# Global, regional, and national burdens of anxiety and depression in adolescents and young adults aged 10-24 years from 1990 to 2021: a trend analysis based on the Global Burden of Disease Study 2021

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# Global, regional, and national burdens of anxiety and depression in adolescents and young adults aged 10-24 years from 1990 to 2021: a trend analysis based on the Global Burden of Disease Study 2021

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## *Abstract*

**Background:** Depressive and anxiety disorders pose a significant public health concern, yet data on its burden and trends among adolescents and young adults are scarce. This study aimed to comprehensively analyze the trends of prevalence, incidence and disability adjusted life year (DALYs) for anxiety and depression among adolescents and young adults between 1990 and 2021 at the global, regional, and national levels.

**Objective:** Our findings aim to elucidate evolving trends and disparities in the burden of these mental health conditions, thereby informing evidence-based policy-making and targeted intervention strategies.

**Methods:** Data and methodologies publicly accessible from the 2021 Global Burden of Diseases (GBD) study were utilized to conduct a systematic analysis aimed at assessing the worldwide burden of anxiety and depression.

**Results:** In 2021, there were 57.49 million prevalent cases, 73.81 million incidence, and 10.72 million DALYs of depression among individuals aged 10-24 years. And there were 93.95 million prevalent cases, 16.67 million incidence, and 11.52 million DALYs of anxiety. Between 1990 and 2021, we observed increases in the prevalence of depression globally (AAPC, 0. 74 [95% CI, 0. 63, 0. 84]), incidence (AAPC, 0. 87 [95% CI, 0. 78, 0. 97]), the DALY rate (AAPC, 0.82 [95% CI, 0.72, 0.92]), and the prevalence of anxiety (AAPC, 0. 69 [95% CI, 0. 52, 0. 86]), incidence (AAPC, 0. 81 [95% CI, 0. 69, 0. 92]) and the DALY rate (AAPC, 0.69 [95% CI, 0.52, 0.86]). Notably, females had higher prevalence, incidence and DALYs rate than males. Globally, the age-standardized DALY rate for mental disorders was 1426·5 (95% UI 1056·4-1869·5) per 100000 population among males and 1703·3 (1261·5-2237·8) per 100 000 population among females. Age-standardized DALY rates of depression were highest in high-income North America, Western Europe, and Australasia, that of anxiety were Western Europe, Tropical Latin America and Andean Latin America. At the national revel, for depression, Greenland, the United States of America, and Palestine had the highest levels of incidence and China, Taiwan (Province of China), Democratic People's Republic of Korea the lowest, while Zambia, Zimbabwe and Canada showed the highest increase in the age-standardized prevalence during 1990-2021.for anxiety, Portugal, Lebanon and Iran had the highest levels of incidence and Uzbekistan, Kyrgyzstan and Kazakhstan the lowest. Overall, a negative association between the DALY rate and SDI was observed over the past thirty-two years.

**Conclusions:** On a global scale, the burden of anxiety and depression among adolescents did not change significantly from 1990 to 2019, but it significantly increased from 2020 to 2021 due to the impact of the COVID-19 pandemic. Therefore, it is necessary to raise awareness of the risk factors, consequences, and evidence-based treatment strategies for anxiety and depression among the population, strengthen effective intervention measures and cooperation among countries to improve adolescents' mental health care, and should focus on the adolescent population in high and low Socio-demographic Index (SDI) countries.

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# Original Manuscript

# Global, regional, and national burdens of anxiety and depression in adolescents and young adults aged 10-24 years from 1990 to 2021: a trend analysis based on the Global Burden of Disease Study 2021

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## Abstract

**Background:** Depressive and anxiety disorders pose a significant public health concern, yet data on its burden and trends among adolescents and young adults are scarce. This study aimed to comprehensively analyze the trends of prevalence, incidence and disability adjusted life year (DALYs) for anxiety and depression among adolescents and young adults between 1990 and 2021 at the global, regional, and national levels.

**Methods:** Data and methodologies publicly accessible from the 2021 Global Burden of Diseases (GBD) study were utilized to conduct a systematic analysis aimed at assessing the

worldwide burden of anxiety and depression.

**Results:** In 2021, there were 57.49 million prevalent cases, 73.81 million incidence, and 10.72 million DALYs of depression among individuals aged 10-24 years. And there were 93.95 million prevalent cases, 16.67 million incidence, and 11.52 million DALYs of anxiety. Between 1990 and 2021, we observed increases in the prevalence of depression globally (AAPC, 0. 74 [95% CI, 0. 63, 0. 84]), incidence (AAPC, 0. 87 [95% CI, 0. 78, 0. 97]), the DALY rate (AAPC, 0.82 [95% CI, 0.72, 0.92]), and the prevalence of anxiety (AAPC, 0. 69 [95% CI, 0. 52, 0. 86]), incidence (AAPC, 0. 81 [95% CI, 0. 69, 0. 92]) and the DALY rate (AAPC, 0.69 [95% CI, 0.52, 0.86]). Notably, females had higher prevalence, incidence and DALYs rate than males. Globally, the age-standardized DALY rate for mental disorders was 1426·5 (95% UI 1056·4-1869·5) per 100000 population among males and 1703·3 (1261·5-2237·8) per 100 000 population among females. Age-standardized DALY rates of depression were highest in high-income North America, Western Europe, and Australasia, that of anxiety were Western Europe, Tropical Latin America and Andean Latin America. At the national revel, for depression, Greenland, the United States of America, and Palestine had the highest levels of incidence and China, Taiwan (Province of China), Democratic People's Republic of Korea the lowest, while Zambia, Zimbabwe and Canada showed the highest increase in the age-standardized prevalence during 1990-2021.for anxiety, Portugal, Lebanon and Iran had the highest levels of incidence and Uzbekistan, Kyrgyzstan and Kazakhstan the lowest. Overall, a negative association between the DALY rate and SDI was observed over the past thirty-two years.

**Conclusions:** On a global scale, the burden of anxiety and depression among adolescents did not change significantly from 1990 to 2019, but it significantly increased from 2020 to 2021 due to the impact of the COVID-19 pandemic. Therefore, it is necessary to raise awareness of the risk factors, consequences, and evidence-based treatment strategies for anxiety and depression among the population, strengthen effective intervention measures and cooperation among countries to improve adolescents' mental health care, and should focus on the adolescent population in high and low Socio-demographic Index (SDI) countries.

**Keywords:** Depressive disorders; Anxiety disorders; Prevalence; Incidence; Disability-adjusted life-years; Global burden

## Introduction

Globally, mental disorders account for nearly 15% of life years lost, ranking them among the foremost causes of disability worldwide[1]. The COVID-19 Mental Disorders Collaborators have determined that, throughout 2020, the pandemic exacerbated this issue, resulting in a staggering 27.6% rise in major depressive disorders and a 25.6% surge in anxiety disorders globally[2]. Of note, anxiety and depression disproportionately affect women, with almost double the prevalence in comparison to men, and among girls aged 15-19, the prevalence of depression doubles[3]. This heightened burden, particularly for depression and anxiety, has been pronounced among adolescents and young adults aged 10-24, a crucial period marked by emotional and social development, educational pursuits, the formation of interpersonal and romantic ties, and career exploration[1]. This demographic, comprising 1.86 billion individuals in 2019 and representing a quarter of the global population, holds immense significance for future population health, social stability, and economic growth[4].

Anxiety and depression are prevalent, debilitating mental health conditions that frequently manifest during adolescence[5]. These disorders often coexist, with patients experiencing features of both anxiety and depression, meeting diagnostic criteria for both[6]. While increased corticotropin-releasing factor in cerebrospinal fluid has been observed in both conditions, other peptides and hormones within the hypothalamic-pituitary-adrenal axis are regulated distinctively[7].Depression inflicts profound and enduring suffering not only on individuals but also extends its impact to

families and communities, undermining social functioning and economic productivity[8].

