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THE PREVALENCE OF DEPRESSION AMONG CHRONIC HEALTH CONDITIONS: RESULTS FROM NHANES DATA 2005 TO 2018

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Abstract

Background: Depression as a multifaceted psychological disorder has grown in prevalence in recent years. This study investigates the trends and prevalence of depression symptoms in the United States from 2005 to 2018, with a particular focus on its relationship with chronic physical conditions including diabetes, asthma, hypertension, and high cholesterol levels.

Method: Using data from NHANES, the responses of 70,190 participants in self-reported surveys are analyzed in terms of depression severity, demographic factors, and chronic conditions from 2005 to 2018. Depression prevalence was categorized into four groups of severities based on PHQ-9 scores, while chronicle conditions were determined with yes and no responses. R was used to carry out statistical analysis for an evaluation of trends and associations.

Results: Depressive symptom prevalence showed increases over time, with females constantly showing a higher percentage compared to males. On average, the depressive prevalence in chronic condition patients fluctuated around 30% while the average prevalence was around 20%. Participants of all four chronic physical conditions show a higher prevalence of depression, suggesting an association.

Conclusion: The results of this study support the associations between chronic health conditions with the development of depressive symptoms. The indicated association highlights the importance of healthcare which integrates physical treatments with mental healthcare interventions.

Keywords: *Depression prevalence, NHANES, chronic conditions, mental health*

Introduction

Depression is a prevalent psychological disorder often associated with lasting feelings of sadness, loss of interest, and low or irritable moods (Chand S. P., Arif H., 2024). Depressive symptoms can often lead to changes with somatic and cognitive, limiting and impacting one's behaviors and ability to function. Depression however is a multifaceted disorder with varying causes, biological, neurological, or environmental, depending on different cases. It can severely hinder the everyday lives of those affected, from fatigue to mood swings to developing thoughts of self-harm and death. Alarmingly, depression has grown significantly in prevalence over

the past few decades. The number of people diagnosed with depressive symptoms nearly doubled from 1990 to 2017 and is still forecasted to continue rising (Liu Q., He H., Yang J., et al. 202), affecting an ever-growing number of individuals worldwide. Given the profound implications of depression on both individual and public health, it is crucial to investigate the trends in depression prevalence to determine the causes of its rising pervasiveness over the years.

Inevitable environmental stressors and genetic factors could easily impact an individual's susceptibility to developing depression, but depression could also put many at risk of developing physical chronic conditions. The prevalence of depression is thus interdependent and intricately linked with various other factors. Several studies have examined the prevalence and trends of depression across different populations, many of which have shown increases in depression rapidly, especially in young adults in America (Weinberger A. H., Gbedemah M., Martinez A. M., et al. 2018; Goodwin R. D., Dierker L. C., Wu M., et al. 2015). Cases of depression have also often been associated with physical chronic illnesses. Patients with chronic physical conditions, such as cancer and coronary heart disease, tend to have up to three times greater chances of obtaining depression (Ma Y., Xiang Q., Yan C., et al. 2021). Unlike conditions such as cancer or tumors, which typically have more complex etiologies and may develop later in life, chronic illnesses like asthma, diabetes, hypertension, and high cholesterol have a more predictable pattern where their early onset can contribute to the development of depression. However, there remains a gap in research that comprehensively evaluates depression prevalence trends in conjunction with less severe chronic medical conditions such as asthma, diabetes, hypertension, and high cholesterol levels. Questions remain about the contributions of each condition to the increasing prevalence of depression.

This rationale underscores the need for more nuanced studies that account for how these moderate chronic illnesses intersect with mental health outcomes. The purpose of this study is therefore to investigate the trends in depression prevalence among people of different genders and those affected by chronic physical conditions. The goal is to provide valuable insights that can guide healthcare providers and policymakers in understanding the relationship between chronic health conditions and mental health, ultimately contributing to more targeted and effective psychological health improvement strategies.

