81	0.812
Suffolk	0.794	0.799	0.804	0.81	0.813	0.816	0.819	0.822	0.824	0.827
Thurrock	0.776	0.78	0.784	0.789	0.792	0.794	0.796	0.799	0.801	0.804
Greater London	0.871	0.874	0.878	0.883	0.886	0.888	0.89	0.892	0.894	0.895
Barking and Dagenham	0.751	0.756	0.761	0.768	0.773	0.777	0.78	0.783	0.787	0.79
Barnet	0.852	0.855	0.859	0.863	0.866	0.869	0.872	0.874	0.876	0.878
Bexley	0.799	0.803	0.807	0.812	0.817	0.82	0.824	0.827	0.83	0.833
Brent	0.824	0.827	0.832	0.837	0.84	0.842	0.844	0.846	0.848	0.851
Bromley	0.835	0.837	0.841	0.844	0.847	0.849	0.852	0.854	0.856	0.858
Camden	0.917	0.92	0.922	0.925	0.926	0.928	0.929	0.93	0.931	0.931

(Contd...)

Supplementary Table 1 (Continued)

Location	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Croydon	0.816	0.818	0.822	0.826	0.829	0.831	0.833	0.835	0.838	0.84
Ealing	0.842	0.845	0.849	0.854	0.858	0.862	0.865	0.868	0.87	0.872
Enfield	0.806	0.81	0.815	0.82	0.823	0.826	0.829	0.831	0.834	0.836
Greenwich	0.805	0.808	0.813	0.818	0.822	0.825	0.827	0.83	0.832	0.834
Hackney	0.853	0.858	0.864	0.87	0.873	0.876	0.877	0.879	0.881	0.882
Hammersmith and Fulham	0.912	0.914	0.917	0.92	0.922	0.924	0.925	0.927	0.928	0.929
Haringey	0.832	0.835	0.84	0.845	0.848	0.851	0.854	0.856	0.858	0.86
Harrow	0.834	0.836	0.839	0.843	0.845	0.847	0.848	0.85	0.852	0.854
Havering	0.793	0.796	0.8	0.805	0.808	0.811	0.814	0.817	0.82	0.823
Hillingdon	0.856	0.859	0.863	0.868	0.871	0.874	0.877	0.879	0.881	0.882
Hounslow	0.85	0.854	0.858	0.864	0.869	0.873	0.876	0.88	0.883	0.885
Islington	0.9	0.903	0.906	0.909	0.911	0.913	0.914	0.916	0.917	0.918
Kensington and Chelsea	0.926	0.929	0.931	0.934	0.935	0.937	0.938	0.939	0.94	0.941
Kingston upon Thames	0.884	0.886	0.888	0.891	0.893	0.895	0.896	0.898	0.9	0.902
Lambeth	0.878	0.881	0.886	0.89	0.894	0.897	0.899	0.902	0.904	0.906
Lewisham	0.816	0.82	0.824	0.829	0.833	0.836	0.839	0.842	0.844	0.846
Merton	0.845	0.848	0.853	0.858	0.862	0.866	0.869	0.872	0.874	0.876
Newham	0.798	0.803	0.808	0.814	0.818	0.822	0.824	0.827	0.829	0.831
Redbridge	0.813	0.816	0.82	0.825	0.828	0.831	0.834	0.836	0.839	0.841
Richmond upon Thames	0.899	0.901	0.904	0.908	0.911	0.914	0.917	0.92	0.922	0.924
Southwark	0.887	0.891	0.895	0.899	0.902	0.904	0.906	0.908	0.909	0.91
Sutton	0.819	0.822	0.826	0.831	0.835	0.838	0.841	0.844	0.847	0.849
Tower Hamlets	0.873	0.877	0.881	0.885	0.888	0.89	0.892	0.893	0.895	0.896
Waltham Forest	0.792	0.796	0.801	0.807	0.811	0.815	0.818	0.822	0.825	0.827
Wandsworth	0.899	0.901	0.904	0.907	0.909	0.911	0.913	0.915	0.916	0.918
Westminster	0.914	0.916	0.919	0.922	0.924	0.925	0.927	0.928	0.929	0.93
North East England	0.788	0.792	0.797	0.802	0.805	0.808	0.811	0.814	0.817	0.819
County Durham	0.777	0.78	0.785	0.79	0.793	0.796	0.798	0.801	0.803	0.805
Darlington	0.791	0.796	0.801	0.807	0.812	0.815	0.818	0.821	0.824	0.826
Gateshead	0.79	0.794	0.799	0.805	0.809	0.812	0.815	0.817	0.82	0.822
Hartlepool	0.749	0.753	0.759	0.766	0.771	0.774	0.778	0.781	0.784	0.786
Middlesbrough	0.765	0.769	0.774	0.78	0.783	0.786	0.788	0.791	0.793	0.796
Newcastle upon Tyne	0.846	0.849	0.853	0.856	0.858	0.86	0.861	0.863	0.865	0.866
North Tyneside	0.793	0.797	0.802	0.808	0.812	0.815	0.818	0.821	0.824	0.826
Northumberland	0.784	0.787	0.792	0.797	0.801	0.804	0.807	0.809	0.812	0.814
Redcar and Cleveland	0.756	0.76	0.765	0.772	0.776	0.78	0.783	0.786	0.789	0.791
South Tyneside	0.756	0.76	0.766	0.772	0.776	0.78	0.783	0.786	0.789	0.792
Stockton-on-Tees	0.791	0.795	0.8	0.805	0.809	0.812	0.815	0.817	0.82	0.822
Sunderland	0.777	0.781	0.786	0.792	0.796	0.799	0.802	0.805	0.807	0.81
North West England	0.8	0.804	0.809	0.815	0.819	0.822	0.825	0.827	0.83	0.832
Blackburn with Darwen	0.755	0.761	0.767	0.775	0.78	0.785	0.789	0.792	0.795	0.798
Blackpool	0.737	0.741	0.746	0.753	0.757	0.76	0.763	0.766	0.769	0.772

(Contd...)

Supplementary Table 1 (Continued)