The Global Burden of Diseases, Injuries, and Risk Factors Study (GBD), initiated in 1991, has provided a comprehensive empirical assessment of global health over the past three decades[9]. This systematic study quantifies health loss attributable to diseases and injuries across various demographics, including age, sex, year, and geographical location, enabling comparative analysis of disease burden. In this study, we present updated global, regional, and national-level estimates of prevalence and years lived with disability (YLDs) for anxiety and depression among adolescents and young adults aged 10-24 years[10,11]. Our findings aim to elucidate evolving trends and disparities in the burden of these mental health conditions, thereby informing evidence-based policy-making and targeted intervention strategies. Given the critical need to address specific childhood cancer burdens, we have utilized the latest data and refined methodology from GBD 2021 to analyze the global, regional, and national cancer-related burdens of anxiety and depression in adolescents and young adults aged 10-24 years from 1990 to 2021, providing crucial information for local governments to develop effective burden-reduction strategies.

## Methods

### Overview

The global burden of anxiety and depressive disorders among adolescents and young adults (aged 10-24 years) was derived from the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) 2021, which offers a comprehensive and updated analysis of 328 diseases and 87 risk factors across 204 countries and territories. Data on these mental health conditions were systematically collected for individuals aged 10-24 years, stratified by sex, three age subgroups (10-14, 15-19, and 20-24 years), and 21 geographically and epidemiologically clustered regional groupings as defined in the GBD framework.

Adolescence, spanning the transition from childhood to adulthood, involves biological maturation alongside social and behavioral development. While the World Health Organization (WHO) defines adolescence as ages 10-19 years, this study further categorizes this population into younger adolescents (10-14 years) and older adolescents (15-19 years), with young adults (20-24 years) analyzed separately. This granular age stratification aligns with established developmental milestones and societal perceptions of this life phase, enhancing the precision of burden assessment[11].

Key epidemiological metrics—including incident cases, prevalent cases, disability-adjusted life years (DALYs), incidence rates, and prevalence rates—were directly extracted from GBD 2021. All rates are standardized per 100,000 population. Uncertainty intervals (95% UIs) were calculated using

the 25th and 975th percentiles of 1,000 ordered estimates generated through GBD's computational algorithms. Detailed methodological protocols for GBD 2021, which align closely with WHO estimates, are described in prior publications and provided in the appendix[12].

The Socio-demographic Index (SDI), a composite metric reflecting regional development levels, integrates three components: lag-distributed income per capita, total fertility rate among females under 25, and average years of schooling for individuals aged 15 and older. This index contextualizes disparities in mental health burden across diverse socioeconomic settings[12].

**Case definition and data sources**

The 371 diseases and injuries analyzed in the Global Burden of Disease (GBD) 2021 are structured into a four-tiered hierarchical classification system, where causes at each level are mutually exclusive and collectively exhaustive. Within this framework, depressive disorders were classified into two distinct categories: major depressive disorder and dysthymia, while anxiety disorders were aggregated as a single cause encompassing all subtypes. To ensure methodological consistency, case definitions primarily followed DSM-IV-TR or ICD-10 diagnostic criteria, reflecting their widespread adoption in the mental health surveys integrated into the GBD analysis.

Major depressive disorder was defined by the presence of at least one major depressive episode characterized by persistent depressed mood or loss of interest/pleasure, occurring daily for a minimum of two weeks (DSM-IV-TR[13]: 296.21–296.24, 296.31–296.34; ICD-10: F32.0–F32.9, F33.0–F33.9). Dysthymia involved chronic depressive symptoms lasting most of the day, on more days than not, for at least two years (or one year in children and adolescents) (DSM-IV-TR: 300.4; ICD-10: F34.1). Anxiety disorders, modelled collectively as “any anxiety disorder” to prevent double-counting individuals with comorbid subtypes, included data sources reporting outcomes for “total” anxiety disorders that covered at least three subtypes (DSM-IV-TR[13]: 300.0–300.3, 308.3, 309.21, 309.81; ICD-10: F40–F42, F43.0, F43.1, F93.0–F93.2, F93.8).

Data for estimating depressive and anxiety disorder burdens were sourced from the GBD repository, the most comprehensive global database of population health information. This repository aggregates vital registration systems, verbal autopsies, disease registries, household surveys, surveillance systems, and administrative records (e.g., police reports) across 204 countries and territories[14]. Non-fatal health estimates incorporated additional sources such as peer-reviewed literature, epidemiological surveillance datasets, clinical informatics, and disease-specific registries. Data identification involved systematic reviews of online research databases, institutional repositories (e.g., WHO, national health agencies), published reports, and primary datasets to ensure

global coverage and methodological rigor.

**Statistical analysis**

The first aim of this study was to analyze global trends in the incidence, prevalence, and disability-adjusted life years (DALYs) of anxiety and depressive disorders. Age-specific rates and their average annual percentage changes (AAPCs) were calculated using linear regression models, with log-transformed rates as the dependent variable and calendar year as the independent variable. The AAPC, a summary metric of trends over a defined period, represents the weighted average of annual percentage changes (APCs) derived from the geometric mean of yearly trends in the regression analysis. For instance, an AAPC of 0.1% signifies an average annual rate increase of 0.1%. Trends were interpreted through AAPC values and their 95% confidence intervals (CIs).

The second aim focused on identifying the year with the most significant shifts in trends for these indicators. Joinpoint Regression Analysis was employed to model temporal trends by fitting segmented linear regressions on a logarithmic scale. The optimal number of inflection points (“joinpoints”) was determined using a Monte Carlo permutation test, with model selection guided by the Weighted Bayesian Information Criterion and expert input within the Joinpoint software (version 4.9.0.0).

The third aim stratified global trends by sex and Socio-demographic Index (SDI), while the fourth aim assessed regional and national patterns. AAPC methodology, as described above, was applied across all stratifications. Results were interpreted using effect sizes, CIs, uncertainty intervals (UIs), and exact p-values. Statistical analyses were conducted in Python (version 1.9.1), RStudio (version 1.4.1106), and the Joinpoint Regression Program.

**Results**

**Global trends**

The global trends in incidence, prevalence, and the DALY rate of anxiety and depressive disorders among adolescents and young adults aged 10-24 years between 1990 and 2021 are shown in Table 1. Overall, the incidence, prevalence and the DALY rate of anxiety and depressive disorders all increased between 1990 and 2021.

The Joinpoint regression analysis identified significant changes in trends [Figure. 1]. The incidence of depressive disorders increased slightly between 1990 and 2006(APC 0. 15), decreased markedly between 2006 and 2010 (APC -1. 28), increased moderate again between 2010 and 2019(APC 0. 34), and then increased dramatically between 2019 and 2021, which was the largest increasing trend (APC 14. 55). The depressive disorders related prevalence and DALY rates showed similar trends of no significant change between 1990 and 2001, an increase between 2001 and 2005,

and a decrease between 2005 and 2010, no significant change between 2010 and 2019, a significant increase between 2019 and 2021.

Otherwise, the incidence of anxiety disorders no significant change between 1990 and 2019(APC -0. 01), and then increased dramatically between 2019 and 2021(APC 13. 73). The anxiety disorders related prevalence and DALY rates showed similar trends of no significant change between 1990 and 2009, and a decrease between 2009 and 2019, a significant increase between 2019 and 2021. The incidence, prevalence, and DALY rate of depressive disorders are all notably higher compared to those of anxiety disorders.

**Global trends by sex**

Between 1990 and 2019, the prevalence, incidence, and DALY rate for anxiety disorders remained relatively stable in both sexes. However, significant increases in the prevalence, incidence, and DALY rate were observed for both sexes between 2019 and 2021. Overall, compared with anxiety disorders, depressive disorders exhibit a more pronounced increasing trend in the incidence.

Between 2019 and 2021, the incidence rate of anxiety disorders among women grew by an annual percentage change (APC) of 12.51%, while the incidence rate of depressive disorders increased by an even higher APC of 13.58%. In contrast, although men also faced an increase in mental health issues, the growth in the incidence rate of anxiety disorders was relatively moderate, reaching an APC of 11.75%, and the growth in the incidence rate of depressive disorders was also slightly lower than that of women.