Methods

The National Health and Nutrition Examination Survey (NHANES) is a program from the United States that conducts studies and surveys to examine national health status. The program is run by the National Center for Health Statistics, the Centers for Disease Control and Prevention (CDC) (NHANES 2024).

Data throughout are from 2005–2018. During the time period from 2005 to 2018, there were a total of 70,190 subjects who took part in the surveys. However, not all are used. Those with insufficient data in the sections: are removed from the study sample, leaving the study with 26260 participants being analyzed. No consent from individual participants was taken given that data from NHANES are publicly available and are anonymized.

We assessed depression symptom levels using two definitions. The binary depression status was determined by the total PHQ9 scores and categorized into two groups: yes (Yes) and no (No). The depression severity status variable was determined by categorizing total PHQ9 scores into four groups: no depression (NoDpr), mild (Mild), moderate (Moderate), and severe (Severe). The independent variables were included in the analysis using self-reported questionnaires such as gender (male, female), diabetes (yes, no), asthma (yes, no), hypertension (yes, no), and high cholesterol levels (yes, no).

The demographic data for gender came from the variable (RIAGENDR) where the gender of the sample person was categorized into female, male, and missing. Diabetes was calculated using the variable DIQ010 where participants answered yes or no to "Doctor told you have diabetes". Participants for those with asthma (MCQ010) were asked "Has a doctor or other health professional ever told you that you have

asthma?" where their answers are categorized into yes and no. The variable BPQ080 assesses if the participant has hypertension by asking if they have "ever been told by a doctor or other health professional that you had hypertension, also called high blood pressure?" The results are similarly divided into yes and no. BPQ020 on the other hand is when participants are asked if they have "ever been told by a doctor or other health professional that your blood cholesterol level was high?" participants were subsequently divided into two groups: yes and no. Sample persons with missing values for any of the above variables were excluded from the models and statistical evaluations.

Statistical analyses

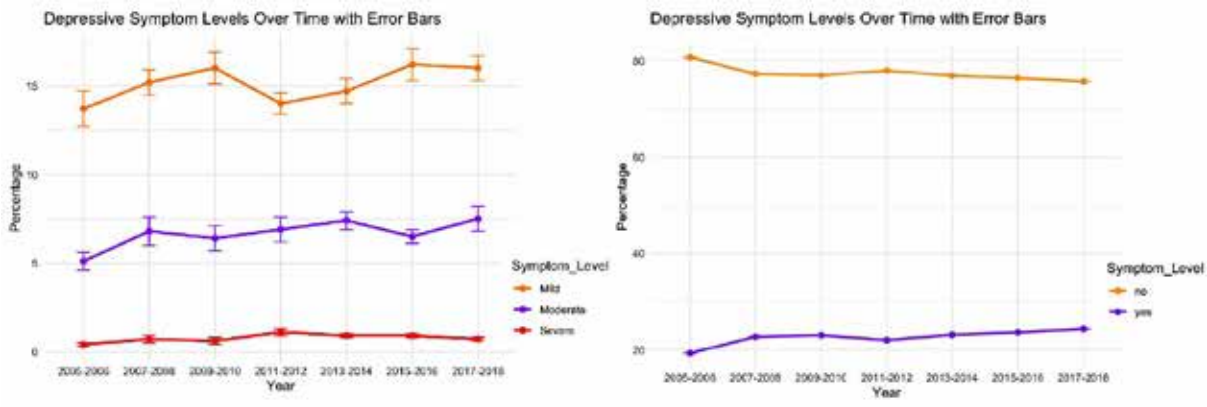
The prevalence of depressive symptoms within participants of the study samples was assessed according to the number of participants with depression and the corresponding percentage. The 95% confidence intervals were also obtained by using the percentage ± 1.96 times of standard error. All percentages were accounted for by the survey weights to represent the whole population in the US. To visualize the statistics and trends of depression prevalence across multiple years, we plotted multiple line charts with error bars. All analyses were conducted in R software (Olive D. J., 2010).

