Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Available online at www.sciencedirect.com

Seminars in Perinatology

www.seminperinat.com

Primed for a pandemic: Implementation of telehealth outpatient monitoring for women with mild COVID-19

Nicole M. Krenitsky, Jessica Spiegelman, Desmond Sutton, Sbaa Syeda, and Leslie Moroz*

Department of Obstetrics and Gynecology, NewYork-Presbyterian Hospital / Columbia University Irving Medical Center, New York, NY, United States

ARTICLE INFO

ABSTRACT

Close observation and rapid escalation of care is essential for obstetric patients with COVID-19. The pandemic forced widespread conversion of in-person to virtual care delivery and telehealth was primed to enable outpatient surveillance of infected patients. We describe the experience and lessons learned while designing and implementing a virtual telemonitoring COVID-19 clinic for obstetric patients. All patients with suspected for confirmed COVID-19 were referred and enrolled. Telehealth visits were conducted every 24 to 72 hours based on the severity of symptoms and care was escalated to in person when necessary. The outcome of the majority (96.1%) of telehealth visits was to continue outpatient management. With regard to escalation of care, 25 patients (26.6%) presented for in person evaluation and five patients (5.3%) required inpatient admission. A virtual telemonitoring clinic for obstetric patients with mild COVID-19 offers an effective surveillance strategy as it allows for close monitoring, direct connection to in person evaluation, minimization of patient and provider exposure, and scalability.

Introduction to Telehealth: Leveraging pre-existing frameworks

On March 11, 2020, the World Health Organization declared the outbreak of the disease caused by the SARS-CoV-2 virus (COVID-19) a pandemic. At that time, the United States had 1,200 cases of COVID-19, with 325 of those in New York City.[1,2] As the crisis escalated over the following weeks, healthcare providers were forced to fundamentally shift patient care paradigms. The pandemic presented unique challenges: a massive influx of patients, an unknown disease course sometimes including rapid deterioration, a highly contagious illness best mitigated by social distancing, and global shortages of personal protective equipment. Often touted for its ability to increase healthcare access among geographically dispersed patient populations, telehealth emerged as a strategy primed to solve many of these challenges at a local level.[3] In response to COVID-19, providers quickly shifted as many appropriate patient visits as possible to telehealth. In the way that social distancing policies forced many businesses to transition to virtual meetings via platforms such as Zoom® or WebEx®, obstetrics, too, went digital.[4] The full scope of this change, including the shift to virtual prenatal care, is discussed in another chapter of this issue.

*Correspondence to: Division of Maternal-Fetal Medicine, Department of Obstetrics and Gynecology, Columbia University College of Physicians and Surgeons, 622 W 168th Street, New York, NY 10032, United States.
E-mail address: lm3000@cumc.columbia.edu (L. Moroz).

https://doi.org/10.1016/j.semperi.2020.151285
0146-0005/

Over the past decade, telehealth has emerged as an alternative and complementary care delivery vehicle. Prior to COVID-19, telehealth was beginning to find a foothold in obstetrics but implementation was limited by a lack of high-quality evidence for its efficacy.[5] Nevertheless, in recent years the American College of Obstetricians and Gynecologists (ACOG) has shown support for telehealth integration in obstetrics, endorsing its use for prenatal and postpartum care.[6] Success in obstetric telehealth has been demonstrated in specific use cases. Parity in pregnancy outcomes between traditional and telehealth routine prenatal care has been shown, and telehealth monitoring programs have improved maternal and neonatal outcomes in high-risk obstetric populations.[7,8] Safety and efficacy have also been demonstrated for remote patient monitoring in obstetrics: home blood pressure cuffs and glucometers with Bluetooth® capability have been used for patients with hypertensive disorders of pregnancy, diabetes and other high-risk conditions.[9,10] Finally, outside of obstetrics, telehealth has been implemented in monitoring of chronic conditions and of post-acute patient stabilization, where close monitoring is used to track improvement and detect exacerbations in patients with specific conditions such as heart failure, chronic obstructive pulmonary disease, myocardial infarctions and acute infections.[11–14]