According to the joint point regression analysis, the trends of incidence, prevalence, and DALY rates of depression and anxiety for both males and females are basically consistent with the overall trend [Figure 1]. From an overall perspective, the incidence, prevalence, and DALY rates associated with depression and anxiety in women are approximately 1.6 times higher than those observed in men, indicating a significant gender disparity. Of note, dramatic increases in the incidence of anxiety disorders were observed between 2019 and 2021 in both sexes (with an APC of 0.93 for males and 2. 01 for females). In terms of prevalence and the DALY rate, upward trends in females were generally maintained irrespective of fluctuations during the three decades, except for a slight decrease between 2008 and 2019 (APC -0. 31). In males, the two indicators remained relatively stable between 1990 and 2019, with a notable increase observed between 2019 and 2021.

[insert Figure 1 here]

**Regional trends**

Overall, at a global level, the disability caused by depression among 10-24-year-olds is positively correlated with the socio-demographic index (SDI) of global disease burden regions. This

means that the burden of depression is higher in regions with higher levels of socio-economic development. The burden in High-Income Asia Pacific, East Asia, South Asia, Southeast Asia, Eastern Europe, Central Europe, and Central Latin America is below the global disease burden expectations. The observed burden in High-Income North America, Western Europe, North Africa and the Middle East, Southern Latin America, Tropical Latin America, and Central Sub-Saharan Africa is above the average expectations. Tropical Latin America and High-Income North America show an inverted U-shape, while Australasia and Southern Latin America show a U-shape. The depression DALY rate in Southeast Asia, East Asia, and Central Asia remains stable with changes in the SDI. Central Latin America and High-Income Asia Pacific show an upward trend. East Asia and Western Europe show a downward trend in depression DALY rates with changes in the SDI. There was a surge in disability caused by depression among 10-24-year-olds globally in 2020 and 2021[Figure 2].

Overall, at a global level, the disease burden caused by anxiety disorders among 10-24-year-olds is positively correlated with the socio-demographic index (SDI) of global disease burden regions. This means that the burden of anxiety disorders is higher in regions with higher levels of socio-economic development. At the regional level, the observed burden in Tropical Latin America, Western Europe, Eastern Europe, North Africa and the Middle East, Andean Latin America, Southern Latin America, and High-Income North America is higher than expected. The observed burden in Western Sub-Saharan Africa, East Asia, Southeast Asia, High-Income Asia Pacific, and South Asia is lower than expected. High-Income Asia Pacific shows an M-shape. Central Latin America, Tropical Latin America, and East Asia show an inverted U-shape. Western Europe, Australasia, and South Asia show a U-shape. Central Europe, Central Asia, Southeast Asia, Sub-Saharan Africa, North Africa and the Middle East, and Andean Latin America overall show a stable trend. Almost all regions observed a surge in disease burden in 2020 and 2021[Figure 2].

[insert Figure 2 here]

**National trends**

For the 204 countries and territories in 2021, Greenland, the United States of America, and Palestine had the highest incidence of depressive disorders. In contrast, China, Taiwan (Province of China), Democratic People's Republic of Korea had the lowest incidence of depressive disorders [Figure. 3A]. Over the past decade, the largest increases in incidence were in the Qatar, Equatorial Guinea and Somalia, and the largest decrease were in the China, Bosnia and Herzegovina, Cuba [Figure. 3B].

During the past 32 years, the ASIRs of depressive disorders have increased the most in America,

followed by Mexico. The decreases of ASIR for depressive disorders was largest in China, followed by Singapore [Figure. 3C].

For the 204 countries and territories in 2021, Portugal, Lebanon and Iran (Islamic Republic of) had the highest incidence of anxiety disorders. In contrast, Uzbekistan, Kyrgyzstan and Kazakhstan had the lowest incidence of anxiety disorders [Figure. 4A]. Over the past decade, the largest increases in incidence were in the Qatar, Equatorial Guinea and Afghanistan, and the largest decrease were in the Taiwan (Province of China), Virgin Islands and South Korea [Figure. 4B]. During the past 32 years, the ASIRs of anxiety disorders have increased the most in Mexico, followed by Bulgaria. The decreases of ASIR for anxiety disorders was largest and unique in Taiwan (Province of China) [Figure. 4C].

[insert Figure 3 here]

[insert Figure 4 here]

At a country-level, in 2021, the DALYs rates of anxiety disorders per 100, 000 in the 14-24 years age group was positively correlated with the social population index When the social population index is less than 0. 75, it suggests a marginal expected increase in the DALYs of anxiety disorders. When the socio-demographic index is between 0. 75 and 0. 8, the DALYs of anxiety disorder has a small temporary decrease; When the sociodemographic index is above 0. 8, the DALYs of anxiety disorders increases significantly, and even approaches exponential growth [Figure. 5].

The variability in the DALYs of anxiety disorders is considerable among different countries, with the DALYs of anxiety disorders in most countries distributed along the black line of expectation, slightly higher or lower than expectation, and a small number of countries significantly lower or higher than expectation. It is worth noting that the DALYs of developed countries is also different, such as Greece, France DALYs is much higher than expected, especially Portugal has the highest DALYs of 204 countries while Japan, Singapore DALYs is far lower than expected. Similarly, there are also disparities in the DALYs of anxiety disorders among developing countries and those categorized as the Third World. such as Afghanistan, Lebanon and Palestine, the DALYs of Brazil is far higher than expectations, India, Kyrgyzstan, Kazakhstan rates are well below expectations. This suggests that in addition to the level of national economic development, the DALYs of anxiety disorders may also be affected by global location or other factors. Overall, around the world, the proportion of countries with less than expected anxiety disorders is about the same as those with higher-than-expected rates.

Significant variations in depression DALYs exist among diverse countries. The majority of

nations adhere to an expected trendline, with depression rates hovering just above or below the anticipated threshold. However, a notable minority of countries exhibit substantial deviations, either significantly below or above the expected DALYs. Notably, even within the category of developed nations, there are distinct disparities in depression DALYs. For example, Greenland, the United States, and the United Kingdom display higher depression rates than the expected values, whereas Norway, Germany, Japan, and Singapore exhibit lower DALYs [Figure. 5].

From a broader perspective, the majority of countries with depression rates exceeding the expected threshold are developing nations or those classified as belonging to the Third World. This suggests that higher socio-economic development is associated with lower depression DALYs. However, it is crucial to recognize that Greenland, despite its status as a developed country, possesses the highest depression DALYs. This outlier status can be attributed to its unique geographical location in the Arctic, surpassing even Iceland's remoteness, coupled with its extreme cold climate and sparse population. This observation underscores the importance of factors beyond socio-economic development, including geographical location and climatic conditions, in influencing depression DALYs [Figure. 5].

[insert Figure 5 here]

**Table. 1 Global incidence, prevalence, DALY rate, and their APCs of anxiety and depressive disorder between 1990 and 2021 by sex, SDI quintile, and region.**