Location	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Bolton	0.766	0.77	0.775	0.782	0.786	0.789	0.792	0.795	0.797	0.8
Bury	0.784	0.788	0.793	0.8	0.804	0.808	0.811	0.814	0.817	0.819
Cheshire East	0.838	0.842	0.847	0.852	0.856	0.86	0.863	0.865	0.868	0.87
Cheshire West and Chester	0.834	0.837	0.842	0.847	0.85	0.853	0.855	0.858	0.86	0.862
Cumbria	0.793	0.797	0.803	0.81	0.815	0.819	0.822	0.825	0.828	0.83
Halton	0.778	0.783	0.789	0.797	0.802	0.806	0.81	0.813	0.817	0.819
Knowsley	0.762	0.766	0.772	0.779	0.783	0.787	0.79	0.794	0.797	0.8
Lancashire	0.801	0.805	0.81	0.815	0.819	0.822	0.824	0.827	0.829	0.831
Liverpool	0.821	0.824	0.827	0.831	0.833	0.835	0.836	0.838	0.84	0.842
Manchester	0.848	0.852	0.856	0.86	0.863	0.865	0.867	0.869	0.872	0.873
Oldham	0.744	0.749	0.755	0.762	0.766	0.77	0.773	0.776	0.779	0.781
Rochdale	0.753	0.757	0.763	0.77	0.774	0.778	0.781	0.784	0.787	0.79
Salford	0.793	0.798	0.803	0.81	0.814	0.817	0.82	0.822	0.825	0.827
Sefton	0.789	0.792	0.795	0.799	0.802	0.804	0.806	0.808	0.81	0.812
St Helens	0.765	0.769	0.774	0.78	0.784	0.787	0.789	0.792	0.794	0.797
Stockport	0.82	0.824	0.828	0.834	0.837	0.84	0.843	0.845	0.848	0.85
Tameside	0.757	0.76	0.766	0.772	0.776	0.779	0.782	0.785	0.788	0.79
Trafford	0.851	0.854	0.859	0.864	0.867	0.871	0.874	0.876	0.879	0.881
Warrington	0.83	0.834	0.84	0.846	0.85	0.854	0.858	0.861	0.864	0.866
Wigan	0.759	0.763	0.769	0.775	0.779	0.782	0.785	0.788	0.791	0.793
Wirral	0.774	0.777	0.783	0.788	0.792	0.796	0.798	0.801	0.804	0.806
South East England	0.838	0.841	0.845	0.85	0.853	0.855	0.858	0.86	0.862	0.864
Bracknell Forest	0.849	0.852	0.857	0.861	0.865	0.868	0.871	0.873	0.876	0.878
Brighton and Hove	0.871	0.873	0.876	0.879	0.881	0.883	0.885	0.887	0.889	0.891
Buckinghamshire	0.853	0.856	0.86	0.864	0.866	0.869	0.871	0.873	0.875	0.877
East Sussex	0.795	0.799	0.803	0.809	0.812	0.816	0.819	0.822	0.825	0.827
Hampshire	0.833	0.836	0.841	0.846	0.85	0.853	0.855	0.858	0.86	0.862
Isle of Wight	0.778	0.781	0.785	0.79	0.793	0.796	0.798	0.8	0.803	0.805
Kent	0.805	0.808	0.813	0.818	0.821	0.824	0.826	0.828	0.831	0.833
Medway	0.78	0.783	0.788	0.792	0.796	0.798	0.8	0.802	0.805	0.807
Milton Keynes	0.834	0.838	0.844	0.85	0.855	0.859	0.862	0.866	0.869	0.87
Oxfordshire	0.864	0.867	0.871	0.875	0.878	0.881	0.883	0.886	0.888	0.89
Portsmouth	0.836	0.839	0.842	0.846	0.849	0.85	0.852	0.854	0.856	0.858
Reading	0.878	0.88	0.883	0.886	0.889	0.89	0.891	0.893	0.894	0.896
Slough	0.831	0.835	0.841	0.847	0.851	0.854	0.857	0.86	0.862	0.864
Southampton	0.837	0.839	0.841	0.844	0.846	0.848	0.849	0.851	0.853	0.855
Surrey	0.871	0.874	0.877	0.881	0.884	0.886	0.889	0.891	0.893	0.895
West Berkshire	0.857	0.861	0.865	0.87	0.874	0.876	0.878	0.88	0.882	0.883
West Sussex	0.825	0.829	0.833	0.838	0.841	0.844	0.847	0.849	0.852	0.854
Windsor and Maidenhead	0.877	0.88	0.884	0.889	0.892	0.895	0.898	0.9	0.903	0.905
Wokingham	0.883	0.885	0.887	0.891	0.893	0.896	0.898	0.9	0.902	0.904
South West England	0.819	0.823	0.827	0.832	0.835	0.838	0.841	0.843	0.846	0.848

(Contd...)

**Supplementary Table 1** (Continued)

Location	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Bath and North East Somerset	0.865	0.868	0.871	0.874	0.876	0.878	0.88	0.882	0.884	0.886
Bournemouth	0.838	0.84	0.844	0.847	0.85	0.852	0.854	0.856	0.858	0.861
Bristol, City of	0.861	0.864	0.868	0.872	0.875	0.877	0.88	0.882	0.884	0.886
Cornwall	0.796	0.799	0.804	0.809	0.812	0.815	0.818	0.82	0.823	0.825
Devon	0.817	0.821	0.825	0.829	0.832	0.835	0.837	0.839	0.841	0.843
Dorset	0.805	0.808	0.813	0.818	0.822	0.825	0.827	0.83	0.833	0.835
Gloucestershire	0.829	0.833	0.837	0.842	0.846	0.849	0.852	0.855	0.857	0.859
North Somerset	0.81	0.814	0.819	0.825	0.829	0.833	0.836	0.838	0.841	0.843
Plymouth	0.809	0.812	0.816	0.821	0.824	0.826	0.828	0.83	0.832	0.834
Poole	0.819	0.823	0.828	0.833	0.837	0.84	0.843	0.846	0.848	0.85
Somerset	0.794	0.798	0.802	0.808	0.812	0.815	0.818	0.821	0.824	0.826
South Gloucestershire	0.843	0.847	0.851	0.856	0.86	0.863	0.865	0.868	0.871	0.873
Swindon	0.821	0.825	0.83	0.835	0.839	0.842	0.844	0.846	0.849	0.85
Torbay	0.765	0.768	0.772	0.777	0.78	0.782	0.785	0.787	0.79	0.793
Wiltshire	0.811	0.815	0.82	0.825	0.829	0.833	0.836	0.839	0.841	0.844
West Midlands	0.792	0.796	0.801	0.807	0.811	0.814	0.817	0.82	0.823	0.825
Birmingham	0.797	0.801	0.806	0.811	0.815	0.818	0.82	0.823	0.825	0.827
Coventry	0.81	0.813	0.818	0.823	0.826	0.829	0.832	0.835	0.837	0.84
Dudley	0.76	0.763	0.768	0.773	0.777	0.779	0.782	0.785	0.788	0.79
Herefordshire, County of	0.796	0.8	0.805	0.811	0.816	0.819	0.823	0.826	0.829	0.832
Sandwell	0.741	0.746	0.752	0.759	0.764	0.768	0.772	0.775	0.778	0.781
Shropshire	0.802	0.806	0.81	0.815	0.819	0.822	0.825	0.827	0.83	0.832
Solihull	0.827	0.83	0.834	0.839	0.842	0.846	0.849	0.852	0.855	0.858
Staffordshire	0.793	0.797	0.801	0.805	0.808	0.811	0.813	0.815	0.817	0.819
Stoke-on-Trent	0.745	0.75	0.756	0.764	0.769	0.773	0.776	0.78	0.783	0.786
Telford and Wrekin	0.778	0.782	0.787	0.794	0.798	0.801	0.804	0.807	0.81	0.813
Walsall	0.74	0.745	0.751	0.758	0.762	0.766	0.77	0.773	0.776	0.779
Warwickshire	0.825	0.829	0.834	0.839	0.843	0.846	0.849	0.852	0.855	0.857
Wolverhampton	0.764	0.768	0.774	0.78	0.784	0.787	0.79	0.793	0.796	0.799
Worcestershire	0.802	0.805	0.809	0.814	0.818	0.82	0.823	0.826	0.828	0.831
Yorkshire and the Humber	0.793	0.797	0.802	0.808	0.812	0.815	0.818	0.821	0.823	0.826
Barnsley	0.737	0.741	0.746	0.753	0.758	0.761	0.765	0.768	0.771	0.774
Bradford	0.761	0.766	0.773	0.78	0.784	0.788	0.791	0.794	0.797	0.8
Calderdale	0.783	0.788	0.794	0.802	0.806	0.81	0.813	0.816	0.819	0.821
Doncaster	0.743	0.748	0.754	0.761	0.766	0.77	0.774	0.777	0.781	0.783
East Riding of Yorkshire	0.794	0.798	0.802	0.806	0.81	0.812	0.814	0.817	0.819	0.821
Kingston upon Hull, City of	0.764	0.768	0.772	0.778	0.781	0.783	0.785	0.787	0.79	0.792
Kirklees	0.777	0.782	0.787	0.793	0.797	0.8	0.803	0.805	0.808	0.81
Leeds	0.838	0.842	0.845	0.849	0.853	0.855	0.858	0.86	0.862	0.864
North East Lincolnshire	0.746	0.751	0.757	0.764	0.768	0.771	0.774	0.778	0.781	0.784
North Lincolnshire	0.781	0.785	0.79	0.796	0.799	0.8	0.801	0.803	0.805	0.806

(Contd...)