Building on these use cases in obstetrics and other specialties, the question arose: Could telehealth be utilized not only as an alternative medium for routine obstetric care, but also as a monitoring strategy for patients with COVID-19? Though preliminary studies do not indicate a significantly increased risk of morbidity due to COVID-19 in obstetric patients, the physiology of pregnancy is unique and respiratory decompensation can have disastrous effects on both maternal and fetal well-being.[15] The close surveillance of obstetric patients with COVID-19 is therefore of the utmost importance, and telehealth is an obvious vehicle.[16] An appropriately implemented telehealth system can ensure that patients with COVID-19 receive adequate monitoring and that their care can be escalated to in-person when warranted by their clinical status. At the same time, telehealth allows patients infected with COVID-19 who are well enough to be managed as outpatients to remain physically out of clinical settings, thereby protecting other patients and providers from exposure.

This chapter describes the experience of an academic institution and its community hospital partner in establishing a virtual clinic for patients with mild or resolving acute COVID-19 infections, including the process, challenges, outcomes and lessons learned.

A virtual COVID-19 clinic: example from the epicenter

Given the constraints of a pandemic and the success of previous obstetric telehealth programs, a virtual outpatient COVID-19 clinic was established at an academic medical center and its affiliated community hospital in New York City, the epicenter of the United States pandemic. This novel clinic was designed to enable the close tracking of pregnant and postpartum women via the integration of telehealth visits, remote patient monitoring devices, and electronic medical record keeping.

The first obstetric case of COVID-19 at this institution was diagnosed on March 13, 2020. In the immediate period that followed, affected patients were monitored with telephone calls while a plan for video visits was developed. Patients with suspected COVID-19 were tested in the obstetric triage unit, on all inpatient services, in some outpatient clinics, and in the hospital's free-standing fever clinics. Patients with COVID-19 symptoms who remained untested were considered "persons under investigation" (PUI) until infection was confirmed. On March 22, 2020, universal COVID-19 testing was mandated for all women admitted to labor and delivery regardless of symptoms. On March 23, a formal virtual COVID-19 clinic went live.[17]

Process

When an obstetric patient tested positive for COVID-19 or was deemed a PUI, the clinical team alerted a dedicated tracking team via a centralized email address. The patient was then added to a shared list on the hospital's electronic medical record (EMR) platform and to a shareable spreadsheet for transparency and information sharing. Patients were individually enrolled in the EMR's mobile application. They were scheduled for a virtual visit by administrators within 24 hours of receiving a diagnosis of COVID-19 or of hospital discharge if testing was performed during an admission.

Each day, the provider or providers assigned to the virtual COVID-19 clinic accessed telehealth visits via an electronic schedule. An algorithm was developed sorting patients to visits every 24, 48 or 72 hours based on severity of symptoms (Fig. 1). The providers assigned to the virtual clinic were either faculty or trainees with direct oversight. Patient volume dictated the allocation of providers to the virtual clinic, with a maximum of three providers per day required during the peak of the pandemic.

During virtual visits, patients were questioned regarding new or worsening symptoms, as well as obstetric symptoms using a standardized visit template. Patients triggering criteria for in-person evaluation were instructed to present to OB triage or the emergency department (henceforth referred to as "triage") depending on gestational age. A patient arrival protocol with patient and provider personal protective equipment and isolation measures was triggered for each escalation of care. Patients discharged from triage restarted virtual outpatient management. Patients were followed for a minimum of 14 days after their positive test result or until noted to have sustained improvement of symptoms, whichever came later. They were then discharged from the virtual COVID-19 clinic to the care of their prenatal provider with recommendations to continue social distancing as endorsed by the CDC.[18]

Integration of Remote Patient Monitoring (RPM)

Conducting telehealth visits inherently limits the objective clinical assessment of a patient, including vital signs and the physical exam. While video technology allows for a modified

