Low prevalence of SARS-CoV-2 among pregnant and postpartum patients with universal screening in Seattle, Washington

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SUMMARY: We found a low prevalence of SARS-CoV-2 among pregnant and postpartum patients after initiating universal testing at University of Washington-affiliated hospitals using a combination of on-site rapid testing, high throughput centralized testing, and outpatient drive-through screening prior to admission.

ABSTRACT

We found a low prevalence of SARS-CoV-2 (2.7% [5/188]) among pregnant and postpartum patients after initiating universal testing. Prevalence among symptomatic patients (22.2% [4/18]) was similar to initial targeted screening approaches (19.1% [8/42]). Among 170 asymptomatic patients, two were positive or inconclusive, respectively; repeat testing at 24 hours was negative.

KEYWORDS: pregnancy; COVID-19; SARS-CoV-2; universal screening; viral shedding

Introduction

To date, most COVID-19 reports in pregnancy are case series, with limited insight into population prevalence [1-5]. Reports from New York City described an alarming rate of asymptomatic SARS-CoV-2 PCR-positive pregnant patients (13.7-14.5%) [6, 7]. Although Washington State was among the first to confirm community transmission [8], our regional epidemic appears to be slowing with early public health response and widespread testing availability [9]. On March 2, 2020, University of Washington (UW) Department of Laboratory Medicine obtained Emergency Use Authorization (EUA) for a laboratory-developed SARS-CoV-2 test. Initial testing at UW Medicine focused on symptomatic persons under investigation (PUI), transitioning to universal testing of labor and delivery (L&D) and pre-surgical patients March 29, 2020. We present results of L&D SARS-CoV-2 PCR testing March 2, 2020-April 15, 2020, encompassing targeted and universal approaches.

Methods

Study design and patients

We performed a retrospective cohort study of SARS-CoV-2 PCR testing of L&D patients at UW Medical Center, Montlake and Northwest campuses. UW Montlake Labor and Delivery unit is a tertiary referral center for high-acuity obstetrical care with ~1850 deliveries per year and cesarean delivery rate of 46%. UW Northwest Birth Center has ~1100 deliveries annually of primarily uncomplicated pregnancies with cesarean delivery rate of 26%. Patients tested for SARS-CoV-2 March 2, 2020-April 15, 2020 were included.

Universal testing strategy

UW Montlake initiated universal testing for L&D inpatients March 24, 2020, followed by full implementation including outpatient screening of planned admissions March 29, 2020. UW Northwest implemented universal testing April 2, 2020. Both campuses had on-site rapid testing available starting March 30, 2020, preferentially utilized for L&D. After rapid testing instrument failure April 4, 2020, UW Northwest reverted to routine testing exclusively. Under universal testing, patients were tested as outpatients, primarily at a drive-through testing center within 48-72 hours of

planned admission, or upon hospital admission. Outpatient testing utilized routine assays located at the off-site centralized UW Virology Laboratory. Patients underwent repeat testing if no result was available within 72 hours of expected delivery or procedure. Known COVID-19 patients underwent repeated testing on admission even if recovered, to facilitate return to standard precautions and personal protection equipment (PPE) stewardship.

SARS-CoV-2 testing

Routine centralized UW Virology Laboratory testing utilized one of three RT-PCR assays depending on instrument availability: Washington state EUA UW CDC-based laboratory-developed SARS-CoV-2 test (UW LDT), or FDA authorized Hologic Panther Fusion or Roche cobas SARS-CoV-2 tests. On-site rapid testing utilized the DiaSorin Simplexa (MDX Liaison) EUA assay with run time of 75-90 minutes (see **Supplemental materials: SARS-CoV-2 test targets and interpretation**).

Data Collection

Eligible patients were identified from outpatient and admission logs of pregnant and postpartum patients. Sociodemographic and clinical characteristics were abstracted from medical records. Test results were queried from UW Laboratory Medicine data warehouse. Data were entered into Research Electronic Data Capture (REDCap, Vanderbilt University, Nashville, Tennessee, USA) and analyzed with STATA version 15. UW Institutional Review Board approved study procedures under a waiver of informed consent.

Outcomes and Statistical Analysis

Patient and testing characteristics were summarized by proportions and medians with interquartile range (IQR) as appropriate. Testing results were characterized as positive, negative, or inconclusive.

Results

Between March 2, 2020-April 15, 2020, 230 pregnant and postpartum patients underwent SARS-CoV-2 testing; 42 (18.3%) under the initial targeted symptomatic PUI approach, and 188 (81.7%) under universal testing (**Figure**).

