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Recorded Diagnoses of Depression During United States Delivery Hospitalizations, 2000–2015

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Abstract

Objective: To describe national, state-specific, and sociodemographic trends in diagnoses of depressive disorders recorded during delivery hospitalizations.

Methods: Data were analyzed from the National Inpatient Sample (2000–2015) and 31 publically available State Inpatient Databases (2000–2015) of the Healthcare Cost and Utilization Project. Delivery Hospitalizations were identified by using International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnostic and procedure codes for obstetric delivery. Depressive disorders were identified from ICD-9-CM diagnoses codes classified as depressive disorders in the Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (291.89, 292.84, 293.83, 296.2–296.26, 296.3–296.36, 300.4, and 311). Prevalence rates and average annual rate change were calculated nationally and across 28 states with at least 3 years of data and age, payer source, and race or ethnicity.

Results: The U.S. rate of depressive disorders recorded during delivery hospitalizations increased from 4.1 diagnoses per 1,000 hospitalizations in 2000 to 28.7 in 2015. Rates significantly increased in 27 of the 28 states. Recent (2014–2015) rates were lowest in Hawaii and Nevada (<14/1,000) and highest in Vermont, Minnesota, Oregon, and Wisconsin (>49/1,000). Rates in 2015 were highest among those aged 35 years or older, public insurance recipients, and non-Hispanic white women (>31/1,000). The highest annual rate increases were in Vermont and Maine (≥3.8/1,000). Non-Hispanic white women, those ≥ 35 years of age, and public insurance recipients showed the highest annual rate increases during 2000–2015 (≥1.7 per 1,000).

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The findings and conclusions in this report are those of the authors and do not necessarily reflect the official position of the CDC.

A list of states participating in the State Inpatient Databases, Healthcare cost and Utilization Project, Agency for Healthcare Research and Quality is available at www.hcup-us.ahrq.gov/hcupdatapartners.jsp.

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Conclusion: During 2000–2015, rates of depressive disorders recorded during delivery hospitalizations increased nationally, in 27 states with available data, and across all sociodemographic categories.

Precis

From 2000–2015, rates of depressive disorders recorded during delivery hospitalizations increased nationally across age, insurance, and race or ethnicity categories.

Introduction

Depression is one of the most common disorders during pregnancy and the postpartum period, with a prevalence ranging from 8.5%–12.9%.[1,2] Depression during pregnancy is associated with an increased risk of poor maternal self-care, inadequate nutrition,[3] obstetric complications,[4–6] preterm labor,[4,6,7] substance use,[8] lower initiation and duration of breastfeeding,[9] poor maternal-fetal attachment,[10] and postpartum and chronic depression.[11] Maternal depression can affect a child's mental and motor development, temperament, self-regulation, self-esteem, and behavior;[12] these detrimental effects can last into adolescence.[13,14] In extreme cases, depression during pregnancy and the postpartum period can contribute to maternal mortality.[15]

There is growing recognition that maternal mental health is an important issue. The 21st Century Cures Act of 2016 authorized appropriations for federal grants to establish, expand, or maintain culturally competent state-based programs to screen and treat women who are pregnant or postpartum with depression.[16] Given this recent focus, it is important to establish a baseline trend of depressive disorder diagnoses amongst pregnant women, prior to this legislation. Whether U.S. rates of depressive disorders recorded during delivery hospitalization have changed over time, or whether they vary by state or sociodemographic characteristics, has not been documented previously. Of population-based studies examining race or ethnicity and self-report depressive symptoms during pregnancy, results are inconclusive.[17,18] Thus, we aim to describe U.S. rates of depressive disorders recorded during delivery hospitalizations, and also how patterns differ by state and socioeconomic factors, such as age, race or ethnicity, and type of insurance, from 2000 to 2015.