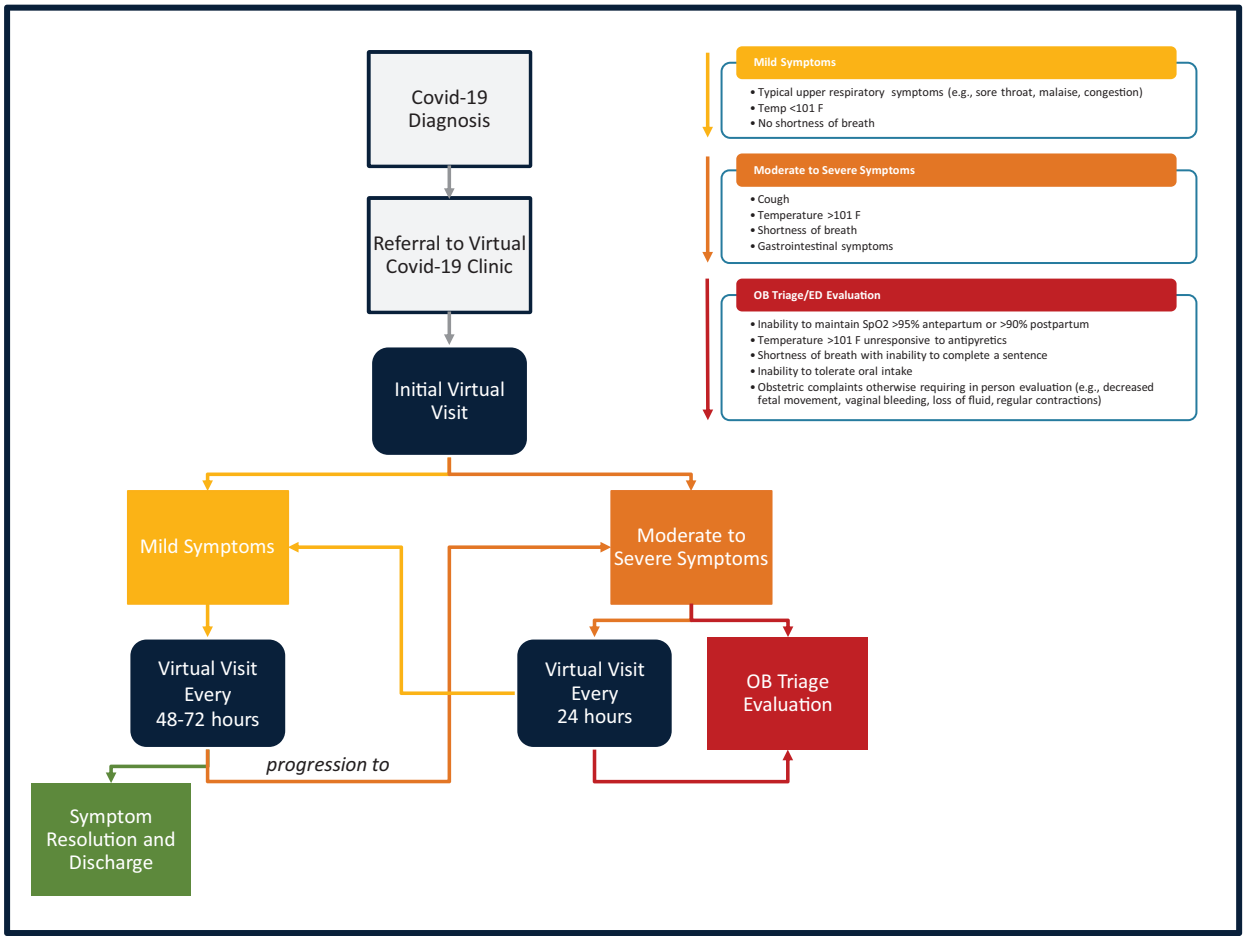

Fig. 1 – Virtual COVID-19 telemonitoring clinic symptom tracking and escalation algorithm. (*Adapted from Spiegelman et al., NEJM Catalyst, accepted for publication.*)

physical exam, the addition of RPM devices for objective clinical data can greatly improve the clinician's ability to diagnose and treat. This is even more significant when the visit is conducted over the phone without visual input.

