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RESEARCH AND QUALITY IMPROVEMENT BRIEF

COVID-19 Prevalence and Trends Among Pregnant and Postpartum Persons in Maine by Rurality and Pregnancy Conditions

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SARS-CoV-2, a highly transmissible respiratory virus, has resulted in more than 1 million deaths in the United States (US) and been associated with adverse fetal and maternal outcomes.[1,2] Persons with common pregnancy conditions, such as gestational diabetes mellitus (GDM), hypertensive disorders of pregnancy (HDP), and prenatal depression, may have a higher risk of COVID-19 infection and adverse sequelae.[3] Further, there is a lack of information about COVID-19 infection postpartum, even though this period is a high-risk time for maternal morbidity and mortality,[4] and peak infant caregiving, with possible maternal-infant transmission of the virus.[5]

Pregnant and postpartum persons living in rural areas may have a greater risk of COVID-19 infection than those living in urban areas.[6] This greater risk could be due to lower COVID-19 vaccination rates in some rural areas and lower use of community mitigation strategies, such as policies on masking, closures, and physical distancing.[7,8]

Therefore, our study aimed to estimate the prevalence and trends in COVID-19 diagnosis in persons during pregnancy and in the first 6 months postpartum by rurality of residence and common pregnancy conditions. We used data from Maine, the second most rural state in the US, where more than 60% of residents live in rural areas.[9] No prior study has reported on COVID-19 prevalence among pregnant and postpartum persons living in Maine.

METHODS

We reviewed the medical claims of persons with deliveries (livebirths or stillbirths) identified in the Maine Health Data Organization's All Payer Claims Data between 2020 and 2021. We defined COVID-19 diagnosis during pregnancy and during the first 6 months postpartum, separately, using the *International Classification of Diseases, Tenth Revision, Clinical Modification* diagnosis code U071 recorded (in any position) on inpatient, outpatient, and professional medical claims. We chose April 2020 as the starting delivery month because it was the first full month after the public health emergency was declared in Maine. We chose December 2021 as the ending delivery month because it was the last month in our dataset. We chose June 2021 as the end of the postpartum cohort because December 2021 marked 6 months postpartum. For the postpartum cohort analysis, we restricted this study population to persons who had continuous health insurance coverage for 6 months postpartum to ensure we could observe their health care claims.

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We used Joinpoint regression software to model trends, which allows for several linear trends to be detected and connected together at "joinpoints." We stratified the analysis by (1) urban and rural residence based on ZIP code of residence at the time of delivery using the US Department of Agriculture Rural-Urban Commuting Area Codes[10] and the New England Rural Health Roundtable's categorization scheme,[11] and (2) common pregnancy conditions (GDM, HDP, and prenatal depression). We used tests of coincidence to assess whether 2 Joinpoint regression functions [intercepts (prevalence at first observed month), slopes (change in prevalence per month), and joinpoints] were identical or not. For delivery months with zero COVID-19 diagnoses, we imputed a case value of 0.1 so the Joinpoint regression model would run.[12] This study was deemed exempt from review by the University of Southern Maine's Institutional Review Board.

RESULTS

COVID-19 during pregnancy

In the pregnancy cohort, 64.6% of deliveries were to persons living in rural areas, 32.9% had prenatal depression, 18.9% had HDP, and 11.4% had GDM. The prevalence of COVID-19 during pregnancy was 3.0% (410/13457) (Supplemental Table 1). The prevalence increased from 0.5% in April 2020 to 10.5% in December 2021, and October 2020 was the start of the positive slope (0.43 per month, $P < .001$) (Figure 1A). Trends among pregnant persons living in urban areas were distinct from those living in rural areas ($P = .02$), with a steeper slope for urban residents during the first months of the pandemic, followed by a later increase among rural residents (Figure 1B). Trends in COVID-19 diagnosis among persons with prenatal depression were flat and then steeply increased after December 2020 ($P < .001$), in contrast to a more moderate, steady increase among those without prenatal depression (Figure 1C). COVID-19 diagnosis in persons with GDM and HDP were similar to those in persons without these conditions (Supplemental Figure 1A-1B).