Methods

Data were analyzed from the National Inpatient Sample (2000–2015) and the State Inpatient Databases (2000–2015) of the Healthcare Cost and Utilization Project, Agency for Healthcare Research and Quality from 2000 through the third quarter of 2015.[19] The fourth quarter of 2015 is excluded because of the transition to the International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM) Codes. The Healthcare Cost and Utilization Project contains the largest collection of longitudinal hospital care data derived from administrative data. The database includes all listed diagnoses and procedures, discharge status, patient demographics, and charges for all patients, regardless of payer. These data are frequently used to document mental health diagnoses[20,21] and have undergone quality control measures.[19] The National Inpatient Sample was used for all national analyses, including those by sociodemographic factors. This dataset approximates a

20% stratified sample of all patients discharged from U.S. community hospitals. Survey-specific analysis techniques were used to account for clustering, stratification, and weighting, making the National Inpatient Sample nationally representative. The State Inpatient Databases were used for all state-specific analyses. This dataset includes census data from states that agree to release public use data, which includes 31 states in this analysis. No survey-specific analysis techniques are required when using the State Inpatient Databases.

The analytical sample of interest, delivery hospitalizations, was identified from the 2000–2015 data files by using International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnostic and procedure codes pertaining to obstetric delivery.[22] The outcome of interest, depressive disorder, was identified from ICD-9-CM diagnoses codes classified as depressive disorders in the Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (Substance or Medication-Induced Depressive Disorder: 291.89, 292.84, Depressive Disorder Due to Another Medical Condition: 293.83, Major Depressive Disorder, single or recurrent episode: 296.2–296.26, 296.3–296.36, Persistent Depressive Disorder [Dysthymia]: 300.4, and Other Specified or Unspecified Depressive Disorder: 311). Premenstrual Dysphoric Disorder (625.4) was not included given our sample of interest, delivery hospitalizations.[23] Given the nature of hospital discharge data, we were unable to identify what screening methods or assessments were used to identify these depressive disorders. Other covariates of interest were sociodemographic factors like age, payer source, and race or ethnicity. For payer source, ‘public’ includes Medicaid and Medicare, although Medicare recipients made up less than 2% of this category, and ‘other’ includes Worker’s Compensation, Tricare, Title V, and other government programs.[19]

National and state-specific prevalence rates and 95% confidence intervals of depressive disorders recorded per 1,000 delivery hospitalizations during 2000–2015 were calculated for each year nationally and across sociodemographic factors (age, payer source, and race or ethnicity) and states. Joinpoint version 4.6 was used to select linear models, by way of permutation tests, to determine the average annual rate change over the study period. For this analysis, we did not allow for any joinpoints, or change in trends, between years. Average annual rate changes were only calculated for the 27 states with at least 3 years of data and significant linear trends. A statistically significant change indicates that the annual rate change is different from zero, or that the trend is significantly decreasing or increasing over time. Joinpoint was also used to perform pairwise comparisons to determine whether trends significantly differed across categories of each sociodemographic factor. *P*-values less than 0.05 were considered statistically significant. Institutional Review Board approval was not needed as this analysis was not considered human subjects research because of the use of publically available de-identified data.

Results

Analyses using the National Inpatient Sample revealed that U.S. rates of depressive disorders recorded during delivery hospitalizations increased from 4.1 diagnoses per 1,000 delivery hospitalizations in 2000 to 28.7 in 2015 (Figure 1; Table 1). This represents a 7-fold increase in the rate and an average rate increase of 1.6/1,000 each year during 2000 to 2015.

State-specific analyses using the State Inpatient Databases revealed that rates of depressive disorders recorded during delivery hospitalizations varied by state (Table 2; Appendix 1 [Appendix 1 is available online at http://links.lww.com/xxx]); 2014–2015 diagnosis rates were lowest in Hawaii and Nevada (<14/1,000) and highest in Vermont, Minnesota, Wisconsin, and Oregon (>49/1,000). During the study period, there were significant increases in the rate of depressive disorders recorded during delivery hospitalizations for 27 of the 28 states with at least 3 years of data. Georgia was the only state where a linear trend was not significantly fit for the data ($P = 0.4$). Rates increased the slowest in Hawaii and Nevada with average increases of 0.7/1,000 each year. Rates increased the fastest in Vermont and Maine, both of which showed average increases of at least 3.8/1,000 each year (Figure 2).

