Open Forum Infectious Diseases

MAJOR ARTICLE

Protocol-Driven Intensive Outpatient Management of Pregnant Patients With Symptomatic Coronavirus Disease 2019

M. D. Soffer,[1] L. L. Shook,[1] K. James,[2] M. R. Sawyer,[2] A. Ciaranello,[3] R. Mahrouk,[2] S. N. Bernstein,[1] A. A. Boatin,[2] A. G. Edlow,[1] C. York-Best,[2] A. J. Kaimal,[1] and I. T. Goldfarb[1]

[1]Department of Obstetrics, Gynecology, and Reproductive Biology, Division of Maternal Fetal Medicine, Massachusetts General Hospital, Boston, Massachusetts, USA, [2]Department of Obstetrics, Gynecology, and Reproductive Biology, Massachusetts General Hospital, Boston, Massachusetts, USA, [3]Department of Internal Medicine, Division of Infectious Disease, Medical Practice Evaluation Center, Massachusetts General Hospital, Boston, Massachusetts, USA

Background. Reports of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection have focused on pregnant women hospitalized due to moderate to severe coronavirus disease 2019 (COVID-19) or asymptomatic women diagnosed through universal screening at the time of obstetric admission. Many pregnant women who have symptomatic SARS-CoV-2 infection may not meet criteria for hospitalization; however, whether and how these women can be managed safely in outpatient setting is not well described.

Methods. We sought to describe the time to symptom and viral clearance and to identify predictors of hospitalization to better understand the safety of monitoring pregnant patients with symptomatic COVID-19 in the outpatient setting. We performed a retrospective cohort study of pregnant patients with symptomatic, confirmed COVID-19 illness at a large, academic medical center. Patients had systematic telehealth follow up by a clinician team to assess for symptoms, provide virtual prenatal care, and arrange in-person visits when appropriate in a dedicated outpatient center. Data were collected via chart abstraction.

Results. Of 180 pregnant patients presenting with symptoms and undergoing reverse-transcription polymerase chain reaction (RT-PCR) testing, 67 patients with confirmed COVID-19 infection were identified during the study period. Nineteen (28%) required acute care given worsening of COVID-19 symptoms, and 95% of these were directed to this acute care setting due to symptom severity telehealth evaluation. Nine women (13%) were admitted to the hospital given worsening symptoms, 3 required intensive care unit care, 2 required ventilatory support, and 2 required delivery. Women with the presenting symptoms of fever, cough, shortness of breath, chest pain, or nausea and vomiting were more likely to require admission. The median duration from initial positive test to RT-PCR viral clearance was 26 days. Disease progression, time to viral clearance, and duration of symptoms did not vary significantly by trimester of infection.

Conclusions. Management of the majority of pregnant women with symptomatic COVID-19 illness can be accomplished in the outpatient setting with intensive and protocol-driven monitoring for symptom progression.

Keywords. COVID-19; COVID-19 prenatal care; outpatient care; outpatient management; pregnancy.

Early reports and case series of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection during pregnancy have focused on the hospital-based care and outcomes of pregnant women with moderate to severe coronavirus disease 2019 (COVID-19) [1, 2]. However, the majority of pregnant women infected with SARS-CoV-2 will be asymptomatic or have mild illness [3, 4]. Other series have described the low rates of disease progression among women with mild symptoms [5, 6]; however, the natural history and outcomes of symptomatic pregnant women with mild symptoms have yet to be described.

The Centers for Disease Control (CDC) and American College of Obstetricians and Gynecologists (ACOG) have published triage algorithms to assess for symptom severity in attempts to provide care for patients in the appropriate setting [7, 8]. Although these published protocols provide a general framework, the optimal approach for both providing prenatal care and assessing symptom severity for pregnant women infected with SARS-CoV-2 given the requirements for physical distancing in the healthcare setting has not been defined.

We sought to describe the natural history of COVID-19 infection in symptomatic pregnant women, including impact on prenatal care, need for and timing of in-person evaluation and hospitalization, and time to symptom and viral clearance, to determine the safety of monitoring pregnant patients with known COVID-19 illness in the outpatient setting in a high prevalence city in the United States.

Received 29 September 2020; editorial decision 17 October 2020; accepted 21 October 2020.

Correspondence: Marti D. Soffer, MD, MPH, Massachusetts General Hospital, 55 Fruit Street, Boston, MA 02114 (msoffer@mgh.harvard.edu).