COVID-19 during the first 6 months postpartum

In the postpartum cohort, 65.2% of deliveries were to persons living in rural areas, 33.6% had prenatal depression, 19% had HDP, and 11.7% had GDM. The prevalence of COVID-19 during the first 6 months postpartum was 1.6% (149/9143) (Supplemental Table 2). The prevalence increased from 0.9% in April 2020 to 3.2% in June 2021 (slope = 0.12 per month, $P < .001$) (Figure 2A). Trends among postpartum persons living in urban areas were distinct from those living in rural areas ($P = .03$), with a steeper slope for rural residents during the pandemic (Figure 2B). Trends in COVID-19 infections among persons with prenatal depression were steeper than those without prenatal depression ($P < .005$) (Figure 2C). Persons without GDM and without HDP had a higher prevalence of and steeper increase in COVID-19 diagnoses postpartum than those with these conditions (GDM: $P < .01$; HDP: $P = .03$) (Supplemental Figure 1C-1D).

DISCUSSION

The prevalence of COVID-19 diagnosis among pregnant and postpartum persons in Maine increased during the pandemic. Our findings of the prevalence of COVID-19 diagnosis among pregnant persons (3.0%) are similar to those reported from other studies among pregnant persons during the same time period (range 3.2% to 6.1%).[13,14] We found trends in COVID-19 diagnosis among pregnant and postpartum persons in Maine that showed distinct patterns of infection by rurality of residence and select pregnancy conditions. Possible explanations for these findings could be higher rates of testing among certain populations, such as urban residents, during the first few months of the pandemic. Also, people with high-risk pregnancy conditions, such as HDP or GDM, could have taken more preventive measures against infection. We speculate that these preventive measures may have reduced their risk of COVID-19 diagnosis postpartum. Our findings showing steeper increases in COVID-19 diagnosis among pregnant and postpartum persons with prenatal depression (versus those without) suggest that depression could indicate a higher risk of COVID-19 infection.

Our study is the first to estimate the prevalence of COVID-19 among pregnant and postpartum persons in Maine, using data that captures both commercial and public insurance and examines differences by rurality, a known modifier of COVID-19 infections in the US.[6] Also, our study examined trends in COVID-19 diagnosis among persons through the first 6 months postpartum, which has not yet been studied.