| Location | Type | Incidence (95%UI) | | | Prevalence (95%UI) | | | DALYs (95%UI) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Count | ASIR (per 100, 000) | APC | Count | ASPR (per 100, 000) | APC | Count | DALY rate (per 100, 000) | APC |
| Global | depressive | 73809680. 85 (53637290. 78 to 97618586. 15) | 3909. 88 (2841. 30 to 5171. 10) | 0. 21 (-0. 31 to 1. 24) | 57488801. 52 (44127193. 40 to 73889611. 62) | 3045. 32 (2337. 53 to 3914. 11) | 0. 18 (-0. 26 to 1. 01) | 10718194. 81 (6792135. 50 to 15633301. 28) | 567. 77 (359. 80 to 828. 13) | 0. 20 (-0. 45 to 1. 84) |
| Global | Anxiety | 16670879. 62 (12024089. 39 to 22032683. 60) | 883. 10 (636. 95 to 1167. 13) | 0. 20 (-0. 32 to 1. 28) | 93947156. 54 (71898221. 62 to 120279390. 63) | 4976. 61 (3808. 62 to 6371. 49) | 0. 17 (-0. 27 to 0. 99) | 11523716. 42 (7273257. 71 to 16910889. 82) | 610. 44 (385. 28 to 895. 81) | 0. 17 (-0. 48 to 1. 81) |
| High SDI | depressive | 12511299. 26 (9407430. 81 to 15996312. 61) | 6741. 92 (5069. 35 to 8619. 87) | 0. 39 (-0. 04 to 1. 69) | 9218395. 51 (7279862. 23 to 11459503. 00) | 4967. 48 (3922. 87 to 6175. 14) | 0. 33 (-0. 04 to 1. 32) | 1785617. 17 (1165099. 33 to 2617759. 78) | 962. 21 (627. 83 to 1410. 62) | 0. 36 (-0. 29 to 2. 53) |
| High SDI | Anxiety | 2274833. 62 (1640893. 25 to 2991722. 64) | 1225. 83 (884. 22 to 1612. 14) | 0. 27 (-0. 25 to 1. 49) | 12979927. 15 (10096444. 62 to 16637656. 37) | 6994. 44 (5440. 63 to 8965. 47) | 0. 25 (-0. 18 to 1. 20) | 1584215. 40 (1000565. 94 to 2303099. 69) | 853. 68 (539. 17 to 1241. 06) | 0. 25 (-0. 43 to 2. 09) |
| High-middle SDI | depressive | 7977472. 44 (5895769. 06 to 10454886. 87) | 3531. 73 (2610. 13 to 4628. 51) | 0. 15 (-0. 33 to 1. 01) | 6224703. 52 (4783419. 34 to 7980204. 78) | 2755. 76 (2117. 68 to 3532. 94) | 0. 12 (-0. 30 to 0. 84) | 1170484. 47 (734971. 44 to 1738150. 46) | 518. 19 (325. 38 to 769. 50) | 0. 14 (-0. 49 to 1. 65) |
| High-middle SDI | Anxiety | 2084463. 64 (1533623. 26 to 2780787. 45) | 922. 82 (678. 95 to 1231. 09) | 0. 22 (-0. 29 to 1. 33) | 12626310. 20 (9562158. 15 to 16260637. 82) | 5589. 83 (4233. 29 to 7198. 79) | 0. 20 (-0. 25 to 1. 03) | 1558091. 64 (976352. 97 to 2307594. 59) | 689. 79 (432. 24 to 1021. 60) | 0. 20 (-0. 47 to 1. 86) |
| Middle SDI | depressive | 17617055. 88 (13056072. 22 to 23397245. 09) | 3187. 19 (2362. 04 to 4232. 92) | 0. 16 (-0. 34 to 1. 13) | 13868381. 90 (10700016. 20 to 17740210. 97) | 2509. 00 (1935. 80 to 3209. 47) | 0. 14 (-0. 29 to 0. 91) | 2574804. 55 (1643530. 06 to 3783562. 30) | 465. 82 (297. 34 to 684. 50) | 0. 16 (-0. 48 to 1. 72) |
| Middle SDI | Anxiety | 5018673. 64 (3600931. 75 to | 907. 95 (651. 46 to 1200. 21) | 0. 23 (-0. 29 to 1. 37) | 29018755. 17 (22578283. 73 to | 5249. 94 (4084. 76 to 6581. 35) | 0. 20 (-0. 23 to 0. 97) | 3572196. 73 (2263863. 40 to | 646. 26 (409. 57 to 945. 90) | 0. 20 (-0. 46 to 1. 84) |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 6634075. 92) | | | 36378105. 27) | | | 5228392. 03) | | |
| Low-middle SDI | depressive | 21250480. 37 (15232170. 63 to 28609514. 33) | 3844. 53 (2755. 73 to 5175. 89) | 0. 19 (-0. 35 to 1. 25) | 16653939. 38 (12699261. 81 to 21849250. 56) | 3012. 95 (2297. 49 to 3952. 86) | 0. 17 (-0. 29 to 1. 07) | 3084347. 30 (1946037. 18 to 4492344. 32) | 558. 01 (352. 07 to 812. 73) | 0. 19 (-0. 47 to 1. 83) |
| Low-middle SDI | Anxiety | 4390668. 87 (3129600. 67 to 5882209. 78) | 794. 34 (566. 19 to 1064. 18) | 0. 21 (-0. 33 to 1. 37) | 23638317. 21 (17899735. 99 to 30770373. 49) | 4276. 53 (3238. 33 to 5566. 83) | 0. 22 (-0. 24 to 1. 19) | 2893763. 53 (1835906. 31 to 4230363. 60) | 523. 53 (332. 14 to 765. 34) | 0. 22 (-0. 44 to 2. 00) |
| Low SDI | depressive | 14398341. 84 (10007286. 25 to 19592571. 76) | 3897. 59 (2708. 94 to 5303. 65) | 0. 14 (-0. 40 to 1. 25) | 11480881. 35 (8605718. 17 to 14945077. 18) | 3107. 84 (2329. 54 to 4045. 59) | 0. 12 (-0. 35 to 0. 94) | 2094963. 97 (1268939. 95 to 3087420. 49) | 567. 10 (343. 50 to 835. 76) | 0. 14 (-0. 52 to 1. 76) |
| Low SDI | Anxiety | 2888375. 27 (2061185. 50 to 3865352. 72) | 781. 87 (557. 96 to 1046. 34) | 0. 16 (-0. 37 to 1. 24) | 15602914. 97 (11559359. 81 to 20929763. 12) | 4223. 66 (3129. 09 to 5665. 63) | 0. 17 (-0. 32 to 1. 18) | 1905521. 99 (1156774. 40 to 2829339. 52) | 515. 82 (313. 14 to 765. 89) | 0. 18 (-0. 50 to 1. 90) |

**Discussion**

This study provides a comprehensive understanding of trends in the prevalence of anxiety and depressive disorders and the associated incidence and DALY rate in adolescents and young adults aged 10-24 years between 1990 and 2021 at the global, regional, and national levels. Our findings show that in 2021, there were 57.49 million prevalent cases of depressive disorder, 73.81 million incidence, and 10.72 million DALYs among individuals aged 10-24 years. And there were 93.95 million prevalent cases of anxiety disorder, 16.67 million incidence, and 11.52 million DALYs among individuals aged 10-24 years. However, though the burden of anxiety and depressive disorders derives mainly from the youth population, detailed information regarding the anxiety and depressive disorders burden and its trends in this population has been scarce. Our present findings help to fill this gap and add important evidence in support of the need for the prevention and control of anxiety and depressive disorders. It is noteworthy that we have observed the most significant trend of increasing prevalence since 2020. This finding underscores the urgent need for attention to the rapidly growing burden of anxiety and depressive disorders that we are currently facing, which caused by the COVID-19 pandemic.

We observed that the age-specific incidence, prevalence and DALY rates of anxiety and depressive disorders were approximately 1.6 times higher in females than in males[15]. The reason why the incidence, prevalence and DALY of anxiety and depression among females aged 10-24 is higher than that of males is multifaceted, involving biological, psychological, and sociocultural factors. Firstly, during puberty, females experience significant hormonal fluctuations, particularly in estrogen and progesterone levels, which are directly linked to emotional fluctuations and depressive symptoms[16,17]. Studies have also found that female brain structure and function differ from males in terms of emotion regulation and stress response, and these differences may make females more prone to anxiety and depressive symptoms[18]. Additionally, females are at a higher risk of experiencing violence and gender-related trauma during puberty, and these experiences have a strong association with the occurrence of anxiety and depressive symptoms[19-21]. The interplay of these

factors results in a higher prevalence of anxiety and depression among females aged 10-24 compared to males. In summary, our research findings underscore the disparities in disease burden between genders, highlighting the need for greater medical, psychological, and social support for adolescent females from national, governmental, and educational institutions.

We also found variation in the burden of anxiety and depressive disorders according to the SDI quintile. In this analysis, the high SDI quintile showed relatively bad control of anxiety and depressive disorders and had the highest incidence and prevalence, with an increasing trend over the years. This may be due to the following reasons: Educational pressures, especially in the context of limited employment opportunities for out-of-school young people, is a risk factor for suicide and poor mental health[22]. Adolescents and young adults in high SDI regions often face significant academic, social, and familial pressures. High expectations in terms of academic performance and career achievements can contribute to stress, anxiety, and depressive disorders[23]; Stronger awareness and superior diagnostic capabilities: In high SDI regions, there is typically greater awareness and better access to mental health services. This can lead to higher rates of diagnosis of anxiety and depressive disorders. While this is positive in terms of identifying and treating these conditions, it also means that prevalence rates appear higher[24]. Otherwise, the low SDI quintile currently also has high incidence, prevalence and DALY rate. In low SDI regions, the prevalence of depression and anxiety among children is influenced by a multitude of factors. These factors encompass poverty, low birth weight, malnutrition, high burden of infectious diseases, lack of early childhood stimulation, exposure to humanitarian crises, and limited access to education[23]. Overall, adolescents and young adults in both high and low SDI quintiles face a heavier burden of anxiety and depression. Consequently, for low SDI quintiles, future global mental health policies and intervention strategies should be tailored specifically to address the needs of these vulnerable populations. In contrast, high SDI quintiles should implement national-level policies that ensure youth employment, regulate drug and alcohol use, and

enforce school-wide programs to prevent bullying, among other measures, in order to reduce the incidence of anxiety and depression among adolescents.

