Hepatitis C Seroprevalence Among Consecutive Labor and Delivery Admissions in Two New York City Hospitals

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Background. Rates of hepatitis C virus (HCV) among women of childbearing age have increased as a result of the opioid epidemic, especially in the nonurban white population. Recently updated US Preventative Services Task Force and Centers for Disease Control and Prevention guidance have recommended universal HCV screening during pregnancy, but obstetrics societies have not yet endorsed this recommendation. We evaluated the seroprevalence of HCV among pregnant women in an inner-city population, compared rates with other sexually transmitted infections (STIs) screened for during pregnancy, and evaluated factors associated with HCV positivity.

Methods. We performed a prospective seroprevalence study of consecutive labor and delivery admissions (both antepartum complications and delivery admissions) by testing serum samples for HCV antibody over 9 months at 2 major hospital settings in New York City.

Results. Fifty-six of 7373 (0.75%; 95% confidence interval [CI], 0.57–0.98) patients screened positive for HCV, with 28 of 4013 (0.70%; 95% CI, 0.46%–1.01%) and 28 of 3413 (0.82%; 95% CI, 0.55%–1.18%) at each hospital. Forty-one percent of HCV-positive patients had any reported HCV risk factors. Hepatitis C virus-positive patients were less likely to have private insurance and more likely to have a history of cannabis, cocaine, and injection drug use ($P < .001$). The HCV rates were higher among antepartum admissions compared with delivery admissions and higher than that of hepatitis B virus (0.65%; 95% CI, 0.48–0.86), human immunodeficiency virus (0.27%; 95% CI, 0.16–0.42), and syphilis (0.16%; 95% CI, 0.08–0.28).

Conclusions. We found a higher than expected HCV seroprevalence among pregnant women and higher than most other STIs routinely screened for in pregnancy. Most patients had no risk factors. These findings support universal screening for hepatitis C during pregnancy.

Keywords. hepatitis C; liver disease; medical conditions complicating pregnancy; screening.

Across the United States, hepatitis C virus (HCV) infection has been increasing among young adults, with similar trends seen in New York State, particularly in rural settings [1, 2]. From 2011 to 2014, the rates of HCV among reproductive aged women in the United States doubled [3, 4]. This striking increase in HCV among women of childbearing age has been linked to the burgeoning problem with illicit injection drug use and is mirrored by an increase in the number of infants born to women infected with HCV [3, 5, 6].

When our study was launched, universal prenatal screening for HCV was not recommended by any professional organization, and the Centers for Disease Control and Prevention (CDC) specifically recommended a risk-based screening approach. This year, the US Preventative Services Task Force (USPSTF) and the CDC have recommended universal HCV screening during pregnancy, although the American College of Obstetrics and Gynecology and Society for Maternal Fetal Medicine have not yet adopted this recommendation [7, 8]. As a result, universal prenatal screening has not been implemented across all health settings. Universal prenatal screening may not identify all HCV cases. In addition, including screening in labor and delivery (L&D) settings would provide the opportunity to test women when they have contact with the health system during pregnancy, even in the absence of comprehensive prenatal care.

Vertical transmission can occur with a 5.8% risk of children developing chronic HCV disease, and that risk almost doubles (~10.8%) if the mother is coinfected with human immunodeficiency virus (HIV) [9]. Current pregnancy-specific guidance has focused on limiting obstetrical practices that increase fetal

exposure to maternal blood such as avoiding prolonged rupture of membranes, invasive fetal monitoring, and episiotomy [7, 10], and screening in L&D may impact pregnancy care decisions (such as decision to avoid episiotomy in women who screen positive for HCV). In addition, knowledge of HCV infection during pregnancy may inform counseling about associated pregnancy risks, such as cholestasis of pregnancy and preterm birth [11, 12]. Although directing-acting antivirals (DAAs) are highly effective in treating adults, there are no current recommendations for DAA treatment during pregnancy for either maternal health or prevention of vertical transmission [13]. Only recently has there been an initial "proof-of-concept" study of HCV treatment during pregnancy, and this would need to be validated with future larger studies [14].