Results

Table 1 presents the frequency and prevalence (95% confidence interval) trends of four depression severity levels, including no, mild, moderate, and severe depression. Generally speaking, people with mild depression had an increasing trend of prevalence from 2005 to 2018, with prevalence growing from 13.7% to 16%. The prevalence of people with moderate depression also showed an increase from 5.1% in 2005 to 7.5% in 2018. People with severe depression show a different pattern with it peaking in 2012 with 1.1%. The general trend however for those with severe depression still shows a slight increase from 2005 to 2018, from 0.4% to 0.7%. On the contrary, people without any depression symptoms had a continuously decreasing trend in the prevalence, which decreased from 80.7% to 75.7%.

Table 2 shows the depression prevalence grouped by a variety of conditions such as gender, diabetes, etc. For gender, males had a continuously increasing trend in depression prevalence from 14.6 (2005–2006) to 20.6 (2017–2018), while females' depression prevalence increased to about 27% in 2007–2008, and then leveled off. However, for each survey cycle, the depression prevalence in female participants was significantly higher than that of males, with a difference between 7% and 11.6%.

Figure 1.



The trend for people who have depression while having the chronic illness diabetes fluctuates at around 30%. It started from 23.7% in 2005–2006 (the lowest) to 30.8 in 2017–2018. Within the same group of people, those without diabetes have a lower average rate of depression at around 20%, starting from 18.8% in 2005–2006 to 23.4% in 2017–2018 (Figure 1).

This trend is similar to the prevalence of depression in asthma patients as it also fluctuates around 30%, growing slightly from

26.2% to 32% from 2005 to 2018. The prevalence of depression in people without asthma fluctuates around 20%, going from 18.1% to 22.9% over the time period from 2005 to 2018 (Figure 4).