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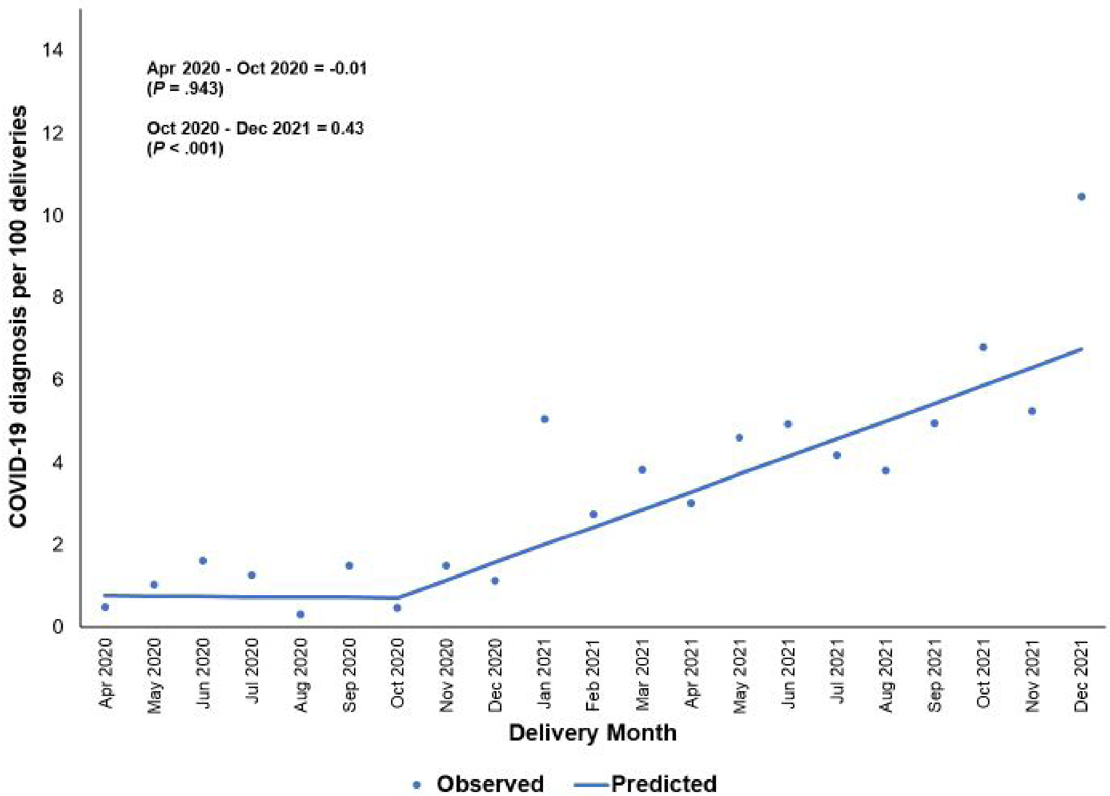
Figure 1. Prevalence of COVID-19 diagnosis during pregnancy, Maine 2020-2021

