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Epidemiology of anxiety disorders: global burden and sociodemographic associations

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Abstract

Background Anxiety disorders comprise some of the most common mental health conditions. This study examined the global and regional burden of anxiety disorders over the last three decades. The study was designed to help accurately target preventative and management efforts by highlighting trends and high-risk groups. Epidemiological data relating to anxiety disorders from the latest Global Burden of Disease dataset were analyzed to determine the prevalence, incidence, and disability adjusted life years (DALYs) rates from 1990 to 2019 for 204 countries and regions.

Results An estimated 4.05% of the global population has an anxiety disorder, translating to 301 million people. The number of persons affected has increased by more than 55% from 1990 to 2019. Anxiety disorder metrics show a continuous increase in prevalence, incidence, and DALY rates. Portugal has the highest prevalence (8,671 cases per 100,000), followed by Brazil, Iran, and New Zealand. The prevalence is higher in high-income regions. Women are 1.66 times more likely to be affected by anxiety disorders than men. Age-standardized rates have remained stable, indicating the possible stability of risk factors.

Conclusions The prevalence of anxiety disorders has been rising over the last three decades. The prevalence of anxiety appears to increase with socioeconomic development, a higher dependent older population, and urbanization. Future research on this topic could include the development of more accurate cross-cultural metrics to assess anxiety and its correlates, as well as population-based studies to assess trends in anxiety over time.

Keywords Mental health, Anxiety disorders, Epidemiology, Prevalence, Morbidity

Background

Anxiety disorders are biopsychosocial conditions associated with generalized or situation-specific responses to perceived threats [1]. The prevalence of anxiety has

attracted significant research interest historically [1–3]. Anxiety disorders are among the most common mental disorders. They generally appear early in life and share, however, with other mental disorders, a deliberately chronic evolution, and a strong functional impact. An increase in global anxiety prevalence represents a significant threat to the population's well-being and quality of life [2]. There are different clinical manifestations of anxiety disorders. For some, it is related to specific environmental stimuli, resulting in phobias [3]. Others may experience severe episodic distress, as in panic disorder [4]. These experiences, when perceived as threats in the prefrontal cortex and the amygdala, trigger a fight-or-flight response, which can manifest in the form of a psychophysiological response like dizziness, increased heart rate, and sweating [5]. If left untreated, chronic anxiety

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can result in many other health issues such as hypertension, cardiovascular disease, and dementia [6–8]. Existing treatments for anxiety typically involve a combination of medication and psychotherapy [9]. While the physiological response associated with anxiety can be treated via pharmacological methods, the psychological memories and triggers that cause anxiety need a psychological solution. A large body of evidence suggests that psychotherapies like cognitive behavioral therapy are more longitudinally beneficial to individuals with anxiety disorders [5, 10, 11]. Researchers must understand the epidemiological nature of anxiety to identify trends pertaining to demographic factors and more accurately target preventive and management efforts across the population [4].

Disease epidemiology is critical for understanding population trends, such as whether or not anxiety is increasing, covariates associated with changing trends, and factors involved in the control and management of anxiety disorders. Globally, the considerable variability in prevalence figures could represent a different distribution of risk factors for these disorders. Nevertheless, methodological and cultural factors and the evolution of diagnostic criteria over time probably play an important role. Although epidemiological data are available for many countries, there has been no known recent synthesis of global epidemiological evidence associated with anxiety disorders [11–13]. Differences in reporting and documentation of anxiety internationally can result in misleading information about the actual incidence and causal factors associated with anxiety disorders [14]. A comprehensive epidemiological study of the global burden of anxiety disorders, as well as their sociodemographic associations, is needed to evaluate population-wide trends and potential factors associated with anxiety, as well as to more efficiently target health promotion efforts to reduce the economic and social burden associated with this mental health issue.

Based on gaps in the literature associated with the epidemiology of anxiety, this study aimed to evaluate the regional and global burden associated with anxiety disorders. Additionally, an examination of forecasts and trends for anxiety disorders was presented based on trends identified in the epidemiological data. A particularly unique contribution of this study was its assessment of annual trends in anxiety disorders via age-standardized rates, which were used to control for the effect of an aging population.

Methods

Data source

The inclusion criteria for the data included prevalence, incidence, and mortality rates associated with anxiety

disorders at global, regional, and national levels. Exclusion criteria comprised subnational data like clinic-based records. Anxiety disorder health metrics were extracted from the Global Burden of Disease (GBD) dataset (see Additional file 1) [15].