Additional analyses using the National Inpatient Sample revealed that rates of depressive disorders recorded during delivery hospitalizations varied across age, payer source, and race or ethnicity, but increased significantly among all groups. Rates in 2000 ranged from 3.4 per 1,000 among women aged 19–24 years to 5.9 among women aged 35 years or older. Rates in 2015 ranged from 27.1 per 1,000 among women aged 18 years or younger to 34.2 among women aged 35 years or older (Figure 3). Rates increased the fastest during 2000–2015 among women aged 35 years and older (1.8/1,000 per year), and pairwise comparisons showed that the annual rate increases were significantly different amongst all age groups ($P's < 0.05$). Rates in 2000 ranged from 2.8 per 1,000 among self-paying women to 4.7 among publicly insured deliveries. Rates in 2015 ranged from 14.3 per 1,000 among self-paying women to 31.4 among publically insured deliveries (Figure 3). Rates increased the fastest during 2000–2015 among publically insured deliveries (1.7/1,000 per year), and pairwise comparisons showed that the annual rate increases were significantly different between public and private and between self-pay and all other groups ($P's <0.05$; Figure 3). By race or ethnicity, rates in 2000 ranged from 0.8 per 1,000 among Asian or Pacific Islander women to 5.6 among non-Hispanic white women. Rates in 2015 ranged from 8.8 per 1,000 among Asian or Pacific Islander women to 37.2 among non-Hispanic white women (Figure 3). Rates increased the fastest over time among non-Hispanic white women (2.0/1,000 per year), and pairwise comparisons showed that the annual rate increases were significantly different amongst all race and ethnicity groups. ($P's <0.05$; Figure 3).

Discussion

Results from this report show that national rates of depressive disorders recorded during delivery hospitalizations increased significantly from 4.1 per 1,000 hospitalizations in 2000 to 28.7 in 2015, an average increase of 1.6 diagnoses per 1,000 each year. The most recent systematic reviews estimating the national prevalence of depression during pregnancy date back to 2005;[1,2] the current report provides the most updated estimates available for depressive disorder recorded at delivery hospitalization. Among the 28 states with at least 3 years of data, 27 showed significant increases in rates of depressive disorders recorded during delivery hospitalizations during 2000–2015. Recent rates (2015) were highest in deliveries to women identified as 35 years or older, publically insured, and non-Hispanic white. Consistent with the literature,[18] women receiving public insurance during pregnancy showed the highest rates of depression diagnoses at delivery. This finding is also consistent

with the United States Preventive Services Task Force's acknowledgement of lower socioeconomic status as a risk factor for depression.[24] Because screening and diagnosing practices may differ by sociodemographic factors, differences in rates across these factors may reflect variability in identification of depression, rather than inherent risk of depression. For example, non-Hispanic white women are more likely to be screened for depression at delivery than non-Hispanic Black women,[25] potentially inflating rates of depression amongst non-Hispanic white women.

Increasing trends in depressive disorders recorded during delivery hospitalization in this report may help to explain previously documented decreasing rates of self-reported postpartum depressive symptoms from 2004 to 2012.[17] Increasing diagnoses at delivery from 2000 to 2015 may have resulted in an increase in treatment during the postpartum period and, in turn, a decrease in self-reported postpartum depressive symptoms. In many cases, pregnancy can be an opportunity for frequent care and monitoring by a health care provider, providing an ideal opportunity for the detection of depressive symptoms and if applicable, the documentation of a diagnosis, and the provision of treatment options through their clinic or referral.[26] In the absence of active case identification strategies, most women with perinatal depression may neither seek nor receive help,[27] thus, the American College of Obstetricians and Gynecologists, the United States Preventive Services Task Force's, and The Council on Patient Safety in Women's Health recommend universal screening for depression in pregnant and postpartum women.[24,26,28] Given that screening is not universally practiced, depressive symptoms are commonly undiagnosed[27,29] and our estimates are most likely underestimated.