From 1990 to 2021, the DALY rates caused by anxiety and depressive disorders exhibited significant differences across regions with varying SDI levels. Globally, the disability rates among 10-24-year-olds due to anxiety and depression disorders are positively correlated with the social demographic index of regions with a high disease burden. Possible explanations include: advanced healthcare systems in high-income countries that can identify early, a prevalent awareness of psychological counseling among high-income populations, a high emphasis on mental health, and the high-pressure lifestyle and intense social competition faced by people in high-income countries[25].

In East Asia, the DALY rates for anxiety and depressive disorders show little variation with SDI and remain stable. This stability may be associated with traditionally tighter social and family structures in these regions, providing stronger social network support[26]. The face culture in East Asia might make anxiety issues appear as weaknesses or failures, which is another possible reason for their lower DALY rates[26]. The introverted culture emphasizes restraint and tends to hide personal emotional problems. The gender expectations in East Asian countries (expecting men to be strong and independent, and women to be gentle and compliant) may also lead to underreporting of anxiety disorders[27].

Southern Latin America and Central Latin America show an upward trend: these regions have experienced rapid urbanization and economic transformation, bringing new social pressures. Traditional social structures and family support networks may be weakened during the urbanization process. The rapid economic development is accompanied by social inequality and poverty, high crime rates, and violence, which are significant factors affecting mental health[28,29].

In less developed regions such as Tropical Latin America, North Africa and the Middle East, and Andean Latin America, poverty, social inequality, violence, and social and political instability are likely the main factors contributing to DALY rates

above the average. However, in extremely underdeveloped areas like Sub-Saharan Africa, the significant lack of medical resources, mental health awareness, education, and cultural differences can explain why their DALY rates are below the average. In these regions, mental health issues are often considered a cultural taboo, with psychological problems misunderstood as a sign of mental weakness or "possession by evil spirits." People may fear being labeled as mentally weak and choose to avoid these issues to escape social stigmatization[30,31].

High-income Asia Pacific shows an upward trend: this region includes countries like Japan, South Korea, Australia, and New Zealand. The highly competitive work culture may contribute to this upward trend. South Korea's highly competitive education system and immense academic pressure result in a significant number of adolescents suffering from anxiety and depression[2].

Furthermore, globally, the disability rates among 10-24-year-olds due to anxiety and depression surged in 2020 and 2021. This increase can largely be attributed to the health crisis caused by the COVID-19 pandemic (such as fear of virus infection, psychological stress from illness and death, and increased feelings of loneliness and psychological discomfort due to isolation and lockdown policies) and economic instability. Limited access to mental health services during the pandemic also contributed to the surge in anxiety and depression rates[32].

Regionally, the burden observed in Tropical Latin America, North Africa and the Middle East, Southern Latin America (due to political turmoil and conflict, social change, and economic and social instability), high-income North America (due to high-pressure lifestyles and high rates of depression diagnosis), the Caribbean, Oceania, and Pacific Islands (due to geographical and social isolation, and frequent natural disasters) is higher than expected, while most other regions fall below the global disease burden expectations. The main reason for the globally lower-than-expected depression rates may be the uneven distribution of medical resources. Low-income countries tend to prioritize acute diseases over mental health issues. These findings highlight the necessity to improve mental health services and reduce the

burden of depression globally, especially in resource-poor low- and middle-income regions. To effectively address this challenge, countries need to formulate appropriate public health policies and interventions based on their socio-economic conditions and cultural backgrounds.

Temporal trends in anxiety and depressive disorders among adolescents and young adults varied markedly across the 204 countries and territories. From 1990 to 2021, relative change in incident cases and the EAPC of depressive disorders in China decreased obvious, and the decline was the most significant worldwide. Otherwise, in 2021, China had the lowest incidence of depression over the world.

China has invested considerable efforts in the mental health of children and adolescents, including implementing the "Double Reduction Policy" nationwide (aiming to alleviate the burden of excessive homework and off-campus tutoring for students). China is standardizing and normalizing the mental health assessments of primary and middle school students, conducting them at least once a year, and providing more training and attention to school leaders and teachers to help them understand, adapt to, and intervene in students' mental health issues early on[33].Furthermore, the decline in the burden of mental illnesses among Chinese adolescents from 1993 to 2018 coincides with a significant increase in health service coverage[34]. We observe a notable decline in the incidence of mental disorders during the period from 1990 to 2019, indicating the effectiveness of the aforementioned intervention measures. However, some articles have also pointed out that the prevalence of depressive symptoms self-reported by Chinese children and adolescents is much higher than that reported by parents or teachers[35]. The lower reported incidence rate may also be related to underreporting, underdiagnosis, and differences in diagnostic criteria and classifications[2]. This underscores the need for enhanced monitoring of mental health disorders, increased investment in preventive policies, including school-based health promotion, and high-quality healthcare, particularly primary healthcare services. Additionally, the sharp rise in clinically significant levels of depression and anxiety experienced by adolescents during the pandemic[36]

reinforces the urgency to augment investments in mental health services and preventive-oriented interventions.

In this research, we present an analysis of the depressive and anxiety disorder Disability-Adjusted Life Years (DALYs) per 100, 000 individuals in 204 countries for the year 2021, alongside the corresponding socio-demographic indices. Our findings indicate considerable variations in the incidence of anxiety disorders across diverse national contexts, including between developed, developing, and third-world nations. Notably, specific countries exhibit alarmingly high DALYs for depressive and anxiety disorders per 100, 000 inhabitants, deviating significantly from anticipated norms.

For instance, High depression DALYs in Greenland and other frigid regions stem from multiple factors. Firstly, Arctic communities have undergone substantial socio-economic transformations in 50 years, impacting indigenous youth's mental health amidst multipolar politics and diverse values. Polar communities also face housing, healthcare, education, and employment inequalities compared to non-indigenous groups[36]. Secondly, cultural factors play a role. Cultural factors play a pivotal role in Arctic mental health. Differences exist among indigenous communities, with Inuit valuing privacy in emotions versus Alaska Natives' openness. A supportive cultural environment for emotional expression enhances mental health. Notably, Sami's low suicide rates reflect cultural identity and belonging, while Norway's cultural renaissance has protected Sami adolescents' mental health[36]. Thirdly, Environmental changes have wide-ranging, severe, and negative impacts on Arctic lifestyles, livelihoods, cultures, health, and well-being[37]. Arctic climate change has made some communities uninhabitable, exacerbating cultural loss and land disconnection, causing depression, and substance abuse. For Canadian Indigenous, altered ice conditions restrict traditional activities (hunting, fishing), crucial to their culture, diminishing spiritual fulfillment and harming mental health[38]. Lastly, contrary to popular belief, long hours of sunlight also affect mental health. Greenland boasts one of the world's highest suicide rates, notably among adolescents and young adults, with suicides peaking during the Polar Day. Inhabitants accustomed to limited daylight struggle to

adjust to extended sunlight exposure, predisposing them to summer insomnia. Disrupted circadian rhythms and sleep deprivation negatively affect mental well-being[39].