GBD also provides a measure of social/human development, the Social Development Index (SDI) for each country. The SDI is a composite of three factors: education, total fertility rate, and income, and ranges from 0 to 1. The robustness of the GBD dataset stems from its reliance on a wide range of sources like independent studies, government reports, vital registration, health-care registries, and census-related data [16]. GBD produces reliable estimates of health metrics and has been used in epidemiological studies for other conditions like dementia [16]. The data reliability is ensured by using modeling adjustments to address data sampling issues like missing data, and variations in the case definition. This study was conducted in accordance with the Guidelines for Accurate and Transparent Health Estimates Reporting (GATHER statement, see Additional file 2) [17].

Additional demographic variables were collected from World Bank Databank (<https://data.worldbank.org/>) [18]. These included gross domestic product (GDP) per capita, urban population as a percentage of the total population (urbanization), unemployment as a percentage of the labor force (unemployment), and the percentage of older persons dependent on the working-age population (age dependency). Data on literacy, economic inequality (Gini index), and alcohol consumption per capita were obtained from Our World in Data (<https://ourworldindata.org/>) [19].

Data variables

Prevalence, incidence, and disability-adjusted life years (DALYs) associated with anxiety disorders were analyzed. DALY combines years lived with disability and the years of life lost due to premature death. Data for anxiety disorders were obtained using the GBD Results tool [20]. The GBD Compare tool was utilized for data visualization [21]. In GBD, anxiety disorders are coded as B.6.4 under the category of Mental Disorders.

Data analysis

We analyzed the data using GBD analytical tools, including visualization [22]. These tools helped to achieve the highest fidelity. Both raw and age-adjusted rates of anxiety disorder prevalence and incidence were analyzed. Age-standardized rates allow interpretations about intrinsic changes in anxiety disorder burden by removing the effect of population age over time and across regions and countries. Age-specific

incidence rates were utilized to evaluate the age of onset of anxiety disorders. The authors aimed to evaluate whether the age of onset was decreasing over time by comparing figures over the last three decades.

Statistical analysis

Data were analyzed for summary statistics, temporal trends, and bivariate correlations. Multivariate analysis was conducted using multiple linear regression. Variables were checked for normality and multicollinearity. Data analysis was carried out using Jamovi statistical software (version 1.8) [23]. Missing data were not imputed. An alpha level of 0.05 was considered statistically significant.

Results

Prevalence

The global prevalence of anxiety disorders in 2019 was 4.05% [uncertainty interval (UI); 3.39, 4.78]. Table 1 outlines the burden of anxiety disorders in selected countries and regions. The total number of individuals affected increased substantially between 1990 and 2019: increasing from 194.9 million to 301.4 million [UI; 252, 356 million] globally. The worldwide prevalence rate for all forms of mental health disorders was 12,537 cases per 100,000 persons [UI; 11,643, 13,497]. The prevalence rate of anxiety disorders was 3,895 per 100,000 population [UI; 3,264, 4,601]. Compared to other major mental health disorders, the prevalence of anxiety disorders was substantially higher. For instance, the prevalence of bipolar

Table 1 The burden of anxiety disorders

Region	Prevalence (cases per 100,000 population)	The burden of human suffering (DALY per 100,000)	Total number of cases
Global average	3 895	370	301 390 000
Europe	4 903	461	41 642 000
Germany	6 739	629	5 722 000
France	6 576	620	4 353 000
Italy	5 935	555	3 580 000
Spain	5 128	482	2 360 000
Netherlands	7 205	680	1 236 000
Switzerland	7 144	673	626 000
Sweden	4 978	469	508 000
Turkey	4 820	461	3 921 000
Russia	3 407	320	4 999 000
United Kingdom	4 688	439	3 151 000
Asia	3 420	326	155 774 000
China	3 363	321	47 842 000
India	3 006	283	41 805 000
Japan	2 438	230	3 116 000
South Korea	3 487	332	1 862 000
Saudi Arabia	4 969	479	1 775 000
Iran	7 537	721	6 353 000
Australia	5 986	566	1 470 000
Americas	5 818	548	58 782 000
United States	6 171	570	20 241 000
Canada	4 683	442	1 710 000
Mexico	3 628	347	4 533 000
Brazil	7 993	757	17 319 000
Argentina	5 162	493	2 329 000
Africa	3 406	328	44 802 000
South Africa	3 868	366	2 150 000
Nigeria	2 722	263	5 848 000
Egypt	4 608	446	4 565 000

Selected countries are shown in this table (all countries were included in the analysis). Data from Global Burden of Disease, 2019. DALY = disability-adjusted life years

disorder was 511 cases, and schizophrenia was 304 cases per 100,000 persons.

Women were more likely to be affected by anxiety disorders than men. Among all ages, the prevalence rate among women was 4,862 per 100,000 [UI; 4,089, 5,746] compared to 2,933 per 100,000 [UI; 2,458, 3,482] in men.