Open Forum Infectious Diseases®2020

DOI: 10.1093/ofid/ofaa524

MATERIALS AND METHODS

We performed a retrospective cohort study of all pregnant women receiving prenatal care at a large, academic medical center serving patients from multiple communities presenting with symptoms consistent with COVID-19 illness and confirmed to have SARS-CoV-2 infection by reverse-transcription polymerase chain reaction (RT-PCR) nasopharyngeal swabs from March 6 to May 22, 2020. Women receiving care at other institutions or who were transferred to our institution for inpatient management were excluded from this analysis.

The cohort was identified by the study staff through 2 primary mechanisms: (1) all patients who called the outpatient prenatal care office with symptoms concerning for COVID-19 illness who were subsequently tested for SARS-CoV-2 infection, and (2) all patients with prenatal care at our outpatient center who presented to the emergency room and/or labor and delivery triage with symptoms concerning for COVID-19 illness and subsequently underwent testing. All patients with confirmed intrauterine pregnancies who were treated in the emergency room or by other services and met criteria as described above were included in this analysis. Ascertainment was optimized by 2 methods: (1) all providers were asked to submit patients with COVID-19 evaluations to our clinical team, and (2) our clinical list was cross-referenced daily against a hospital-wide daily census of COVID-19-positive patients. As depicted in Figure 1, testing criteria in Massachusetts evolved throughout the study period, and thus not all patients with symptoms concerning for COVID-19 illness underwent testing. Those without testing data available were not included in the analysis. We did not include asymptomatic patients because the ascertainment of data would have been incomplete because the availability of and guidelines for testing asymptomatic patients changed over time.

Outpatient Tracking and Telehealth Care for Pregnant Women With Coronavirus 2019

Pregnant women with symptoms consistent with COVID-19 who were found to be positive for SARS-CoV-2 were followed on a patient tracking list. This list was kept via the Epic electronic health record system, which is a secure platform for the safeguarding of health information.

A team of obstetricians and obstetrical registered nurses followed these patients with 3 times weekly phone calls to (1) assess for COVID-19-related symptoms and screen for severity according to the ACOG guidelines [9], (2) provide telemedicine prenatal care and anticipatory guidance about pregnancy during the quarantine period, (3) arrange for repeat testing to confirm clearance of the infection and subsequent return to in-person prenatal care as per CDC recommendations at the time of the study, and (4) arrange in-person appointments and