As with other respiratory illnesses, temperature, heart rate, and oxygen saturation are useful parameters to gauge COVID-19 illness severity. Unique to pregnancy, blood pressure monitoring to facilitate early diagnosis of gestational hypertension or preeclampsia is critical and a recognized part of a routine obstetric visit.[19] As such, thermometers, blood pressure cuffs, and portable pulse oximeters were prescribed and utilized in real time during telehealth visits. Doppler tones and non-stress tests for fetal monitoring were unable to be obtained for home use due to the lack of validated, commercially available RPM equipment, but qualitative fetal movement assessment and fetal kick counts allowed for assessment of fetal well-being.[20]

Results

From March 23, 2020 to April 30, 2020, the virtual COVID-19 clinic followed 94 patients, 92 of whom were pregnant and two of whom postpartum at the time of testing. The median gestational age of pregnant patients was 32.5 weeks (IQR 25-38 weeks). Sixty-six (70.2%) patients held public insurance while the rest were privately insured. Most patients enrolled in the virtual COVID-19 clinic were symptomatic; 22.2% (21 patients) were asymptomatic carriers. Three of these patients went on to develop symptoms during the period of telemonitoring. Upon initial presentation, seven patients (7.5%) required inpatient management and the remainder were discharged home with close telehealth follow up.

In total, 470 telehealth visits were scheduled during this period. Four hundred and seven visits were conducted, 213 (52.6%) via video and 194 (47.4%) by telephone. Patients no-showed to 63 visits, yielding a no-show visit rate of 13.4% (63 of 470). At the time of writing, 59 patients have been successfully discharged from the virtual COVID-19 clinic to continue with routine antenatal or postpartum care while three remain enrolled under active management. Thirty-two patients (34.0% of all patients in the program) did not complete follow up with the virtual clinic. Of these 32 patients, the majority (23 patients) were lost to follow up from the virtual clinic and never formally discharged but continued routine care with their providers. Nine patients (9.6% of all patients in the program) did not follow up with their prenatal providers within the period of interest nor complete follow up with the virtual clinic. Only one patient (3.1%) was completely lost to follow up after her COVID-19 diagnosis, with no virtual clinic visits ever performed and no further care with her obstetric provider. The no show rate for the virtual

COVID-19 clinic visits (13.4%) was comparable to department-wide in person (13.0%) and general telehealth no show rates (11.1%) during the first five weeks of the pandemic.

The outcome of the majority of telehealth visits (391 visits, 96.1%) was to continue outpatient management, with only 3.9% of visits requiring escalation of care to inpatient evaluation. Of the 94 patients in the program, 25 (26.6%) were seen in triage at least once during the period that they were being followed, with a total of 38 triage visits. Of these 25 patients, 18 patients (72.0%) had one triage visit, five (20.0%) had two triage visits and two (8.0%) had four triage visits. Thirteen of the 38 triage visits (34.2%) were escalations from the virtual clinic; the remaining 25 visits (65.8%) were self-directed. Of the total triage visits, 21 (55.3%) were for COVID-19 related symptoms, while 17 (44.7%) were for other indications, mostly obstetric related (Table 1). The most common chief complaint was shortness of breath with or without chest pain, followed by upper respiratory infection symptoms and decreased fetal movement.

Table 2 summarizes all triage visits—those escalated from the virtual clinic and those self-initiated by patients. All patients presenting to triage had known or suspected COVID-19 infection; none were asymptomatic carriers. Of the 13 triage visits triggered by escalation from the virtual clinic, 2 resulted in admissions and 11 were discharged from triage. Of those discharged, 7 had no further COVID-19-related workup resulting from their triage visit, and 4 required an intervention (for example, an inhaler, intravenous hydration or chest X-ray) prior to discharge. Of the 25 triage visits that were self-directed and not the result of an escalation from a virtual visit, 8 led to a hospital admission and 17 resulted in patient discharge. Of those discharged, six required further COVID-19-related intervention in triage and 11 did not.

Table 1 – Triage visit chief complaints.

Triage Chief Complaint	Number of Visits (% Visits)
Total Visits	**38 (100.0)**
Shortness of breath and/or chest pain	16 (42.1)
Decreased fetal movement	5 (13.2)
Contractions	3 (7.9)
Fetal monitoring	2 (5.3)
GI symptoms	2 (5.3)
Abdominal pain	2 (5.3)
Itching	2 (5.3)
URI symptoms	1 (2.6)
Vaginal discharge	1 (2.6)
Vaginal bleeding	1 (2.6)
Headache, dizziness	1 (2.6)
Elevated blood pressure	1 (2.6)
Fall	1 (2.6)

Table 2 – Summary of triage visits during telemonitoring and their dispositions.