**Supplementary Table 1** (Continued)

Location	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
North Yorkshire	0.811	0.815	0.819	0.824	0.827	0.83	0.832	0.834	0.836	0.838
Rotherham	0.75	0.754	0.76	0.766	0.77	0.773	0.775	0.778	0.781	0.784
Sheffield	0.822	0.826	0.83	0.834	0.837	0.84	0.842	0.844	0.847	0.848
Wakefield	0.755	0.76	0.765	0.772	0.777	0.78	0.783	0.786	0.789	0.792
York	0.863	0.865	0.868	0.871	0.873	0.875	0.877	0.879	0.881	0.883
Northern Ireland	0.792	0.796	0.802	0.808	0.811	0.815	0.818	0.821	0.823	0.825
Scotland	0.805	0.809	0.814	0.819	0.823	0.826	0.828	0.831	0.833	0.834
Wales	0.788	0.792	0.797	0.802	0.806	0.809	0.812	0.815	0.818	0.82
Latin America and Caribbean	0.589	0.594	0.6	0.605	0.611	0.616	0.62	0.625	0.629	0.633
Andean Latin America	0.585	0.591	0.596	0.602	0.608	0.613	0.618	0.624	0.628	0.632
Bolivia	0.521	0.525	0.528	0.533	0.538	0.544	0.55	0.556	0.562	0.566
Ecuador	0.591	0.597	0.603	0.609	0.615	0.621	0.626	0.632	0.636	0.64
Peru	0.601	0.608	0.614	0.62	0.625	0.63	0.635	0.64	0.645	0.648
Caribbean	0.598	0.601	0.605	0.609	0.612	0.616	0.621	0.625	0.628	0.631
Antigua and Barbuda	0.709	0.713	0.716	0.719	0.723	0.727	0.731	0.735	0.739	0.743
The Bahamas	0.774	0.779	0.78	0.782	0.784	0.786	0.789	0.791	0.794	0.796
Barbados	0.718	0.721	0.725	0.728	0.73	0.733	0.735	0.737	0.74	0.742
Belize	0.564	0.569	0.574	0.579	0.583	0.588	0.592	0.596	0.6	0.603
Bermuda	0.785	0.79	0.795	0.799	0.802	0.805	0.807	0.809	0.811	0.813
Cuba	0.62	0.624	0.631	0.636	0.64	0.645	0.653	0.66	0.665	0.668
Dominica	0.7	0.705	0.709	0.713	0.717	0.721	0.724	0.727	0.728	0.729
Dominican Republic	0.544	0.549	0.554	0.559	0.563	0.569	0.574	0.58	0.587	0.592
Grenada	0.628	0.633	0.637	0.641	0.645	0.65	0.654	0.659	0.664	0.669
Guyana	0.565	0.571	0.577	0.583	0.59	0.596	0.602	0.608	0.614	0.618
Haiti	0.395	0.399	0.403	0.407	0.412	0.416	0.42	0.424	0.428	0.432
Jamaica	0.653	0.657	0.661	0.664	0.668	0.671	0.675	0.678	0.681	0.684
Puerto Rico	0.769	0.774	0.779	0.785	0.793	0.802	0.808	0.811	0.813	0.814
Saint Kitts and Nevis	0.706	0.71	0.714	0.719	0.724	0.728	0.733	0.738	0.742	0.746
Saint Lucia	0.634	0.639	0.643	0.648	0.652	0.656	0.659	0.663	0.667	0.67
Saint Vincent and the Grenadines	0.589	0.593	0.598	0.602	0.606	0.61	0.615	0.619	0.623	0.627
Suriname	0.598	0.602	0.607	0.611	0.616	0.62	0.625	0.629	0.633	0.636
Trinidad and Tobago	0.732	0.736	0.739	0.742	0.745	0.748	0.751	0.753	0.755	0.757
Virgin Islands	0.785	0.788	0.79	0.791	0.792	0.794	0.795	0.796	0.798	0.799
Central Latin America	0.584	0.589	0.594	0.599	0.604	0.609	0.614	0.618	0.623	0.626
Colombia	0.574	0.582	0.589	0.596	0.603	0.609	0.616	0.622	0.628	0.633
Costa Rica	0.637	0.642	0.647	0.652	0.657	0.662	0.667	0.672	0.676	0.68
El Salvador	0.526	0.531	0.536	0.542	0.547	0.552	0.558	0.563	0.568	0.573
Guatemala	0.472	0.478	0.485	0.491	0.498	0.504	0.51	0.516	0.522	0.526
Honduras	0.454	0.459	0.464	0.469	0.473	0.478	0.482	0.487	0.492	0.496
Mexico	0.608	0.613	0.617	0.621	0.626	0.631	0.636	0.64	0.645	0.649

(Contd...)