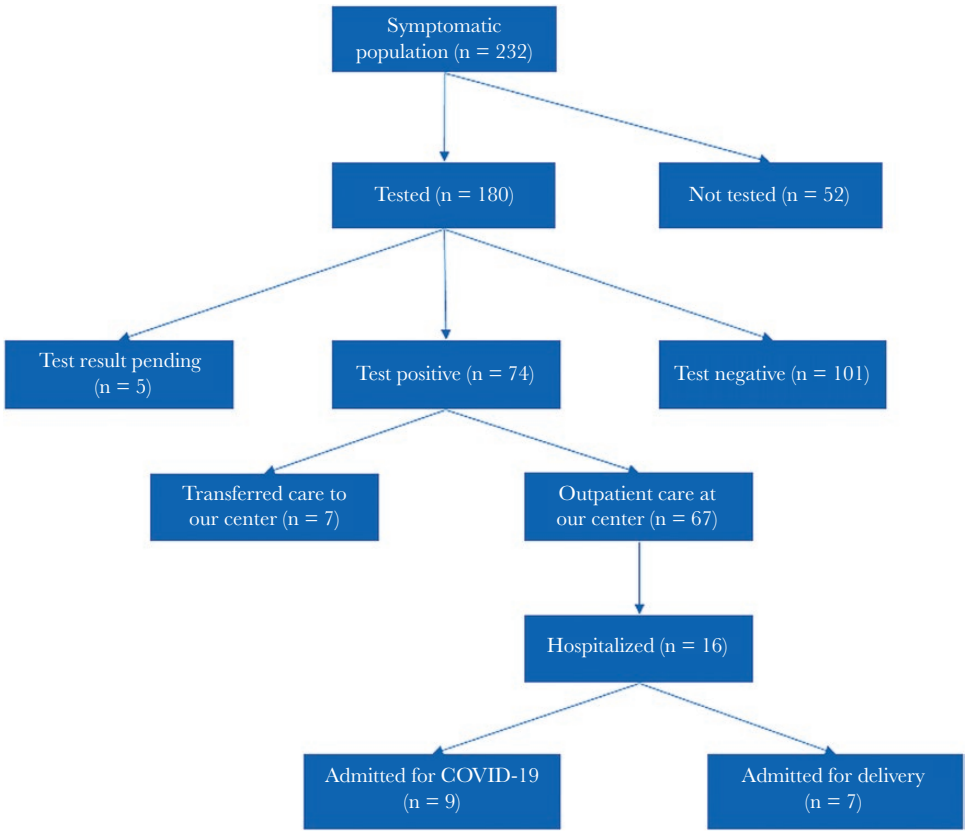

Figure 1. Pregnant patients with symptoms concerning for severe acute respiratory syndrome coronavirus 2 infection. COVID-19, coronavirus disease 2019.

ultrasounds in a hospital-wide COVID-19 ambulatory care center when prenatal care could not be deferred until clearance. Dedicated team members with Spanish language proficiency reached out to Spanish-speaking patients when appropriate. These calls were scripted using the template in Appendix A. All patients were instructed to present for repeat PCR testing as soon as possible by the dedicated staff as per CDC guidelines at the time of the study and irrespective of the patient's gestational age (GA).

When in-person visits were required as determined by the modified prenatal care schedule (Appendix B), patients were seen with appropriate personal protective equipment (PPE) in a dedicated COVID-19-specific area, named the RACC (Routine Ambulatory Care for COVID-19 patients) (Figure 2). Based on hospital policies during this period, we defined viral clearance as 2 consecutive COVID-19 negative test results performed at least 24 hours apart after the resolution of symptoms. Once viral clearance was achieved, patients were removed from this close monitoring by the clinic staff and returned to the routine combination of in-person and virtual prenatal care visits [8].

Data Abstraction

Data for patients with suspected SARS-CoV-2 infection were collected prospectively in a password-protected REDCap database. Patient demographics including maternal age, self-reported ethnicity/race, insurance, and preferred language were abstracted from the electronic medical record by a trained clinical research coordinator. In addition, pregnancy-specific variables such as GA, parity, prepregnancy body mass index (BMI), and medical comorbidities were recorded. The COVID-19-specific information including initial symptoms, duration and severity of symptoms, need for emergency room visits, or hospitalization were also collected, as well as information regarding interruption of prenatal care, including delay of in-person visits and need for visits in the RACC. All SARS-CoV-2 testing data were collected and stratified by GA at diagnosis and at viral clearance. Additional laboratory evaluation for COVID-19 prognostic markers were not routinely collected and were therefore not included in this analysis. All data abstracted were verified by chart review when applicable and verified by the primary author. Any missing data were supplemented with chart review, and if these remained unknown, they were reflected in the denominator reported. This study was approved by the institutional review board and received a waiver of informed consent.

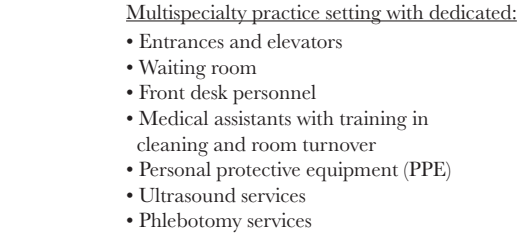

Figure 2. Routine ambulatory care for coronavirus disease 2019 (RACC [Routine Ambulatory Care for COVID-19 patients]).

Data Analysis

Patient characteristics for the cohort of symptomatic, SARS-CoV-2-positive patients were summarized with descriptive statistics. The COVID-19-specific parameters, such as presenting symptoms, day of disease progression (calculated as days from date of symptom onset to date of presentation to the emergency department or hospital admission for COVID-19 symptom severity), any acute care presentation (visit to the emergency room or hospitalization), hospitalization-specific factors (intensive care unit [ICU] admission and ventilator use), time to symptom clearance (calculated as days from date of symptom onset to the date of symptom clearance), and time to viral clearance (calculated as days from date of positive test result to the date of second negative test result), were summarized with descriptive statistics. In addition, all charts were abstracted to determine location of visits (routine prenatal care or RACC) as well as delays in prenatal care based on our modified approach to prenatal care during this time. Time to SARS-CoV-2 RT-PCR clearance, time to symptom resolution, and symptom day of disease progression were compared by trimester at time of diagnosis using Student's *t* test.