Globally, certain regions had a higher prevalence of anxiety disorders. Latin America and Caribbean regions, as well as high-income regions of North America and Western Europe, had the highest rates (Fig. 1). South Asia and sub-Saharan Africa ranked the lowest in terms of the prevalence of anxiety disorders. The highest prevalence rates in descending order were: Portugal (8,671 cases per 100,000 population), Brazil (7,993 cases per 100,000), Iran (7,537 cases), New Zealand (7,375 cases), Netherlands (7,205 cases), and Switzerland (7,144 cases per 100,000). In terms of the total number of individuals living with anxiety disorders, China (47.8 million cases), India (41.8 million), the United States (20.2 million), Brazil (17.3 million), and Indonesia (9.5 million) have the highest burden in the world.

Trends

Anxiety disorder metrics presented a stable pattern, with mild fluctuations in prevalence, incidence, and disability adjusted life years (DALYs) rates worldwide between 1990 and 2019. Age-standardized rates were used to adjust for changes in the underlying population age structure. Western European countries showed a faster rate of rise than the global average. Brazil, in particular, experienced a marked increase in prevalence rates, from 5,894 cases

per 100,000 population in 1990 to 7,410 per 100,000 in 2019. The total number of cases continued to rise with population growth and aging in all world regions except Europe. After age standardization (to control for population aging), incidence and prevalence rates appeared to remain stable during the same period (Fig. 2). Hence, there appeared to be no intrinsic increase in the rates of anxiety disorders after controlling for population aging.

Age of onset

Remarkably, the age distribution of new cases showed an incidence starting as early as ten years of age onwards (Fig. 3A). There were two modal peaks at 10-to-14 and 35-to-39 years of age. The incidence of new cases declines after 65 years of age. However, the prevalence remains high in the elderly (Fig. 3B). The age distribution of new cases and the prevalence of anxiety disorders has not changed over the last three decades (Fig. 3B).

Bivariate correlations

Anxiety prevalence was strongly correlated with measures of economic development (Fig. 4A). Higher prevalence of anxiety disorders was associated with greater GDP per capita ($r=0.47$; $p<0.001$). Similarly, other indicators of economic prosperity such as SDI ($r=0.53$; $p<0.001$), access to electricity ($r=0.42$; $p<0.001$), clean drinking water ($r=0.44$; $p<0.001$) and literacy rate ($r=0.31$; $p=0.007$). However, anxiety disorders did not correlate with unemployment rates ($r=-0.03$; $p=0.8$) or economic inequality (Gini index; $r=-0.11$; $p=0.15$).

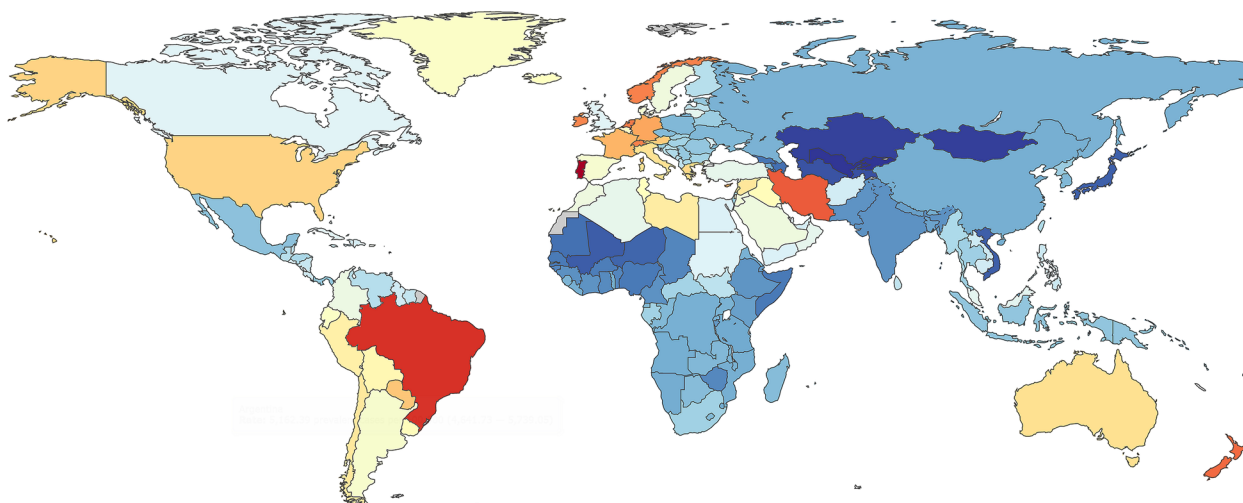
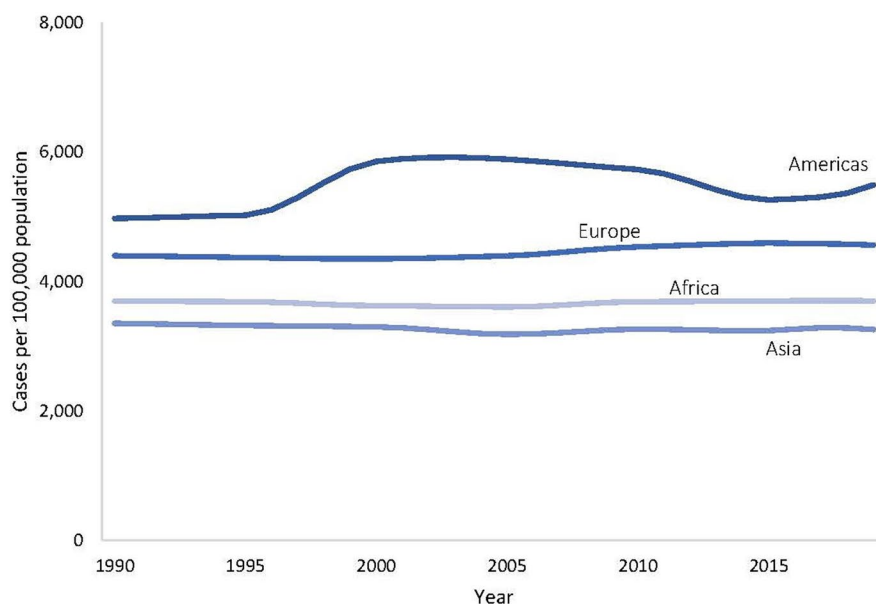