Figure 2. *Gender and Depression*

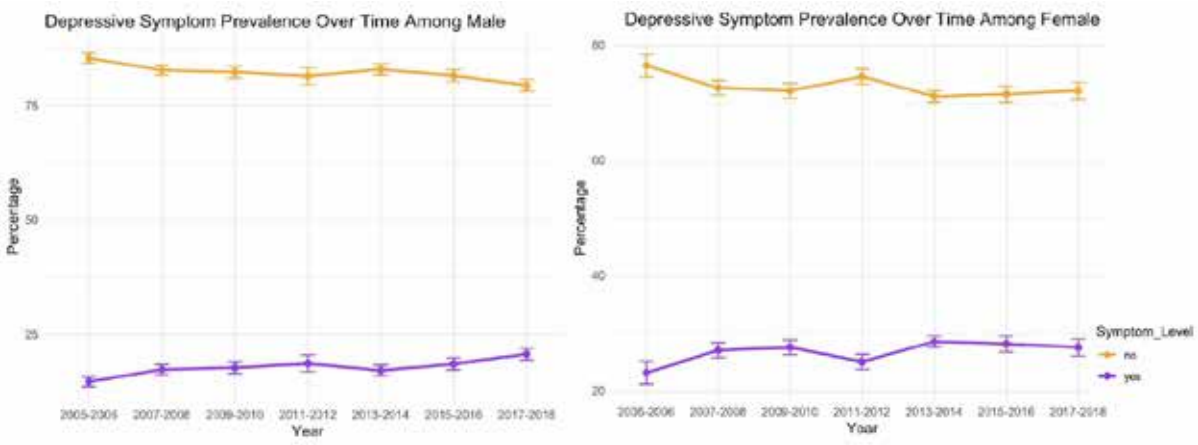


Figure 3. *Diabetes and Depression*

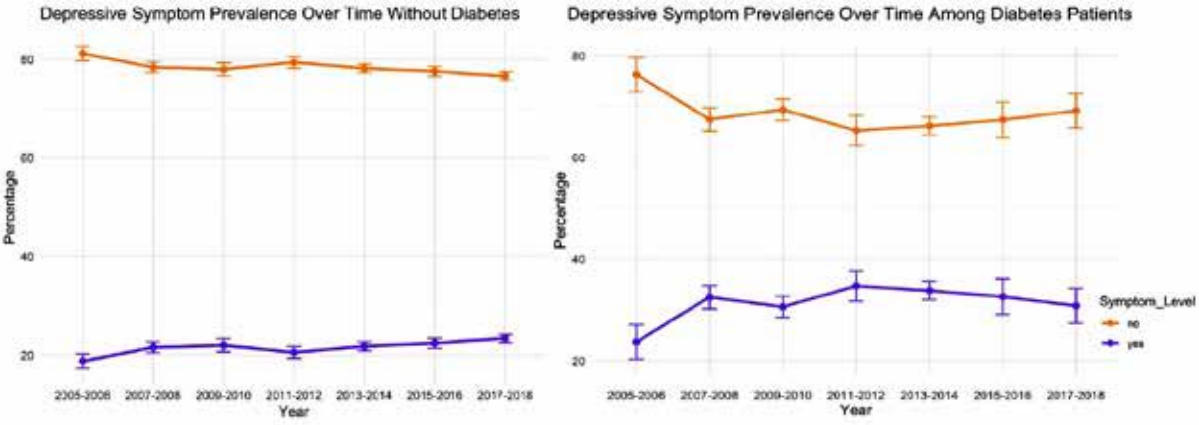
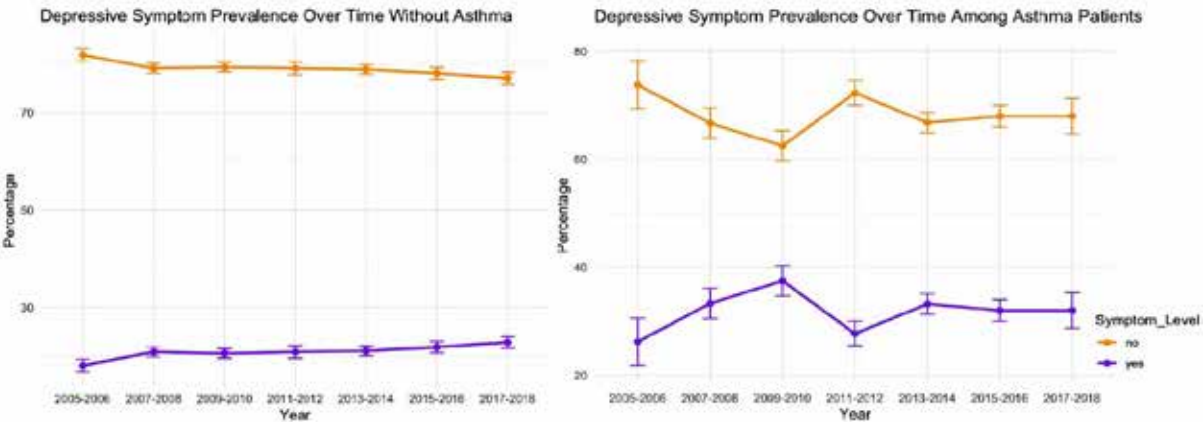


Figure 4. *Asthma and Depression*



The rate of depression in people with hypertension and high cholesterol also sees a similar trend, the prevalence however is slightly lower, oscillating around 25%. Over

2005 to 2018, depression in hypertension patients grew from 22.7% to 30.8%, while high cholesterol patients with depressive symptoms grew from 20.5% to 26.4%.