Given the alarming increases in cases of hepatitis C among women of childbearing age and our concerns about the failure of risk-based screening for other infectious diseases, we designed a study to compare the seroprevalence and risk factors for HCV seropositivity between 2 different maternity populations in New York City (NYC) with distinct risk factor profiles by evaluating consecutive L&D admissions. Our health system serves an extremely diverse population, and a more granular understanding of HCV and HCV risks in our community were needed to inform our screening approach. In addition, we compared HCV rates and associated risk factors to other infectious pathogens whose screening has already become a universal part of routine prenatal care.

MATERIALS AND METHODS

We performed a prospective study evaluating HCV status among consecutive L&D admissions at 2 hospital sites in New York's Mount Sinai Health System, Mount Sinai Hospital (MSH), and Mount Sinai West (MSW). Labor and delivery screening was chosen rather than prenatal clinic screening or newborn screening to avoid underestimating the true HCV prevalence in our population and to help inform antepartum admission HCV testing recommendations. Prenatal screening could result in underestimating HCV prevalence because the highest risk women (those with active drug use) might receive little or no prenatal care. Newborn screening could result in underestimating HCV prevalence if HCV infections were associated with pregnancy losses.

This study was approved by the Mount Sinai School of Medicine Institutional Review Board (IRB) in November 2017 by expedited review procedure category 5 and granted a waiver of signed informed consent. As part of the approved protocol, when a patient's study specimen screened positive for HCV, R.S. (at MSH) and B.W. (at MSW) contacted the referring obstetrician and provided study information, testing results, and guidance about confirmatory testing and follow-up for their patient.

Study Endpoints
The primary endpoint was the seroprevalence of HCV. Other measures of interest included patient demographics, risk factors for HCV, medical history, and history and prevalence of other infections.

Study Settings
The MSH, located in the Upper East Side (UES) of Manhattan, has ~7800 deliveries per year. The MSH serves a socioeconomically mixed population including women from the wealthiest congressional district (UES), as well as lower socioeconomic, inner city women from East Harlem. Mount Sinai West, located in Midtown West of Manhattan, has ~6000 deliveries per year. Mount Sinai West is recognized regionally for its midwifery practice and also has drug treatment and detox programs.

Data Sources
Data were abstracted from maternal electronic medical records (EMRs) and infant birth certificates. Birth certificate records served as the primary data source for sociodemographic factors including race, country of origin, ethnicity, marital status, occupation, and employment status. Occupations were categorized into jobs with and without occupational exposures. Electronic medical records served as the data source for maternal age, admission indication, parity, medical insurance status, history of substance use (including tobacco, intravenous drug, cannabis, and cocaine), blood transfusion, and domicile in a shelter or residential treatment program. For those subjects for whom a birth certificate was unavailable, data were abstracted exclusively from the EMR.

Patient Consent Statement
This study was IRB-approved with a waiver of informed consent; the study was judged to be low risk and could not have practically been conducted (ie, 8000 consecutive patients could not be screened) without this waiver.

Sample Collection and Processing
Specimens were collected from September 2018 through May 2019. As part of standard L&D practice, all admissions have serologic screening for syphilis (rapid plasma regain [RPR]) drawn regardless of gestational age or fetal viability. After testing, these specimens are routinely stored by the clinical laboratories for ~1 week in the event that additional testing is required. Based on information from daily L&D visit logs, the research coordinators created a list of eligible patients (all antepartum and delivery admissions) and assigned each patient a unique alphanumeric study number. During the study period, after RPR testing, the clinical laboratory stored all L&D specimens in designated refrigerators to preserve sample integrity and facilitate specimen location. Three times a week, research coordinators went to the laboratory to

pull saved samples for eligible patients and relabel with the study number. All samples were tested at MSH laboratories within 5 days of collection. Samples transported by research coordinators from MSW were maintained in a temperature-controlled environment. Hepatitis C virus Ab testing was performed on deidentified specimens utilizing the MSH laboratory's automated enzyme immunoassay test. If patients had multiple specimens collected within a 48-hour time period, only a single specimen was tested. If a subject had a subsequent L&D admission with repeat syphilis screening sent >48 hours after their prior visit, HCV testing was repeated and recorded. A separate deidentified database was created to link HCV test results with sociodemographic and relevant medical histories abstracted from EMRs and NYC birth certificates. This deidentified database was used for all statistical analyses.

