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# A multidisciplinary telemedicine model for management of coronavirus disease 2019 (COVID-19) in obstetrical patients



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**BACKGROUND:** The COVID-19 pandemic caused by the SARS-CoV-2 has increased the demand for inpatient healthcare resources; however, approximately 80% of patients with COVID-19 have a mild clinical presentation and can be managed at home.

**OBJECTIVE:** This study aimed to describe the feasibility and clinical and process outcomes associated with a multidisciplinary telemedicine surveillance model to triage and manage obstetrical patients with known exposures and symptoms of COVID-19.

**STUDY DESIGN:** We implemented a multidisciplinary telemedicine surveillance model with obstetrical physicians and nurses to standardize ambulatory care for obstetrical patients with confirmed or suspected COVID-19 based on the symptoms or exposures at an urban academic tertiary care center with multiple hospital-affiliated and community-based practices. All pregnant or postpartum patients with COVID-19 symptoms, exposures, or hospitalization were eligible for inclusion in the program. Patients were assessed by means of regular nursing phone calls and were managed according to illness severity. Patient characteristics and clinical and process outcomes were abstracted from the electronic medical record.

**RESULTS:** A total of 135 patients were enrolled in the multidisciplinary telemedicine model from March 17 to April 19, 2020, of whom 130 were pregnant and 5 were recently postpartum. In this study, 116 of 135

patients (86%) were managed solely in the outpatient setting and did not require an in-person evaluation; 9 patients were ultimately admitted after ambulatory or urgent evaluations, and 10 patients were observed after hospital discharge. Although only 50% of the patients were tested secondary to limitations in ambulatory testing, 1 in 3 of those patients received positive results for SARS-CoV-2 (N=22, 16% of entire cohort). Patients were enrolled in the telemedicine model for a median of 7 days (interquartile range, 4–8) and averaged 1 phone call daily, resulting in 891 nursing calls and 20 physician calls over 1 month.

**CONCLUSION:** A multidisciplinary telemedicine surveillance model for outpatient management of obstetrical patients with COVID-19 symptoms and exposures is feasible and resulted in rates of ambulatory management similar to those seen in nonpregnant patients. A centralized model for telemedicine surveillance of obstetrical patients with COVID-19 symptoms may preserve inpatient resources and prevent avoidable staff and patient exposures, particularly in centers with multiple ambulatory practice settings.

**Key words:** coronavirus disease 2019, implementation research, multidisciplinary, outpatient management, pandemic, quality improvement, severe acute respiratory syndrome coronavirus 2, telemedicine

## Introduction

The coronavirus disease 2019 (COVID-19) pandemic caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has created unprecedented demand for inpatient healthcare resources, increasing the need for ambulatory evaluation and management of pregnant patients with symptoms. Hospital-based triage requires personnel, space, and personal protective equipment (PPE). In-person evaluation also increases the risk of staff and patient exposure to SARS-CoV-2; in 1 study, nosocomial transmission was responsible for SARS-CoV-2 infections

in 29% of healthcare workers and 12% of hospitalized patients.<sup>1</sup> Measures that decrease unnecessary in-person visits may therefore be valuable to preserve resources and protect patients and staff.

Supportive home care is the mainstay of treatment for patients with symptoms of COVID-19. Preliminary data suggest that although 20% to 30% of hospitalized patients with COVID-19 require critical care,<sup>2,3,4</sup> approximately 80% of patients have a mild clinical presentation and do not require hospital admission.<sup>5</sup> For those with sufficiently mild symptoms, home quarantine should be paired with frequent symptom monitoring and an escalation plan if clinical status worsens. Although a centralized phone-based system for management of obstetrical patients with symptoms or exposures was associated with successful prevention of unnecessary inpatient evaluations during the H1N1 influenza epidemic,<sup>6</sup> similar systems have yet to be

described during the current COVID-19 pandemic.

As part of the clinical process improvements for COVID-19 management at our institution, we created a multidisciplinary telemedicine model with obstetricians and nurses to systematically triage and manage obstetrical patients. We hypothesized that a telemedicine model would be feasible, with rates of inpatient management similar to nonpregnant patients with COVID-19. This article will describe our experience with the first month of this care model.