Figure 5. *Hypertension and Depression*

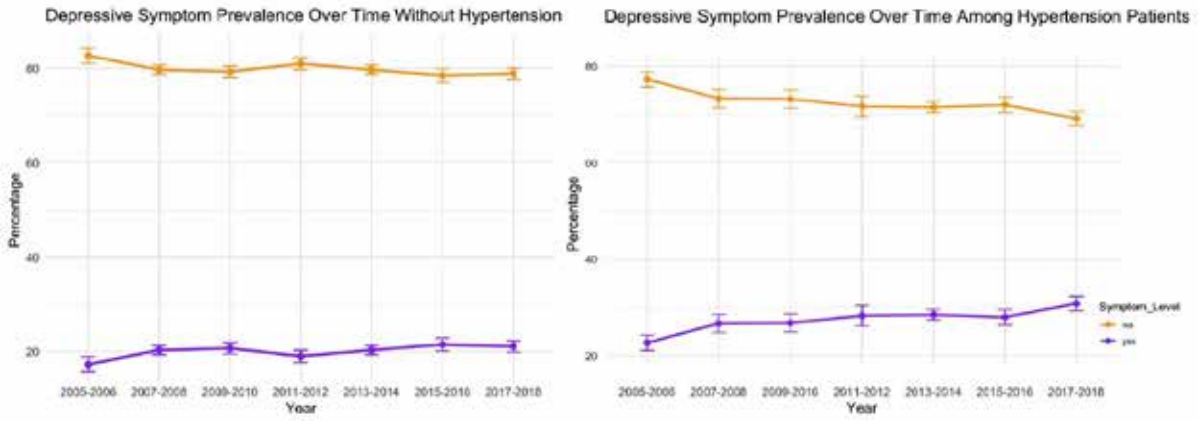


Figure 6. *High Cholesterol and Depression*

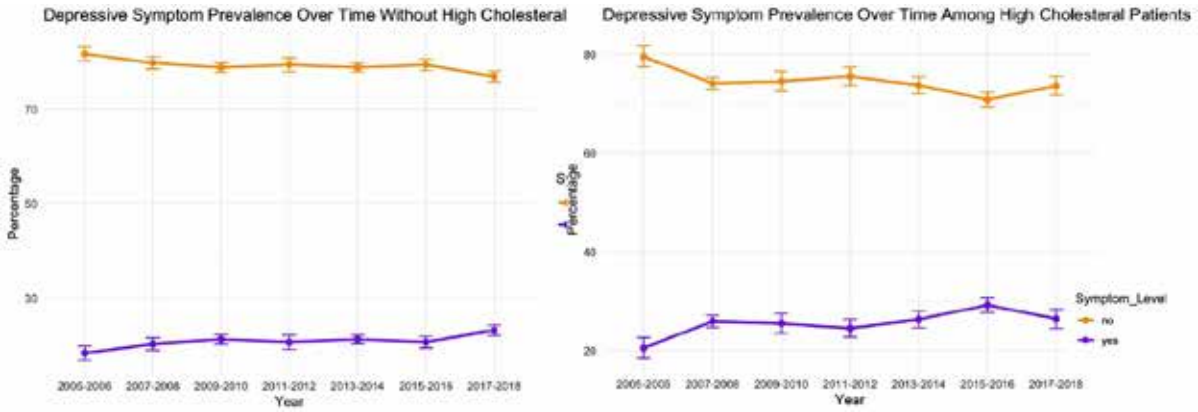


Table 1. *Prevalence of different depression severities over time*

Year	No (n, %, 95% CI)	Mild	Mod	Sev
2005–2006	2181 (80.7 [77.956, 77.956])	370 (13.7 [11.74, 15.66])	160 (5.1 [4.12, 6.08])	14 (0.4 [0.204, 0.596])
2007–2008	2457 (77.3 [75.144, 79.456])	509 (15.2 [13.828, 16.572])	262 (6.8 [5.232, 8.368])	30 (0.7 [0.308, 1.092])
2009–2010	2495 (77 [74.844, 79.156])	528 (16 [14.236, 17.764])	267 (6.4 [5.028, 7.772])	30 (0.6 [0.208, 0.992])
2011–2012	3146 (78 [75.452, 80.548])	617 (14 [12.824, 15.176])	325 (6.9 [5.528, 8.272])	51 (1.1 [0.708, 1.492])
2013–2014	3375 (76.9 [75.136, 78.664])	711 (14.7 [13.328, 16.072])	374 (7.4 [6.42, 8.38])	45 (0.9 [0.704, 1.096])
2015–2016	3182 (76.4 [74.244, 78.556])	734 (16.2 [14.436, 17.964])	297 (6.5 [5.716, 7.284])	49 (0.9 [0.704, 1.096])
2017–2018	3032 (75.7 [73.74, 77.66])	668 (16 [14.628, 17.372])	319 (7.5 [6.128, 8.872])	32 (0.7 [0.504, 0.896])