Statistical Analysis

The primary aim of this study was to determine the HCV seroprevalence among consecutive labor floor admissions at 2 NYC hospitals. The percentage of women positive for HCV across both hospitals was calculated along with the corresponding exact binomial 95% confidence interval (CI). Before data collection, based on annual delivery rates at both sites, we expected a total sample size of ~8000 over a 6-month period. Given an expected 1% HCV seroprevalence among women delivering, this sample size ensured high precision around our estimate of seroprevalence with a 95% CI equal to the sample percentage plus or minus 0.2%. In addition to computing the percentage of HCV-positive women across both sites, we also report seroprevalence at each site and the associated 95% CIs. Patient characteristics were compared using t tests for continuous measures and χ^2 or Fisher's exact tests as appropriate for categorical measures. All analyses were conducted using SAS version 9.4 (SAS Institute Inc., Cary, NC).

RESULTS

During the study period, 8124 L&D unit visits were recorded across 7698 patients (see Figure 1). Among these, 4019 patients received prenatal care from MSH, 3414 from MSW, 2 from both, and 3 were unregistered. In these patients, 7225 (97.1%) were tested for HCV once during the study period and 213 (2.9%) were tested multiple times, with 125 of 7429 (1.7%) patients tested during both antepartum and delivery admissions. All subjects with repeat tests had the same results except 1 patient who converted from a negative result to a positive result on testing 2 months apart. The final dataset consisted of the most recent admission from 7429 patients. The majority (77.4%; 5747 of 7429) were assessed at time of delivery (5405 [73%] term and 342 [4.6%] preterm), with 22.6% (1682 of 7429) tested during antepartum admissions.

Overall Hepatitis C Seroprevalence

Overall, there were 56 of 7429 (0.75%; 95% CI, 0.57%–0.98%) patients who screened positive for HCV, with 28 of 4013 (0.70%; 95% CI, 0.46%–1.01%) at MSH and 28 of 3413 (0.82%; 95% CI, 0.55%–1.18%) at MSW (Table 1). When comparing positivity rates in antepartum admissions versus delivery admissions, 21 of 1682 (1.2%) tested positive antepartum and 37 of 5747 (0.6%) tested positive at delivery ($P = .008$) (Table 2). Of the patients who tested positive in our study, only 16 of 56 (29%) had been recognized by their obstetrical care providers to have an HCV infection (either identified through prenatal testing or known to be positive before pregnancy).

Characteristics of Hepatitis C-Positive Versus Hepatitis C-Negative Subjects

Demographic characteristics including age, race, and ethnicity were similar between HCV-positive and -negative patients (Table 1). The patients who were HCV positive were more likely to have Medicaid insurance as opposed to private health insurance and to be homeless (reside in a shelter) ($P < .05$). Six of 56 (10.7%) of HCV-positive patients compared with 336 of 7373 (4.6%) of the HCV-negative patients were tested during preterm delivery ($P = .04$) (Table 2). Compared with HCV-negative patients, HCV-positive patients were more likely to have a history of injection drug use, cocaine use and cannabis use, history of multiple tattoos, as well as more likely to have a history of gonorrhea and chlamydia ($P < .05$) (Table 3). Among HCV-positive patients, 23 of 56 (41.1%) had a history of any known risk factor including history of injection drug, cannabis or cocaine use, history of blood transfusion, being a healthcare worker, having a history of chronic hepatitis B, HIV, gonorrhea, chlamydia or syphilis, and/or having multiple tattoos (Table 3). The 1 patient who converted from negative to positive status during the study follow up had no documented risk factors, other than employment as a home health aide.