This analysis documents baseline trends prior to 2016 legislation aimed at improving perinatal depression screening and treatment.[16] State efforts to improve depression education and screening practices may be associated with differences in rates of diagnosed depressive disorders. A study of New Jersey data during 2009–2010 found that approximately 90% of women were screened for depression at delivery following a 2006 mandate requiring depression screening at hospital delivery.[25] However, this may not be the case in all states and the overall impact of legislation on perinatal depression treatment outcomes remains unclear.[30] Increasing trends in this report could be a result of more cases, better recognition of depression, or improved diagnoses following screening and assessment. Future analyses documenting rates post-legislation and incorporating multiple data sources with varying forms of depression ascertainment would complement this analysis and allow for a better understanding of the burden of depression in pregnant women.

Results of our study are subject to several limitations. First, the nature of the data used affects the generalizability of the results. Data do not include deliveries outside of the hospital; however, those births represent only 1.5% of all US births.[31] Not all hospitals participated; however, at least 80% of National Center for Health Statistics births are represented for each state. Not all states provided data to the public-use State Inpatient databases, and amongst those that did, not all had data for every year in the study period. Second, estimates are most likely underestimates because screening for depression is not universally practiced. In addition, because many women deliver without a prenatal care record,[32] depressive disorders recorded in other points during the pregnancy may not be

documented on the delivery encounter for hospital discharge data. Third, analyses were dependent on ICD-CM coding, which may vary by hospital and state, and which may contribute to underestimated rates as ICD-CM codes are for billing and depressive disorders may not be documented. Depression screening and diagnosis are not typically included in reimbursed global obstetric payments, and providers may be less likely to document these ICD-CM codes because there is limited to no financial benefit from billing.[33] We are also unable to determine what type of screener was used to identify and document the depressive disorders, so we are unable to comment on the sensitivity of these diagnoses. However, these data are frequently used to identify mental health diagnoses.[20,21]

Findings from this first state-based analysis of rates of depressive disorders recorded during hospitalization can help states understand the overall burden of depression among women at delivery. During 2000–2015, rates of depressive disorders recorded at delivery hospitalization increased significantly across the nation and in 27 states, and differed across age, insurance type, and race or ethnicity.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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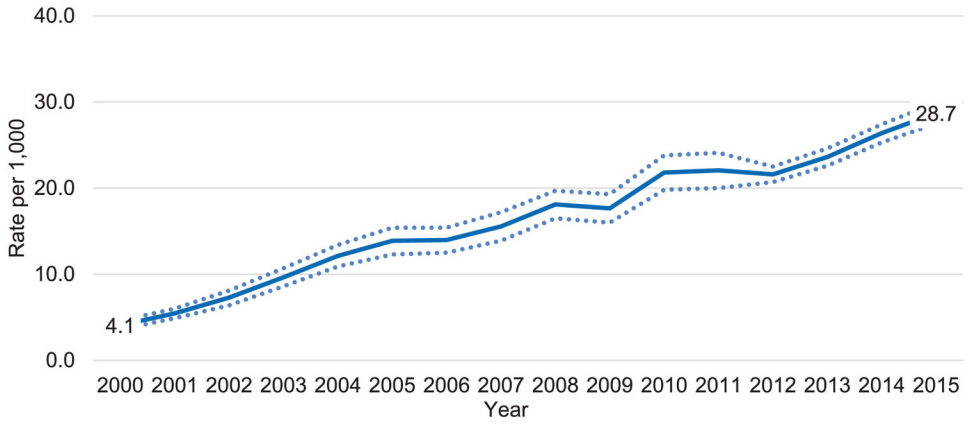

Figure 1.