Fig. 1 Global distribution of anxiety disorders. Legend: Colors indicate prevalence rates per 100,000 population (all ages) in 2019. Color shades represent the range of prevalence rates of anxiety disorders, in decreasing order, from dark red (8,600 cases per 100,000), orange, yellow, light blue, and dark blue hues (2,000 cases per 100,000)

A. Prevalence rates



B. DALY rates

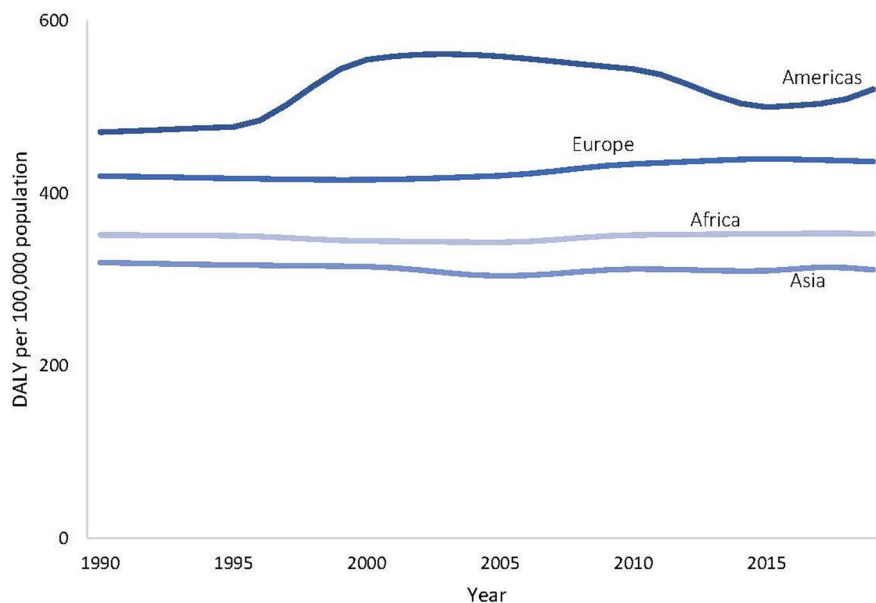


Fig. 2 Trends in the burden of anxiety disorders (1990–2019). Legend. The rates are age-adjusted. Age-standardization removes the effect of changes in population age distribution over time and across regions. Prevalence = cases per 100,000 population; DALY = disability-adjusted life years per 100,000 population

Urbanization was associated with higher anxiety rates ($r=0.46$; $p<0.001$; Fig. 4B). The social burden of the dependent elderly was also associated with increased anxiety disorders ($r=0.42$; $p<0.001$). There was a weak but statistically significant association with alcohol consumption per capita ($r=0.26$; $p<0.001$).