Patient Characteristics at Mount Sinai Hospital Compared With Mount Sinai West

Overall patient populations had distinct patient characteristics at both sites. Patients differed in regards to ethnicity, race, whether they were US-born, age, and insurance status (Supplementary Table 2). There was no statistically significant difference in rates of drug use in the overall population between sites (Supplementary Table 3). Among HCV-positive patients, 23% from MSW and 15% from MSH had a history of injection drug use (Supplementary Table 3a). More HCV-positive patients at MSW were non-US born than at MSH (Supplemental Table 4).

Comparison of Hepatitis C-Positive Patients to Patients With Other Infectious Pathogens

Within both hospitals, hepatitis C had a higher prevalence than HBV, HIV, and syphilis (Table 4). Gonorrhea and chlamydia
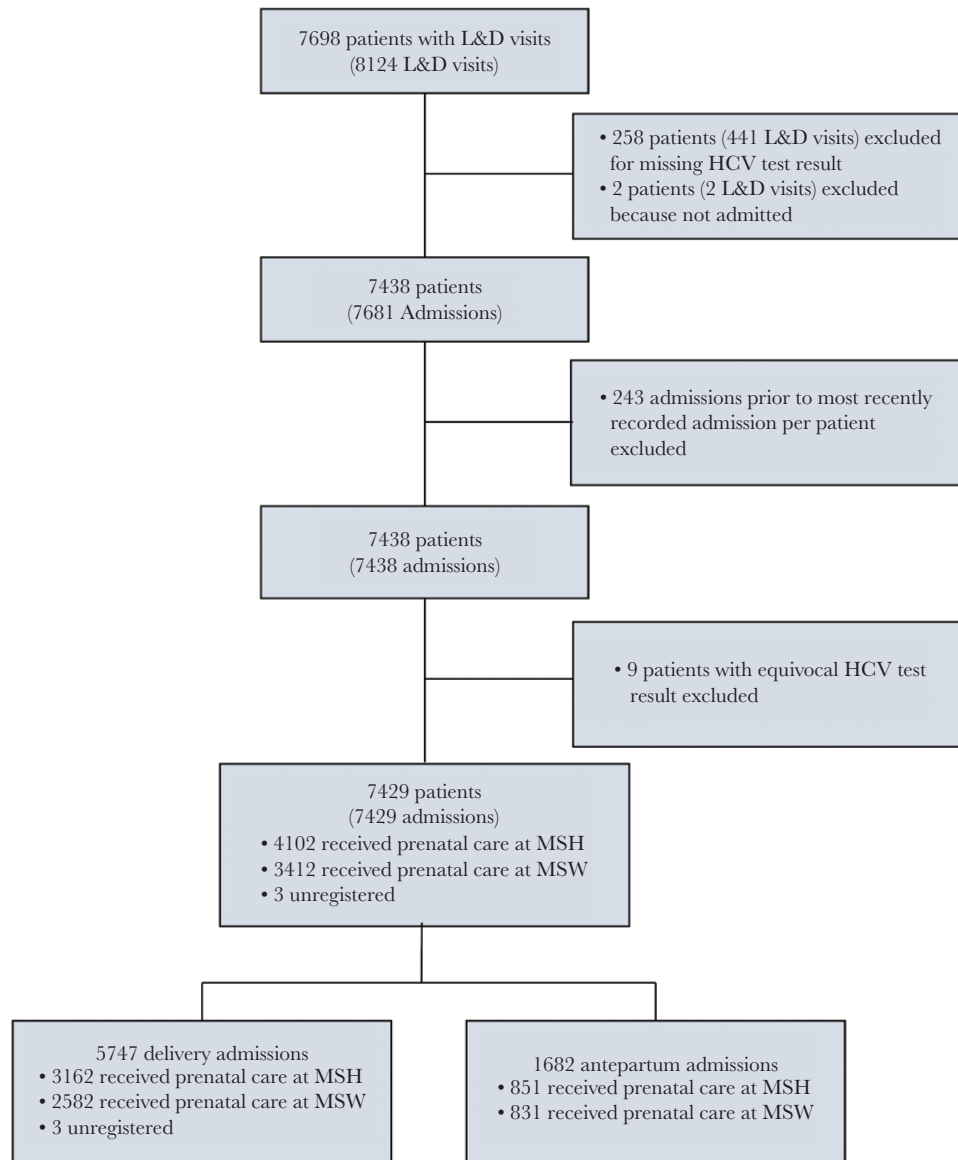
Figure 1. Flow chart of study participants. HCV, hepatitis C virus; L&D, labor and delivery; MSH, Mount Sinai Hospital; MSW, Mount Sinai West.