Supplemental Table 1 summarizes sociodemographic characteristics, pregnancy status, location and indication of testing. Among 224 pregnant (median gestational age 37.4 weeks [IQR 32.9-39.1), and 6 postpartum patients (median postpartum age 1.3 weeks [IQR 0.0-3.6], median age was 32 years [IQR 29-35]). Eighty-nine (38.7%) initially tested as outpatients, including 63 (70.8%) with drive-through testing, 16 (7.0%) during emergency room/obstetric triage evaluation not requiring admission, and 125 (54.4%) during admission. More than half of hospitalizations at initial testing were for L&D (66 [52.8%]), followed by antenatal (52 [41.6%]), outpatient/same day procedures (3 [2.4%]), and postpartum admissions (2 [1.6%]).

One hundred and eighty-four (80.0%) patients had a pregnancy outcome during the study period; 172 (74.8%) resulted in live birth, 3 (1.3%) fetal or neonatal demise, 8 (3.5%) termination of pregnancy, 1 (0.4%) spontaneous abortion, while 46 (20.0%) remained pregnant.

Results of SARS-CoV-2 testing

SARS-CoV-2 prevalence among symptomatic patients during initial targeted PUI screening (19.1% [8/42]) and after universal screening (22.2% [4/18]) were similar (**Figure**). Among 170 asymptomatic patients tested under universal screening, one tested positive and one inconclusive, with repeat testing at 24 hours negative for both. The asymptomatic positive patient's initial positive test had cycle threshold near the detection limit and was negative when retested 24 hours later. Neither patient developed symptoms during the study period.

Thirty patients (13%) underwent repeat testing with 45 additional tests performed (**Supplemental Table 2**). Additional testing indication included: 6 (13.3%) symptomatic PUI (with negative results), 19 (42.2%) known SARS-CoV-2 positive, 2 (4.3%) previously inconclusive, and 18 (40.0%) for universal screening of asymptomatic patients. Nine patients with initial positive tests underwent retesting;

seven had at least one additional positive test, including six initially symptomatic patients who remained PCR-positive for ≥2 weeks (**Figure 1**). No patient with an initial negative or inconclusive test subsequently tested positive.

Among 275 total tests performed, 193 (70.2%) were tested by routine and 82 (29.8%) by rapid test. Median turn-around time was 2.5 hours (IQR 2.0-3.1) for rapid, and 7.1 hours (IQR 5.5-9.3) for routine tests (aggregate data reported; disaggregated initial and repeat testing reported in **Supplemental Table 1, 2**).

Discussion

We found low prevalence of SARS-CoV-2 among L&D patients after initiating universal screening. Universal testing was accomplished using a combination of on-site rapid testing, high throughput centralized testing, and outpatient drive-through screening prior to admission. This multipronged approach ensured almost all patients had a known SARS-CoV-2 status prior to delivery or procedure, including patients with precipitous labor or requiring emergent/urgent procedures. Among a small subset of PCR-positive patients retested, a high proportion remained positive for ≥2 weeks. While rapid testing aided in short turn-around times, routine testing provided results within 8 hours, further improved to ~6 hours by study end as laboratory capacity increased. This approach was feasible and yielded valuable real-time data on SARS-CoV-2 status enabling judicious PPE use.

Our study has some similar features to recent reports from New York including universal screening of all L&D patients [6, 7], however, prevalence of confirmed SARS-Cov-2 among both symptomatic and asymptomatic patients differed substantially. The positive rate for symptomatic PUI screening in our study was 19.1-22.2%, in contrast to reported rates of 68.8% (11/16) and 100% (4/4) in New York [6, 7]. Only 1.2% of asymptomatic women tested positive or inconclusive for SARS-CoV-2 in our study, compared to 13.7-14.5% in New York reports, and neither patient was positive upon retesting at 24 hours. Our lower SARS-CoV-2 prevalence among pregnant and postpartum patients likely reflects local epidemic dynamics including potentially earlier community spread, but currently lower

prevalence within our region. We estimate the average population prevalence in greater Seattle and King County between March 23 and April 9, 2020 was 0.24% [95% CI 0.05% - 0.75%], with evidence of continued decline [9].

PCR-based diagnostics are limited in their ability to differentiate infectious SARS-CoV-2 virus from persistent viral shedding in the setting of clinically recovered COVID-19 that likely poses a markedly decreased risk of person-to-person transmission. While we routinely retest known COVID-19 patients on admission and prior to procedures to inform infection prevention practice, the clinical significance of persistently positive PCR in the setting of clinical improvement including among L&D patients in unknown [10]. Our institutional practice is to maintain COVID-precautions using a test-based strategy, and counsel patients per CDC guidance that that the risk of transmission is substantially reduced after 10 days of symptom onset and >72 hours after symptom resolution [11].