U.S. national prevalence rate* and 95% confidence interval[†] of depressive disorders recorded per 1,000 hospitalizations Nationwide Inpatient Sample, Healthcare Cost and Utilization Project, 2000–−2015.[‡] The *solid blue line* represents the prevalence rate and the *dotted blue lines* represent the 95% confidence intervals. *Prevalence rate numerator consisted of depressive disorder International Classification of Diseases-9-Clinical Modification codes (291.89, 292.84, 293.83, 296.2–296.26, 296.3–296.36, 300.4, and 311), prevalence rate denominator consisted of delivery hospitalization discharges. [†]Confidence intervals are based on unweighted data. [‡]Rates are for 2000 through the third quarter of 2015.

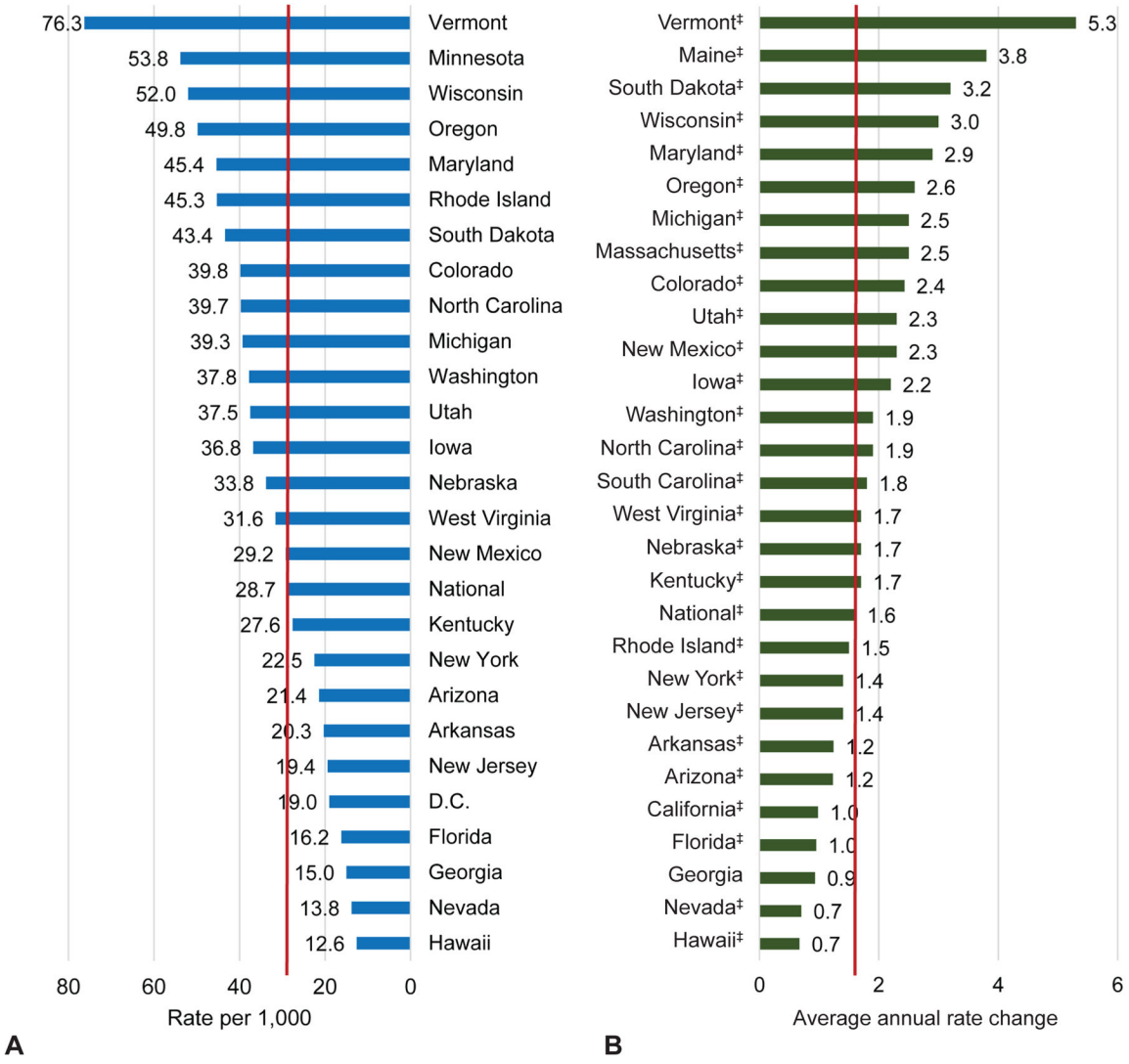

Figure 2.

A state-specific comparison of depressive disorders recorded per 1,000 delivery hospitalizations: (A) prevalence rate*, 2014–2015† and (B) average annual rate change, 2000–2015. Data from state inpatient databases, Healthcare Cost and Utilization Project. *Red line* notes national value. *Prevalence rate numerator consisted of depressive disorder International Classification of Diseases-9-Clinical Modification codes (291.89, 292.84, 293.83, 296.2–296.26, 296.3–296.36, 300.4, and 311), prevalence rate denominator consisted of delivery hospitalization discharges. †Rates for Arizona, Colorado, Iowa, Kentucky, Minnesota, Nebraska, North Carolina, and Wisconsin are 2015, the remainder are 2014. ‡Significant at $P<.05$.