were higher in prevalence at MSH compared with HCV. In comparison to women with other infections (HBV, syphilis, and gonorrhea/chlamydia), women with HCV were more likely to have a history of injection drug use and multiple tattoos, but they were less likely to have coinfection with gonorrhea/chlamydia compared with HIV patients (Supplementary Table 1). Among HCV-positive women, the majority were US-born (in contrast, among HBV patients, the majority were from Asia and Africa).

DISCUSSION

We performed a US-based study to evaluate the seroprevalence of HCV among consecutive L&D admissions, a unique study design using existing serum specimen (as opposed to relying

on ordered HCV testing). Overall, 0.75% of consecutive labor floor admissions screened positive for HCV antibodies. Most women who were positive had "not" been tested through routine clinical practice and did not have known HCV risk factors, thus supporting the benefit of universal screening. Although we identified multiple sociodemographic differences between the populations at the 2 hospital sites of interest, the overall rates of HCV-positive results were similar. Hepatitis C virus seroprevalence was higher than most of the other infectious pathogens routinely tested for during pregnancy, including HBV, syphilis, and HIV, all of which have known interventions to prevent mother-to-child transmission. Although women with HCV were more likely to have a history of drug use, infection with gonorrhea/chlamydia, or tattoo history, the majority (59%) did not have any suspected or recognized risk factors

Table 1. Patient Characteristics by HCV Status

Characteristics	All (n = 7429)	HCV Positive (n = 56)	HCV Negative (n = 7373)	P Value
Age (mean ± SD)	32.4 ± 5.6	32.5 ± 5.9	32.4 ± 5.6	.92
Race, no. (%)				.76[a]
Asian	899 (12.1)	6 (10.7)	893 (12.1)	
Black or African American	1042 (14.0)	9 (16.1)	1033 (14.0)	
White	4657 (62.7)	34 (60.7)	4623 (62.7)	
Other	769 (10.4)	7 (12.5)	762 (10.3)	
Unknown	62 (0.8)		62 (0.8)	
Ethnicity, no. (%)				.68
Hispanic or Latino	1451 (19.5)	13 (23.2)	1438 (19.5)	
Not Hispanic or Latino	5937 (79.9)	43 (76.8)	5894 (79.9)	
Unknown	41 (0.6)	0	41 (0.6)	
Country of Origin, no. (%)				.95
Non-US	2471 (33.3)	19 (33.9)	2452 (33.3)	
US	4741 (63.8)	35 (62.5)	4706 (63.8)	
Unknown	217 (2.9)	2 (3.6)	215 (2.9)	
Marital Status, no. (%)				.0004[b]
Married, common law, or significant other/life partner	6387 (86)	39 (69.6)	6348 (86.1)	
Divorced or separated	34 (0.5)	0	34 (0.5)	
Single	945 (12.7)	17 (30.4)	928 (12.6)	
Widowed	3 (0)	0	3 (0)	
Unknown	60 (0.8)	0	60 (0.8)	
Occupation, no. (%)				.88
Healthcare[c]	694 (9.3)	4 (7.1)	690 (9.4)	
Not employed	1146 (15.4)	10 (17.9)	1136 (15.4)	
Other	5272 (71.0)	39 (69.6)	5233 (71.0)	
Unknown	317 (4.3)	3 (5.4)	314 (4.3)	
Insurance—no. (%)				.001[d]
Government (Medicare/Medicaid)	1992 (26.8)	26 (46.4)	1966 (26.7)	
Private (commercial carriers, HMOs, PPOs)	5413 (72.9)	30 (53.6)	5383 (73.0)	
Uninsured	7 (0.1)	0	7 (0.1)	
Other (self-pay, charity)	14 (0.2)	0	14 (0.2)	
Unknown	3 (0.0)	0	3 (0.0)	
Residing in Shelter, no. (%)				.02
No	7398 (99.6)	54 (96.4)	7344 (99.6)	
Yes	27 (0.4)	2 (3.6)	25 (0.3)	
Unknown	4 (0.1)	0	4 (0.1)	
Residing in Residential Treatment Program, no. (%)				>.99
No	7420 (99.9)	56 (100.0)	7364 (99.9)	
Yes	1 (0.0)	0	1 (0.0)	
Unknown	8 (0.1)	0	8 (0.1)	
Parity, median (IQR)	1.0 (0.0–2.0)	1.0 (0.0–3.0)	1.0 (0.0–2.0)	.12