**Supplementary Table 1** (Continued)

Location	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Aguascalientes	0.633	0.637	0.641	0.646	0.65	0.655	0.66	0.664	0.669	0.673
Baja California	0.653	0.656	0.66	0.663	0.667	0.671	0.675	0.68	0.685	0.688
Baja California Sur	0.653	0.658	0.662	0.666	0.67	0.675	0.68	0.684	0.689	0.693
Campeche	0.6	0.606	0.611	0.617	0.623	0.629	0.634	0.639	0.644	0.648
Chiapas	0.517	0.522	0.527	0.532	0.536	0.541	0.545	0.55	0.554	0.557
Chihuahua	0.617	0.62	0.623	0.627	0.632	0.637	0.643	0.648	0.654	0.659
Coahuila	0.625	0.628	0.631	0.634	0.639	0.644	0.648	0.653	0.658	0.663
Colima	0.642	0.646	0.65	0.654	0.659	0.664	0.669	0.673	0.678	0.682
Durango	0.571	0.575	0.58	0.585	0.591	0.596	0.602	0.608	0.614	0.618
Guanajuato	0.582	0.588	0.594	0.6	0.606	0.612	0.618	0.624	0.63	0.634
Guerrero	0.522	0.529	0.535	0.541	0.548	0.553	0.558	0.563	0.568	0.572
Hidalgo	0.559	0.565	0.571	0.577	0.584	0.59	0.596	0.601	0.606	0.611
Jalisco	0.625	0.629	0.634	0.638	0.643	0.647	0.652	0.657	0.661	0.665
México	0.625	0.629	0.632	0.636	0.64	0.644	0.648	0.652	0.657	0.66
Mexico City	0.697	0.7	0.704	0.708	0.712	0.716	0.72	0.724	0.729	0.732
Michoacán de Ocampo	0.568	0.572	0.576	0.581	0.585	0.59	0.594	0.598	0.602	0.606
Morelos	0.617	0.621	0.624	0.628	0.632	0.637	0.641	0.646	0.65	0.654
Nayarit	0.603	0.607	0.612	0.617	0.621	0.626	0.63	0.635	0.639	0.643
Nuevo León	0.661	0.665	0.669	0.673	0.677	0.682	0.686	0.691	0.696	0.699
Oaxaca	0.528	0.534	0.54	0.545	0.55	0.555	0.561	0.566	0.571	0.574
Puebla	0.567	0.572	0.577	0.583	0.588	0.593	0.598	0.603	0.608	0.612
Querétaro	0.63	0.634	0.639	0.644	0.649	0.653	0.658	0.663	0.667	0.671
Quintana Roo	0.629	0.634	0.638	0.643	0.647	0.652	0.657	0.662	0.666	0.67
San Luis Potosí	0.59	0.596	0.602	0.607	0.612	0.617	0.622	0.626	0.631	0.635
Sinaloa	0.621	0.626	0.631	0.636	0.641	0.647	0.652	0.657	0.662	0.667
Sonora	0.645	0.649	0.653	0.658	0.662	0.668	0.673	0.678	0.683	0.687
Tabasco	0.592	0.597	0.602	0.608	0.613	0.619	0.624	0.629	0.634	0.638
Tamaulipas	0.624	0.628	0.632	0.636	0.641	0.647	0.652	0.657	0.662	0.666
Tlaxcala	0.601	0.605	0.61	0.614	0.619	0.623	0.628	0.632	0.636	0.64
Veracruz de Ignacio de la Llave	0.567	0.572	0.578	0.582	0.587	0.592	0.596	0.601	0.605	0.609
Yucatán	0.594	0.599	0.605	0.611	0.616	0.622	0.627	0.631	0.636	0.64
Zacatecas	0.587	0.591	0.595	0.599	0.604	0.609	0.615	0.62	0.625	0.63
Nicaragua	0.47	0.474	0.479	0.484	0.489	0.495	0.5	0.506	0.512	0.517
Panama	0.627	0.63	0.635	0.642	0.65	0.658	0.666	0.674	0.68	0.686
Venezuela	0.586	0.591	0.596	0.6	0.604	0.607	0.608	0.608	0.608	0.607
Tropical Latin America	0.59	0.597	0.604	0.61	0.617	0.622	0.627	0.632	0.636	0.64
Brazil	0.59	0.597	0.603	0.61	0.616	0.622	0.627	0.632	0.636	0.64
Acre	0.501	0.509	0.518	0.526	0.533	0.54	0.547	0.552	0.558	0.562
Alagoas	0.461	0.469	0.477	0.485	0.492	0.498	0.504	0.509	0.514	0.518
Amapá	0.594	0.6	0.606	0.612	0.618	0.624	0.629	0.633	0.637	0.641
Amazonas	0.548	0.555	0.562	0.569	0.576	0.582	0.588	0.593	0.598	0.602

(Contd...)

Supplementary Table 1 (Continued)

Location	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Bahia	0.505	0.514	0.521	0.529	0.536	0.542	0.548	0.553	0.558	0.562
Ceará	0.501	0.51	0.518	0.525	0.533	0.539	0.544	0.549	0.554	0.558
Distrito Federal	0.732	0.739	0.745	0.751	0.756	0.761	0.766	0.77	0.774	0.777
Espírito Santo	0.607	0.614	0.622	0.629	0.636	0.642	0.647	0.652	0.657	0.66
Goiás	0.573	0.581	0.588	0.596	0.603	0.609	0.614	0.619	0.624	0.628
Maranhão	0.376	0.385	0.394	0.403	0.412	0.42	0.427	0.433	0.439	0.444
Mato Grosso	0.587	0.595	0.603	0.61	0.617	0.623	0.629	0.634	0.638	0.642
Mato Grosso do Sul	0.585	0.593	0.601	0.608	0.615	0.621	0.626	0.631	0.636	0.639
Minas Gerais	0.596	0.603	0.61	0.616	0.622	0.627	0.632	0.636	0.64	0.643
Pará	0.51	0.518	0.526	0.534	0.542	0.549	0.554	0.56	0.565	0.569
Paraíba	0.49	0.499	0.507	0.515	0.522	0.528	0.534	0.539	0.544	0.548
Paraná	0.615	0.621	0.628	0.634	0.64	0.645	0.65	0.654	0.659	0.662
Pernambuco	0.51	0.519	0.527	0.536	0.543	0.55	0.556	0.561	0.567	0.571
Piauí	0.448	0.457	0.466	0.474	0.482	0.489	0.494	0.5	0.505	0.509
Rio de Janeiro	0.658	0.664	0.67	0.675	0.681	0.686	0.69	0.694	0.698	0.702
Rio Grande do Norte	0.519	0.527	0.535	0.543	0.551	0.557	0.562	0.567	0.572	0.576
Rio Grande do Sul	0.642	0.648	0.653	0.659	0.664	0.669	0.673	0.677	0.681	0.684
Rondônia	0.547	0.556	0.565	0.573	0.58	0.587	0.592	0.598	0.603	0.606
Roraima	0.55	0.558	0.566	0.575	0.582	0.589	0.595	0.601	0.606	0.61
Santa Catarina	0.646	0.652	0.659	0.665	0.67	0.676	0.68	0.684	0.688	0.691
São Paulo	0.658	0.663	0.669	0.675	0.68	0.686	0.69	0.694	0.698	0.702
Sergipe	0.532	0.539	0.546	0.553	0.56	0.566	0.57	0.575	0.579	0.583
Tocantins	0.514	0.524	0.534	0.544	0.552	0.56	0.567	0.573	0.579	0.583
Paraguay	0.582	0.588	0.594	0.601	0.608	0.615	0.621	0.627	0.633	0.638
North Africa and Middle East	0.595	0.603	0.611	0.619	0.626	0.633	0.64	0.647	0.654	0.66
North Africa and Middle East	0.595	0.603	0.611	0.619	0.626	0.633	0.64	0.647	0.654	0.66
Afghanistan	0.264	0.274	0.285	0.295	0.304	0.313	0.321	0.329	0.337	0.343
Algeria	0.599	0.605	0.611	0.617	0.623	0.628	0.634	0.64	0.646	0.652
Bahrain	0.711	0.715	0.72	0.726	0.731	0.735	0.739	0.743	0.747	0.751
Egypt	0.582	0.591	0.6	0.609	0.617	0.626	0.635	0.643	0.651	0.658
Iran	0.622	0.63	0.635	0.64	0.645	0.649	0.654	0.659	0.665	0.67
Iraq	0.57	0.583	0.597	0.61	0.622	0.632	0.644	0.654	0.663	0.671
Jordan	0.681	0.688	0.695	0.702	0.707	0.713	0.718	0.723	0.727	0.731
Kuwait	0.801	0.808	0.815	0.822	0.828	0.834	0.839	0.844	0.848	0.851
Lebanon	0.639	0.649	0.66	0.67	0.677	0.685	0.691	0.698	0.704	0.708
Libya	0.691	0.695	0.703	0.707	0.707	0.707	0.705	0.705	0.707	0.709
Morocco	0.475	0.483	0.491	0.499	0.508	0.516	0.524	0.533	0.541	0.548
Oman	0.715	0.726	0.737	0.747	0.754	0.76	0.767	0.773	0.778	0.783
Palestine	0.497	0.509	0.521	0.533	0.543	0.553	0.564	0.573	0.582	0.588
Qatar	0.772	0.779	0.786	0.793	0.799	0.806	0.812	0.818	0.825	0.83

(Contd...)