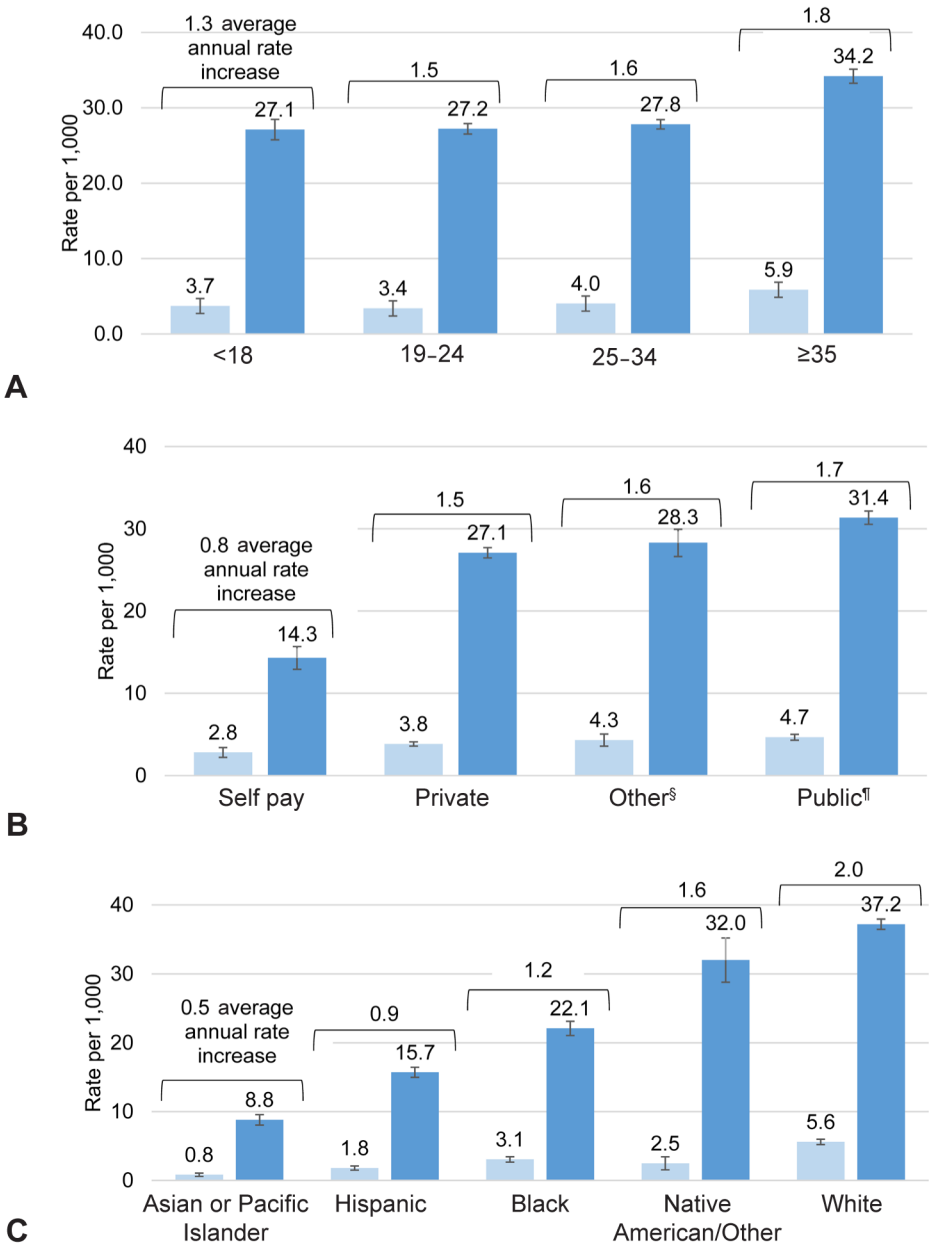

Figure 3.

Prevalence rates,* 95% confidence intervals,† and average annual percent change in the rate of depressive disorders recorded during delivery hospitalizations by sociodemographic characteristics: (A) age at admission, (B) payer source, and (C) race–ethnicity. Data from the Nationwide Inpatient Sample, Healthcare Cost and Utilization Project, 2000–2015.‡ *Light blue* bars indicate the year 2000; *dark blue* bars indicate the year 2015. *Prevalence rate numerator consisted of depressive disorder ICD-9-CM codes (291.89, 292.84, 293.83, 296.2–296.26, 296.3–296.36, 300.4, and 311), prevalence rate denominator consisted of delivery hospitalization discharges. †Confidence intervals are based off of unweighted data.

[‡]Rates are for 2000 through the third quarter of 2015. [§]Includes Worker's Compensation, Tricare, Title V, and other government programs. [¶]Includes Medicaid and Medicare (<2%).

Table 1.

National Case Counts and 95% Confidence Intervals (CI) of Depressive Disorders* Recorded at Delivery Hospitalization by Year; National Inpatient Database, Healthcare Cost and Utilization Project, 2000–2015

Year	N (95% CI)
2000	16,055 (14,150 – 18,081)
2001	20,999 (18,843 – 23,073)
2002	29,045 (25,488 – 32,258)
2003	37,919 (33,804 – 42,058)
2004	49,496 (44,493 – 54,698)
2005	56,306 (49,893 – 62,468)
2006	57,731 (51,626 – 63,603)
2007	68,080 (60,847 – 75,293)
2008	73,349 (66,858 – 79,825)
2009	69,650 (63,113 – 76,131)
2010	81,063 (73,613 – 88,485)
2011	81,044 (73,466 – 88,526)
2012	81,360 (77,964 – 84,743)
2013	88,375 (84,564 – 92,048)
2014	100,290 (96,182 – 104,165)
2015†	82,086 (78,654 – 85,518)

*Consists of depressive disorder ICD-9-CM codes (291.89, 292.84, 293.83, 296.2–296.26, 296.3–296.36, 300.4, and 311)

†Case counts are only for the first three quarters of 2015 and are not representative of the entire year

Table 2.