Abbreviations: HCV, hepatitis C virus; HMOs, health maintenance organizations; IQR, interquartile range; PPO, preferred provider organization; SD, standard deviation; US, United States.

[a]P value computed comparing percentage white between groups.

[b]P value computed comparing percentage married, common law, and significant other/life partner between groups.

[c]Healthcare workers include physicians, dentists, physician assistants, nurses, housekeepers, technicians, home health aides, and first responders (paramedics, emergency medical technicians, police, and firefighters).

[d]P value computed comparing percentage with private insurance between groups.

[15] listed in their medical charts. In our urban population, although women with HCV were predominantly US-born, 34% were foreign-born; this is in contrast to HCV prevalence reports from elsewhere in the country where the HCV-positive population are predominantly non-Hispanic white individuals from rural settings [1, 16].

Our observed HCV seroprevalence rates among live births was similar to some and higher than other previously reported US-based studies. In a recent HCV pregnancy seroprevalence study of New York State where newborn blood was tested for maternal HCV Ab, an overall prevalence of 0.8% was found, although rates within NYC rates were lower at 0.5% [17]. In a systematic review conducted by the CDC based on 26 applicable studies conducted from 1998 to 2018 of HCV during pregnancy, the median anti-HCV positivity prevalence was 1.2% (range, 0.1%–70.8%) [8]. Analysis of the Healthcare Cost and

Table 2. Rates of Positive HCV Tests by Site and Admission Indication for Patients' Most Recent Admission[a]

Hospital Site	Indication for Admission	No./No. Obs (%)
MSH	Delivery	19/3162 (0.6)
	Term delivery (>37 weeks)	15/2965 (0.5)
	Preterm delivery (<37 weeks)	4/197 (2)
	Antepartum	9/851 (1.1)
	Antepartum admission, maternal indication	6/469 (1.3)
	Antepartum admission, fetal indication	3/382 (0.8)
	Total	28/4013 (0.7)
MSW	Delivery	16/2582 (0.6)
	Term delivery (>37 weeks)	14/2437 (0.6)
	Preterm delivery (<37 weeks)	2/145 (1.4)
	Antepartum	12/831 (1.4)
	Antepartum admission, maternal indication	7/507 (1.4)
	Antepartum admission, fetal indication	5/324 (1.5)
	Total	28/3413 (0.8)

Abbreviations: HCV, hepatitis C virus; MSH, Mount Sinai Hospital; MSW, Mount Sinai West; Obs, obstetricians.

[a]Three unregistered patients who did not received prenatal care at either site are excluded from this table.

Utilization Project's National Inpatient Sample between 2000 and 2015 through *International Classification of Diseases* codes found an HCV infection prevalence among women giving birth of 0.41% by 2015 [18]. Most recently, the Maternal-Fetal Medicine Units Network published their results of HCV Ab testing among 106 842 women and found a rate of 2.4 cases per 1000 women from 2012 to 2015, although this study only tested women who presented for early prenatal care before 23 weeks gestation [19]. None of these other studies utilized our study approach of testing consecutive samples of women admitted to L&D, emphasizing the importance of capturing patients at all opportune times.

