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ORIGINAL ARTICLE

Incidence of depression and suicide rate in Mexico: an observational analysis of databases from the past years

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Abstract

Objective: *The objective of this study was to determine the incidence of depression as well the suicide rate in Mexico in the past years.* **Materials and Methods:** *Observational analysis through open access databases on cases of depression and mortality in Mexico between the years 2014-2021; the incidence and suicide rate were calculated along the 95% confidence interval by assuming a Poisson distribution.* **Results:** *The incidence of depression in Mexico has increased since 2014; the calculated incidence in the next years shows that this trend will continue. Females are more affected than men, while the age group most affected is people over 60 years of age. The Mexican state that registers more new cases is Durango. The suicide rate also shows an increasing trend in recent years.* **Conclusion:** *Depression is a growing health public problem. The early diagnosis of depression in Mexico is still insubstantial; then, better surveillance of this disease is necessary to properly address the problem.*

Keywords: *Depression. Suicide. Incidence. Epidemiological surveillance. Mexico.*

Incidencia de la depresión y tasa de suicidio en México: un análisis observacional de bases de datos de los últimos años

Resumen

Objetivo: *Determinar la incidencia de la depresión, así como la tasa de suicidio en México en los últimos años.* **Materiales y métodos:** *Análisis observacional mediante bases de datos de acceso abierto sobre casos de depresión y mortalidad en México entre los años 2014-2021; se calculó incidencia y tasa de suicidio a partir de ellos junto a un intervalo de confianza del 95% asumiendo una distribución de Poisson.* **Resultados:** *Desde 2014 se observa un aumento en la incidencia de la depresión en México; las proyecciones calculadas muestran que esta tendencia de aumento continuará durante los próximos años. El sexo femenino muestra mayor incidencia, mientras que el grupo de edad más afectado es el superior a 60 años. El estado con mayor incidencia es Durango. Del mismo modo, la tasa de suicidio muestra una tendencia de aumento en los años estudiados.* **Conclusiones:** *La depresión es un problema creciente en materia de salud en todo el mundo. En México aún existe mucha desinformación acerca de la prevalencia e incidencia de esta enfermedad, por lo que un diagnóstico temprano podría derivar en una planeación para el eficiente tratamiento del problema en los próximos años.*

Palabras clave: *Depresión. Suicidio. Incidencia. Vigilancia epidemiológica. México.*

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Introduction

Major depressive disorder, commonly known as depression, is a type of mental health problem that affects nearly 4% of the worldwide population, with women having a higher prevalence than men[1-4]. Depression is also a leading cause of disability around the world and represents an important health challenge in both developing and developed countries[5].

Depression is clinically characterized by physical and mental abnormalities such as changes in appetite, sleep disorders, increased fatigue, persistent feeling of sadness, anhedonia, and suicidal ideation[6]. According to the Diagnostic and Statistical Manual of Mental Disorders of the American Psychiatric Association-5, all the symptoms mentioned are known and abbreviated as SIGECAPS[7]. In this way, depression severely affects the individual functioning and life quality while increasing the risk of premature death. Although the precise etiology of depression is still under revision, some neurobiological factors could be related to the vulnerability and onset of this mental condition. In this regard, monoamine neurotransmitter disorders, particularly serotonin, have been widely associated with depression since brain imaging studies with radio-labeled receptor ligands have shown that decreased serotonin binding in the amygdala, frontal, temporal, and limbic regions is correlated to depression symptoms[8-10]. Furthermore, changes in the brain cytoarchitecture have been also linked to the development of depression in affected individuals[11].

Despite the efforts to reduce the impact of depression, no reduction in the global prevalence of this disease has been observed since 1990[12]. Moreover, depression represents a large economic cost not only in the direct treatment of patients but also in the disabling effects of the disease on society, and these costs are just increasing as the prevalence of the disease increases[4]. Moreover, it is expected that low- and middle-income countries will be among the most affected in the coming years[13]. Particularly in Mexico, there are no precise data about how many people live currently in the country with depression[14]; although data collected by the Global Burden of Diseases, Injuries, and Risk Factors Study 2019 suggest that the prevalence of depression symptoms has increased significantly in Mexico during 1990–2019[3], it is necessary to address depression as a serious public health problem to minimize its social and economic consequences in the coming years; therefore, an adequate diagnosis and better epidemiological surveillance for the disease in the Mexican population is required. In consideration of this, in the following study, data on new cases of depression in Mexico during the past 8 years were extracted from public health databases to analyze the disease's incidence in the population, as well as to estimate the number of new cases during the coming years. Since suicide is related to depression in most cases[15], the suicide rate in Mexico during the past years was also analyzed.