## Methods Context

The first confirmed case of COVID-19 in Massachusetts was identified on February 1, 2020. By March 15, 2020, that number had increased to 3487 cases.<sup>7</sup> As of April 22, 2020, Massachusetts became one of the most

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**AJOG MFM at a Glance**

**Why was this study conducted?**

We describe the clinical and process outcomes associated with the implementation of a novel multidisciplinary telemedicine surveillance model for the outpatient management of patients with suspected coronavirus disease 2019 (COVID-19).

**Key findings**

Most patients (86%) were appropriately managed in the outpatient setting and did not require an in-person evaluation.

**What does this add to what is known?**

Multidisciplinary telemedicine models can be successfully applied to the obstetrical population during the COVID-19 pandemic.

including symptoms, positive test results, and exposures.

**Team**

The team was comprised of obstetrical physicians and ambulatory obstetrics and gynecology nurses with experience in providing prenatal and postpartum care.

**Patients**

All pregnant or recently pregnant ( $\leq 6$  weeks after delivery) patients who were obtaining prenatal care from a BIDMC obstetrical provider and had symptoms, exposures, or confirmed COVID-19 were eligible for inclusion in the telemedicine model of care. Patients who were transferred to BIDMC from affiliate hospitals were also eligible for inclusion. Referrals resulted from patient phone calls to their providers, telemedicine visits, ambulatory visits, triage, and emergency department evaluations and at hospital discharge. Patient information was kept on an electronic roster within the electronic medical record (EMR) system.

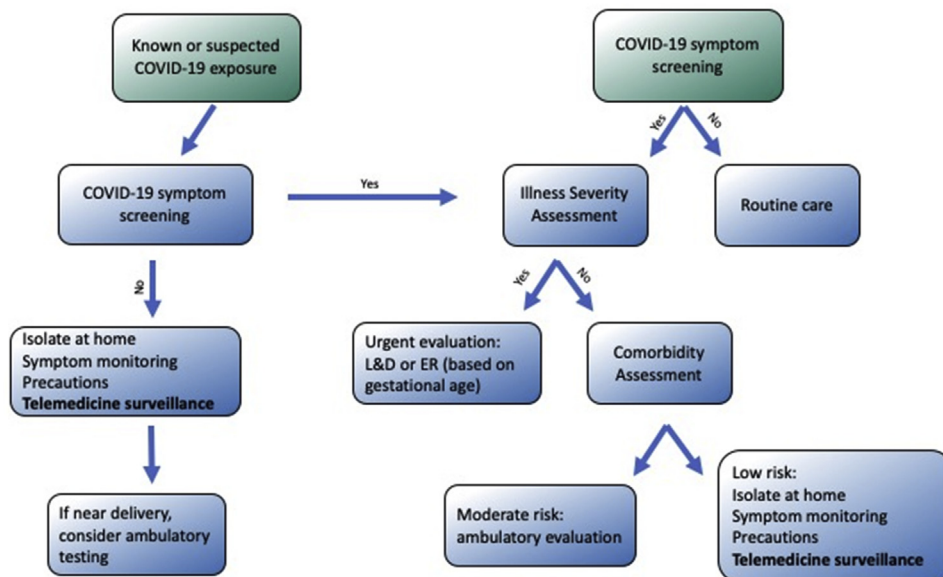
affected states in the United States, with 616 new infections per 100,000 people since January 1, 2020.<sup>8</sup> Beth Israel Deaconess Medical Center (BIDMC) is the tertiary maternal and neonatal center for the Beth Israel Lahey Health system, which provides care for nearly 15,000 births annually in eastern Massachusetts. Of those, 30% occur at BIDMC. Prenatal care is provided at 3 community health centers, 5 satellite offices, and 3 practice groups, including

a faculty physician group, a private practice group, and an employed multispecialty group. In 2019, there were 5296 births of which 1480 (27.9%) were covered by Medicaid, and 1191 of these patients (80.5%) self-identified as non-white.