To examine demographic and COVID-19 disease course differences between patients who required hospitalization and patients who were managed as outpatients, χ^2 tests, Fisher's exact test, Student's *t* tests, or Mann-Whitney *U* tests were applied, as appropriate. Due to the small number of patients requiring hospitalization, further adjusted modeling could not be conducted. All statistical analyses were conducted in Stata 15.0. $P < .05$ was used to represent statistical significance.

RESULTS

Of the 232 symptomatic women identified, 180 women were tested and 67 women with outpatient care at our institution were found to be positive for SARS-CoV-2 by RT-PCR (Figure 2). All patients in this cohort were then closely monitored via telephone visits by a COVID-19 team of physicians and nurses, and no patients were lost to follow up. Among the cohort of 67 women with symptoms and confirmed SARS-CoV-2 infection, the average maternal age was 31 years, and 31% were nulliparous. Although Hispanic women make up 17% of our pregnancy population, 61% of women in this cohort were Hispanic by self-reported ethnicity. Table 1 summarizes demographic characteristics including underlying medical comorbidities. Of women in our cohort, 37% were in the second trimester and 49% were in the third (Table 1).

The most common presenting symptoms were cough (72%), runny nose (57%), and myalgia (52%). Fever was reported in 42% of patients and shortness of breath in 39%. The least common

Table 1. Demographics

Demographic	Confirmed COVID-19-Positive Cohort (N = 67)
Age (mean ± SD)	31 ± 6.2
Parity (mean ± SD)	1.3 ± 1.3
Nulliparous	21 (31%)
Hispanic	41 (61%)
Race	
Black	7 (10%)
White	15 (22%)
Asian	1 (1%)
Other/Unspecified	44 (66%)
Primary language	
English	34 (51%)
Spanish	30 (45%)
Other/Unspecified	3 (4%)
Prepregnancy BMI (mean ± SD)	29 ± 4.4
Insurance	
Public	37 (55%)
Private	26 (39%)
None	1 (1%)
Unspecified	3 (4%)
Medical Comorbidities	
Gestational DM	9 (13%)
Pregestational DM	1 (1%)
Chronic hypertension	7 (10%)
Asthma	8 (12%)
Chronic liver disease	1 (1%)
Gestational age at first diagnostic sign, in weeks (mean ± SD)	25.5 ± 9.7
First trimester	9 (13%)
Second trimester	25 (37%)
Third trimester	33 (49%)

Abbreviations: BMI, body mass index; COVID-19, coronavirus disease 2019; DM, diabetes mellitus; SD standard deviation.

Table 2. COVID-19-Specific Information

Clinical Characteristic	Confirmed Symptomatic Cohort (N = 67)
Initial Symptoms	
Fever	28 (42%)
Cough	48 (72%)
Shortness of breath	26 (39%)
Chest pain	13 (19%)
Myalgia	35 (52%)
Runny nose	38 (57%)
Sore throat	22 (33%)
Anosmia	23 (34%)
Nausea/vomiting	7 (10%)
Duration of symptoms (days) (mean ± SD)[a]	17.2 ± 9.7
Time from positive test to clearance (days) (mean ± SD)[b]	28.5 ± 11.9
Presentation for acute care	19 (28%)
Disease day of acute care presentation (mean ± SD)	5.7 ± 4.5
Called for severity[c]	18 (95%)
Hospitalization for COVID-19 illness	9 (13%)
Disease day of hospitalization (mean ± SD)	6.2 ± 1.9
ICU admission	3 (33%)[d]
Ventilator use	2 (22%)[d]
Delivery	2 (22%)[d]

Abbreviations: COVID-19, coronavirus disease 2019; ICU, intensive care unit; SD standard deviation.

[a]N = 64 patients had complete data on symptom resolution at the time of this manuscript.

[b]N = 45 patients had complete data on COVID-19 clearance at the time of this manuscript.

[c]Denominator is patients with acute care presentations (n = 19).

[d]Denominator is all those hospitalized (n = 9).

presenting symptom was nausea and vomiting, reported in 10% of patients (Table 2). In-person prenatal care visits that would have been planned based on our modified approach to prenatal care during this time were delayed due to COVID-19 in 23 patients, or 35% of the cohort. In addition, 17 patients (25%) required visits in the RACC given the inability to delay in-person care.

The median duration from initial positive test to viral clearance, as defined in Methods, was 26 days with a range of 10–56 days. Patients reported symptoms for an average of 17 days with a range of 3–45 days (Table 2). Day of disease progression, day of hospitalization (both as defined in Methods), time to viral clearance, and duration of symptoms did not vary by trimester of infection (Table 3).