Case Counts of Depressive Disorders* Recorded at Delivery Hospitalizations, by State and Year; State Inpatient Databases, Healthcare Cost and Utilization Project, 2000–2015

State	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15†
Arizona	218	324	495	686	887	962	1,067	1,058	1,236	1,225	1,333	1,436	1,440	1,564	1,676	1,299
Arkansas	---	---	---	---	204	316	449	404	372	522	505	516	549	650	740	---
California	1,187	1,613	---	2,748	3,463	4,037	4,241	4,757	5,058	5,400	6,171	6,817	---	---	---	---
Colorado	307	553	825	976	1,245	1,444	1,582	1,706	1,930	2,033	2,092	2,242	1,940	2,092	2,321	1,891
D.C.	---	---	---	---	---	---	---	---	---	---	---	---	---	233	268	---
Florida	559	845	1,110	1,438	1,926	2,052	2,352	2,479	2,642	2,742	2,815	2,874	2,807	2,943	3,422	---
Georgia	---	---	---	---	---	---	---	---	---	---	---	---	1,658	1,594	1,893	---
Hawaii	43	61	62	106	109	105	140	98	148	166	172	211	149	198	191	---
Iowa	194	202	324	456	631	652	688	846	829	928	967	1,136	1,080	1,236	1,295	1,058
Kentucky	165	218	306	459	588	620	651	660	812	1,041	1,094	1,160	1,220	1,260	1,390	1,064
Maine	198	272	360	543	---	---	576	685	709	763	692	647	690	---	---	---
Maryland	352	559	816	992	1,380	1,624	1,961	2,158	2,216	2,295	2,554	2,617	2,662	2,735	3,060	---
Massachusetts	772	909	1,200	1,454	1,649	1,765	1,956	2,185	2,088	2,360	2,603	2,856	2,661	2,822	---	---
Michigan	636	772	1,148	1,387	1,825	2,404	2,615	2,710	2,982	3,154	3,233	3,388	3,352	3,928	4,333	---
Minnesota	---	---	---	---	---	---	---	---	---	---	---	---	---	---	3,398	2,695
Mississippi	---	---	---	---	---	---	---	---	---	---	301	316	---	---	---	---
Nebraska	---	134	218	337	293	293	361	418	527	597	605	648	553	726	775	657
Nevada	---	---	72	116	164	173	211	226	238	255	262	304	290	279	465	---
New Jersey	340	385	562	746	897	1,023	1,249	1,746	2,051	1,815	1,887	1,752	1,605	1,821	1,917	---
New Mexico	---	---	---	---	---	---	---	---	416	501	518	640	618	635	669	---
New York	873	1,122	1,548	2,054	2,444	2,743	3,104	3,287	3,790	3,820	4,356	4,708	4,488	4,572	5,154	---
North Carolina	503	707	1,009	1,432	1,736	1,883	2,181	2,152	2,284	2,462	2,589	2,716	2,802	3,223	4,061	3,385
Oregon	336	525	666	730	875	944	987	1,124	1,335	1,372	1,487	1,569	1,661	1,706	2,120	---
Rhode Island	---	---	338	338	403	453	415	432	431	378	437	564	466	431	503	---
South Carolina	183	235	360	495	595	630	674	733	968	1,138	1,358	1,395	1,361	1,469	---	---
South Dakota	---	---	---	---	---	---	---	237	245	330	324	368	394	451	509	---
Utah	234	348	567	716	883	876	932	1,114	1,346	1,578	1,503	1,595	1,555	1,798	1,856	---
Vermont	---	52	51	69	111	156	186	290	249	265	313	277	301	400	421	---
Washington	436	534	724	879	1,007	1,018	1,198	1,296	1,507	1,816	1,885	2,001	2,046	2,456	3,006	---
West Virginia	101	151	175	233	272	340	406	452	403	439	456	418	544	591	631	---
Wisconsin	505	650	862	1,258	1,566	1,759	1,998	2,257	2,325	2,396	2,613	2,709	2,517	2,755	3,147	2,501

--- Data not available

* Consists of depressive disorder ICD-9-CM codes (291.89, 292.84, 293.83, 296.2–296.26, 296.3–296.36, 300.4, and 311)

† Case counts shown are only for the first three quarters of 2015 and are not representative of the entire year