Materials and methods

This is a national ambispective observational study to describe the incidence of depression and the suicide rate in Mexico in the past years.

Data collection

All data were collected from open-access databases. New cases of depression during 2014–2021 were collected from the Annals of Morbidity available from Mexico's Secretary of Health (https://epidemiologia.salud.gob.mx/anuario/html/index.html) (visited on 10th November, 2022). Population size data during 2014–2030 were obtained from the National Council for Population (CONAPO) (https://datos.gob.mx/busca/dataset/proyecciones-de-la-poblacion-de-mexico-y-de-las-entidades-federativas-2016-2050) (visited on 14th November, 2022). Data on suicides in Mexico in 2014–2021 were captured from the National Institute of Statistics and Geography (INEGI) (https://www.inegi.org.mx/app/tabulados/interactivos/?pxq=Salud_Mental_05_101eeb31-ab5d-4238-899b-47a8d85786cc) (visited on 14th November, 2022).

Data analysis

All data were analyzed and plotted using the package ggplot2 in R software version 4.1.2. The incidence of depression and suicide rate in Mexico was calculated for each studied year by dividing the number of new cases by the respective mid-year population size, and then, multiplied by 10^5 to show the results per 100,000 persons. The total incidence, as well as incidence by sex and age group, was separately calculated, while the suicide rate was calculated for the sex group. Confidence intervals (95% CI) were estimated by assuming a Poisson distribution using the function *PoissonCI* of the package DescTools in R software. Incidence by each Mexico state was calculated for 2014-2021 and then averaged to plot the heatmap of depression

incidence in Mexico. Incidence by each group age was also averaged to build a bar plot. To estimate the incidence of depression in the coming years, the growth rate of new cases of depression in Mexico was determined by calculating the growth rate per year.

Results

The incidence of depression was higher in women than in men (Fig. 1). A decline was noted in the total incidence of depression during 2020–2021; however, this reduction in registered cases coincides with the most critical period of the COVID-19 pandemic in Mexico, in which the health-care system focused almost all of its resources to attend the health emergency; therefore, an underreporting of new cases of depression could be associated with the decrease observed in the incidence of the disease in those years and not to an effective reduction in the number of affected persons. Considering that the incidence of the disease increased significantly until 2019 (before the COVID-19 pandemic), the growth rate of new cases was calculated using 2014-2019 as a reference to subsequently estimate the total incidence of depression up to 2030 in Mexico. Using this approach, it is observed that the expected incidence of the disease for 2020 and 2021 is greater than that shown by the data collected from the health databases (Fig. 2). Furthermore, if the same growth trend continues, it is expected that by 2025-2026, the number of new cases registered will double the number initially registered in 2014, which suggests a worsening in the prevalence of depression in the country.

According to the data collected, the age group most affected by depression in Mexico corresponds to individuals over 60 years of age; however, a substantial increase in cases of this disease is notable in the population over 45 years of age (Fig. 3). Meanwhile, the states in which the most cases of depression have been diagnosed in recent years correspond to Durango, Chihuahua, Nayarit, Mexico City, and Colima (Fig. 4).

Finally, people affected by depression commonly embrace suicidal thoughts and behaviors. Moreover, it is estimated that about 50% of people who commit suicide meet the criteria for a clinical diagnosis of depression[16,17]. In Mexico, the suicide rate has been increasing since 2014; however, it is very noticeable that the suicide rate in men is much higher than in women (Fig. 5), contrary to what was observed with the incidence of depression, which affects more women.