Although the majority of pregnant women in this cohort were managed as outpatients, 19 (28%) required presentation to an acute care setting because of worsening symptoms of COVID-19 illness. The average day of acute care presentation was day 5.7, with a standard deviation of 4.5 days. Nine patients (13% of the total cohort) were admitted to the hospital. Among those 19 women with increased symptom severity necessitating an acute care visit, 18 (95%) had a telephone visit with a provider before their presentation in which their symptoms were assessed for severity, and they were advised to present for further evaluation. The single patient who presented to an outside emergency department without prompting by a telehealth provider had developed worsening symptoms between her 3 times weekly clinic follow-up calls. She was not admitted to the outside institution. None of the patients sent to the hospital were sent for obstetrical complaints.

Of the 9 women admitted to the hospital secondary to complications from COVID-19 illness, 3 women required ICU admission, 2 required ventilatory support, and 2 were delivered. To identify potential predictors of hospitalization, women requiring hospitalization were compared to the women who continued outpatient management (Table 4). Women hospitalized were more likely to present with initial symptoms of fever ($P = .019$), cough ($P = .042$), shortness of breath ($P = .01$), chest pain ($P = .041$), or nausea and vomiting ($P = <.001$). As anticipated based on symptom severity, patients who required admission to the hospital reported persistence of symptoms for longer than women who were not admitted (24 vs 14 days, $P = .002$); however, time to viral clearance did not vary between the groups (18 vs 18 days, $P = .6$).

Table 3. Clearance Days, Disease Progression, and Symptom Days by Trimester

Clinical Characteristic	Trimester at First Diagnostic Test[a]			Global *P* Value
	1st (0–11.9 Weeks) (n = 9)	2nd (12–27.9 Weeks) (n = 25)	3rd (28–40 + Weeks) (n = 33)	
Time from RT-PCR positive test to RT-PCR clearance (days)	38.3 ± 7.7	26.8 ± 10.8	27.3 ± 13.1	.095
Time from first symptom to symptom resolution (days)	18 ± 9.0	17 ± 10.1	17.2 ± 9.8	.97
Disease day of acute care presentation[b]	3.5 ± 0.7	6.7 ± 6.0	5.4 ± 3.7	.67
Disease day of hospitalization[c]	—	5.6 (2.1)	7 (1.6)	.31

Abbreviations: RT-PCR, reverse-transcription polymerase chain reaction.

[a]All data presented as mean ± standard deviation.

[b]For those who presented to acute care (total N = 19; 1st trimester N = 2; 2nd trimester N = 7; 3rd trimester N = 10).

[c]For those who were admitted to the hospital for coronavirus disease 2019 (total N = 9; 1st trimester N = 0; 2nd trimester N = 5; 3rd trimester N = 4).

All 67 patients were contacted regularly with telephone visits documented in the medical record. Some patients were still being followed at the time that data analysis began and therefore information regarding symptom duration and viral clearance was not yet available. No patient was lost to follow up.

DISCUSSION

In our cohort, we found that among 67 symptomatic pregnant patients with confirmed SARS-CoV-2 infection receiving outpatient care at our institution, the majority experienced mild symptoms and could undergo continued outpatient management for both of their COVID-19 symptoms and their routine prenatal care. Among our cohort, 19 (28%) required an acute level of care, only 9 (13%) required hospitalization for COVID-19 disease progression, and only 3 required ICU admission. The majority of patients were able to remain at home; however, of those requiring an acute care setting, progression of disease severity occurred on average on day 6 after symptom onset. In addition, among those requiring presentation to an acute care setting for COVID-19 illness, 95% had a telephone encounter with our team before their presentations, appropriately triaging these patients for further evaluation. We also identified that having initial symptoms of fever, cough, shortness of breath, chest pain, and nausea and vomiting were associated with higher rates of disease progression and hospitalization. We did not find an association between maternal ethnicity, race, BMI, age, or GA of infection and acute care needs.

These findings echo the findings by Breslin et al [4] who reported a 14% rate of hospitalization among 29 symptomatic women initially managed at home; however, this differs from the most recent findings published by the CDC identifying a 31% risk of hospitalization [10]. Although the CDC data are representative of a large group of patients, their data notably did not distinguish between hospitalizations for obstetrical indications and those for COVID-19 complications. Our data was able to differentiate by reason for hospitalization, perhaps making it more representative of the risk for COVID-19-related hospitalizations.