Multivariate analysis

On multiple linear regression, economic development factors (SDI and GDP per capita) and urbanization were predictors of anxiety disorders, while literacy rate and dependency were not statistically significant (adjusted $R^2=0.32$). The standardized regression coefficients,

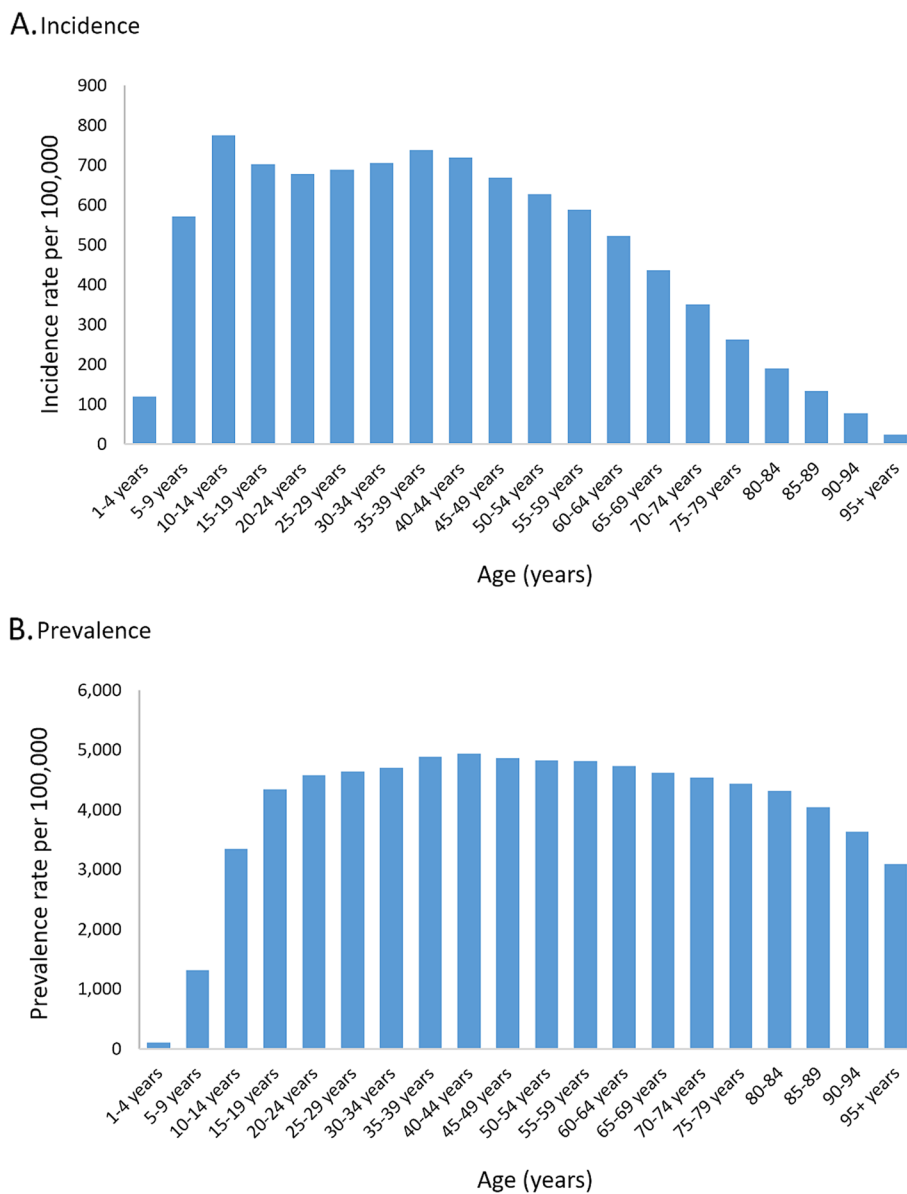


Fig. 3 Age distribution of anxiety disorders

which can be compared to indicate relative importance, were SDI (0.32), GDP per capita (0.18), and urbanization (0.16).