Discussion

Depression represents a significant burden on society. Health-care systems around the world allocate part of their resources to the treatment of affected individuals; nevertheless, as a leading cause of disability, the economic costs of the disease increase even more due to the loss of functionality of affected individuals and decreased quality of life, a problem that is just worsening as the incidence and prevalence of this disease are increasing worldwide[3]. Furthermore, since the association between depression and suicide has been widely documented, the social and economic costs of depression also include dealing with mortality, being suicide ideation and suicidal behavior frequently reported in depressed individuals[18]. Given these facts, developed and developing countries have recognized the urgency of the problem; in Mexico, depression was included in 2014 in the list of diseases under epidemiological surveillance by the Mexican Secretary of Health and currently has first place in mental and behavioral disorders[19]; however, it is still difficult to have a clear depiction of the epidemiology of the disease in the country because a high degree of social inequality in the access to the health services still persists; thus, a large number of affected individuals have no medical diagnosis[20,21]; however, according to the current reports of the Secretary of Health, 3.6 million of adults suffer depression, while the World Health Organization indicates that Mexico ranks 16th globally with more people living with depression[22]. Despite this, some studies have been performed to obtain data about the epidemiology of depression in Mexico and, as a result, it is known that the prevalence of symptoms associated with depression has increased significantly among the population in the past 30 years, as well as that the prevalence is higher in rural areas than in urban areas[1,16,23-25]. Furthermore, people living in the southern part of the country were also found to have more depressive symptoms than those living in northern[26]. Although the economic costs of the disease have not yet been calculated for the country, it is estimated that by 2030, it will be the leading cause of disability[27].

In this study, it was noticed that the disease's incidence is higher in women than in men; the same situation is observed for the rest of the world[3]; furthermore, it has been reported that the proportion of depression in children of both sexes is similar but is higher in women after puberty[28], a phenomenon that has been associated to the effect of female sex hormones[29,30]. Importantly, depression incidence in