Although the majority of pregnant patients with COVID-19 illness experience mild disease [1, 3–6] similar to what has been reported for the general population [7], it is unknown whether pregnant patients experience symptoms similarly to nonpregnant individuals. In our cohort, the most common symptoms were cough, myalgia, fever, and shortness of breath, and the average duration of symptoms was 17 days with a range of 3 to 45 days. In addition, the CDC reports that progression to severe disease, should it occur, is a higher risk at day 7 after symptom onset [11]. Among our hospitalized patients, the average day after symptom onset at which women required acute care was day 6.

The pregnant population is a unique outpatient group because their ongoing care varies in frequency as the pregnancy progresses and may not be able to be safely deferred or performed via telemedicine given GA-specific screenings and testing [12]. Although ACOG has proposed safe changes to the routine prenatal care schedule for all patients during the time of the pandemic, the prenatal care schedule for patients with documented ongoing SARS-CoV-2 infection continues to be changed and adapted [13].

At our institution, retesting pregnant women to confirm viral clearance was a clinical priority of the COVID-19 care team in anticipation of needed in-person visits and potential need for labor and delivery to occur during this time period. In this cohort, we identified a median of 26 days from initial positive test to clearance of the infection defined as 2 negative tests performed 24 hours apart. However, there was a large range of clearance from 10 to 56 days. This prolonged demonstration of RT-PCR-positive viral status may impact the prenatal care schedule differentially according to trimester. For women with infection during the early trimester, it would be reasonable to defer routine visits until patients have recovered fully from their COVID-19 illness. However, should patients require time-sensitive assessments such as fetal anatomical survey evaluation, glucose screening, antenatal testing, or group B streptococcus screening, it may not be possible to defer their visits until viral clearance has been demonstrated. In our center, we were able to care for all patients with documented SARS-CoV-2

Table 4. Patient and COVID19 Factors by Hospitalization Status

Demographic and/or Clinical Characteristic	Managed Outpatient (n = 58)	Hospitalized for COVID19 (n = 9)	*P* Value
Age (median, IQR)	30.5 (28–35)	31 (26–35)	.96
Parity (median, IQR)	1 (0–2)	1 (0–1)	.22
Nulliparous	17 (29%)	4 (44%)	.36
Hispanic	36 (62%)	5 (56%)	.71
Race			.85
Black	6 (10%)	1 (11%)	
White	12 (21%)	3 (33%)	
Asian	1 (2%)	0 (0%)	
Other/Unspecified	39 (67%)	5 (56%)	
Primary Language			.52
English	28 (48%)	6 (67%)	
Spanish	27 (47%)	3 (33%)	
Other	3 (5%)	0 (0%)	
BMI (median, IQR)	29.1 (25.2–31.2)	30.7 (29.8–34.7)	.062
Insurance			.59
Public	33 (57%)	4 (44%)	
Private	21 (36%)	5 (56%)	
None	1 (2%)	0 (0%)	
Unknown	3 (5%)	0 (0%)	
Medical Comorbidities			
Gestational diabetes	8 (14%)	1 (11%)	.83
Pregestational diabetes	1 (2%)	0 (0%)	.69
Chronic hypertension	5 (9%)	2 (22%)	.21
Asthma	6 (10%)	2 (22%)	.31
Chronic liver disease	1 (2%)	0 (0%)	.69
Initial Symptoms			
Fever	21 (36%)	7 (78%)	.019
Cough	39 (67%)	9 (100%)	.042
Shortness of breath	19 (33%)	7 (78%)	.010
Chest pain	9 (16%)	4 (44%)	.041
Myalgia	28 (48%)	7 (78%)	.099
Runny nose	33 (57%)	5 (56%)	.94
Sore throat	18 (31%)	4 (44%)	.43
Anosmia	21 (36%)	2 (22%)	.41
Nausea/vomiting	3 (5%)	4 (44%)	<.001
Duration from positive test to clearance (days) (median, IQR)	18 (14.5–21.5)	18 (16–26)	.91
Duration of symptoms (days) (median, IQR)	14 (7–18)	24 (18–31)	.002
Gestational age at first diagnostic sign, in weeks (median, IQR)	27.9 (17.6–32.4)	25.7 (20.1–28.9)	.83
First trimester	9 (16%)	0 (0%)	.31
Second trimester	20 (34%)	5 (56%)	
Third trimester	29 (50%)	4 (44%)	

Abbreviations: BMI, body mass index; COVID-19, coronavirus disease 2019; IQR, interquartile range.

infection in an outpatient unit dedicated to the care of COVID-19 patients (Figure 2). The same strategy should be considered in all prenatal care settings when prenatal care cannot be deferred or performed remotely.