In the United States, women of reproductive age with HCV have been reported to be predominantly non-Hispanic white women with history of opioid use; that profile was seen in less than half of the HCV-positive women in our cohort [1]. Significant sociodemographic characteristics that we identified were consistent with findings from other studies. Tattoos, substance abuse, homelessness, insurance through federal programs such as Medicaid, and a history of sexually transmitted infections such as gonorrhea and chlamydia are all strong independent predictors of HCV infection [1, 3, 20–22].

In our study, only 41% of women who screened positive for HCV had a recognized risk factor recorded in their medical record. Per the latest CDC report, known risk factors were identified in just 38% of acute HCV infections, with either missing risk data or no risk identified in the remaining cases [23]. Our experience underscores the challenges of obtaining

Table 3. Risk Factors by HCV Status

Risk Factors	HCV Positive (n = 56) No./No. Obs (%)	HCV Negative (n = 7373) No./No. Obs (%)	P Value
Any known risk factor	23/56 (41.1)	1285/7369 (17.4)	<.0001
Substance Use			
History of cannabis use	4/49 (8.2)	155/6743 (2.3)	.03
History of IV drug use	10/52 (19.2)	6/6725 (0.1)	<.0001
History of cocaine use	5/50 (10)	19/6728 (0.3)	<.0001
Healthcare Exposure			
History of blood transfusion	2/25 (8)	199/3402 (5.8)	.66
Healthcare worker	4/53 (7.5)	690/7059 (9.8)	.59
Comorbidities			
Chronic hepatitis B	1/56 (1.8)	46/7197 (0.6)	.31
HIV	0/55 (0)	19/7080 (0.3)	>.99
History of gonorrhea/chlamydia	5/53 (9.4)	267/6525 (4.1)	.07
History of syphilis	0/56 (0)	19/7058 (0.3)	>.99
Other			
Tattoos[a]	5/56 (8.9)	11/7373 (0.1)	<.0001

Abbreviations: HCV, hepatitis C virus; HIV, human immunodeficiency virus; IV, intravenous; Obs, obstetricians.

[a]Patients missing the tattoos variable are included in the denominator and inferred as not having tattoos.

Table 4. Percentage Positive for HCV and Other Sexually Transmitted Infections by Site of Prenatal Care With 95% CI

Sexually Transmitted Infection	All[a] (N = 7429)		MSH (N = 4013)		MSW (N = 3413)	
	No./No. Obs	Percentage (95% CI)	No./No. Obs	Percentage (95% CI)	No./No. Obs	Percentage (95% CI)
HCV	56/7429	0.75 (0.57–0.98)	28/4013	0.70 (0.46–1.01)	28/3413	0.82 (0.55–1.18)
Chronic hepatitis B	47/7253	0.65 (0.48–0.86)	26/3957	0.66 (0.43–0.96)	20/3293	0.61 (0.37–0.94)
HIV	19/7135	0.27 (0.16–0.42)	11/3985	0.28 (0.14–0.49)	8/3147	0.25 (0.11–0.50)
Gonorrhea/chlamydia	56/6352	0.88 (0.67–1.14)	33/3514	0.94 (0.65–1.32)	23/2838	0.81 (0.51–1.21)
Syphilis	11/7077	0.16 (0.08–0.28)	3/3969	0.08 (0.02–0.22)	8/3105	0.26 (0.11–0.51)

Abbreviations: CI, confidence interval; HCV, hepatitis C virus; HIV, human immunodeficiency virus; MSH, Mount Sinai Hospital; MSW, Mount Sinai West; Obs, obstetricians.

[a]Three patients whose site of prenatal care was neither MSH nor MSW are included in this column. All 3 patients were negative for HCV, chronic hepatitis C, HIV, and syphilis, and their gonorrhea/chlamydia status was unknown.

information about at-risk behavior and how patients may be reluctant to disclose information due to perceived stigma. In our study, 2 women only acknowledged past drug use history only after study results were shared with them by their obstetrical provider. Although universal HCV screening will identify patients who fail to acknowledge risk behaviors, discussing HCV and the medical complications associated with acquiring HCV should also be part of prenatal counseling. One patient in our study seroconverted during the study period, an important reminder that women can remain at risk for new HCV infections even during pregnancy, and a careful risk history can help determine candidates for rescreening during prenatal care.