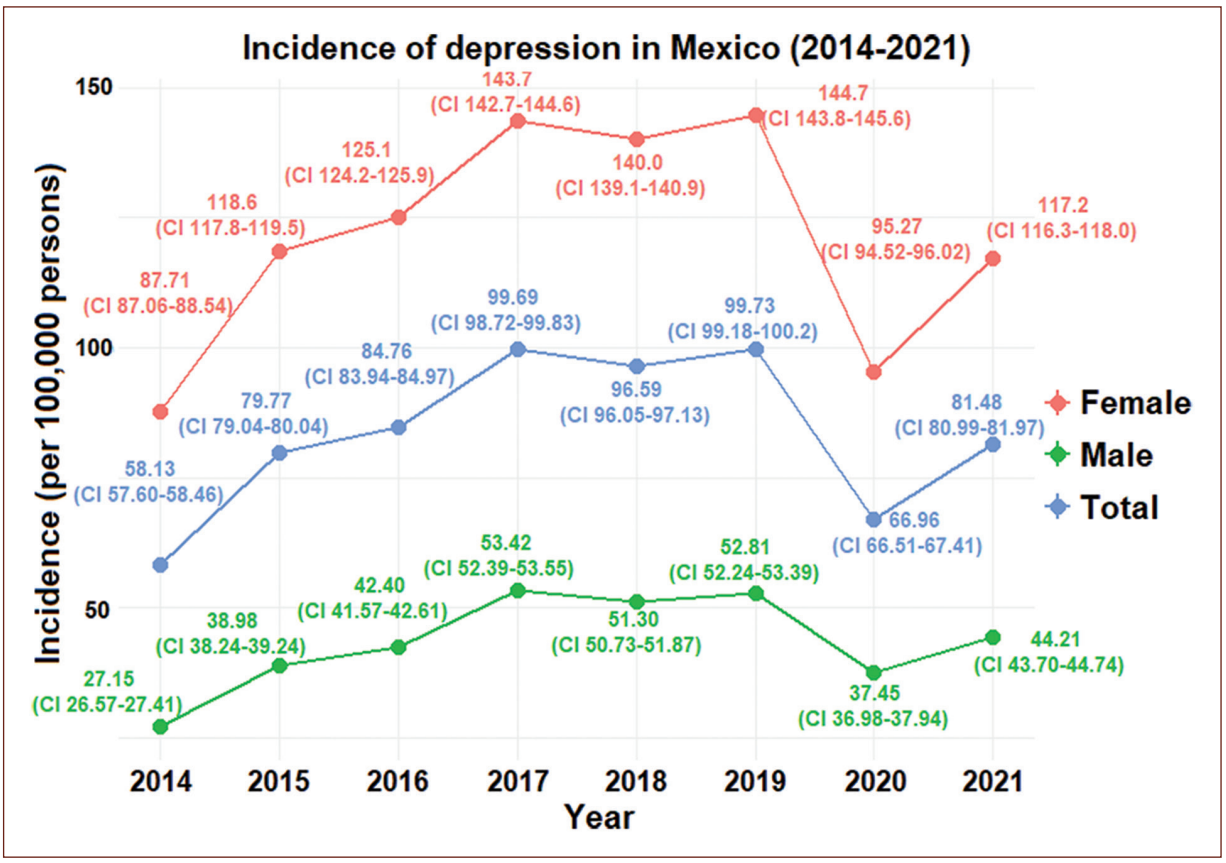

Figure 1. Depression incidence in Mexico during 2014-2021. The plot shows the incidence of depression for both sexes (total), females and males. CI: confidence interval 95%.

Mexico has increased for both sexes since 2014, although it was also observed that the register of new cases of depression was significantly diminished during 2020 and 2021 as a consequence of the COVID-19 outbreak in the country, which forced the entire health-care system to attend the emergency, thus affecting medical services nationwide, including epidemiological surveillance of noncommunicable diseases (NCD) like depression[31-33]. Whereas in 2021, 8,351 deaths were registered in people between 19 and 29 years old (with a higher frequency in males) due to self-inflicted injuries in our country, the highest suicide rate ever in the history of Mexico, and some factors related to these deaths were problems in social interaction, psychological health, employment stability, drug abuse, low economic income, as well as physical or sexual violence[34]. Moreover, considering that new cases of depression were rising prior COVID-19 pandemic in Mexico, the annual growth rate of depression incidence was calculated to infer the number of cases up to 2030; thus, it is observed that the expected number of cases for 2020-2021 is higher when compared to those captured in the health databases; furthermore, it is shown that the estimated incidence per 100,000 inhabitants in 2030 is up to 216 cases, although this number could be much higher depending on the behavior of the mental illnesses and the coverage of health services in the Mexican population in the coming years[35]. Although it is also important to mention that the Mexican authorities have already begun to take action on the matter, and for instance, in 2021, the National Mental Health Council was established to increase care in those individuals affected by this type of disorders[34].

Depression is one of the most common mental health disorders in elderly people[36]; in Mexico, the highest levels of incidence of this disease were detected in people over 60 years of age. Furthermore, this scenario is expected to worsen considering the current demographic transformation in Mexico, where the increase in life expectancy continues to increase the number of elderly people; particularly, it is expected an