Supplementary Table 1 (Continued)

Location	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Saudi Arabia	0.726	0.738	0.75	0.76	0.769	0.778	0.786	0.793	0.8	0.805
Sudan	0.416	0.428	0.44	0.451	0.462	0.474	0.485	0.497	0.507	0.515
Syria	0.594	0.601	0.605	0.606	0.607	0.608	0.61	0.613	0.616	0.619
Tunisia	0.622	0.628	0.634	0.64	0.646	0.651	0.657	0.662	0.667	0.672
Turkey	0.68	0.689	0.698	0.707	0.715	0.723	0.729	0.736	0.743	0.748
United Arab Emirates	0.853	0.859	0.863	0.868	0.87	0.872	0.874	0.876	0.879	0.88
Yemen	0.366	0.375	0.384	0.393	0.402	0.407	0.41	0.412	0.413	0.412
South Asia	0.456	0.465	0.475	0.485	0.495	0.505	0.515	0.525	0.535	0.543
South Asia	0.456	0.465	0.475	0.485	0.495	0.505	0.515	0.525	0.535	0.543
Bangladesh	0.408	0.416	0.425	0.433	0.441	0.449	0.457	0.466	0.475	0.483
Bhutan	0.384	0.394	0.403	0.411	0.419	0.426	0.434	0.442	0.449	0.455
India	0.473	0.483	0.493	0.504	0.515	0.526	0.537	0.547	0.558	0.566
Andhra Pradesh	0.451	0.461	0.471	0.481	0.492	0.504	0.515	0.527	0.537	0.546
Arunachal Pradesh	0.469	0.481	0.492	0.503	0.515	0.526	0.537	0.548	0.558	0.566
Assam	0.467	0.476	0.484	0.493	0.502	0.512	0.522	0.532	0.542	0.551
Bihar	0.346	0.356	0.367	0.378	0.389	0.4	0.412	0.423	0.434	0.444
Chhattisgarh	0.436	0.447	0.458	0.469	0.48	0.492	0.503	0.514	0.524	0.533
Delhi	0.634	0.643	0.652	0.661	0.671	0.682	0.692	0.701	0.71	0.717
Goa	0.655	0.663	0.669	0.676	0.682	0.689	0.697	0.704	0.711	0.717
Gujarat	0.515	0.524	0.534	0.545	0.557	0.569	0.58	0.591	0.601	0.609
Haryana	0.506	0.518	0.53	0.542	0.555	0.567	0.579	0.59	0.601	0.609
Himachal Pradesh	0.544	0.555	0.566	0.577	0.588	0.599	0.61	0.62	0.63	0.638
Jammu and Kashmir	0.518	0.529	0.539	0.549	0.558	0.568	0.578	0.587	0.596	0.605
Jharkhand	0.415	0.426	0.437	0.448	0.46	0.47	0.481	0.491	0.501	0.51
Karnataka	0.496	0.506	0.518	0.529	0.541	0.554	0.566	0.578	0.589	0.598
Kerala	0.587	0.595	0.604	0.614	0.625	0.636	0.646	0.655	0.664	0.671
Madhya Pradesh	0.405	0.415	0.425	0.436	0.448	0.46	0.472	0.484	0.495	0.505
Maharashtra	0.536	0.545	0.555	0.566	0.576	0.587	0.599	0.609	0.619	0.628
Manipur	0.527	0.534	0.541	0.548	0.556	0.564	0.572	0.58	0.588	0.595
Meghalaya	0.488	0.497	0.506	0.515	0.523	0.532	0.54	0.549	0.557	0.564
Mizoram	0.535	0.543	0.552	0.561	0.571	0.582	0.592	0.603	0.612	0.621
Nagaland	0.544	0.551	0.559	0.567	0.576	0.584	0.593	0.602	0.61	0.618
Odisha	0.452	0.462	0.472	0.482	0.493	0.504	0.514	0.524	0.534	0.542
Punjab	0.544	0.553	0.561	0.57	0.58	0.589	0.598	0.607	0.615	0.623
Rajasthan	0.415	0.427	0.439	0.451	0.464	0.476	0.489	0.501	0.512	0.521
Sikkim	0.535	0.55	0.564	0.577	0.589	0.601	0.612	0.622	0.632	0.64
Tamil Nadu	0.528	0.538	0.548	0.558	0.57	0.582	0.593	0.603	0.613	0.621
Telangana	0.467	0.479	0.491	0.503	0.516	0.528	0.54	0.552	0.563	0.572
Tripura	0.486	0.493	0.499	0.507	0.515	0.523	0.532	0.541	0.549	0.557
Union Territories other than Delhi	0.593	0.601	0.609	0.617	0.625	0.633	0.641	0.649	0.657	0.664
Uttar Pradesh	0.417	0.428	0.439	0.45	0.461	0.472	0.483	0.494	0.505	0.513

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Supplementary Table 1 (Continued)

Location	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Uttarakhand	0.516	0.531	0.545	0.559	0.572	0.585	0.597	0.608	0.619	0.628
West Bengal	0.469	0.476	0.484	0.491	0.5	0.509	0.518	0.528	0.537	0.545
Nepal	0.347	0.356	0.365	0.373	0.382	0.391	0.399	0.408	0.416	0.422
Pakistan	0.379	0.387	0.394	0.402	0.41	0.418	0.426	0.434	0.442	0.449
Southeast Asia, east Asia, and Oceania	0.614	0.622	0.629	0.636	0.643	0.647	0.651	0.659	0.667	0.673
East Asia	0.628	0.637	0.644	0.652	0.66	0.662	0.665	0.675	0.684	0.691
China	0.621	0.631	0.638	0.646	0.654	0.657	0.659	0.669	0.679	0.686
North Korea	0.513	0.518	0.523	0.528	0.534	0.538	0.543	0.548	0.553	0.558
Taiwan (province of China)	0.83	0.833	0.838	0.843	0.848	0.852	0.856	0.86	0.865	0.868
Oceania	0.426	0.428	0.431	0.433	0.436	0.44	0.443	0.446	0.449	0.452
American Samoa	0.678	0.682	0.686	0.69	0.694	0.698	0.702	0.706	0.709	0.712
Cook Islands	0.722	0.726	0.73	0.734	0.739	0.744	0.75	0.755	0.76	0.764
Fiji	0.622	0.626	0.63	0.635	0.639	0.644	0.649	0.654	0.659	0.664
Guam	0.785	0.789	0.792	0.795	0.797	0.799	0.803	0.807	0.81	0.813
Kiribati	0.492	0.495	0.497	0.501	0.504	0.509	0.514	0.518	0.523	0.527
Marshall Islands	0.498	0.504	0.509	0.515	0.52	0.525	0.531	0.536	0.541	0.544
Federated States of Micronesia	0.546	0.55	0.554	0.558	0.561	0.565	0.569	0.573	0.577	0.58
Nauru	0.529	0.538	0.547	0.559	0.573	0.585	0.595	0.605	0.613	0.618
Niue	0.669	0.675	0.681	0.685	0.69	0.695	0.699	0.703	0.707	0.711
Northern Mariana Islands	0.751	0.75	0.75	0.75	0.75	0.751	0.756	0.761	0.767	0.771
Palau	0.707	0.71	0.714	0.717	0.72	0.725	0.729	0.732	0.735	0.738
Papua New Guinea	0.356	0.36	0.363	0.367	0.372	0.377	0.382	0.386	0.391	0.394
Samoa	0.612	0.615	0.618	0.62	0.623	0.626	0.629	0.633	0.637	0.641
Solomon Islands	0.358	0.364	0.371	0.377	0.382	0.387	0.393	0.398	0.403	0.407
Tokelau	0.565	0.573	0.58	0.588	0.595	0.602	0.608	0.615	0.621	0.626
Tonga	0.598	0.602	0.606	0.61	0.614	0.618	0.622	0.627	0.632	0.636
Tuvalu	0.545	0.549	0.553	0.558	0.562	0.567	0.573	0.579	0.584	0.589
Vanuatu	0.446	0.451	0.455	0.46	0.464	0.468	0.473	0.477	0.481	0.485
Southeast Asia	0.585	0.592	0.599	0.606	0.612	0.619	0.626	0.632	0.639	0.644
Cambodia	0.406	0.413	0.421	0.428	0.435	0.442	0.449	0.456	0.463	0.469
Indonesia	0.593	0.601	0.609	0.617	0.625	0.633	0.64	0.647	0.654	0.66
Aceh	0.608	0.614	0.62	0.626	0.633	0.64	0.646	0.653	0.66	0.666
Bali	0.582	0.59	0.598	0.606	0.613	0.621	0.628	0.635	0.642	0.648
Bangka-Belitung Islands	0.581	0.589	0.597	0.604	0.612	0.619	0.627	0.634	0.641	0.647
Banten	0.575	0.583	0.591	0.599	0.606	0.614	0.621	0.629	0.636	0.642
Bengkulu	0.55	0.558	0.567	0.575	0.583	0.591	0.598	0.606	0.613	0.619
Gorontalo	0.496	0.505	0.514	0.523	0.532	0.54	0.548	0.555	0.563	0.569
Jakarta	0.74	0.748	0.756	0.764	0.771	0.778	0.785	0.791	0.797	0.802
Jambi	0.571	0.581	0.59	0.598	0.606	0.614	0.621	0.628	0.635	0.641
West Java	0.582	0.59	0.598	0.606	0.614	0.621	0.629	0.636	0.643	0.648