Triage Visit Outcomes	Triage Visits No. visits (%)
COVID-related chief complaint	**21 (55.3)**
Admitted	**5 (23.8)**
Discharged	**16 (76.2)**
Further COVID-related care performed in triage	11 (68.8)
No COVID-related care performed	5 (31.2)
Non COVID-related chief complaint	**17 (44.7)**
Admitted	**5 (29.4)**
Discharged	**12 (70.6)**
Further COVID-related care performed in triage	1 (8.3)
No COVID-related care performed	11 (91.7)

While 23.1% of escalations of care triggered by telehealth visits were for non COVID-19-related complaints, 56.0% of patient-directed presentations were due to complaints unrelated to COVID-19. Approximately the same percent of patients discharged from triage required COVID-19-related workup or interventions regardless of whether the visits were self-directed versus clinic-escalated (35.3% and 36.4%, respectively). Patients who self-presented had a higher rate of admissions. The rate of admission from self-initiated triage visits was 32.0% (8 of 25 visits) while that of virtual visit escalations was 15.4% (2 of 13 visits). No patients admitted while in the virtual telemonitoring program required intubation or ICU-level care. The mortality rate of patients in the virtual telemonitoring clinic was 0%.

Discussion

It is impossible to draw firm conclusions from this preliminary experience with a new model of care in response to a disease that remains incompletely understood; however, this series provides some insight into the challenges of operationalizing a new model for care.

At a loss rate of approximately one third of patients in the program, the major barrier to close monitoring proved to be inconsistent follow up. The majority of patients who did not complete the virtual COVID-19 clinic program were still seen by their prenatal provider for care and only nine of 94 (9.6%) were truly lost to any follow-up within our health system. Yet, high rates of patient retention are integral to the success of any disease-specific telehealth monitoring program, and assumption of follow-up with the patient's primary provider cannot be relied upon. Overcoming this challenge requires further analysis of the reasons that patients did not complete surveillance with the virtual clinic. These could include patients symptomatically improving so deemed close follow up was unnecessary, assuming that their normal prenatal surveillance would be sufficient, or misunderstanding the importance of disease-specific surveillance. Additional reasons may be inability of schedulers to contact patients to schedule visits or poor follow up by clinicians and schedulers of patients who no-showed. Potential strategies to decrease loss to follow up include improved communication to patients regarding the importance and structure of home monitoring in the setting of COVID-19 and clear documentation of no shows and requests to schedulers for patient outreach.

Occasionally, patients or providers were unable to connect to the telehealth video interface. In these instances, phone visits were conducted. While office staff contacted patients to troubleshoot the application and IT staff were available for providers, nearly half the telehealth visits were conducted over the phone. Superiority of video visits over telephone visits for patient comprehension has previously been