A. During pregnancy, overall



B. During pregnancy, by rurality of maternal residence[a]

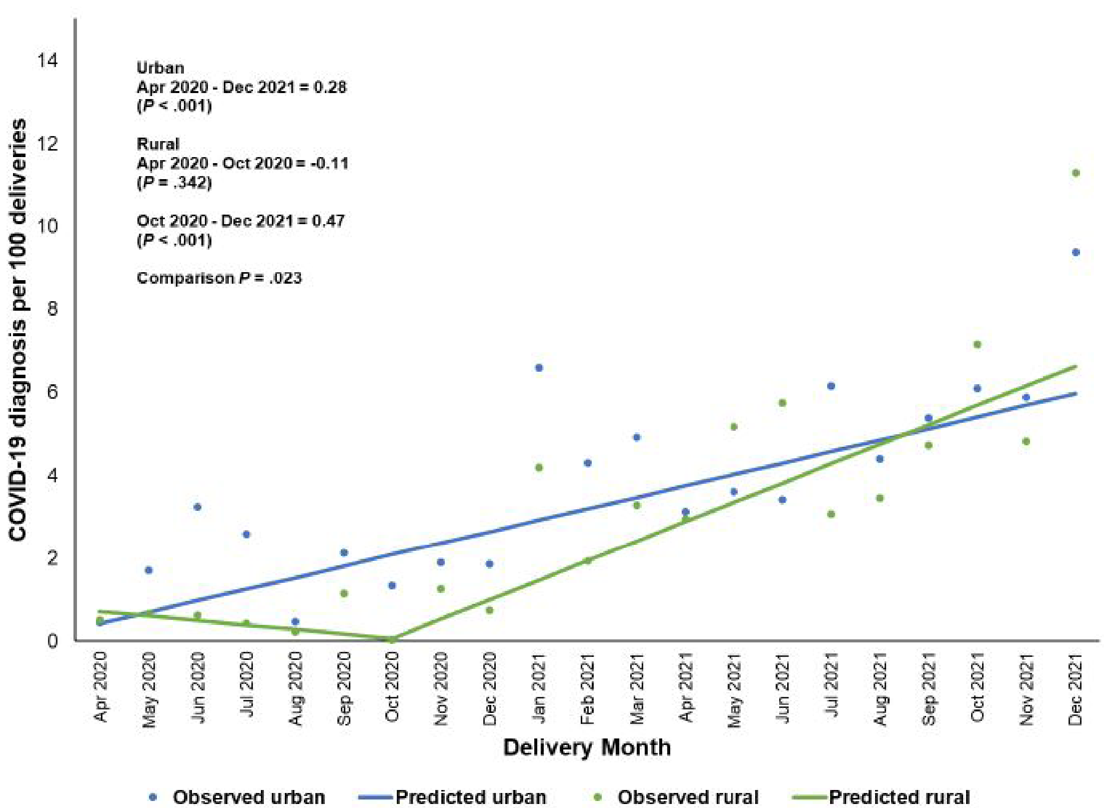
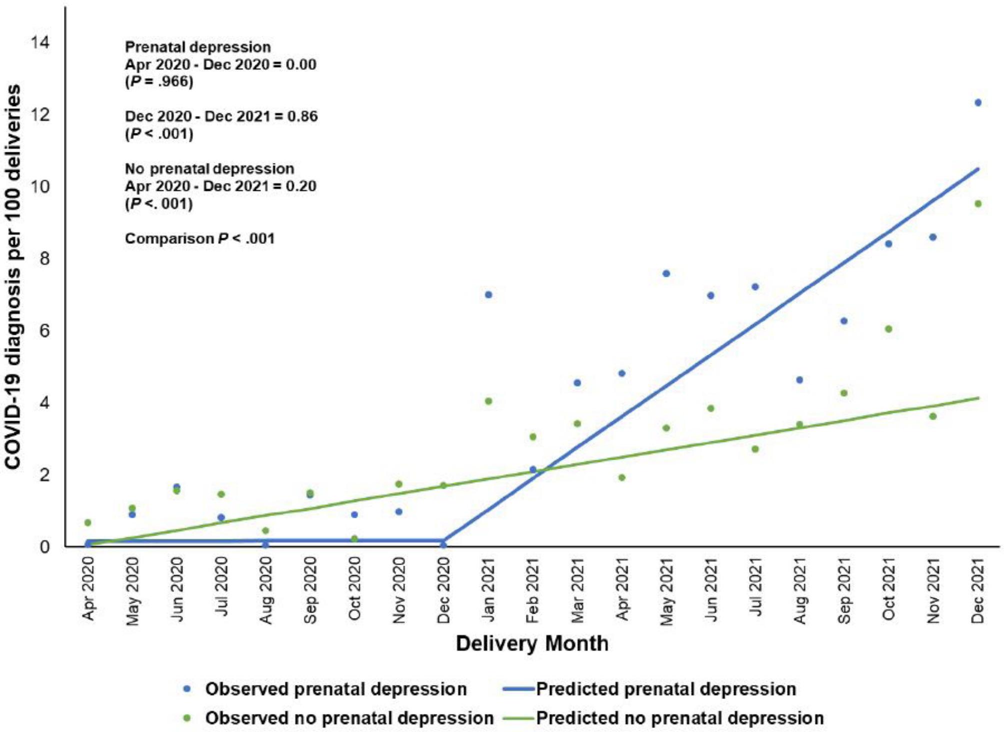


Figure 1. Prevalence of COVID-19 diagnosis during pregnancy, Maine 2020-2021, cont'd

C. During pregnancy, by prenatal depression[b]



[a]Zero COVID-19 diagnoses for October 2020 replaced with 0.1 for rural residents.

[b]Zero COVID-19 diagnoses for April 2020, August 2020, and December 2020 replaced with 0.1 for prenatal depression group.