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Supplementary Table 1 (Continued)

Location	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Central Java	0.547	0.555	0.563	0.571	0.579	0.586	0.593	0.6	0.607	0.613
East Java	0.58	0.589	0.597	0.604	0.612	0.619	0.626	0.633	0.64	0.646
West Kalimantan	0.532	0.54	0.548	0.555	0.563	0.57	0.578	0.585	0.592	0.598
South Kalimantan	0.571	0.579	0.586	0.594	0.601	0.609	0.616	0.623	0.63	0.636
Central Kalimantan	0.589	0.596	0.604	0.611	0.619	0.626	0.633	0.64	0.647	0.653
East Kalimantan	0.695	0.703	0.711	0.719	0.727	0.734	0.742	0.749	0.756	0.762
North Kalimantan	0.689	0.698	0.707	0.715	0.723	0.731	0.738	0.745	0.752	0.758
Riau Islands	0.68	0.687	0.695	0.702	0.709	0.717	0.724	0.731	0.737	0.742
Lampung	0.546	0.556	0.565	0.574	0.582	0.59	0.598	0.605	0.612	0.617
Maluku	0.503	0.511	0.519	0.527	0.535	0.544	0.552	0.56	0.568	0.575
North Maluku	0.487	0.495	0.504	0.513	0.522	0.531	0.539	0.547	0.555	0.562
West Nusa Tenggara	0.513	0.522	0.53	0.538	0.546	0.554	0.561	0.568	0.575	0.582
East Nusa Tenggara	0.472	0.48	0.488	0.497	0.505	0.513	0.521	0.529	0.537	0.543
Papua	0.559	0.567	0.575	0.583	0.591	0.599	0.607	0.615	0.623	0.629
West Papua	0.58	0.593	0.604	0.615	0.625	0.634	0.643	0.652	0.66	0.666
Riau	0.663	0.67	0.678	0.685	0.693	0.7	0.707	0.714	0.721	0.727
West Sulawesi	0.495	0.505	0.515	0.524	0.533	0.542	0.55	0.558	0.566	0.573
South Sulawesi	0.554	0.564	0.573	0.581	0.59	0.598	0.605	0.613	0.62	0.626
Central Sulawesi	0.557	0.566	0.575	0.583	0.592	0.6	0.608	0.615	0.622	0.628
Southeast Sulawesi	0.536	0.546	0.556	0.565	0.574	0.582	0.59	0.598	0.606	0.612
North Sulawesi	0.6	0.608	0.615	0.623	0.631	0.638	0.645	0.652	0.658	0.664
West Sumatra	0.6	0.609	0.617	0.625	0.633	0.641	0.648	0.655	0.662	0.668
South Sumatra	0.59	0.598	0.607	0.615	0.622	0.63	0.637	0.644	0.651	0.657
North Sumatra	0.605	0.614	0.623	0.631	0.639	0.647	0.654	0.662	0.669	0.675
Yogyakarta	0.608	0.616	0.624	0.631	0.639	0.646	0.652	0.659	0.665	0.671
Laos	0.413	0.422	0.431	0.441	0.45	0.458	0.467	0.475	0.483	0.49
Malaysia	0.693	0.698	0.704	0.71	0.716	0.722	0.726	0.728	0.732	0.737
Maldives	0.504	0.511	0.518	0.525	0.532	0.538	0.544	0.551	0.557	0.562
Mauritius	0.652	0.658	0.665	0.673	0.68	0.686	0.69	0.695	0.7	0.705
Myanmar	0.446	0.455	0.464	0.473	0.482	0.49	0.498	0.506	0.514	0.521
Philippines	0.567	0.572	0.577	0.583	0.589	0.596	0.603	0.61	0.617	0.623
Seychelles	0.679	0.683	0.687	0.691	0.696	0.702	0.707	0.713	0.719	0.724
Sri Lanka	0.628	0.636	0.644	0.651	0.658	0.666	0.672	0.678	0.684	0.69
Thailand	0.638	0.643	0.649	0.655	0.66	0.666	0.671	0.676	0.682	0.687
Timor-Leste	0.458	0.469	0.48	0.488	0.493	0.498	0.503	0.508	0.511	0.514
Vietnam	0.549	0.558	0.566	0.573	0.581	0.589	0.596	0.604	0.611	0.617
Sub-Saharan Africa	0.394	0.401	0.409	0.416	0.423	0.431	0.438	0.445	0.452	0.456
Central sub-Saharan Africa	0.378	0.389	0.4	0.412	0.423	0.434	0.445	0.454	0.463	0.47
Angola	0.376	0.387	0.398	0.41	0.421	0.432	0.443	0.454	0.463	0.47
Central African Republic	0.253	0.258	0.263	0.263	0.263	0.264	0.266	0.268	0.271	0.274
Congo (Brazzaville)	0.491	0.5	0.509	0.519	0.528	0.538	0.547	0.556	0.563	0.568
DR Congo	0.266	0.277	0.289	0.305	0.321	0.336	0.35	0.362	0.374	0.382

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Supplementary Table 1 (Continued)