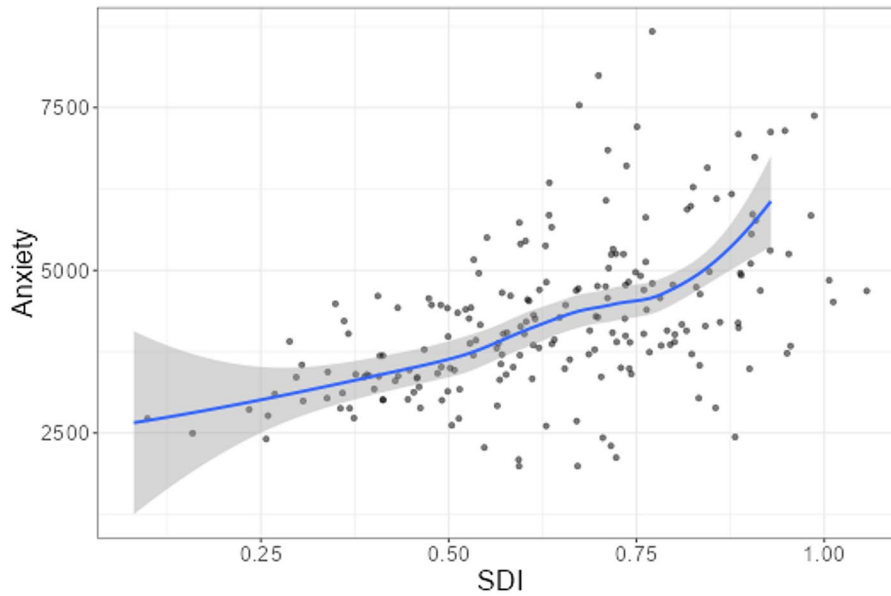
Discussion

Three key findings were identified based on a sample of the latest data from GBD. Age-adjusted prevalence and incidence of anxiety disorders have been stable over the past three decades. Furthermore, it was determined that anxiety disorders (as measured by the total number of cases) were higher in high-income, economically developed countries. Finally, we found weak associations

between anxiety disorder prevalence and alcohol consumption, urbanization, and the proportion of dependent older persons in the population.

As with other mental disorders, data on the prevalence of anxiety disorders are numerous but often conflicting. Globally, the considerable variability in prevalence figures could represent a different distribution of risk factors for these disorders. Nevertheless, methodological and cultural factors as well as the evolution of diagnostic criteria over time probably play an important role. The reason that age-adjusted prevalence and incidence

A. Social Development Index (SDI)



B. Urbanization

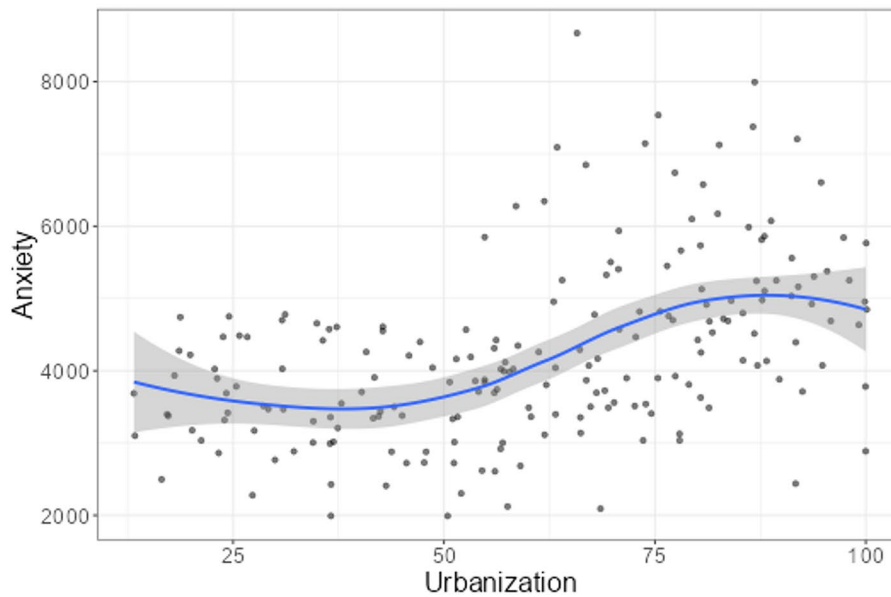


Fig. 4 Association between anxiety disorder prevalence, Social Development Index, and Urbanization ($n = 204$ countries). Legend. Prevalence = cases per 100,000 population; SDI = Social Development Index; Urbanization = proportion of population in Urban areas

of anxiety disorders have been stable over the past three decades is not immediately apparent, but multiple factors are likely involved. This finding appears to conflict with the literature showing that common mental health issues are on the rise [12, 14, 24]. Much of the extant literature from the United States, Canada, and Western Europe has shown that common mental health issues like anxiety

and depression are more prevalent now than in the past [24]. This discrepancy is potentially due to us reporting the global prevalence and incidence of anxiety disorders, combining the data from Western countries with those from other regions of the world where anxiety may not be increasing. This study showed that the total number of individuals affected rose by more than 50%. Thus,

more individuals worldwide are developing anxiety disorders, but the age-adjusted prevalence rate has probably remained the same due to changes in underlying population structure.

The incidence pattern of anxiety disorders changes with age. Anxiety disorders are among the most common mental disorders in young people, whereas the incidence of new cases of anxiety declines after the age of 65 [25, 26]. Thus, the overall population increase and an increasing proportion of the younger and older population in different countries may result in misleading prevalence and incidence measurements associated with anxiety disorders. The prevalence of anxiety disorders may appear to remain stable when it actually has increased for some age ranges.