Universal SARS-CoV-2 testing of pregnant and postpartum patients occurred in conjunction with all pre-surgical patients, to reduce risk of SARS-CoV-2 transmission from intubation for general anesthesia, an aerosol-generating procedure. The pre-surgical universal SARS-CoV-2 screening policy was extended to L&D patients with the rationale that many require cesarean delivery or other surgical procedures and may potentially require urgent general anesthesia. Our cesarean delivery rates of 26-46% illustrate the frequency of surgery during a delivery hospitalization. The American College of Obstetricians and Gynecologists recently strengthened their recommendations regarding testing on L&D units [12]. Our current institution-wide screening approach continues to evolve in response to local epidemiology and testing availability, and now includes universal screening of all hospital admissions. Our most recent estimates suggest <1% of asymptomatic patients have tested positive since initiating universal screening. Early adoption of universal screening (starting with surgical and L&D patients) allowed data-driven decisions to be made informing PPE use to ensure protection of patients and health care workers, including L&D-related units (i.e. newborn nursery and neonatal intensive care unit). Further, this information aided in counseling regarding risks and

benefits of infant separation/co-location and breastfeeding practices, utilizing a shared-decision making approach. Despite low numbers of additional cases identified, universal screening of pregnant patients provides important surveillance information due to the representativeness of this population to the greater community.

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REFERENCES

1. Li N, Han L, Peng M, et al. Maternal and neonatal outcomes of pregnant women with COVID-19 pneumonia: a case-control study. Clin Infect Dis **2020**: DOI: 10.1093/cid/ciaa352.

2. Yu N, Li W, Kang Q, et al. Clinical features and obstetric and neonatal outcomes of pregnant patients with COVID-19 in Wuhan, China: a retrospective, single-centre, descriptive study. Lancet Infect Dis **2020**: DOI: 10.1016/S1473-3099(20)30176-6.

3. Breslin N, Baptiste C, Gyamfi-Bannerman C, et al. COVID-19 infection among asymptomatic and symptomatic pregnant women: Two weeks of confirmed presentations to an affiliated pair of New York City hospitals. Am J Obstet Gynecol MFM **2020**: 100118 DOI: 10.1016/j.ajogmf.2020.100118.

4. Chen L, Li Q, Zheng D, et al. Clinical Characteristics of Pregnant Women with Covid-19 in Wuhan, China. N Engl J Med **2020**: DOI: 10.1056/NEJMc2009226.

5. Zaigham M, Andersson O. Maternal and Perinatal Outcomes with COVID-19: a systematic review of 108 pregnancies. Acta Obstet Gynecol Scand **2020**: DOI: 10.1111/aogs.13867.

6. Vintzileos WS, Muscat J, Hoffmann E, et al. Screening all pregnant women admitted to Labor and Delivery for the virus responsible for COVID-19. American Journal of Obstetrics and Gynecology **2020**: DOI: https://doi.org/10.1016/ j.ajog.2020.04.024.

7. Sutton D, Fuchs K, D'Alton M, Goffman D. Universal Screening for SARS-CoV-2 in Women Admitted for Delivery. N Engl J Med **2020**: DOI: 10.1056/NEJMc2009316.

8. Holshue ML, DeBolt C, Lindquist S, et al. First Case of 2019 Novel Coronavirus in the United States. N Engl J Med **2020**; 382(10): 929-36 DOI: 10.1056/NEJMoa2001191.

9. Greater Seattle Coronavirus Assessment Network (SCAN) Technical Report, April 17, 2020. Available at: https://publichealthinsider.com/wp-content/uploads/2020/04/SCAN-Technical-Report-v1-17-APR-2020.pdf. Accessed April 28, 2020.

10. Wolfel R, Corman VM, Guggemos W, et al. Virological assessment of hospitalized patients with COVID-2019. Nature **2020**: DOI: 10.1038/s41586-020-2196-x.

11. CDC. Symptom-Based Strategy to Discontinue Isolation for Persons with COVID-19. Available at: https://www.cdc.gov/coronavirus/2019-ncov/community/strategy-discontinue-isolation.html. Accessed May 20, 2020.

12. American College of Obstetricians and Gynecologists (ACOG). Novel Coronavirus 2019 (COVID-19): Practice Advisory April 2020 (last updated April 23, 2020). Available at: https://www.acog.org/clinical/clinical-guidance/practice-advisory/articles/2020/03/novel-coronavirus-2019. Accessed April 24, 2020.