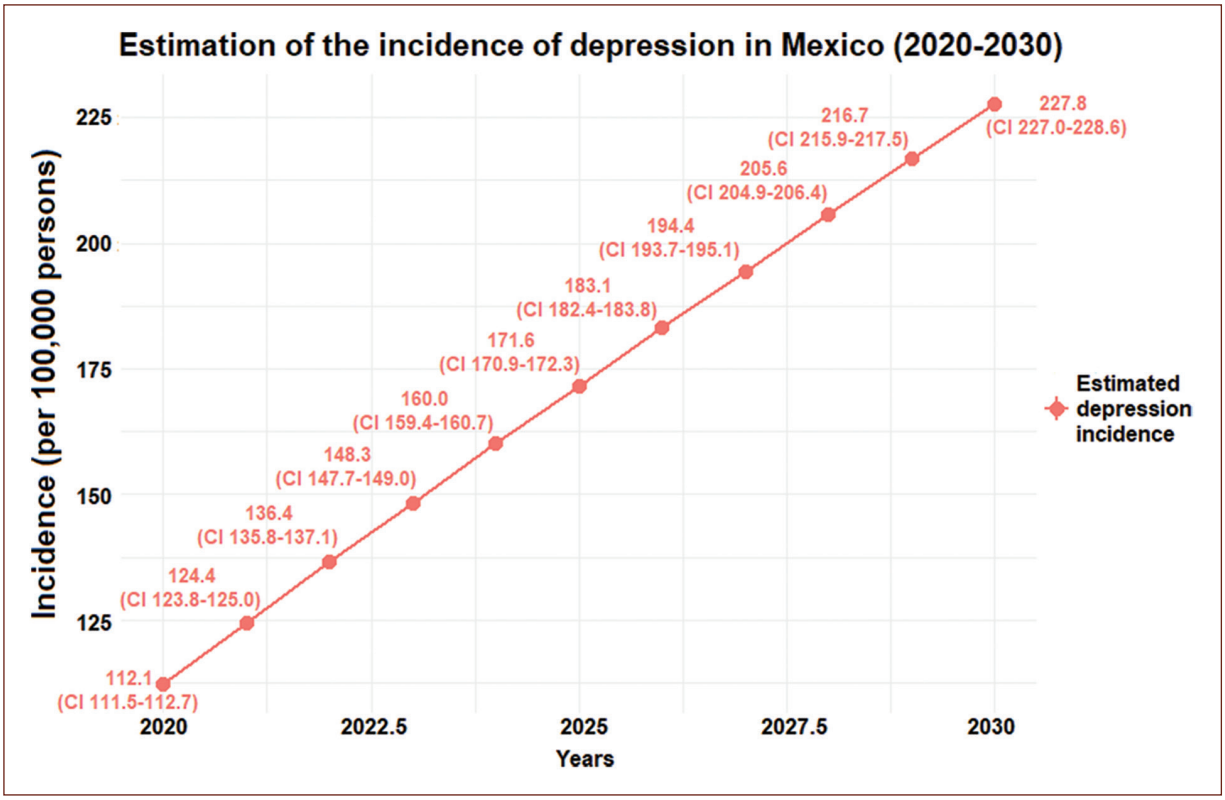

Figure 2. Projection of the new cases of depression for both sexes in Mexico up to 2030. CI: confidence interval 95%.

increase of 3.5 in the number of older adults in the next half of century[37]. Moreover, it is known that the incidence of this disease increases with age in both men and women; however, in other countries, higher levels of prevalence and incidence of depression are detected in people between 20 and 45 years of age; although it has also been determined that these rates may depend on the income of each person[38-41], it would be very important to determine the prevalence of depression in Mexico as well as the influence of individual's economic income on the development of the disease to better understand its epidemiology in a country with high economic inequity. In addition, it is important to mention that in Mexico, attempts to determine the prevalence of depression in people over 60 years of age have been made in the past years; however, it is a difficult task since depression is undiagnosed in a large proportion of the cases due to the limitations of the health-care system and the lack of access to the medical services in marginalized sectors[14,23,42-44]. Therefore, addressing depression in elderly people could reduce morbidity, disability, and even mortality in this population sector.

Self-inflicted injury and suicide can be linked to depression in up to 50% of cases[17]. Although the suicide rate was analyzed in this study, we do not present a direct association between cases of depression and suicide, which is further complicated since most depression cases remain undiagnosed in Mexico[23]. However, it was observed that new cases of depression increased during 2014-2019 along with suicide cases; therefore, it would be important to study the relationship between depression and suicide in the country. In addition, it is advisable to conduct a systematic review as a meta-analysis to quantitatively associate suicide with depression in Mexico.

Although women are more prone to depression, it is observed that the suicide rate is higher in men than women. This phenomenon is also observed in other countries, to which the concept of "male depressive syndrome" has been proposed to refer it, and it is thought that low-stress tolerance and low impulse control in males could contribute to a greater suicidal tendency in men[45,46], although it also considered that macho behaviors (which it is a persistent behavior in Mexican men) may lead to the underreporting of cases of depression in men[47].