Figure 2. Prevalence of COVID-19 diagnosis during first 6 months postpartum, Maine 2020-2021

A. During first 6 months postpartum, overall

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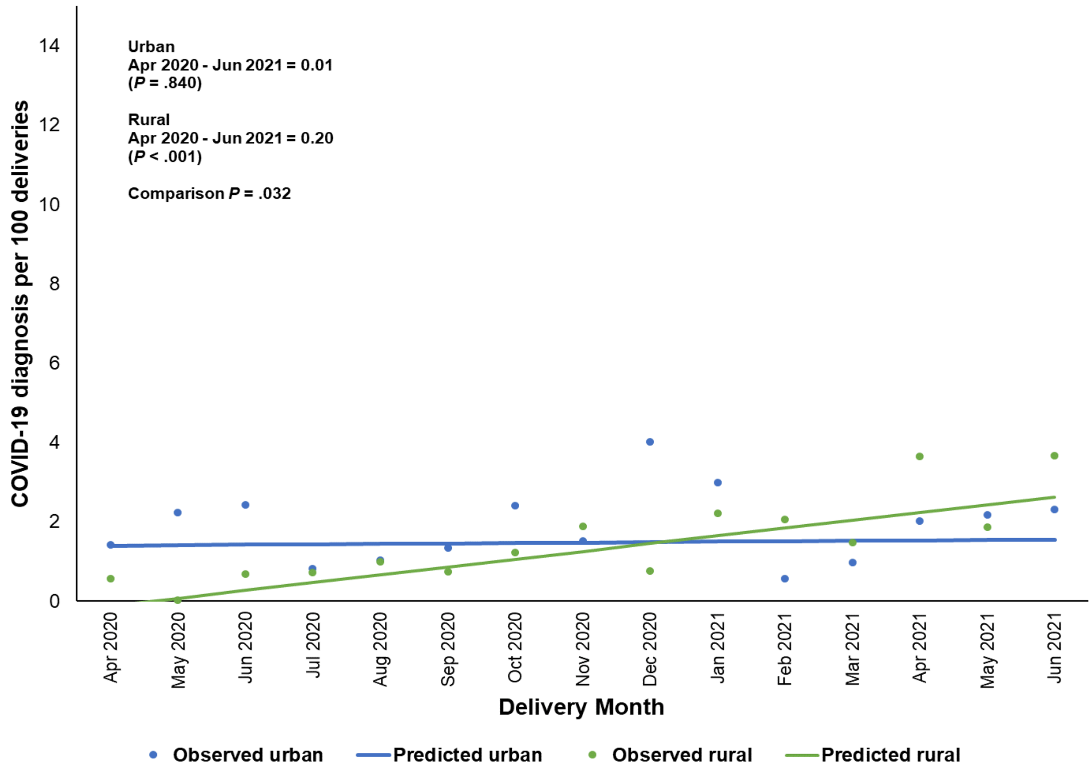
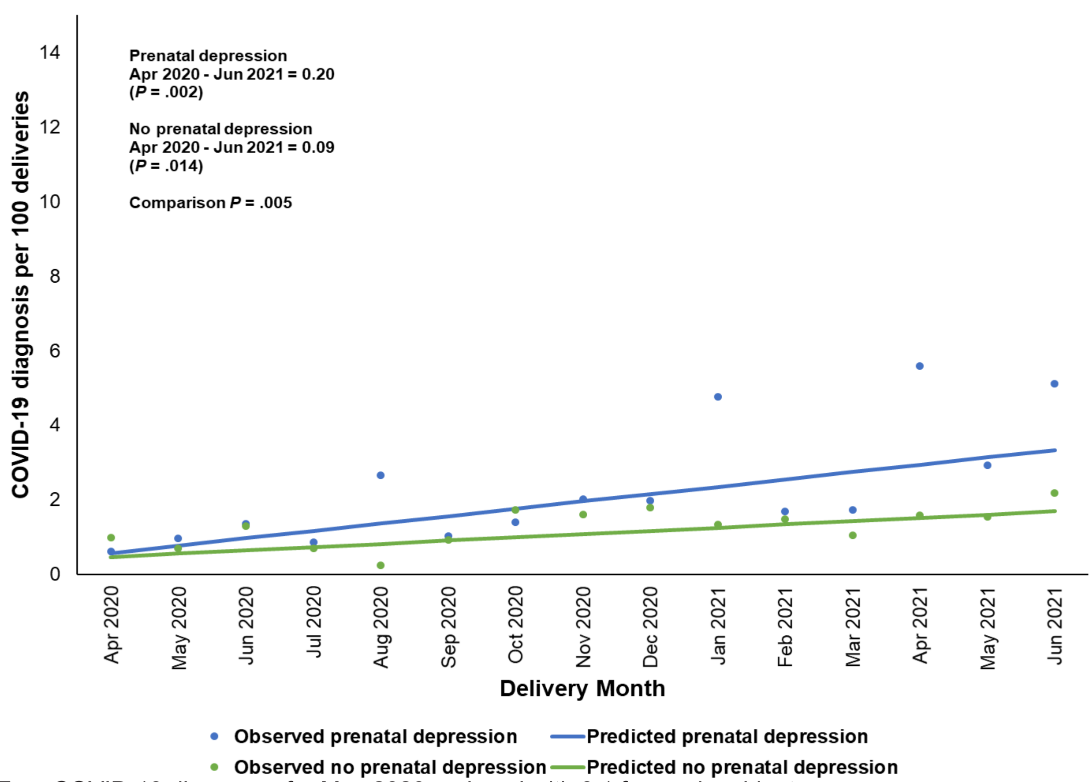
Figure 2. Prevalence of COVID-19 diagnosis during first 6 months postpartum, Maine 2020-2021

