

## LETTERS

## Concise Research Reports

## Trends in Cannabis Use Disorder among Pregnant Women in the U.S., 1993–2014

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## INTRODUCTION

Using data from the National Survey on Drug Use and Health, Brown et al. demonstrated that the prevalence of cannabis use increased from 2.4% to 3.9% from 2002 through 2014.<sup>1</sup> Our study examines the prevalence of cannabis use disorder (CUD) and demographic disparities in prevalence among pregnancy-related hospitalizations during the period from 1993 to 2014, using an inpatient database. The findings are expected to inform clinicians who provide obstetric care and general internists who manage women contemplating pregnancy.

## METHODS

The National Inpatient Sample (NIS) is the largest nationally representative database of hospital discharge records, comprising approximately 20% random samples from U.S. community hospitals regardless of payer. Records from January 1, 1993 through December 31, 2014 were obtained for pregnancy-related hospitalizations of female patients in reproductive age (15–44).

The International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnosis and procedure codes for up to 15 diagnoses and 15 procedures were used to identify hospitalizations related to pregnancy. Using a validated method,<sup>2</sup> delivery and antenatal hospitalizations were categorized separately. ICD-9-CM diagnosis codes 304.3 (cannabis dependence) and 305.2 (cannabis abuse) were used to identify CUD. Annual rates of diagnosed CUD among 10,000 pregnancy-related hospitalizations were estimated by age (15–19, 20–29, and 30–44 years) and race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, and other non-Hispanic minority). Time trends in annual rates and differences in trends by age and racial/ethnic subgroups were examined by linear regressions. Stata software was used to conduct statistical analysis (version 14; StataCorp LLC, College Station, TX, USA), accounting for sampling weight and complex sampling design.<sup>3</sup>

## RESULTS

Approximately 17.6 million records in NIS were identified as delivery hospitalizations during the study period, representing 84.7 million deliveries nationally. The rates of diagnosed CUD among delivery hospitalizations increased 5.06-fold, from 18.52 per 10,000 deliveries (95% CI, 15.02–22.02) in 1993 to 93.64 (95% CI, 97.33–99.94) in 2014. The total number of deliveries identified with CUD in the U.S. was estimated to be 35,507 in 2014.

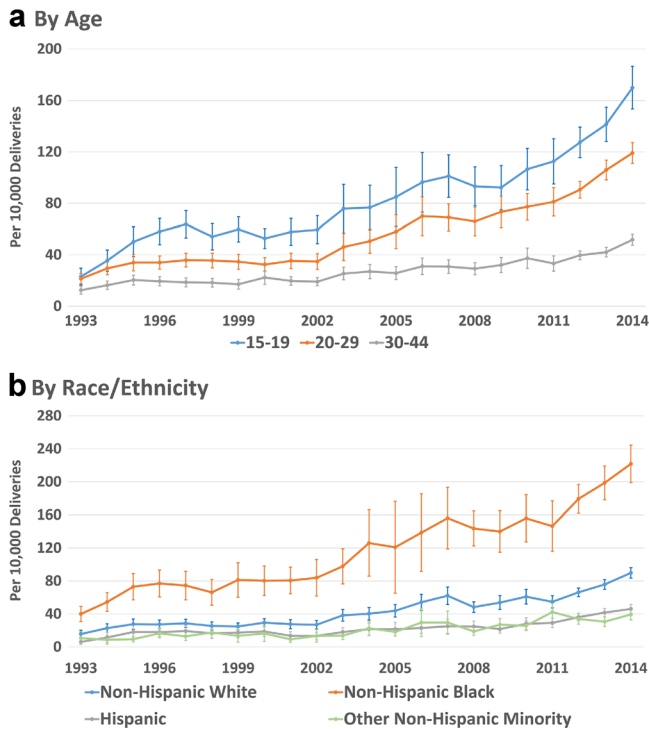
An increasing trend in diagnosed CUD among delivery hospitalizations was observed in all age and racial/ethnic subgroups ( $P$ s < 0.0001; Fig. 1). All age groups started with similar rates of CUD in 1993, but teenage mothers (aged 15–19) had a more rapid increase than adult mothers (aged 20–29 and 30–44;  $P$ s < 0.01). Non-Hispanic black mothers exhibited a greater increase than other racial/ethnic subgroups ( $P$ s < 0.0001).

Approximately 9.9 million additional hospitalizations nationally had antenatal diagnoses or procedures during the study period. These women were more frequently diagnosed with CUD than women who delivered in any given year, and they exhibited trends of increased CUD diagnosis nearly identical to those who delivered.