**Intervention**

We implemented a multidisciplinary telemedicine surveillance model for patients with concern for COVID-19,

**FIGURE**  
**Clinical assessment algorithm**



This flowchart describes the algorithm for clinical assessment of patients with known or suspected COVID-19 exposure or COVID-19 symptoms.

COVID-19, coronavirus disease 2019; ER, emergency room; L&D, labor and delivery.

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## Procedures

A team of obstetrical nurses enlisted for this model called each patient using telephone at enrollment to complete a standardized assessment adapted from the American College of Obstetricians and Gynecologists and Society for Maternal Fetal Medicine recommendations for outpatient assessment and monitoring (Figure, Box 1, Box 2).<sup>9</sup> Those who needed urgent or emergent evaluation were referred immediately to the covering physician of the day and appropriately triaged for urgent in-person evaluation. Urgent evaluations were referred to the emergency department or labor and delivery depending on the gestational age (<22 weeks' gestation or ≥22 weeks' gestation, respectively). Patients who needed to be seen non-urgently were evaluated in an ambulatory site with prespecified isolation processes and the appropriate PPE recommended by infection control practitioners. For patients who did not need in-person evaluation, nurses provided education regarding standardized guidelines for home care with COVID-19, including isolation, hygiene, and symptom monitoring. The nurses continued regular telephone calls to review severity of symptoms and determine continued eligibility for home management for a minimum of 7 days after referral and longer as clinically indicated. Phone calls were made every 1 to 2 days based on symptom assessment. Communication with the primary obstetrics provider was sent electronically at discharge from the program, and the clinical course, testing results, and recommended infection control precautions were documented in the EMR.

We arranged ambulatory testing for all eligible patients; the criteria for testing expanded over the course of the month as our institutional testing capacity grew. All symptomatic patients were treated as presumed SARS-CoV-2 positive unless test results was negative. Patients referred for surveillance after an inpatient hospitalization were called by a physician until they were considered to be symptomatically improved; patients from community hospital affiliates were observed until their primary obstetrical

### BOX 1 Illness severity assessment

#### Box 1: Illness Severity Assessment

- Difficulty breathing or shortness of breath? (e.g. difficulty completing a sentence without gasping to catch breath frequently when walking across the room)
- Coughing more than 1 teaspoon of blood
- New pain or pressure in the chest other than pain with coughing
- Inability to keep liquids down
- Signs of dehydration such as dizziness when standing
- Less responsive than normal or becomes confused talking

If the answer is yes, the patient needs urgent evaluation:

- <22 weeks referred to emergency department
- >22 weeks referred to labor and delivery

Criteria for the assessment of symptom severity for patients with COVID-19 symptoms. Adapted from the American College of Obstetricians et al.<sup>9</sup>

COVID-19, coronavirus disease 2019.

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### BOX 2 Comorbidity assessment

#### Box 2: Comorbidity Assessment

- Hypertension; diabetes; asthma; BMI >40; HIV; chronic heart, liver, or kidney disease; blood dyscrasia, immunosuppressive medications, unstable behavioral health conditions
- Obstetric issues (e.g. preterm labor, gestational hypertension, GDMA2, cholestasis)
- Inability to care for self or arrange follow-up (e.g. housing instability, food insecurity, transportation barriers, intimate partner violence)
- If the answer is yes, the patient needs urgent evaluation (<22 weeks referred to emergency department; >22 weeks referred to ambulatory clinic)

Criteria for the assessment of comorbidities for patients with COVID-19 symptoms. Adapted from the American College of Obstetricians and Gynecologists et al.<sup>9</sup>

BMI, body mass index; COVID-19, coronavirus disease 2019; GDMA2, gestational diabetes mellitus A2; HIV, human immunodeficiency virus.