This observation suggests a correlation between depression incidence and socioeconomic status, indicating that higher levels of socioeconomic development are associated with relatively lower depression incidence rates. However, there are exceptions such as the USA. In developed, individualistic countries like the US, high SDI contributes to higher depression DALYs due to greater competition and social pressure[40]. Societal changes, including economic transitions, value diversification, demographic shifts, and social pressures, have led to increased adolescent morbidity, especially during late adolescence. Technological advancements and lifestyle changes have reduced physical activity, increased weight, and disrupted sleep, while marijuana use and excessive electronic device usage contribute to depression. Urbanization drives migration from rural to urban areas, exposing adolescents to stressors like competition, income inequality, and social stratification, leading them to seek coping mechanisms like alcohol and cigarettes[41]. Drug use, initially for health, can lead to psychological and physical dependence, causing neurotransmitter imbalances and depression, exacerbated by opioids, tobacco, alcohol, marijuana, and recreational drugs[42]. Bullying, rooted in factors like immigration, refugee status, and sexual norms, elicits negative emotions, impairs emotional regulation, and correlates with depression, with lasting impacts. High-income North American youth's increased device and internet access heightens cyberbullying risks[43]. Of particular note are public health emergencies. Taking COVID-19 as an example, it has undeniably impacted mental health at both individual and societal levels globally, with the potential risk of death elevating stress levels among the public and students. It has caused a range of psychological and emotional disturbances, including anxiety, depression, stress, sleep disturbances, and fear, while also increasing substance use and suicidal ideation[44]. During the pandemic, mental health issues were most prevalent among ethnic minorities (e.g., Hispanics and African Americans),

individuals with children in the household, those residing in both rural and urban areas, individuals with an annual household income of less than $60,000, and individuals aged 18-25[45].

In regions with frequent wars and political turmoil, such as Syria, Lebanon, and the primary cause of high rates of anxiety DALYs is societal. Undoubtedly, political instability affects mental health, and its impacts are manifested in several aspects: Firstly, an individual's intolerance for uncertainty positively correlates with the levels of anxiety[45]. The ongoing Lebanese crisis has led to an increase in psychological distress among citizens, particularly young people, heightened uncertainty about their future, resulting in high levels of anxiety. Secondly, social cohesion is crucial. Refugees are vulnerable to attacks from host countries or communities, leading to psychological problems, which can be improved by enhancing community cohesion. Vulnerable host communities and Syrian refugee communities often exhibit low social cohesion, with living conditions, poverty, and overt aggression from host communities (like neighbors or employers) exacerbating mental health issues[46]. Fourthly, unsafe public spaces[46] direct abuse or indirect abuse can prompt adolescents to withdraw, but this limited mobility can worsen mental health, particularly feelings of restriction and hopelessness for the future. Fifthly, adolescents in both Syria and Lebanon live in overcrowded and substandard housing which can limit adolescents' solitary spaces for self-reflection and contemplation, reducing their quality of life and affecting their mental health. Sixthly, supportive and trusting relationships[46] facilitate good mental health among adolescents. Conversely, trauma from domestic and interpersonal violence hinders mental health and requires increased attention in both refugee and non-refugee settings. Seventhly, food insecurity[47] significantly correlates with depression in mental health indicators. In Greater Beirut, Lebanon, one-third of mothers experience moderate to severe food insecurity and suffer from PTSD or moderate to severe depression.

Our study further reveals a notable relationship between the anticipated anxiety disorder DALYs and the socio-demographic index (SDI). When the SDI falls below 0.

75, the anticipated rise in anxiety disorder incidence remains modest. Conversely, within the SDI range of 0. 75 to 0. 8, there is a transient and minor decrement in anxiety disorder incidence. However, as the SDI surpasses 0. 8, a substantial, and potentially exponential, surge in anxiety disorder incidence is observed, presenting a novel direction for treating anxiety disorders and mitigating their prevalence. The Socio-demographic Index (SDI), a composite metric, serves as a barometer for gauging the developmental status of a country or region.

**Limitations**

This study has some limitations. First, the analysis relied on data from the Global Burden of Diseases (GBD) Study 2021, which aggregates information from a wide array of sources. While the GBD study employs robust methodologies to ensure consistency and comparability, variations in data quality and availability across regions and time periods may have introduced bias. For instance, low- and middle-income countries often have limited mental health surveillance systems, leading to potential underreporting or misclassification of anxiety and depressive disorders. Second, the study's reliance on diagnostic criteria such as DSM-IV-TR and ICD-10 may limit the generalizability of findings to regions that use alternative diagnostic frameworks or where cultural perceptions of mental health differ. Additionally, the criteria may not fully capture the spectrum of anxiety and depressive disorders, particularly subclinical or emerging symptoms among adolescents and young adults. Third, the study's broad categorizations may mask substantial heterogeneity within regions and countries. For example, rural versus urban differences or disparities among subpopulations such as refugees, ethnic minorities, and indigenous groups were not explicitly analyzed, potentially overlooking key vulnerabilities.

To address these limitations, future studies should: Enhance data collection systems, particularly in low- and middle-income countries, to improve the accuracy and granularity of mental health surveillance. Incorporate mixed-methods approaches to capture cultural and contextual nuances in mental health diagnosis and treatment. Evaluate the effectiveness of targeted interventions across diverse settings to identify

scalable and context-specific strategies. By addressing these gaps, future research can build on the findings of this study to better inform global and regional mental health policies and interventions.

**Conclusions**

This study comprehensively analyzes the global, regional, and national burdens of anxiety and depression among adolescents and young adults aged 10-24 years over the past three decades. The findings underscore the increasing prevalence, incidence, and disability-adjusted life years (DALYs) of these mental health conditions, particularly since 2020, driven largely by the COVID-19 pandemic. The disparities in the burden of anxiety and depression across different sexes, socio-demographic indices (SDIs), and geographic regions emphasize the multifaceted nature of these challenges. Females consistently show higher rates compared to males, reflecting complex biological, psychological, and sociocultural determinants. Similarly, regions with both high and low SDI levels experience unique risk factors contributing to the mental health burden, ranging from academic and social pressures in high-SDI regions to poverty and lack of resources in low-SDI regions. Significant global, regional, and national variations in trends highlight the need for targeted, evidence-based interventions. For instance, while some countries like China demonstrate declining trends due to robust policies and interventions, others face growing burdens necessitating urgent action. Ultimately, addressing the growing mental health burden requires a holistic, multi-sectoral approach. This includes increasing awareness, investing in mental health services, strengthening preventive measures, and fostering international collaboration to reduce disparities and improve mental health outcomes for adolescents and young adults globally.

**Author Contributions**

Lu Fan and Hongguo Rong conceived of the presented idea. Jiaxuan Lv monitored the data collection and analysis. Jiaxuan Lv and Guolin Guo extracted the data. Jiaxuan Lv, Huangxin Zhao and Zijian Liu composed the first draft of the paper, and Guolin Guo inputted into subsequent drafts. Lu Fan and Hongguo Rong provided

comments related to the presentation of the findings and critically reviewed the manuscript. All authors had complete access to all the results of the study and approved the final manuscript.

**Competing interests**

The authors declare that there is no conflict of interest.

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**Figure legends**

**Figure. 1 Joinpoint regression analysis of the prevalence, incidence, and DALY rate for anxiety disorders and depressive disorders in adolescents and young adults aged 10-24 years from 1990 to 2021.**

**Figure 2. 10-24 years Disability-Adjusted Life Years (DALY) from depressive and anxiety disorders per 100 000 population for 21 Global Burden of Disease regions by sociodemographic index, 1990-2021. Purple line represents expected values based on sociodemographic index and disease rates in all locations.**

**Figure. 3 The global disease burden of depressive disorders among 10-24 years in 204 countries or territories. (A) The ASIR of depressive disorders in 2021. (B) The relative change in incident cases of depressive disorders between 1990 and 2021. (C) The EAPC of ASIR of depressive disorders from 1990 to 2021.**