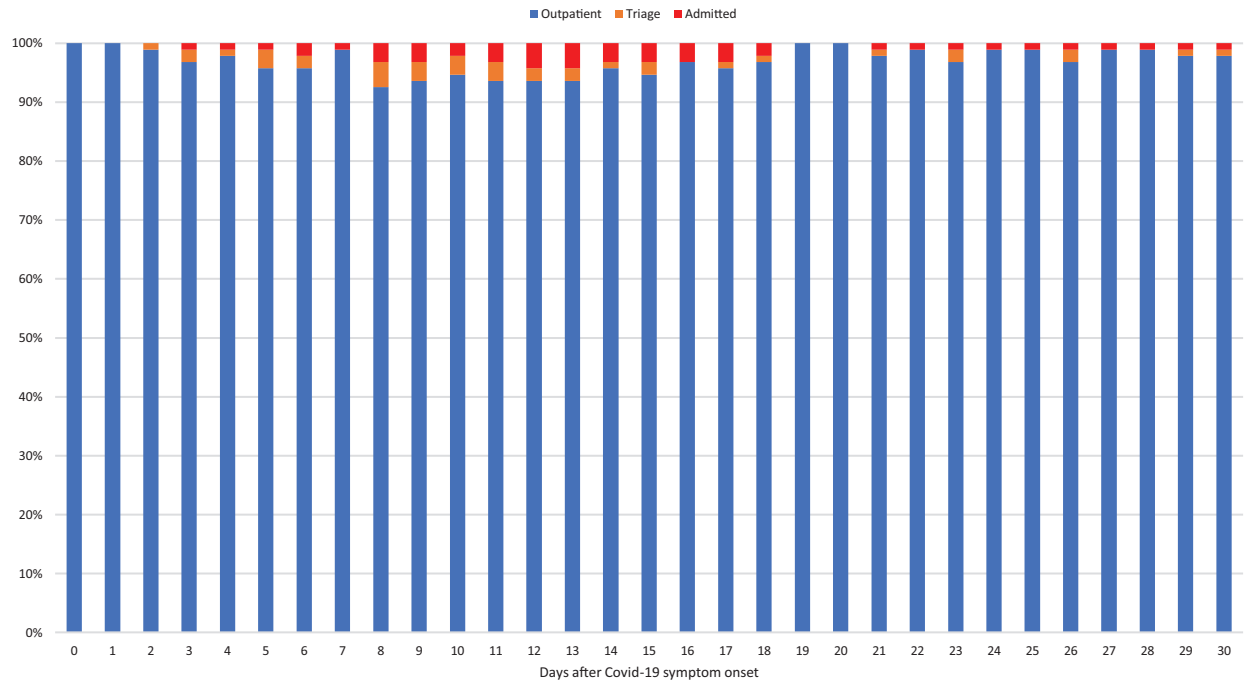

Fig. 2 – Percent of patients in each level of care (outpatient management, triage or emergency department, inpatient admission) by days after symptom onset.

demonstrated.[21,22] Additionally, phone visits limit the provider's ability to perform a virtual physical exam. In the case of COVID-19, this included gauging general appearance, assessing respiratory effort, and ensuring the correct measurement of vital signs. Thus, technological difficulties surrounding patients' use of the video technology was a significant barrier.

The majority of patients remained in outpatient management throughout the course of illness (Fig. 2). Twenty-six percent of patients required inpatient evaluation. Cases in which patients self-presented (i.e., were not sent from telemonitoring) with COVID-19 complaints may serve as illustrative tools. One patient came in with fever, myalgias and shortness of breathing during the 72 hours between virtual visits and required admission. Another patient presented with worsening symptoms during a 24-hour interval between visits. This reflects how rapidly a patient with COVID-19 can deteriorate, as well as the importance of patient education regarding in-person presentation and utilizing the patient arrival protocol. There may be a role for closer monitoring (ex: every 24 or 48 hours) versus every 72 hours, particularly in the first two weeks after symptom onset.

Telehealth monitoring lessons learned and future directions

Building on previous telehealth models and reflecting on a single center's rapid implementation of telehealth monitoring, several best practices emerge Fig. 3). A specific advantage to telehealth during an infectious public health crisis is its inherent ability to reduce disease spread via remote care. In keeping with this, developing a protocol

Fig. 3 – Telehealth monitoring lessons learned.

by which triage and inpatient teams are alerted to the arrival of a patient with suspected or confirmed illness and ensuring patients follow these protocols can reduce exposure. In order to further promote awareness of public health policies, the closing of each visit during a pandemic should include a summary of the most recent guidance for hygiene and isolation.

As with any new program, communication of new workflows and protocols can be challenging. The task of emailing regarding any patient with suspected or confirmed COVID-19 was an added duty to already overburdened providers but was critical in identifying patients who would benefit from virtual monitoring. A note template and a step-by-step guide including program algorithms proved essential for rapid provider training.

Whether during or outside of a pandemic, a clear referral pattern is critical to capturing patients that would benefit from telehealth surveillance. This should be circulated widely to providers at the main entry points to care such as obstetric triage, the emergency department, clinics, ultrasound units, and call centers. Once referred, patients should be supported by dedicated schedulers and readily available information technology support for enrollment and installation of the telehealth technology platform.