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**TABLE 1**  
**Patient characteristics**

Characteristic	n (%) or median (IQR)
Total	135
Age (y)	33.0 (29–35)
Self-reported race and ethnicity	
White	60 (44.4)
Black	28 (20.7)
Hispanic	12 (8.9)
Asian or Pacific Islander	13 (9.6)
Middle Eastern	2 (1.5)
Other	2 (1.5)
Not specified	18 (13.3)
Interpreter needed	
Yes	21 (15.6)
No	114 (84.4)
Payor	
Commercial	88 (65.2)
Public	47 (34.8)
Practice setting	
Hospital-affiliated	78 (57.8)
Private	22 (16.3)
Community health center	27 (20.0)
Outside hospital transfer	7 (5.2)
No prenatal care	1 (0.7)
Pregnant at enrollment	130 (96.3)
Gestational age (wk)	26.7 (17–34)
Nulliparous	54 (41.5)

IQR, interquartile range.

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provider assumed responsibility for follow-up. If a patient received negative results for SARS-CoV-2 test but remained symptomatic, they were also continued to be observed until an alternative diagnosis was determined or their symptoms improved and a plan of care was established. The nurses and physicians huddled daily by means of a virtual platform to discuss all active patients. All nurses and at least 1 obstetrician joined the team huddle daily. Nurses had the opportunity to request that a physician calls a patient directly if they needed additional guidance with clinical

decision-making. If patients had routine obstetrical questions during daily surveillance check-ins, they were encouraged to call their primary obstetrics provider.

### Implementation

The multidisciplinary telemedicine surveillance model was announced through multiple channels, including departmental meetings and divisional meetings, and through frequent emails. A dedicated email address was created to centralize referrals. The ambulatory management algorithm was published to the obstetrics

and gynecology department COVID-19 policy intranet. A 90-second video orienting providers to the team and the referral process was also disseminated electronically. Providers at all affiliated academic practices, community health centers, and private practices attend departmental grand rounds, receive electronic communications, and have access to materials posted on the intranet.

The standard operating procedures, including evaluation algorithm, testing procedures, and necessary infection control steps, were reviewed and reinforced at the daily team huddle. Physicians who were new to the team joined the huddle at least once before taking primary responsibility for coverage.

### Study of the intervention

The primary clinical outcome for our intervention was the percentage of patients managed in the ambulatory setting only. We hypothesized that the use of the multidisciplinary telemedicine surveillance model will help to keep the number of patients presenting for in-person evaluation similar to the inpatient rates of the general public. Based on literature of nonpregnant patients with COVID-19, at least 80% would be able to be managed entirely at home. We defined the feasibility of our model by its ability to reach similarity with these rates. We evaluated secondary clinical outcomes, including admission or readmission to the hospital based on the surveillance follow-up. We also evaluated the resources needed to implement the surveillance model.

### Measures

Clinical measures included the percentage of patients who were appropriately managed in the outpatient setting, percentage of patients requiring in-person ambulatory or urgent evaluation, and percentage requiring admission. Key process measures included nurse and physician time, number of calls, and patient engagement defined as 2 or more accepted calls. We abstracted clinical information and process measures from clinical documentation.

The intervention was implemented as a practice change to improve the quality

of care. This study (protocol number 2020P000306) was considered exempt research by the BIDMC institutional review board. Data were collected and stored using REDCap (Research Electronic Data Capture), a Health Insurance Portability and Accountability Act–compliant, web-based data collection tool stored in a restricted access folder on the BIDMC secure server. Descriptive statistics were reported as proportions and median and interquartile range (IQR).

## Results

### Patient characteristics

From March 17 to April 19, 2020, 135 patients with COVID-19 exposures or symptoms were monitored using our multidisciplinary telemedicine model. Here, 96% of patients had not yet delivered at the time they were referred (Table 1). Although most patients (78 of 135 [58%]) received their care at a hospital-affiliated faculty practice, 20% were referred by the faculty at community health centers. Moreover, 42% identified as non-white. An interpreter was needed for the 21 patients (16%) who preferred a language other than English.

Clinical concern for COVID-19 based on signs and symptoms was the most common reason for referral to telemedicine management, with a small number of patients (20 of 135 [15%]) referred for exposure only (Table 2). COVID-19 testing was performed on 68 patients (50%), and 14 patients were tested twice. Of the 68 patients (50.4%) who were tested (N=68, 50.4%), 1 in 3 received positive results for SARS-CoV-2 (Table 2).