Although time to viral clearance has not previously been described in a pregnant population, prolonged positive RT-PCR test results have been reported in a nonpregnant cohort [14–16], and, more importantly, no viral transmission has been documented from infected individuals 9 days after symptom onset despite persistently positive RT-PCR testing [17, 18]. Given these findings, the CDC introduced the idea of time-based infection clearance that allows for resolution of COVID-19-enhanced precautions based on symptom resolution and time elapsed since the onset of symptoms [19]. These clinical recommendations were implemented after completion of this database, and therefore 2 consecutive negative RT-PCR tests were required for clearance during the study time period. Utilizing the time-based infection status resolution in future pregnant cohorts may improve the prenatal and hospital-based care of pregnant women with SARS-CoV-2 infection by avoiding the resource-heavy pursuit of 2 consecutive negative tests, which does not correlate with disease transmission. However, it is important to note that because our pregnant cohort was symptomatic for an average of 17 days, the CDC's current time-based clearance of 10 days after symptom onset will allow for clearance of persistently symptomatic patients. Although transmission is thought to not occur at this time point, it will be important to educate patients and providers that women may continue to experience symptoms even when they are thought to be out of the window the risk for COVID-19 transmission. In addition, it is important to note that although this study used test-based clearance no longer recommended by the CDC, we were able to continue to care for all patients despite a longer time required for clearance. Current time-based guidelines may decrease the delay in routine prenatal care delivery, or they may decrease the need for designated clinical areas such as the RACC.

Although disease progression was not common in our cohort, when increased severity occurred in this population, it occurred at a similar time frame compared to the general population, namely, on day 6. Understanding the time course of disease progression in a pregnant population can aid providers caring for these patients in the outpatient setting to anticipate care needs, provide anticipatory guidance for patients, and plan closer contact during the time when the potential for additional care is highest.

Further research is needed to identify predictors of disease progression that can guide the triage of pregnant women with COVID-19 to supportive care at home versus the acute care setting. In our center, in anticipation of a second wave, we plan to center telemedicine calls for COVID-19-affected patients at approximately day 6 and to provide enhanced anticipatory guidance for those presenting initially with more severe symptoms. In addition, future studies should aim to describe maternal, fetal, and neonatal outcomes by maternal disease severity and timing of maternal infection with SARS-CoV-2 according to

trimester of pregnancy. Although this report details our experience with telehealth for symptomatic patients, further studies are needed to determine patient outcomes to fully determine the safety of these protocols [20].

This study has several strengths. The rigorous tracking of pregnant patients with known SARS-CoV-2 infection included telephone calls to assess for symptom severity 3 times per week, which allowed for frequent contact with patients and prompt referral for either acute care when symptoms worsened or RT-PCR testing for viral clearance when symptoms improved or acute care evaluation when they worsened. No patient was lost to follow up. The patients included in this analysis were identified through the emergency department, outpatient prenatal care office, and labor and delivery consistent with how patients are identified in clinical practice and thus adding to the generalizability of the cohort.

This study is not without limitations. Although the study was performed in a high prevalence city and in the hospital with the most cases in our state during the pandemic surge, [21] our small sample size precludes a full analysis of predictors for hospitalization. Because we did not include asymptomatic patients in this cohort, this study is unable to detail the course and prenatal care for asymptomatic women. In addition, although our approximately 100% follow-up rate was a strength of this study, it may lack generalizability in populations and areas with less reliable access to phone services and limited resources. Finally, the resources of our institution to create a dedicated RACC and implement these intensive management protocols may not be generalizable to obstetrical providers in all care settings.

CONCLUSIONS

Our series demonstrates that outpatient management can be a reasonable strategy for pregnant women affected with SARS-CoV-2, regardless of GA. The safe delivery of care relied heavily on frequent contact between patients and medical providers. Another important factor was the availability of an outpatient center dedicated to the care of patients with COVID-19, which provided an option for continued routine prenatal care that could not be deferred or performed remotely.

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.

Acknowledgments

Potential conflicts of interest. All authors: No reported conflicts of interest. All authors have submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest.