Table 2. *Depression prevalence in different variable groups*

Variable	2005–2006	2007–2008	2009–2010	2011–2012	2013–2014	2015–2016	2017–2018
Gender							
Male	198 (14.6 [12.4, 16.8])	286 (17.3 [15.1, 19.5])	304 (17.7 [15.2, 20.2])	408 (18.6 [15.1, 22.1])	416 (17.1 [14.7, 19.5])	441 (18.5 [16, 21])	409 (20.6 [18.1, 23.1])
Female	346 (23.3 [19.4, 27.2])	515 (27.2 [24.7, 29.7])	521 (27.7 [25.2, 30.2])	585 (25.2 [22.7, 27.7])	714 (28.7 [26.7, 30.7])	639 (28.3 [25.6, 31])	610 (27.7 [24.8, 30.6])
Diabetes							
No	456 (18.8 [15.9, 21.7])	643 (21.6 [19.4, 23.8])	648 (22 [19.5, 24.5])	799 (20.6 [18.2, 23])	905 (21.8 [20, 23.6])	862 (22.4 [20.4, 24.4])	822 (23.4 [21.6, 25.2])
Yes	88 (23.7 [17, 30.4])	158 (32.5 [28, 37])	177 (30.6 [26.5, 34.7])	194 (34.7 [28.8, 40.6])	225 (33.8 [30.3, 37.3])	218 (32.6 [25.7, 39.5])	197 (30.8 [24.1, 37.5])
Asthma							
No	440 (18.1 [15.6, 20.6])	620 (20.9 [18.9, 22.9])	638 (20.6 [18.6, 22.6])	776 (20.9 [18.4, 23.4])	876 (21.1 [19.1, 23.1])	860 (21.9 [19.5, 24.3])	793 (22.9 [20.5, 25.3])
Yes	104 (26.2 [17.6, 34.8])	181 (33.3 [27.8, 38.8])	187 (37.5 [32, 43])	217 (27.7 [23.2, 32.2])	254 (33.2 [29.5, 36.9])	220 (32 [28.1, 35.9])	226 (32 [25.5, 38.5])
Hyper-tension							
No	294 (17.3 [14.2, 20.4])	405 (20.3 [18.3, 22.3])	423 (20.7 [18.3, 23.1])	540 (19 [16.5, 21.5])	591 (20.3 [18.3, 22.3])	625 (21.5 [18.8, 24.2])	563 (21.1 [18.7, 23.5])
Yes	250 (22.7 [19.6, 25.8])	396 (26.7 [23, 30.4])	402 (26.8 [23.1, 30.5])	453 (28.3 [24.2, 32.4])	539 (28.5 [26.3, 30.7])	455 (28 [24.9, 31.1])	456 (30.8 [27.9, 33.7])
Choles-terol							
No	311 (18.4 [15.5, 21.3])	395 (20.3 [17.8, 22.8])	432 (21.3 [19.3, 23.3])	587 (20.7 [17.8, 23.6])	665 (21.3 [19.5, 23.1])	635 (20.7 [18.3, 23.1])	618 (23.2 [21, 25.4])
Yes	233 (20.5 [16.4, 24.6])	406 (25.9 [23.5, 28.3])	393 (25.5 [21.6, 29.4])	406 (24.5 [21, 28])	465 (26.3 [23, 29.6])	445 (29.2 [26.3, 32.1])	401 (26.4 [22.7, 30.1])