### Clinical outcomes

After enrollment in the telemedicine model, 86% of patients were managed solely on an outpatient basis (Table 2), whereas 19 patients required an in-person evaluation. Of these patients, 10 were deemed stable for continued outpatient surveillance. Among the 9 patients admitted to the hospital, 7 were confirmed to have COVID-19, whereas 2 had other diagnoses, including pre-eclampsia and bacterial endocarditis. In

**TABLE 2**

**Clinical outcomes for patients undergoing telemedicine surveillance for suspected or confirmed COVID-19**

Characteristic	n (%)
<b>Referral origin</b>	
Outpatient care	109 (80.7)
L&D triage	8 (5.9)
ED	4 (3.0)
Postdischarge after COVID-19 admission	10 (7.4)
L&D screening	4 (3.0)
<b>Reason for surveillance</b>	
Signs and symptoms	92 (68.1)
Exposure	20 (14.8)
Both	23 (17.0)
<b>At least 1 COVID-19 test performed</b>	
Positive	22 (16.3)
Negative	44 (32.6)
No result	2 (1.5)
<b>Clinical management</b>	
Telemedicine only	116 (85.9)
Recommended ambulatory evaluation	13 (9.6)
Recommended urgent evaluation (ED or L&D)	6 (4.4)
Unplanned emergent evaluation	0 (—)
<b>Hospital admission</b>	
Admission after ambulatory evaluation	5 (—)
Admission after urgent evaluation	4 (—)
<b>Readmission</b>	
	1 (0.7)

COVID-19, coronavirus disease 2019; ED, emergency department; L&D, labor and delivery.

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addition, 1 patient was initially referred to the telemedicine team after a 3-day admission for respiratory symptoms with confirmed COVID-19. After 2 days of stability at home, her symptoms worsened, and she was brought in for an evaluation resulting in readmission. The remainder of the 10 patients who were referred at discharge following admission for COVID-19 symptoms remained stable after outpatient surveillance.

### Process outcomes

During the study period, there was a median of 3 referrals per day (range, 1–9). Most clinical concerns arose in the outpatient setting. For patients

who needed an in-person evaluation, this recommendation was made after a median of 2 days (IQR, 1–7). Most patients (116 of 135 [86%]) engaged with the telemedicine model (Table 3). Patients were monitored for 7 days on an average, with a total of 891 nursing phone calls completed over the course of the month; this required 2 full-time nurses during business hours and 1 on weekends. Physician involvement was necessary for only 20 phone calls or less than 1 daily. There are 104 patients who have been discharged from the surveillance model as of April 19, 2020, with 31 patients still actively observed.

**TABLE 3**  
**Telemedicine pregnancy surveillance process measures**

Process	n (%)	Median (IQR) per patient
Nursing calls	891	7 (4–8)
Spoke to patient	737 (82.7)	5 (3–8)
Left voicemail	154 (17.2)	1 (0–2)
MD calls	20	0
Days of follow-up	—	7 (4–8)
Patient engagement (accepted $\geq 2$ calls)	116 (85.9)	—
Lost to follow-up	6 (4.4)	—
Discharged from model at time of analysis	104 (77.0)	—

IQR, interquartile range; MD, doctor of medicine.

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## Comment

### Principal findings

We were able to implement a multidisciplinary telemedicine model for the management of confirmed and suspected COVID-19 in an obstetrical population. We served a diverse group of patients from a large hospital system with a wide variety of practice sites using a standardized algorithm, which would have been more challenging without a centralized system. Our experience during the first month revealed that most patients (86%) were able to be managed without in-person evaluation, similar to what has been described in nonpregnant adults.<sup>5</sup> Indications for enrollment in the telemedicine surveillance model included both symptoms and COVID-19 exposure. A total of 20 patients had suspected exposures only and did not have symptoms. In the absence of a centralized system for management of these patients, some may have been referred for an in-person evaluation for testing and thus were included in our analysis. None of these patients ultimately required an in-person evaluation. Among the 115 patients who were symptomatic regardless of exposure, 91 (79%) were managed by telemedicine only.