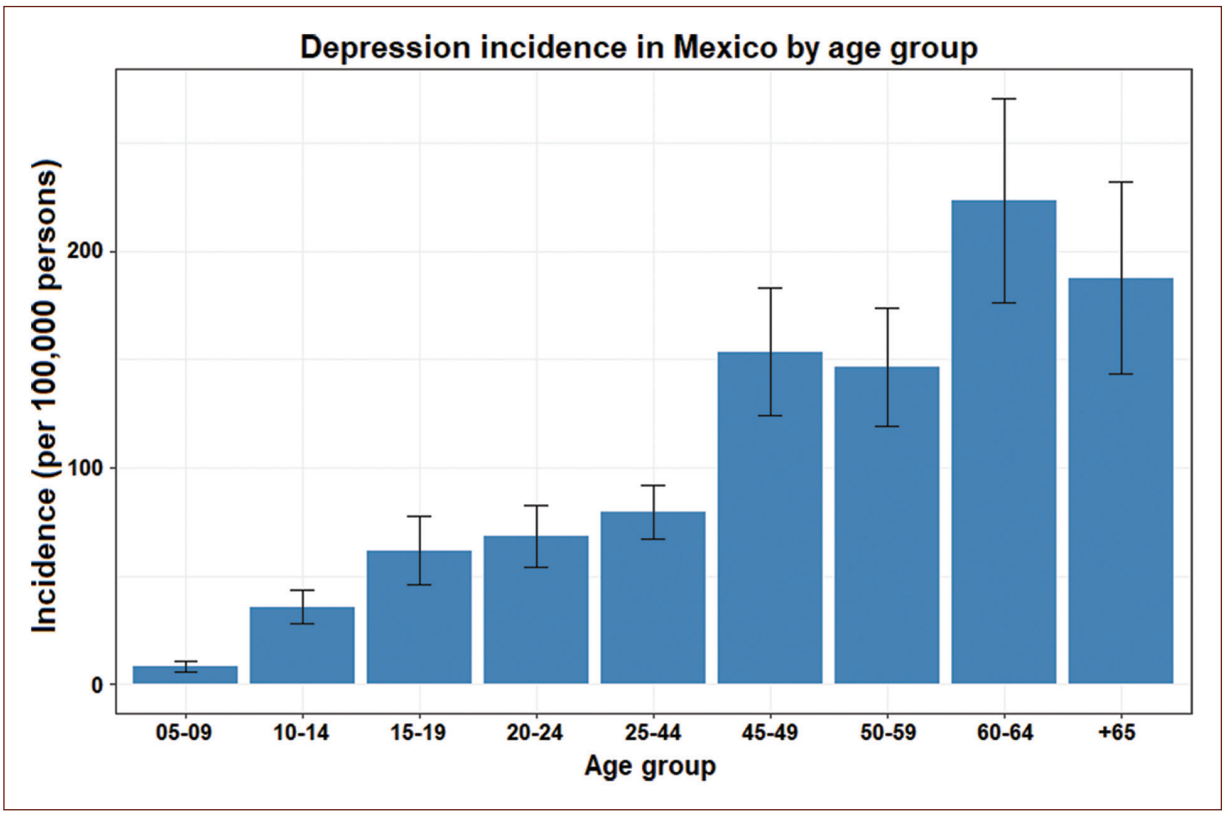

Figure 3. New cases of depression are higher among people over 60 years of age in Mexico. The plot shows the mean ± SD.