Location	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Equatorial Guinea	0.578	0.594	0.611	0.626	0.64	0.652	0.663	0.673	0.681	0.685
Gabon	0.579	0.587	0.596	0.605	0.614	0.623	0.632	0.641	0.649	0.656
Eastern sub-Saharan Africa	0.336	0.343	0.351	0.359	0.367	0.375	0.383	0.391	0.399	0.405
Burundi	0.243	0.248	0.254	0.26	0.266	0.27	0.274	0.278	0.282	0.284
Comoros	0.401	0.407	0.413	0.419	0.426	0.432	0.438	0.444	0.45	0.455
Djibouti	0.384	0.392	0.4	0.408	0.416	0.425	0.434	0.443	0.452	0.459
Eritrea	0.334	0.34	0.346	0.353	0.36	0.367	0.375	0.382	0.39	0.396
Ethiopia	0.244	0.256	0.268	0.279	0.291	0.302	0.313	0.324	0.334	0.343
Kenya	0.441	0.448	0.455	0.463	0.47	0.478	0.486	0.494	0.502	0.508
Baringo	0.392	0.4	0.408	0.417	0.426	0.436	0.447	0.457	0.468	0.476
Bomet	0.433	0.443	0.454	0.465	0.476	0.487	0.499	0.511	0.522	0.531
Bungoma	0.395	0.404	0.413	0.423	0.433	0.444	0.454	0.465	0.475	0.483
Busia	0.37	0.378	0.387	0.396	0.405	0.415	0.425	0.435	0.445	0.453
Elgeyo Marakwet	0.406	0.416	0.426	0.437	0.449	0.46	0.471	0.483	0.494	0.503
Embu	0.478	0.485	0.492	0.5	0.508	0.516	0.525	0.534	0.542	0.55
Garissa	0.259	0.264	0.27	0.275	0.281	0.287	0.293	0.299	0.305	0.31
Homa Bay	0.348	0.358	0.369	0.381	0.393	0.405	0.418	0.431	0.443	0.452
Isiolo	0.339	0.346	0.353	0.361	0.369	0.378	0.387	0.396	0.405	0.413
Kajiado	0.48	0.489	0.498	0.507	0.516	0.526	0.536	0.545	0.555	0.563
Kakamega	0.401	0.41	0.419	0.429	0.439	0.449	0.46	0.47	0.481	0.489
Kericho	0.408	0.419	0.43	0.441	0.453	0.465	0.477	0.489	0.501	0.509
Kiambu	0.538	0.546	0.554	0.562	0.57	0.578	0.586	0.594	0.602	0.609
Kilifi	0.407	0.415	0.424	0.433	0.443	0.453	0.463	0.474	0.484	0.492
Kirinyaga	0.477	0.484	0.491	0.499	0.506	0.514	0.523	0.531	0.539	0.546
Kisii	0.468	0.477	0.487	0.497	0.507	0.518	0.528	0.539	0.549	0.557
Kisumu	0.465	0.475	0.485	0.496	0.507	0.518	0.529	0.54	0.551	0.559
Kitui	0.388	0.396	0.406	0.415	0.425	0.435	0.446	0.456	0.466	0.474
Kwale	0.39	0.397	0.405	0.414	0.423	0.432	0.442	0.452	0.461	0.469
Laikipia	0.479	0.489	0.498	0.508	0.518	0.528	0.538	0.549	0.559	0.567
Lamu	0.414	0.421	0.429	0.436	0.444	0.453	0.462	0.471	0.48	0.488
Machakos	0.472	0.48	0.489	0.498	0.508	0.517	0.527	0.536	0.546	0.553
Makueni	0.381	0.389	0.398	0.406	0.416	0.425	0.435	0.445	0.455	0.462
Mandera	0.245	0.251	0.257	0.264	0.27	0.277	0.283	0.29	0.296	0.302
Marsabit	0.313	0.32	0.328	0.337	0.346	0.354	0.363	0.372	0.381	0.388
Meru	0.448	0.456	0.464	0.472	0.481	0.49	0.5	0.509	0.518	0.525
Migori	0.345	0.354	0.364	0.375	0.386	0.397	0.409	0.421	0.433	0.442
Mombasa	0.507	0.514	0.522	0.53	0.539	0.548	0.557	0.566	0.575	0.582
Murang'a	0.478	0.486	0.493	0.501	0.509	0.518	0.526	0.535	0.543	0.55
Nairobi	0.604	0.61	0.617	0.624	0.63	0.637	0.645	0.652	0.66	0.665
Nakuru	0.461	0.47	0.479	0.489	0.499	0.509	0.52	0.53	0.54	0.548
Nandi	0.453	0.462	0.471	0.481	0.491	0.502	0.513	0.524	0.534	0.543
Narok	0.33	0.338	0.347	0.356	0.366	0.376	0.387	0.398	0.409	0.418

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**Supplementary Table 1** (Continued)

Location	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Nyamira	0.487	0.496	0.506	0.517	0.527	0.538	0.55	0.561	0.571	0.579
Nyandarua	0.467	0.475	0.483	0.492	0.501	0.51	0.519	0.529	0.538	0.546
Nyeri	0.496	0.504	0.512	0.52	0.528	0.536	0.545	0.553	0.561	0.568
Samburu	0.281	0.289	0.297	0.306	0.314	0.324	0.333	0.343	0.353	0.361
Siaya	0.347	0.358	0.368	0.38	0.392	0.404	0.416	0.428	0.44	0.449
Taita Taveta	0.462	0.47	0.478	0.486	0.495	0.504	0.513	0.522	0.531	0.539
Tana River	0.317	0.324	0.331	0.34	0.348	0.357	0.366	0.375	0.384	0.391
Tharaka Nithi	0.479	0.488	0.497	0.506	0.516	0.526	0.536	0.546	0.556	0.564
Trans Nzoia	0.451	0.459	0.468	0.478	0.488	0.498	0.509	0.52	0.53	0.539
Turkana	0.286	0.292	0.299	0.306	0.314	0.322	0.33	0.339	0.347	0.355
Uasin Gishu	0.496	0.505	0.514	0.524	0.535	0.545	0.556	0.566	0.577	0.585
Vihiga	0.391	0.398	0.405	0.413	0.421	0.429	0.438	0.447	0.457	0.464
Wajir	0.21	0.215	0.22	0.225	0.231	0.236	0.242	0.248	0.253	0.259
West Pokot	0.326	0.336	0.346	0.357	0.368	0.379	0.39	0.402	0.413	0.422
Madagascar	0.336	0.342	0.348	0.355	0.361	0.369	0.376	0.383	0.391	0.396
Malawi	0.317	0.326	0.335	0.342	0.35	0.358	0.365	0.372	0.379	0.384
Mozambique	0.237	0.244	0.252	0.26	0.268	0.277	0.285	0.294	0.301	0.307
Rwanda	0.359	0.368	0.376	0.384	0.391	0.399	0.407	0.415	0.422	0.429
Somalia	0.0692	0.0703	0.0716	0.0728	0.0742	0.0756	0.077	0.0785	0.0799	0.081
South Sudan	0.32	0.325	0.33	0.334	0.339	0.342	0.345	0.351	0.358	0.363
Uganda	0.325	0.335	0.345	0.355	0.364	0.373	0.382	0.391	0.399	0.404
Tanzania	0.354	0.361	0.368	0.375	0.383	0.391	0.399	0.408	0.416	0.423
Zambia	0.418	0.429	0.44	0.451	0.462	0.472	0.481	0.491	0.499	0.505
Southern sub-Saharan Africa	0.605	0.61	0.614	0.619	0.623	0.628	0.632	0.636	0.639	0.642
Botswana	0.581	0.587	0.593	0.6	0.606	0.612	0.618	0.624	0.63	0.634
eSwatini	0.526	0.532	0.538	0.545	0.551	0.557	0.563	0.569	0.574	0.577
Lesotho	0.448	0.455	0.462	0.469	0.476	0.483	0.489	0.496	0.502	0.507
Namibia	0.558	0.564	0.571	0.577	0.584	0.591	0.597	0.603	0.608	0.612
South Africa	0.642	0.647	0.651	0.656	0.66	0.664	0.668	0.672	0.676	0.678
Zimbabwe	0.425	0.427	0.432	0.438	0.445	0.452	0.459	0.465	0.471	0.476
Western sub-Saharan Africa	0.383	0.391	0.399	0.407	0.415	0.422	0.43	0.437	0.443	0.448
Benin	0.297	0.301	0.306	0.312	0.318	0.324	0.331	0.338	0.346	0.352
Burkina Faso	0.21	0.215	0.22	0.226	0.231	0.236	0.241	0.247	0.252	0.257
Cape Verde	0.461	0.469	0.477	0.484	0.491	0.498	0.505	0.512	0.519	0.525
Cameroon	0.412	0.42	0.428	0.436	0.445	0.455	0.464	0.474	0.483	0.49
Chad	0.185	0.191	0.197	0.203	0.21	0.216	0.223	0.228	0.234	0.238
Côte d'Ivoire	0.346	0.35	0.355	0.362	0.369	0.376	0.384	0.393	0.401	0.408
The Gambia	0.334	0.341	0.348	0.356	0.363	0.37	0.378	0.385	0.393	0.399
Ghana	0.474	0.484	0.494	0.504	0.514	0.523	0.531	0.541	0.549	0.557
Guinea	0.267	0.272	0.278	0.284	0.29	0.296	0.303	0.31	0.318	0.325
Guinea-Bissau	0.297	0.304	0.31	0.316	0.322	0.328	0.335	0.342	0.349	0.355