Access to testing was initially quite limited, and the high positive PCR testing rates for SARS-CoV-2 (32%) suggest that our prioritization of testing

was effectively targeted. The model was labor intensive, requiring 2 full-time nurses at the peak of the pandemic to serve an obstetrical population with approximately 5300 deliveries annually. These nurses were redeployed from clinical areas with decreased patient volume owing to restrictions on elective care and did not independently bill for their services. Nonetheless, the model was feasible and highly utilized, with high rates of patient engagement (86%).

We are unaware of other published literature on multidisciplinary telemedicine models for obstetrical patients during the COVID-19 pandemic. Similar strategies have been implemented in prior epidemics,<sup>6</sup> which have contributed to the judicious use of emergency room and triage utilization for patients reporting symptoms or exposure.<sup>10</sup> Although we do not have a control group to compare rates of emergency care utilization, we estimate that some fraction of the 116 patients who were completely managed as outpatients would have presented for evaluation in the absence of this clinical program. Because there is no known treatment for COVID-19 at this time, supportive care and home symptom surveillance can be augmented with telemedicine.

### Clinical implications

The feasibility of our collaborative telemedicine surveillance model has implications for addressing other clinical

problems in obstetrics. Recent data suggest that patients are open to utilizing telemedicine for routine care.<sup>11,12</sup> For obstetrical patients with barriers to access, such as geography, transportation, lack of time away from work, and lack of childcare, telemedicine models may increase adherence to care in both the prenatal and postpartum settings.<sup>13</sup> Nurses in our program were able to coordinate social work services, help navigate transportation barriers, provide a personal connection, and direct patients toward medical care when indicated. The multidisciplinary telemedicine model was an effective way to reach a diverse population of patients, including 1 in 6 patients who required an interpreter, which was readily available by phone using this approach.

### Research implications

Telemedicine models may also have a role in improving access to high-quality prenatal and postpartum care. An estimated 20% to 40% of women do not attend a postpartum visit.<sup>14</sup> The role of nursing support to coordinate complex care needs in the postpartum period has yet to be well studied and is an important potential application of this model. Future research is needed to evaluate telemedicine models in routine obstetrical settings and should include evaluation of financial sustainability.

### Strengths and limitations

This is a descriptive study of a clinical quality improvement initiative during an unprecedented situation, with limitations to generalizability that include local contextual factors. However, we suspect that launching similar programs in other settings will be facilitated by the national healthcare context of the COVID-19 pandemic. We noted that all patients observed in the program had a working mobile or home phone number; a limitation to all phone-based telemedicine surveillance models are that patients must have access to a phone. Nonetheless, we did not have any patients who were unable to be observed after referral and found that even patients who experienced housing insecurity during the time they were observed

were engaged in the program. Our small sample size, reflecting only the first month's experience with the multidisciplinary telemedicine model, gave us limited opportunity to observe any impact on morbidity. We noted that 1 patient with febrile illness presumed to be COVID-19 was diagnosed with endocarditis after appropriate triage to the hospital, underscoring the role of SARS-CoV-2 testing in appropriate ambulatory management. Our testing capacity was initially limited, and we argued that universal availability of ambulatory testing would enhance the safety of this model. One future consideration for this telemedicine surveillance model is the addition of video visits, which can augment the clinical assessment.

## Conclusions

The current COVID-19 pandemic poses a unique challenge to the way we deliver healthcare for all patients, and obstetrical practices must meet this challenge.<sup>15</sup> Although it is customary to have a low threshold for in-person evaluation or even inpatient observation for many ailments that occur during pregnancy, there is a good reason to create systems that may safely avoid in-person contact during the COVID-19 crisis. Our findings help support the use of multidisciplinary telemedicine surveillance models for obstetrical patients during the pandemic and provide important feasibility data for other obstetrical care needs. Other obstetrical departments can apply our algorithm to their context. Further work is needed to assess the impact on clinical outcomes and patient and provider satisfaction. This model may help to improve the coordination of patient care between the outpatient and

inpatient settings, improve patient and staff safety, and preserve hospital resources. ■

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