Providers should be trained in telehealth and in the specific aims of and clinical knowledge required for a disease-specific clinic. They, too, require technology support as well as translation services, ideally built into the telehealth technology platform. Standardized symptom monitoring and escalation of care algorithms and note templates can assist in quality assurance among providers. The benefits of a lean staffing team should not be overlooked as this diverts as few providers as possible to monitoring efforts and enables program flexibility. Scalability, particularly in the face of an unknown peak number of patients, is paramount. A team headed by an attending physician who oversees several fellows, residents, or advanced practice providers worked well and could easily be scaled up or down according to patient load.

Whenever possible, RPM should be leveraged to augment the objective information able to be garnered virtually. Vital sign data can help corroborate subjective data and assist in clinical decision-making required to safely recommend continued outpatient surveillance or escalate care. In obstetrics, remote fetal monitoring would be useful as well, allowing not only for assessment of fetal well-being but also for further maternal evaluation via this additional vital sign. While a widely validated remote fetal monitoring device does not currently exist, multiple devices are gaining traction and fetal monitoring may be able to be integrated into virtual clinics of the future.[23]

Like many telehealth programs created in response to COVID-19, this virtual COVID-19 clinic was an expeditious response to a looming threat.[24,25] In the fast-paced implementation of a program, frequent evaluation is crucial. Program reviews should encompass both the overall panel of patients as well as intermediate outcomes such as loss to follow up, adherence to program standards and algorithms, appropriateness of escalations and discharges and ratio of providers to patients. The program should be designed from the outset with clinical outcomes and performance measures in mind, and they should be tracked for real-time program analysis. This continuous improvement process provides a space to adjust to the needs of both the patient population and the pandemic.

Telehealth will undoubtedly remain firmly embedded in obstetric care delivery models long past the peak of this pandemic. Future directions for virtual obstetrics include continued evaluation of patient satisfaction and experience of telehealth visits compared to in-person care, particularly in the wake of a pandemic. Previous studies have shown the cost-effectiveness of outpatient telehealth surveillance versus standard of care in obstetrics.[26] A similar cost-effective analysis for COVID-19-monitoring, including benefits of reduced disease burden, should be undertaken. Cost-effectiveness analyses may help support advocating for televisit reimbursements or parity in billing for certain visit types between in-person and telehealth visits. Finally, integration of telehealth monitoring into disease tracking measures such as self-reporting applications or contact tracing could increase patient access to care while upholding social distancing.

In many ways, COVID-19 forced telehealth, primed for the challenge, into mainstream clinical care. In turn, telehealth helped flatten the curve of the pandemic by enabling remote patient care. Telehealth offers a unique and effective surveillance strategy. The experience of designing and implementing a virtual COVID-19 clinic demonstrated its effectiveness in monitoring patients with mild symptoms, allowing for close patient monitoring, efficient patient interaction with the health system, readily available escalation of care, and minimal provider exposure.

Declaration of Competing Interest

The authors have no conflicts of interest to disclose.

Funding

The authors have no sources of funding to disclose.

REFERENCES

1. Centers for Disease Control and Prevention. COVID-19 Cases, Data, & Surveillance, Cases in the U.S. Retrieved from: https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/cases-in-us.html
2. NYC Health. COVID-19: data, cases, hospitalizations and deaths. Retrieved from: https://www1.nyc.gov/site/doh/covid/COVID-19-data.page
3. Oommen J. Video consultations for triage of patients with COVID-19. *BMJ*. 2020;369:m1583.
4. Novet, J.Cisco says Webex video-calling service is seeing record useage too, even as competitor Zoom draws all the attention. CNBC: Tech. Retrieved from: https://www.cnbc.com/2020/03/17/cisco-webex-sees-record-usage-during-coronavirus-expansion-like-zoom.html
5. Lanssens D, Vandenberk T, Thijs IM, Grieten L, Gyselaers W. Effectiveness of telemonitoring in obstetrics: scoping review. *J Med Internet Res*. 2017;19(9):e327.
6. ACOG Committee Opinion Number 798: implementing telehealth in practice. *Obstet Gynecol*. 2020;135(2):493–494.
7. Tobah YSB, Leblanc A, Branda M, Inselman J, Gostout B, Famuyide A. OB Nest—a novel approach to prenatal care. *Obstet Gynecol*. 2016;127: p7S-8S.
8. Leighton C, Conroy M, Bilderback A, Kalocay W, Henderson JK, Simhan HN. Implementation and impact of a maternal-fetal medicine telemedicine program. *Am J Perinatol*. 2019;36(7):751–758.
9. Xie W, Dai P, Qin Y, Wu M, Yang B, Yu X. Effectiveness of telemedicine for pregnant women with gestational diabetes mellitus: an updated meta-analysis of 32 randomized controlled trials with trial sequential analysis. *BMC Pregnancy Childbirth*. 2020;20(1):198.
10. Hauspurg A, Lemon LS, Quinn BA, Binstock A, Larkin J, Beigi RH, Watson AR, Simhan HN. A postpartum remote