B. During pregnancy, by prenatal depression[a]



C. During first 6 months postpartum, by prenatal depression



[a]Zero COVID-19 diagnoses for May 2020 replaced with 0.1 for rural residents

In terms of limitations, the introduction of universal COVID-19 testing upon admission for delivery hospitalizations in Maine may be responsible for some of the increases in infection we found among pregnant persons. The start and use of universal COVID-19 testing varied by hospital, and documentation is not publicly available. However, testing was presumably well underway by mid-2020,[15] before we saw the start of the increase in infections in October 2020. Also, COVID-19 vaccination status among our study population was not available in our dataset, so we could not assess the association of vaccination with COVID-19 diagnosis. Furthermore, although our data did not capture any COVID-19 diagnoses detected outside of the claims system (eg, at-home tests), at-home tests were not widely used or available in Maine until after our study period ended.[16] In addition, we imputed a case value of 0.1 for delivery months with zero COVID-19 diagnoses found, which artificially inflated COVID-19 prevalence estimates for those months (though these prevalence estimates were all still less than 0.07%). Our study period ended just before the Omicron surge began,[17] limiting generalizability to that and later surges of the pandemic. Lastly, claims data may provide a lower count for COVID-19 infections than laboratory data.[18]

CONCLUSIONS

In conclusion, our results show the use of All Payer Claims Data for assessing perinatal trends in COVID-19 diagnosis. Our findings can be used to inform interventions aimed at preventing the spread of respiratory infections like COVID-19 among pregnant and postpartum persons in the future. These interventions could include enhanced early efforts to vaccinate in rural communities and inclusion of prenatal depression as a high-risk pregnancy indicator.

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Conflicts of interest: Kristi Palmsten receives research contracts from AbbVie, GSK, and Sanofi that are unrelated to this study. The remaining authors declare no conflicts of interest. Heather Lipkind is on the Data and Safety Monitory Board for Pfizer COVID-19 vaccination and is contracted by the Vaccine Safety Datalink for post vaccine surveillance in pregnancy and the postpartum period.

Disclosure: Prior to publication, the data in this manuscript was available as a preprint on MedRxiv at https://www.medrxiv.org/content/10.1101/2023.04.21.23288878v1.

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