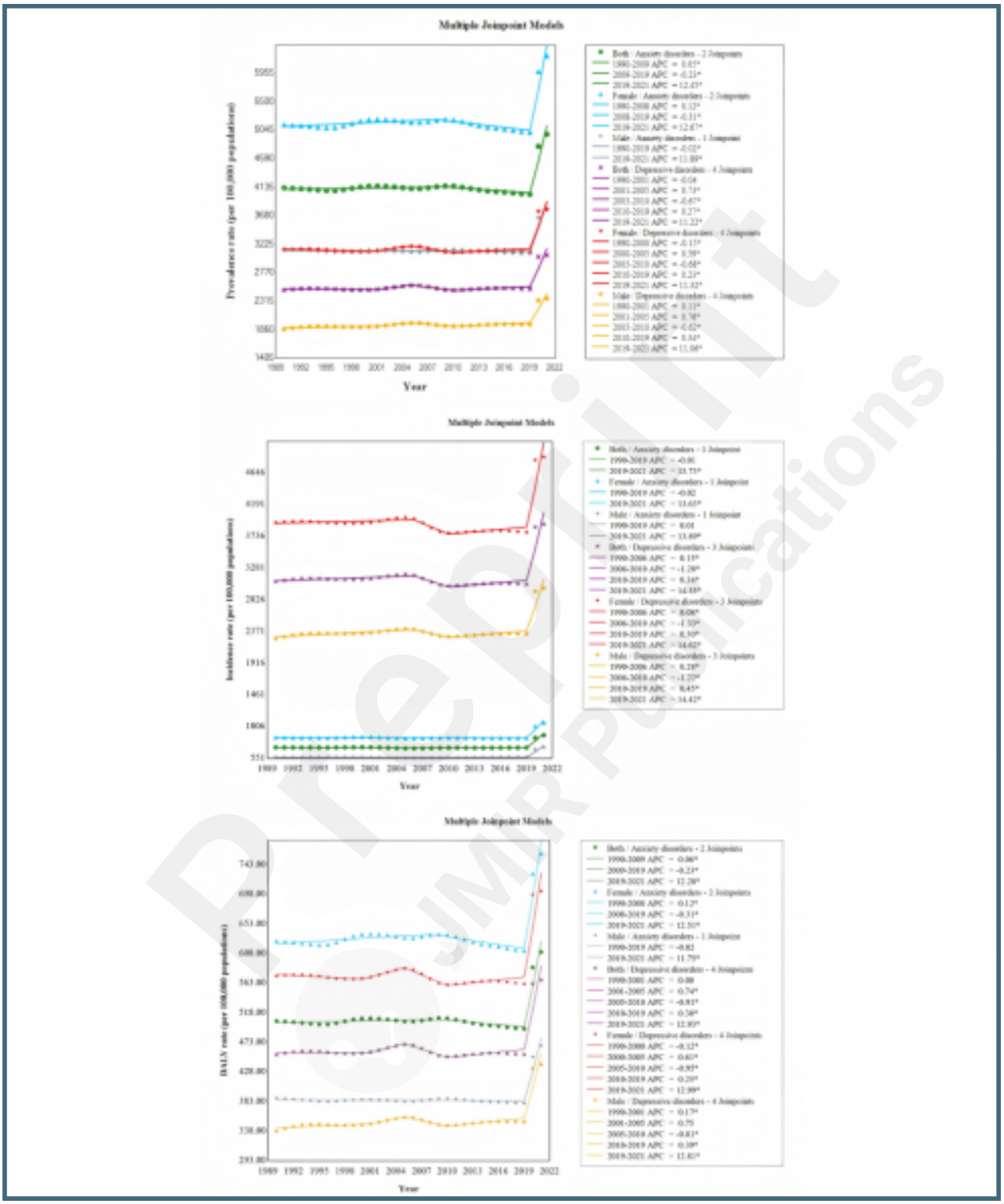
**Figure. 4 The global disease burden of anxiety disorders among 10-24 years in 204 countries or territories. (A) The ASIR of anxiety disorders in 2021. (B) The relative change in incident cases of anxiety disorders between 1990 and 2021. (C) The EAPC of ASIR of anxiety disorders from 1990 to 2021.**

**Figure. 5 10-24 years DALYs from anxiety and depressive disorders per 100, 000 population by 204 countries and sociodemographic index, 2021.**