hypertension monitoring protocol implemented at the hospital level. *Obstet Gynecol*. 2019;134(4):685–691.
11. Cruz J, Brooks D, Marques A. Home telemonitoring in COPD: a systematic review of methodologies and patients' adherence. *Int J Med Inform*. 2014;83(4):249–263.
12. Cowie MR, Lobos AA. Telemonitoring for patients with heart failure. *Can Med Assoc J*. 2012;184(5):509–510.
13. Ben-Assa E, Shacham Y, Golovner M, Malov N, Leshem-Rubinow E, Zatelman A, Oren Shamir A, Rogowski O, Roth A. Is telemedicine an answer to reducing 30-day readmission rates post-acute myocardial infarction. *Telemedicine and e-Health*. 2014;20(9):816–821.
14. Eron L. Telemedicine: the future of outpatient therapy? *Arch Clin Infect Dis*. 2010;51(S2):S224–S230.
15. Breslin N, Baptiste C, Gyamfi-Bannerman C, et al. COVID-19 infection among asymptomatic and symptomatic pregnant women: Two weeks of confirmed presentations to an affiliated pair of New York City hospitals. *Am J Obstet Gynecol MFM*. 2020 100118. [Published online ahead of print, 2020 Apr 9].
16. Hollander JE, Carr BG. Virtually perfect? Telemedicine for COVID-19. *N Engl J Med*. 2020 Epub ahead of print https://www.nejm.org/doi/full/10.1056/NEJMp2003539.
17. Spiegelman J, Krenitsky NM, Syeda S, Sutton D, Moroz LM. Rapid development and implementation of a COVID-19 telehealth clinic for obstetric patients. *NEJM Catalyst*. 2020 in press.
18. Centers for Disease Control and Prevention. Social distancing, quarantine, and isolation. Retrieved from: www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/social-distancing.html
19. American College of Obstetricians and Gynecologists. Hypertension in pregnancy: executive summary. *Obstet Gynecol*. 2013;122(5):1122–1131.
20. American College of Obstetricians and Gynecologists. Antepartum Fetal Surveillance: Practice Bulletin No. 145. *Obstet Gynecol*. 2014;124:182–192.
21. Lion KC, Brown JC, Ebel BE. Effect of telephone vs video interpretation on parent comprehension, communication, and utilization in the pediatric emergency department. 2015; 169:1117-25.
22. Voils CI, Venne VL, Weidenbacher H, Sperber N, Datta S. Comparison of telephone and televideo modes for delivery of genetic counseling: a randomized trial. *J Genet Couns*. 2018;27:339–348.
23. Houzé de l'Aulnoit A, Boudet S, Génin M, Gautier PF, Schiro J, et al. Development of a smart mobile data module for fetal monitoring in e-healthcare. *J Med Syst*. 2018;42(5):83.
24. Artandi M, Thomas S, Shah NR, Srinivasan M. Rapid system transformation to more than 75% primary care video visits within three weeks at Stanford: response to public safety crisis during a pandemic. *NEJM Catalyst*. 2020 Published online April 21.
25. Mehrotra A, Ray K, Brockmeyer DM, Barnett ML, Bender JA. Rapidly Converting to "Virtual Practices": Outpatient Care in the Era of COVID-19. *NEJM Catalyst*. 2020 Published online April 1.
26. Morrison J, Bergauer NK, Jacques D, Coleman SK, Stanziano GJ. Telemedicine: cost-effective management of high-risk pregnancy. *Manag Care*. 2001;10(11):42–46: 28-9.