Figure 1

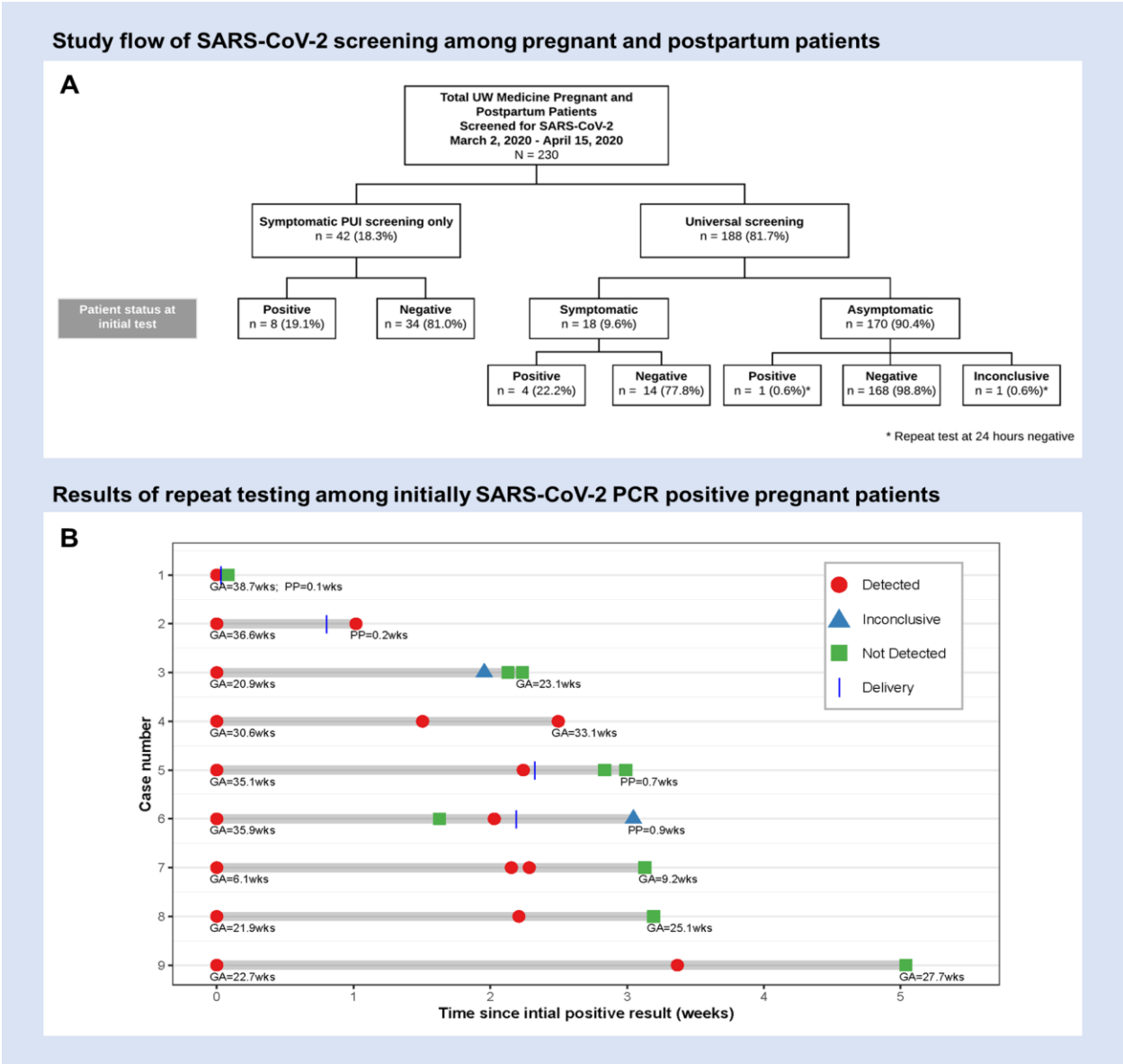

Figure: SARS-CoV-2 screening among pregnant and postpartum patients in the UW Medicine system, Seattle, Washington. *Panel A:* Study flow of pregnant and postpartum patients screened for SARS-CoV-2 prior to and after initiation of universal screening in Seattle, Washington. Figure includes results of initial testing only. Among 230 patients, there were 275 tests performed. Results of repeat testing are detailed in Supplemental Table 2.*Panel B:* Results of repeat SARS Co-V-2 testing among initially positive pregnant patients. Timing denotes first and last test performed during the study period by either gestational age (GA) or postpartum (PP) age.