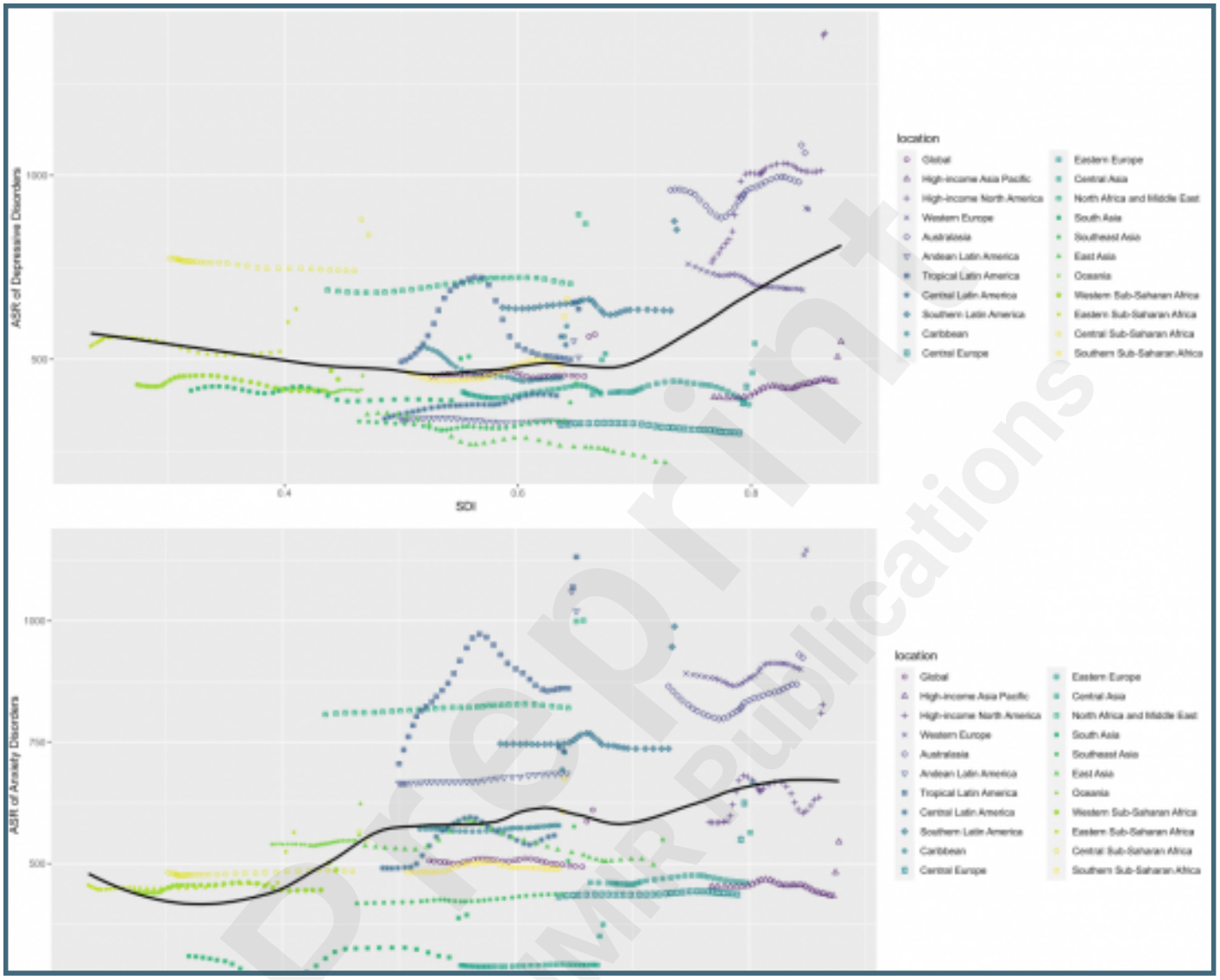
# Supplementary Files

# Figures

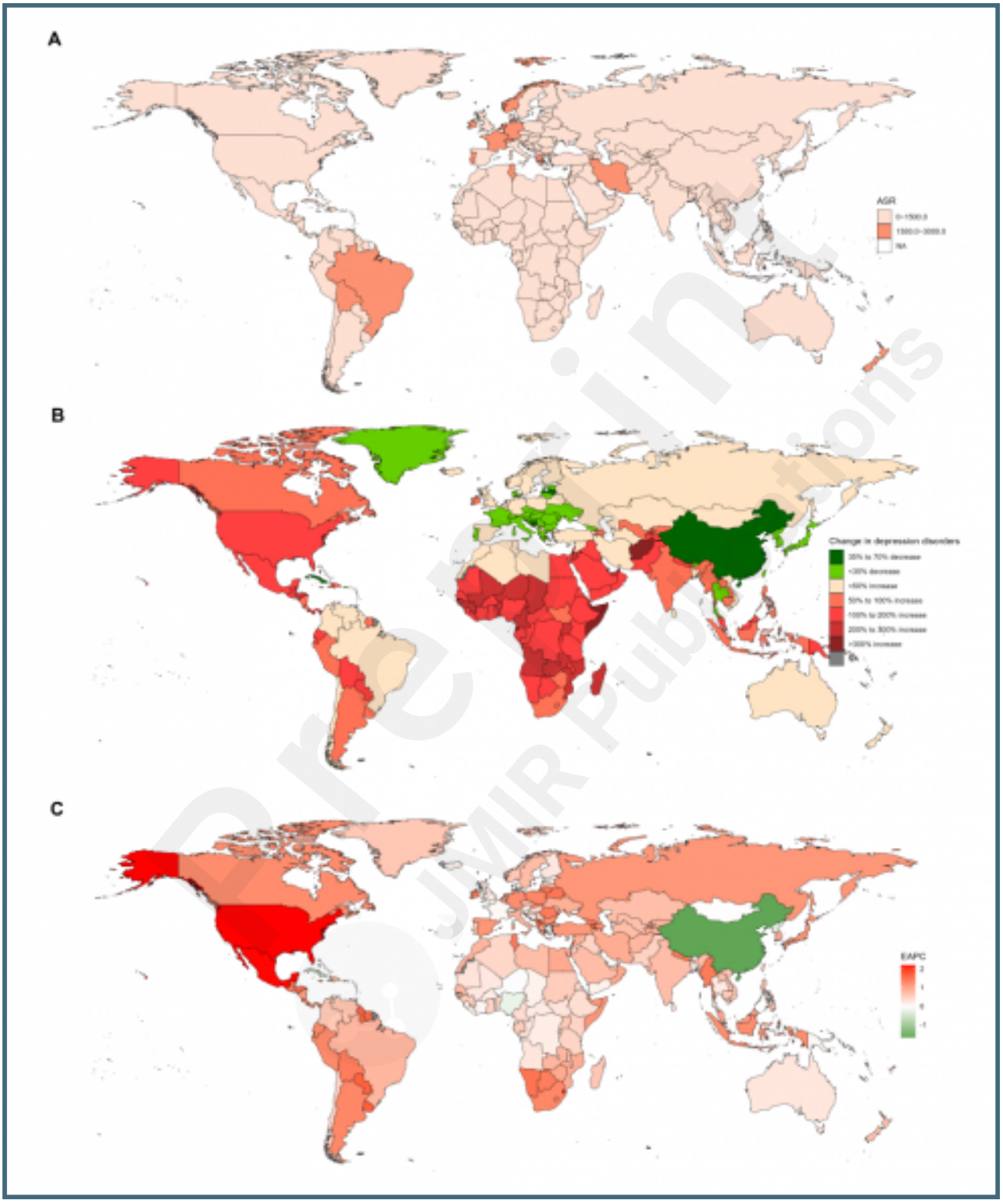
Joinpoint regression analysis of the prevalence, incidence, and DALY rate for anxiety disorders and depressive disorders in adolescents and young adults aged 10-24 years from 1990 to 2021.



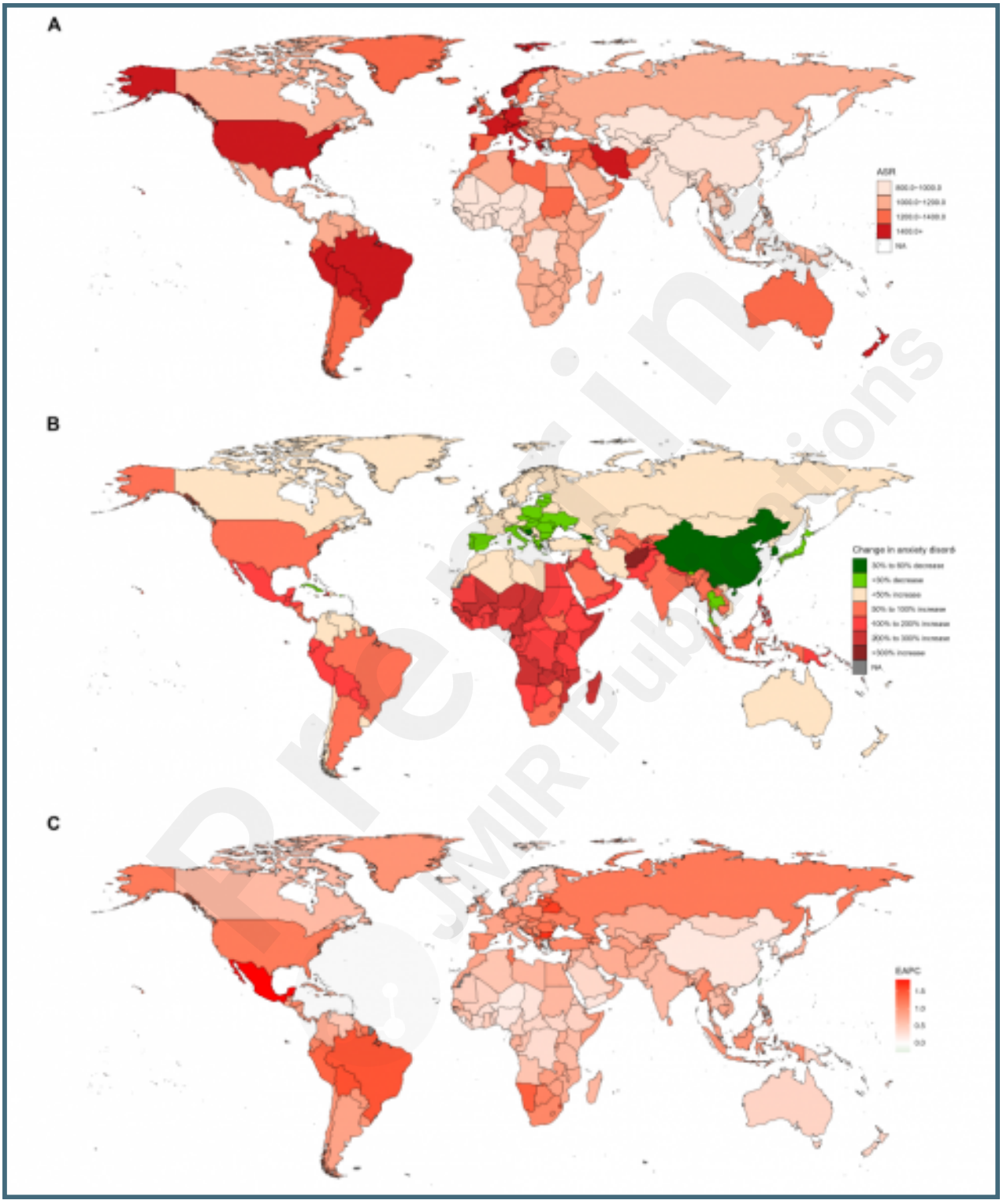
10-24 years Disability-Adjusted Life Years (DALY) from depressive and anxiety disorders per 100 000 population for 21 Global Burden of Disease regions by sociodemographic index, 1990-2021. Purple line represents expected values based on sociodemographic index and disease rates in all locations.



The global disease burden of depressive disorders among 10-24 years in 204 countries or territories. (A) The ASIR of depressive disorders in 2021. (B) The relative change in incident cases of depressive disorders between 1990 and 2021. (C) The EAPC of ASIR of depressive disorders from 1990 to 2021.



The global disease burden of anxiety disorders among 10-24 years in 204 countries or territories. (A) The ASIR of anxiety disorders in 2021. (B) The relative change in incident cases of anxiety disorders between 1990 and 2021. (C) The EAPC of ASIR of anxiety disorders from 1990 to 2021.



10-24 years DALYs from anxiety and depressive disorders per 100, 000 population by 204 countries and sociodemographic index, 2021.