In recent decades, there has been increased knowledge of the causes of anxiety disorders, enhanced preventive measures, and greater access to proactive mental health care services [9, 13, 24]. More service users are capitalizing on available mental health services now than in past generations, and there is a large body of evidence supporting the effectiveness of interventions like cognitive behavioral therapy for reducing symptoms of anxiety disorders [9, 27, 28]. In many cases, these interventions can be delivered virtually, allowing for service provision to reach a global clientele and increasing access to affordable mental health care for a large proportion of the population than ever before [13].

This study also found that a significantly large burden of anxiety disorders, as measured by the total number of cases, was present in high-income, economically developed countries. This finding is consistent with previous research demonstrating a link between affluence and anxiety [29–31]. The reason that anxiety is more prevalent in higher-income countries could be due to a range of factors, like the typical lifestyle in affluent compared to developing countries [29, 30]. In more prosperous societies, jobs are typically more sedentary in nature. People obtain less physical activity; individuals are more likely to consume a diet heavy in processed foods, sodium, and sugar, which can catalyze psychophysiological reactions that impact mood and affect [14, 27, 29]. High sodium levels can result in elevated blood pressure, resulting in psychological symptoms like stress and anxiety [14, 29]. Simple sugars can cause sharp spikes in blood glucose levels, resulting in anxiety symptoms [27]. These factors can negatively impact mental health and increase the risk of developing an anxiety disorder over time [27].

Despite being economically affluent, mean happiness ratings in many wealthier countries are often lower than those of emerging countries, suggesting that income is not a buffer against mental health issues [30]. Individuals in wealthier nations may face more daily pressures

to achieve and portray an image of wealth and beauty to others, which can adversely affect self-image and contribute to anxiety [11]. Evidence suggests a higher rate of mental health problems in individualistic societies compared to collectivistic settings and that culture may be a significant factor underpinning the relationship between mental health and wealth throughout the world. Those in individualistic cultures may perceive less available social support and instead feel either isolated from or competitive with fellow members of society [31, 32]. Furthermore, engagement with technology can be a risk factor for anxiety [4]. Individuals in prosperous countries have higher social media and technology use rates than developing countries [30]. An increasing body of evidence has shown that technology and engagement with social media are positively correlated with anxiety disorders in young people [28].

There is considerable variance in how different countries and cultures define mental health issues and mental illness [33]. How mental health issues like anxiety are defined can significantly impact epidemiological measurements and help-seeking behaviors on the part of the population and approaches to prevention and service provision on the part of healthcare providers and health and social care policymakers [33]. The relatively larger volume of research and evidence related to anxiety disorders emerging from more affluent countries may also indicate that the prevalence is higher in these countries, as more efforts are made to survey and monitor the population. In developing countries, there are relatively less consistent and standardized efforts to monitor anxiety levels, and population members are less likely to seek available help due to a lack of knowledge of anxiety, a lack of economic resources, or different cultural conceptions of appropriate ways in which to manage symptoms of anxiety [34]. These factors may contribute to the appearance that anxiety is more prevalent in affluent nations when this discrepancy may be more strongly related to differences in how anxiety is perceived, understood, and measured in affluent versus emerging nations.

The study revealed weak associations between anxiety disorders and alcohol consumption, urbanization, and the proportion of dependent older persons. This finding is compatible with the existing literature on the relationship between alcohol and mental health [32, 34]. Research has shown that common mental health issues tend to be more prevalent in individuals who consume higher amounts of alcohol [35, 36]. Alcohol is often used as a coping method for underlying mental health issues, and those with issues like depression and anxiety are much more likely to self-medicate via easily accessible substances like alcohol [35]. However, self-reported rates of anxiety in individuals who consume large amounts of

alcohol may not accurately reflect the actual level of anxiety in this population subgroup because alcohol may partially or entirely alleviate their symptoms [34].

The finding associated with the relationship between anxiety and urbanization is consistent with recent research evidence [1, 37]. Our study has demonstrated that individuals living in high-income countries are more likely to report anxiety disorders. Urbanization is inextricably linked to socioeconomic development. Socioeconomic factors and the need for the workforce to be close to the work environment drive urbanization, resulting in large cities and built-up environments [35]. Previous research has suggested that urbanization is linked with mental health issues, such as depression and chronic stress [38]. Urbanization tends to increase population density, which can be detrimental to mental health by increasing noise, potentially reducing safety, and generally increasing sources of stress and anxiety [37]. The association between anxiety and urbanization may suggest that, like greater GDP per capita and access to electricity and clean water, urbanization is an important feature of socioeconomic development in relation to anxiety prevalence in society.