## DISCUSSION

In the U.S., rates of diagnosed CUD among pregnancy-related hospitalizations have increased rapidly, reaching approximately 1% in 2014. Teenage and non-Hispanic black mothers exhibited greater increases. The disparity may reflect increasing risk of developing CUD among these populations, and suggest targeting CUD prevention and intervention programs to those at high risk.

This study has limitations. Antenatal hospitalizations in NIS do not account for terminated pregnancies not resulting in hospitalizations. However, because only 1% of births occur outside hospitals,<sup>4</sup> and NIS represents 97% of all hospitalizations in the U.S.,<sup>5</sup> CUD rates estimated from delivery hospitalizations should provide nationally representative estimates among those delivered. Detection of CUD in hospitals may be influenced by social norms, legality of cannabis use, and clinical practice. The increase in the prevalence may be partly attributed to the increasingly higher rates of CUD screening



**Figure 1** Rates of diagnosed cannabis use disorder among delivery hospitalizations from 1993 through 2014 by (a) age and (b) race/ethnicity. National Inpatient Sample (NIS). Error bars indicate 95% CI. Trends for each subgroup were assessed by logistic regression, with a continuous term for year. All subgroups exhibited increasing trends over time ( $P$ s < 0.0001). Between-group differences in trends were assessed by linear regressions, with a continuous term for year, group indicators, and interaction terms between group indicators and year.  $P$ -values for the interaction terms: age\*year (reference: 15–19 years): 20–29,  $P$  < 0.006; 30–44,  $P$  < 0.0001; race/ethnicity\*year (reference: non-Hispanic black): non-Hispanic white,  $P$  < 0.0001; Hispanic,  $P$  < 0.0001; other non-Hispanic minority,  $P$  < 0.0001.

among pregnant women over time. The reported prevalence may also underestimate CUD in certain demographic and geographic subgroups. Further, NIS does not allow for identification of multiple hospitalizations of the same patient. A few states opted not to report race/ethnicity data for confidentiality protection, and the related records were removed from the racial/ethnic subgroup analyses.

Despite these limitations, the study demonstrates an alarming increase in diagnosed CUD among pregnant women. As recommended by the American College of Obstetricians and Gynecologists, cannabis use should be screened and

discouraged among all women who are pregnant or contemplating pregnancy. General internists are also encouraged to screen cannabis use among women of reproductive age and to include a CUD prevention component in preconception counseling.

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**Author Contributions:** Drs. Shi and Zhong had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

Study concept and design: Drs. Shi and Zhong.

Acquisition, analysis, or interpretation of data: Dr. Shi.

Drafting of the manuscript: Drs. Shi and Zhong.

Critical revision of the manuscript for important intellectual content: Drs. Shi and Zhong.

Statistical analysis: Drs. Shi and Zhong.

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**Compliance with Ethical Standards:**

**Conflict of Interest:** The authors declare that they do not have a conflict of interest.

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## REFERENCES

1. Brown GL, Sarvet AL, Shmulewitz D, Martins SS, Wall MM, Hasin DS. Trends in marijuana use among pregnant and nonpregnant reproductive-aged women, 2002–2014. *JAMA*. 2017;317(2):207–9.
2. Kuklina EV, Whiteman MK, Hillis SD, et al. An enhanced method for identifying obstetric deliveries: implications for estimating maternal morbidity. *Matern Child Health J*. 2008;12(4):469–77.
3. Houchens R, Ross D, Elizhauser A. Using the HCUP National Inpatient Sample to estimate trends. HCUP Methods Series. Report # 2006-05. 2015; [https://www.hcup-us.ahrq.gov/reports/methods/2006\\_05\\_NISTrendsReport\\_1988-2004.pdf](https://www.hcup-us.ahrq.gov/reports/methods/2006_05_NISTrendsReport_1988-2004.pdf). Accessed Jan 2017.
4. MacDorman MF, Matthews T, Declercq E. Trends in out-of-hospital births in the United States, 1990–2012. *NCHS Data Brief*. 2014(144):1–8.
5. Healthcare Cost and Utilization Project (HCUP) Administrative data: inpatient, emergency department, and ambulatory surgery care. 2016; [https://www.hcup-us.ahrq.gov/news/exhibit\\_booth/hcup\\_90\\_min\\_pres.jsp](https://www.hcup-us.ahrq.gov/news/exhibit_booth/hcup_90_min_pres.jsp). Accessed Jan 2017.