A strength of our study was the information provided about antepartum admissions. Screening consecutive L&D admissions provided a snapshot about 2 distinct populations of pregnant women: those admitted for antepartum complications and those admitted for delivery. The HCV Ab prevalence among antepartum admissions was 1.1% at MSH and 1.4% at MSW. The rates of HCV Ab prevalence among live births was 0.6% at MSH and 0.8% at MSW. The higher rates among antepartum admissions was not surprising given that this population of women is likely overrepresented by those with significant comorbid medical conditions and suboptimal prenatal care and also includes women with pregnancy losses. Our study was not designed to address the contributions that these (and other potential) factors made to differences in HCV rates but instead to address whether HCV Ab testing should also be included as part of our hospitals' antepartum admission laboratory tests, similar to the routine inclusion of syphilis and HIV testing.

There are limitations to our study. First, given that tests were performed on discarded blood samples, we were not able to test HCV polymerase chain reaction (PCR) (HCV viral load) on patients (unable to run HCV PCR on sample submitted), and HCV Ab testing alone overestimates HCV infections. In addition, our study was performed in 2 institutions within NYC, which may not reflect rates in other parts of the United States and the world. In addition, given the retrospective chart review for risk assessment, a comprehensive risk assessment via patient interview was not able to be performed as part of the study. Finally, we do not have follow up on either mothers or infants about definitive HCV testing and whether there was appropriate linkage to care.

At the time our study was initiated, professional organizations had not yet endorsed universal HCV screening during pregnancy. However, in 2018, universal hepatitis C screening during pregnancy was recommended by the American Association for the Study of Liver Diseases and the Infectious Diseases Society of America. Since that time, the CDC and USPSTF have updated their previous guidance and specifically recommended screening for all pregnant women during each pregnancy, except in settings where the prevalence of HCV infection is <0.1% [8]. These guidelines all acknowledge the cost-effectiveness of universal screening and the inadequacies of risk-based screening. However, in the absence of endorsement of these guidelines from the obstetrics societies, screening practices will likely remain nonuniform across obstetrics practice units in the United States. Future research should evaluate the impact of these guidelines on clinical practice. Furthermore, with more women being diagnosed during pregnancy, evaluation of HCV treatment during pregnancy warrants evaluation.

CONCLUSIONS

In summary, in this large US-based study, in an urban setting in a geographic area not known to be highly affected by the opioid epidemic, we still found a HCV prevalence of 0.6%–0.8% among live births and a prevalence of 1.1% ribonucleic acid 1.4% among antepartum admissions. This prevalence of HCV was higher than that of other pathogens routinely screened for during pregnancy. Our study supports recent recommendations for universal HCV screening during pregnancy. Based on our data, we recommend that obstetrical care providers include HCV Ab screening with routine first prenatal visit laboratory tests, screen all L&D admissions who were not previously tested during the current pregnancy, and consider rescreening women with known risk factors at delivery. Hepatitis C virus Ab screening is a necessary first step in addressing modifiable risk behaviors, linking women and their children to care, and

developing strategies/clinical trials to interrupt mother-to-child transmission. Further work is needed through public health systems and clinical trials to identify ways to prevent mother-to-child transmission of HCV.

Supplementary Data

Supplementary materials are available at *Open Forum Infectious Diseases online*. Consisting of data provided by the authors to benefit the reader, the posted materials are not copyedited and are the sole responsibility of the authors, so questions or comments should be addressed to the corresponding author.

Supplementary Table 1. Risk factors among current STI+ patients*.
Supplementary Table 2. Patient characteristics by site of prenatal care.
Supplementary Table 3. Risk factor by site of prenatal care.
Supplementary Table 3a. Risk factor by HCV status and by site of prenatal care.
Supplementary Table 4. Region of origin by HCV status and site of prenatal care.

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