This study confirms the relationship between anxiety burden and a high proportion of dependent older persons in a society. The proportion of the older population is on the rise globally, with the proportion of the global population over 60 years projected to reach 22% in the next three decades [39]. In 2017, the World Health Organization estimated that 4% of the older population worldwide suffered from anxiety disorders [39]. Providing mental healthcare to older persons is a significant challenge for nations worldwide. The prevalence of mental disorders in the older segment of the population puts stress on an individual's well-being and jeopardizes society's health and socioeconomic security on the whole [39–41]. The relationship between the anxiety burden and the proportion of dependent older persons in the wider society can be explained by societal attitudes informing the relationship between an individual and the older, frail members of society. In individualistic cultures, caring for an older person can become a source of stress, financially and emotionally. This results in many older persons being looked after in formal care settings [42]. In these societies, a high percentage of dependent older persons may negatively impact stress levels for their families and carers and represent a source of anxiety for a wider section of the population. A higher percentage of dependent elderly persons may also impact how healthcare funds are allocated and which types of health issues are prioritized. In a country with a high percentage of dependent older persons, there is a strong likelihood that chronic and long-term physical conditions will represent the most

significant portion of healthcare spending, and issues like mental health will be less strongly emphasized [43, 44]. This will potentially result in unmet mental health needs of the older population with increasing rates of anxiety in nations with more dependent elderly persons.

Limitations

While this study makes an important contribution to the literature associated with the global burden of anxiety disorders and its regional distribution, some limitations were present that warrant consideration. In general, comorbidity with at least one other psychiatric disorder is the rule rather than the exception in the case of anxiety disorders. The most common comorbid disorders are other anxiety and mood disorders, especially depression [45, 46]. First, the country-level comparisons made in this study are generalizations that are potentially susceptible to ecological bias. Thus, the findings from this study may reveal more about ecological factors than individual susceptibility to anxiety. Additionally, the GBD dataset relies on multiple sources that adopt heterogeneous methodologies and varying case definitions. This reliance can make the comparisons less robust. However, the statistical modeling techniques employed by GBD allowed for adjustments to be made for these potential sources of error. Currently, GBD provides the most comprehensive and current data on the burden of anxiety disorders, and its associated limitations were considered acceptable in this study and mildly influential on study outcomes. Each of these limitations elicits the need for caution when interpreting the results of this study.

Conclusions

The global prevalence of anxiety continues to increase, along with the associated social and economic burdens of anxiety disorders. This study adds important insights into the global burden of anxiety disorders and their regional distribution. Higher rates of anxiety disorders were associated with more economic development, a higher dependent older population, and urbanization. These findings may be used to better understand risk factors and buffers against anxiety based on global population trends. Future research on this topic could include the development of more accurate cross-cultural metrics to assess anxiety and its correlates, as well as population-based studies to assess trends in anxiety over time.

Abbreviations

GBD	Global Burden of Disease
DALY	Disability Adjusted Life Years
SDI	Social Development Index

GATHER Guidelines for Accurate and Transparent Health Estimates Reporting
 GDP Gross Domestic Product
 UI Uncertainty Interval

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s43045-023-00315-3>.

Additional file 1. Anxiety study dataset. Description of data: The underlying data associated with this article can be found in the online version at Open Science Foundation: Epidemiology of Anxiety 2019 study https://osf.io/xve6h/?view_only=fdb8260c84b84f19b2c6c2d5128175e4.

Additional file 2. GATHER-checklist Anxiety project. Description of data: The GATHER checklist can be found in the online version at Open Science Foundation: GATHER checklist for Epidemiology of Anxiety 2019 study https://osf.io/xve6h/?view_only=fdb8260c84b84f19b2c6c2d5128175e4.

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Authors' contributions

SFJ contributed in study conceptualization and supervision, data curation and original manuscript preparation and editing. IH did data curation and helped with writing the original draft. MH contributed in devising the methodology, data analysis and writing the manuscript. ES helped with the writing and editing of the original manuscript. MAS was involved with writing, reviewing and editing the original manuscript. AAH helped with data curation, writing and editing the original manuscript. All authors read and approved the final manuscript.

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Availability of data and materials

The underlying data associated with this article can be found in the online version at Open Science Foundation: Epidemiology of Anxiety 2019 study https://osf.io/xve6h/?view_only=fdb8260c84b84f19b2c6c2d5128175e4. Data are available under the terms of the Creative Commons Attribution-NonCommercial 4.0 International (CC BY-NC 4.0).

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare that there are no conflicts of interest regarding the publication of this article.

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