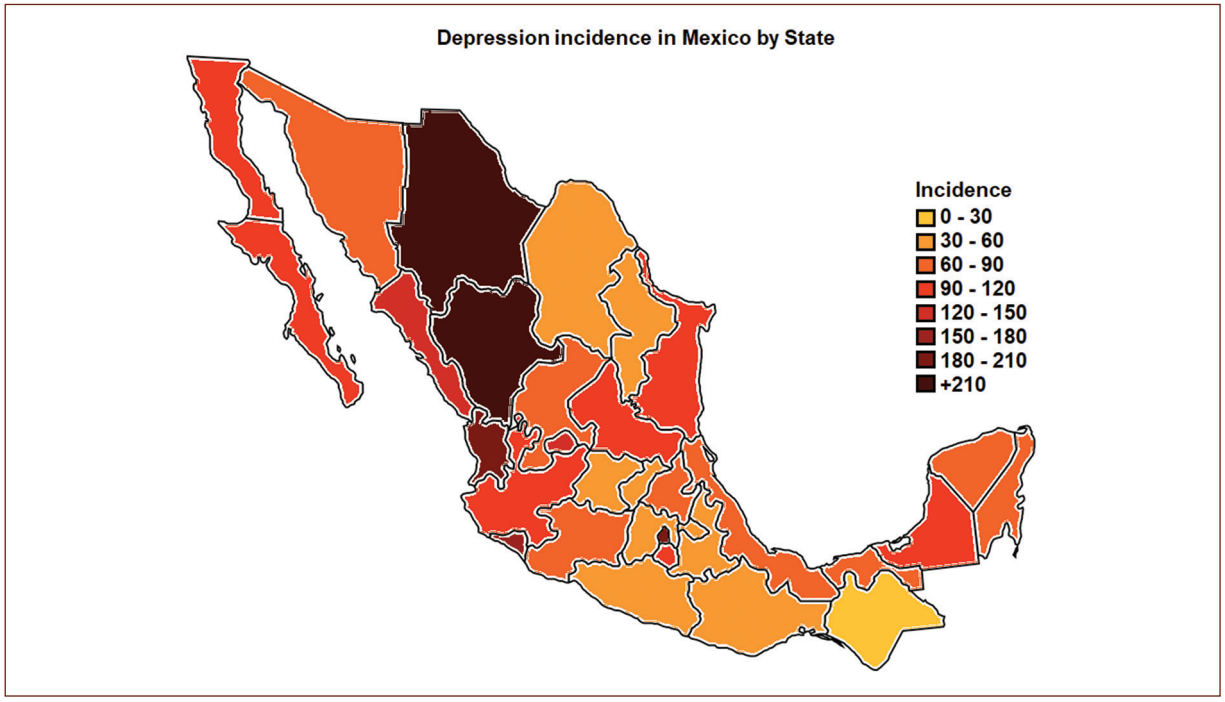

Figure 4. Heatmap of depression incidence in Mexico during 2014-2021.