Discussion

This research investigates the increasing prevalence of depression in different severity levels and in relation to chronic physical conditions in the U.S. from 2005 to 2018. Depression rates showed a general increase

in all severities, with women showing a higher prevalence than men on the whole. The prevalence of depression in the sample from NHANES tends to fluctuate around 30% on average. Participants with chronic illnesses including diabetes, asthma, hypertension, and high cholesterol demonstrated higher percentages of depression generally in comparison to the average level of the sample group. Those without chronic conditions exhibited lower but still rising depression rates, averaging around 20%. The findings of this study underscore the potential interrelation between chronic physical conditions and depression, emphasizing the importance of addressing mental health in individuals with chronic physical conditions.

Many studies align with the findings of this research. A study that reported the depression prevalence trend between 2005 and 2016 showed that severe depression has an increasing trend (Yu B., Zhang X., Wang C., et al. 2020). Our study showed a consistent trend before 2017, but during 2017–2018, the prevalence increased significantly. Another study showed that depression prevalence increased dramatically between 2005/2006 and 2007/2008, and then levels off (Iranpour S., Sabour S., Koohi F., et al. 2022). Another trend was also that females generally show more prevalence with depression in comparison to men. Both these trends were consistent with our results, though our criteria for determining depression were different. The prevalence the study shows fluctuates around 7% while our results are around 20%. In terms of the relationship between depression prevalence and chronic medical conditions, a study on their epidemiology has shown that patients with coronary heart diseases and myocardial infarction show a greater prevalence of depression (Spijkerman T., de Jonge P., van den Brink R. H., et al. 2005), and those with chronic medical conditions tend to have greater risks of developing psychiatric disorders, not just depression. The study suggests a bidirectional causation relationship which gives reasons why depressive symptoms are higher in prevalence in those with chronic health conditions. This aligns with our research findings as patients with the chronic physical conditions examined in this study also have a higher prevalence of depression, a type of psychiatric disorder. Our finding is also supported by another research that focused on the epidemiology of depression and specifically diabetes, which suggested that the prevalence rate of depression triples in people with type 1 diabetes and is twice as high in those with type 2 diabetes in comparison to people without (Bobo W. V., Grossardt B. R., Virani S., et al. 2022). This result shows a much more significant difference but has a similar correlation to our findings. Research studies conducted in other countries like China in 2015 have also indicated the close relationship between chronic illnesses in elderlies and the likelihood of developing depression.

This research study possesses both strengths and limitations. One significant strength is the use of a representative and reliable source of sample data. Seven cycles of samples were used from NHANES, a large database. The PHQ scores provide sufficient inference in determining the prevalence of depression. Another advantage is that this study extends previous ones with a multitude of variables like asthma, diabetes, hypertension, and high cholesterol levels, along with an extended time frame from 2005 to 2018. A series of complex data analyses in examining depression prevalence over time were done to enhance precision of results. Nevertheless, there exist some disadvantages in the research process. First, given that no analysis or calculations were done for ages, it is unknown how people of different ages may have had an impact on the results. Other demographics should also be evaluated. Second, the relationship between sociodemographic factors and the prevalence of different depression severities was not evaluated. Third, no data was available regarding pharmacotherapy or access to mental health treatments. Finally, and importantly, all data used for the different variables are self-reported which could lack authenticity.

Conclusion

In conclusion, this study was able to highlight the increasing and fluctuating prevalence of depression in the United States from 2005 to 2018, with particular emphasis on its potential interrelation with chronic physical conditions. Women consistently showed higher depression rates than men, and individuals with chronic illnesses such

as diabetes, asthma, hypertension, and high cholesterol generally demonstrated higher depression prevalence compared to those without. Similar findings were identified in other related research studies. Further research is needed to explore the causal pathways and mechanisms underlying these associations. These findings which address the interrelation between chronic physical conditions and depression underscore the need for integrated healthcare strategies that address both mental health and chronic physical conditions.

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Declaration Conflict of Interest

None.

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