(Contd...)



**Supplementary Table 1 (Continued)**

Location	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Liberia	0.296	0.305	0.314	0.325	0.335	0.344	0.351	0.358	0.365	0.37
Mali	0.214	0.22	0.225	0.23	0.235	0.241	0.247	0.253	0.259	0.263
Mauritania	0.427	0.435	0.443	0.45	0.459	0.467	0.474	0.482	0.49	0.496
Niger	0.119	0.123	0.128	0.133	0.138	0.143	0.148	0.153	0.158	0.162
Nigeria	0.442	0.451	0.46	0.469	0.478	0.487	0.495	0.503	0.51	0.515
São Tomé and Príncipe	0.424	0.433	0.443	0.452	0.461	0.47	0.478	0.487	0.495	0.502
Senegal	0.33	0.336	0.342	0.348	0.354	0.361	0.368	0.375	0.382	0.389
Sierra Leone	0.275	0.283	0.292	0.304	0.314	0.321	0.328	0.335	0.342	0.347
Togo	0.352	0.358	0.364	0.371	0.379	0.386	0.394	0.402	0.411	0.417

Data obtained from Global Burden of Disease Collaborative Network. Global Burden of Disease Study 2019 (GBD 2019) Socio-Demographic Index (SDI) 1950–2019. Seattle, United States of America: Institute for Health Metrics and Evaluation (IHME), 2020

**Supplementary Table 2** Data quality rating for cause of death data 2010–2019, by country

Country	Data quality rating
Afghanistan	1
Albania	3
Algeria	1
American Samoa	3
Andorra	1
Angola	1
Antigua and Barbuda	4
Argentina	4
Armenia	5
Australia	5
Austria	5
Azerbaijan	3
Bahrain	3
Bangladesh	2
Barbados	4
Belarus	4
Belgium	4
Belize	4
Benin	1
Bermuda	5
Bhutan	0
Venezuela	5
Bosnia and Herzegovina	2
Botswana	0
Brazil	4
Brunei	3
Bulgaria	4

(Contd...)

**Supplementary Table 2 (Continued)**

Country	Data quality rating
Burkina Faso	1
Burundi	1
Cambodia	1
Cameroon	0
Canada	5
Central African Republic	0
Chad	0
Chile	4
China	3
Colombia	4
The Bahamas	4
Comoros	0
Congo (Brazzaville)	0
Cook Islands	2
Costa Rica	5
Croatia	4
Cuba	5
Cyprus	2
Czech Republic	4
North Korea	0
DR Congo	1
Denmark	5
Djibouti	0
Dominica	3
Dominican Republic	3
Ecuador	3
Egypt	2
El Salvador	3

(Contd...)

Supplementary Table 2 (Continued)

Country	Data quality rating
Equatorial Guinea	0
Eritrea	0
Estonia	5
Ethiopia	1
Federated States of Micronesia	0
Fiji	2
Finland	5
France	4
Gabon	0
Georgia	4
Germany	4
Ghana	1
Greece	4
Greenland	3
Grenada	4
Guam	3
Guatemala	4
Guinea	1
Guinea-Bissau	1
Guyana	4
Haiti	1
Honduras	2
Hungary	5
Iceland	5
India	2
Indonesia	2
Iraq	2
Ireland	5
Iran	2
Israel	4
Italy	5
Jamaica	4
Japan	5
Jordan	2
Kazakhstan	4
Kenya	1
eSwatini	1
Kiribati	2
Kuwait	4
Kyrgyzstan	4
Laos	1
Latvia	5

(Contd...)

Supplementary Table 2 (Continued)

Country	Data quality rating
Lebanon	1
Lesotho	0
Liberia	1
Libya	1
Lithuania	5
Luxembourg	4
Madagascar	1
Malawi	1
Malaysia	2
Maldives	2
Mali	1
Malta	5
Marshall Islands	0
Mauritania	0
Mauritius	4
Mexico	4
Mongolia	2
Montenegro	2
Morocco	2
Mozambique	2
Myanmar	1
Namibia	0
Nepal	1
The Netherlands	5
New Zealand	5
Nicaragua	3
Niger	1
Nigeria	1
Northern Mariana Islands	2
Norway	5
Oman	2
Pakistan	2
Palestine	2
Panama	4
Papua New Guinea	1
Paraguay	3
Peru	3
Philippines	3
Bolivia	1
Poland	4
Portugal	4
Monaco	2

(Contd...)

Supplementary Table 2 (Continued)

Country	Data quality rating
Puerto Rico	4
Qatar	2
Cape Verde	2
Côte d'Ivoire	1
South Korea	3
Moldova	5
Nauru	0
Niue	0
Palau	1
San Marino	3
The Gambia	1
Romania	4
Russia	5
Rwanda	1
Saint Kitts and Nevis	4
Saint Lucia	4
Saint Vincent and the Grenadines	4
Samoa	0
São Tomé and Príncipe	1
Saudi Arabia	2
Senegal	1
Serbia	3
Seychelles	3
Sierra Leone	1
Singapore	5
Slovakia	3
Slovenia	4
Vietnam	2
Solomon Islands	1
Somalia	0
South Africa	3
South Sudan	0
Spain	4
Sri Lanka	3
Sudan	0

(Contd...)

Supplementary Table 2 (Continued)

Country	Data quality rating
Suriname	3
Sweden	5
Switzerland	4
Syria	3
Taiwan (province of China)	4
Tajikistan	3
Thailand	3
North Macedonia	3
Timor-Leste	0
Togo	0
Tokelau	0
Tonga	1
Trinidad and Tobago	5
Tunisia	1
Turkey	3
Turkmenistan	4
Tuvalu	0
Uganda	1
Ukraine	5
United Arab Emirates	1
United Kingdom	5
Northern Ireland	5
Scotland	5
Wales	5
England	5
Tanzania	1
Virgin Islands	3
USA	5
Uruguay	4
Uzbekistan	4
Vanuatu	0
Yemen	0
Zambia	1
Zimbabwe	2

Data obtained from Global Burden of Disease Collaborative Network. Global Burden of Disease Study 2019 (GBD 2019). Seattle, United States of America: Institute for Health Metrics and Evaluation (IHME), 2020