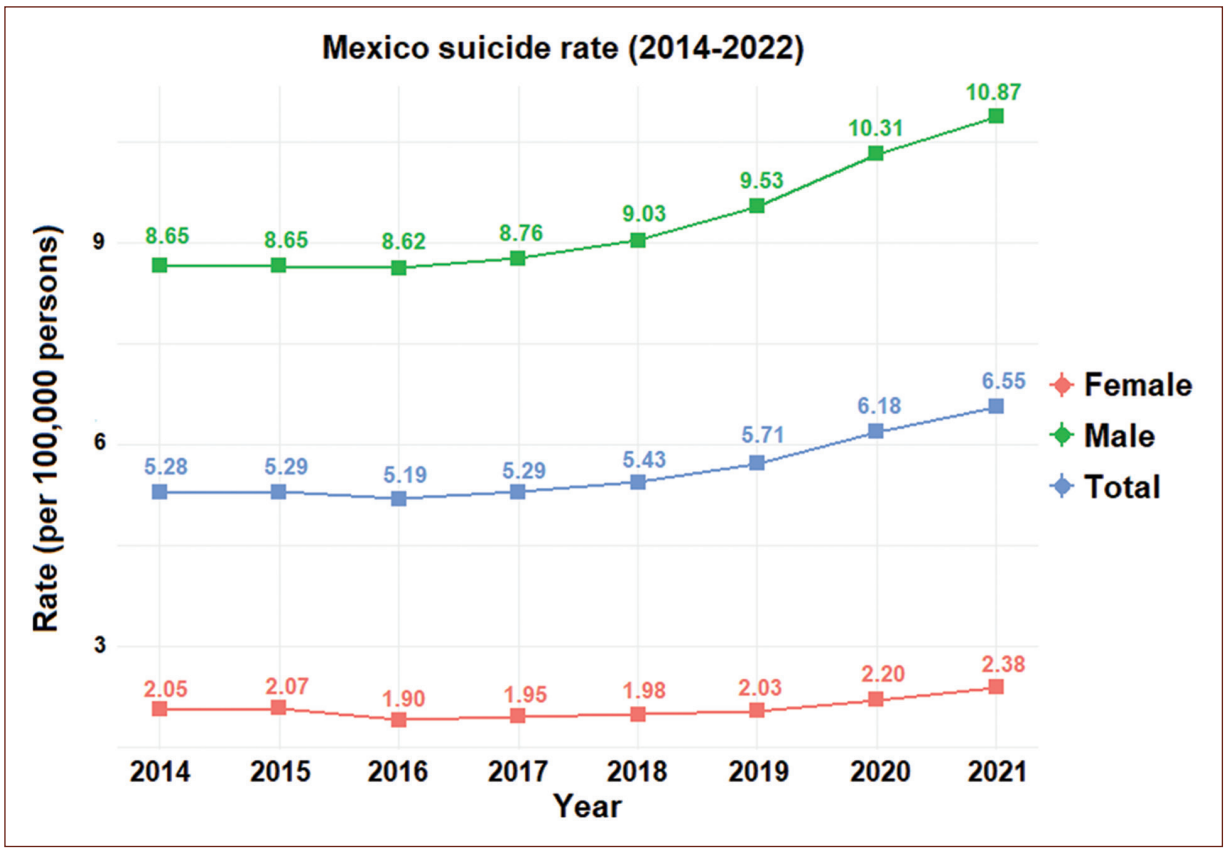

Figure 5. The suicide rate in Mexico during 2014-2021. The plot shows the suicide rate for both sexes (total), females and males.

Although the neurobiological, psychological, and social causes of depression can be diverse, it is important to analyze which are the causes that could promote depression currently in Mexicans. The present digital era, globalization, massive information access through the Internet, as well as social media usage, have become integral parts of our lives; however, the prolonged use of screens on devices such as smartphones, computers, tablets, or TV can become an addiction called screen dependency disorder, and it is known that is a significant source of stress and anxiety, which are the principal causes of depression according to the American Psychological Association[47]. Meanwhile, radiofrequency electromagnetic fields are invisible waves of electromagnetic energy emitted by electronic devices, and prolonged exposure may increase the risk of headaches, fatigue, sleep disorders, and depression[48]. This affects mainly children, but also youth, adults, and the elderly. Many studies indicate a strong association between screen time usage and depression risk. According to the global reports of DATAREPORTAL DIGITAL: 2023, the total world population is 8 billion, and 5.4 billion are smartphone users, while the number of Internet users is 5.16 billion. In Mexico, there were more than 100 million Internet users at the start of 2023[49]. Screen addiction could be also associated with NCD since sedentarism is an important risk factor for their development, and 57% of Mexicans are sedentary according to the Module of Sports and Physical Exercise of INEGI[50]. As a result, the most prevalent NCDs in Mexico are high blood pressure, type II diabetes mellitus, and obesity, which are leading causes of death. In addition, social determinants of health, such as ethnicity, sex, education, and socioeconomic status are also determinants of NCD as well as determining factors in the access to health services and health outcomes[51]. Given the growing problem, it is necessary to strengthen current health programs that promote healthy habits. A simple balanced diet focused on low consumption of ultra-processed food with physical activity helps release endorphins that improve the mood, keeping anxiety and depression symptoms under control. Furthermore,

regulating screen time usage could improve individual health. Finally, addressing depression and its risk factors could contribute to reducing economic costs in the country and improving the quality of life in the population because mental health is important for optimal individual operation as well as for optimal integration in an ever-changing environment.

Conclusion

Depressive disorders are a major concern in the whole world. In Mexico there are no precise data on the prevalence and incidence of depression due to incomplete coverage of health services and persistent social inequity. By using epidemiological data collected from public databases, in this paper we show that depression is a highly prevalent disease in Mexico, a situation that is projected to increase in the coming years. Thus, improving the epidemiological surveillance of depression in Mexico will be important for a better management of the problem and therefore to minimize the social and economic impacts of this disease in the near future.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

Ethical disclosures

Protection of humans and animals. The authors declare that no experiments on humans or animals have been performed for this research.

Confidentiality of data. The authors declare that they have followed their center's protocols for the publication of patient data.

Right to privacy and informed consent. Right to privacy and informed consent. The authors have obtained approval from the Ethics Committee for the analysis and publication of routinely obtained clinical data. The informed consent of the patients was not required because this was a retrospective observational study.

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