References

1. Chen L, Li Q, Zheng D, et al. Clinical characteristics of pregnant women with Covid-19 in Wuhan, China. N Engl J Med **2020**; 382:e100.
2. Di Mascio D, Khalil A, Saccone G, et al. Outcome of coronavirus spectrum infections (SARS, MERS, COVID-19) during pregnancy: a systematic review and meta-analysis. Am J Obstet Gynecol MFM **2020**; 2:100107.
3. Andrikopoulou M, Madden N, Wen T, et al. Symptoms and critical illness among obstetric patients with coronavirus disease 2019 (COVID-19) Infection. Obstet Gynecol **2020**; 136:291–9
4. Breslin N, Baptiste C, Gyamfi-Bannerman C, et al. Coronavirus disease 2019 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**; 2:100118.
5. Fox NS, Melka S. COVID-19 in pregnant women: case series from one large New York City obstetrical practice. Am J Perinatol **2020**; 37:1002–4
6. London V, Jr RM, Atallah F, et al. The relationship between status at presentation and outcomes among pregnant women with COVID-19. Am J Perinatol **2020**; 37:991–4
7. Centers for Disease Control and Prevention. Coronavirus Disease 2019 (COVID-19). Available at: https://www.cdc.gov/coronavirus/2019-ncov/hcp/clinical-guidance-management-patients.html. Accessed 2 June 2020.
8. Riley LE, Beigi R, Jamieson DJ, Hughes BL. The American College of Obstetricians and Gynecologists' Immunization, Infectious Disease, and Public Health Preparedness Expert Work Group. Novel Coronavirus 2019 (COVID-19). Available at: https://www.acog.org/en/Clinical/Clinical Guidance/Practice Advisory/Articles/2020/03/Novel Coronavirus 2019. Accessed 2 June 2020.
9. American College of Obstetricians and Gynecologists (ACOG). Outpatient Assessment and Management for Pregnant Women With Suspected or Confirmed Novel Coronavirus (COVID-19). Available at: https://www.acog.org/-/media/project/acog/acogorg/files/pdfs/clinical-guidance/practice-advisory/covid-19-algorithm.pdf?la=en&hash=2D9E7F62C97F8231561616FFDCA3B1A6. Accessed 13 May 2020.
10. Ellington S. Characteristics of women of reproductive age with laboratory-confirmed SARS-CoV-2 infection by pregnancy status—United States, January 22–June 7, 2020. MMWR Morb Mortal Wkly Rep **2020**; 69:769–75.
11. Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet **2020**; 395:497–506.
12. London V, Jr RM, Stein J, et al. Caring for pregnant patients with COVID-19: practical tips getting from policy to practice. Am J Perinatol **2020**; 37:850–3.
13. Duzyj CM, Thornburg LL, Han CS. Practice modification for pandemics: a model for surge planning in obstetrics. Obstet Gynecol **2020**; 136:237–51.
14. Liu Y, Yan LM, Wan L, et al. Viral dynamics in mild and severe cases of COVID-19. Lancet Infect Dis **2020**; 20:656–7.
15. Zhou F, Yu T, Du R, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. Lancet **2020**; 395:1054–62.
16. Young BE, Ong SWX, Kalimuddin S, et al; Singapore 2019 Novel Coronavirus Outbreak Research Team. Epidemiologic features and clinical course of patients infected with SARS-CoV-2 in Singapore. JAMA **2020**; 323:1488–94.
17. He X, Lau EHY, Wu P, et al. Temporal dynamics in viral shedding and transmissibility of COVID-19. Nat Med **2020**; 26:672–5.
18. Cheng H-Y, Jian S-W, Liu D-P, Ng T-C, Huang W-T, Lin H-H. Contact tracing assessment of COVID-19 transmission dynamics in Taiwan and risk at different exposure periods before and after symptom onset. JAMA Intern Med **2020**; 180:1156–63.
19. Centers for Disease Control and Prevention. Communities, schools, workplaces, & events. Available at: https://www.cdc.gov/coronavirus/2019-ncov/community/strategy-discontinue-isolation.html. Accessed 12 June 2020.
20. DeNicola N, Grossman D, Marko K, et al. Telehealth interventions to improve obstetric and gynecologic health outcomes: a systematic review. Obstet Gynecol **2020**; 135:371–82.
21. Massachusetts Department of Public Health COVID-19 Dashboard, June **2020**. Available at: https://www.mass.gov/doc/covid-19-dashboard-june-1-2020/download. Accessed 2 June 2020.