

Commentary

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The care of pregnant women during the COVID-19 pandemic – response of a large health system in metropolitan New York

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Abstract: The rapid progression of the coronavirus disease 2019 (COVID-19) outbreak presented extraordinary challenges to the US health care system, particularly straining resources in hard hit areas such as the New York metropolitan region. As a result, major changes in the delivery of obstetrical care were urgently needed, while maintaining patient safety on our maternity units. As the largest health system in the region, with 10 hospitals providing obstetrical services, and delivering over 30,000 babies annually, we needed to respond to this crisis in an organized, deliberate fashion. Our hospital

footprint for Obstetrics was dramatically reduced to make room for the rapidly increasing numbers of COVID-19 patients, and established guidelines were quickly modified to reduce potential staff and patient exposures. New communication strategies were developed to facilitate maternity care across our hospitals, with significantly limited resources in personnel, equipment, and space. The lessons learned from these unexpected challenges offered an opportunity to reassess the delivery of obstetrical care without compromising quality and safety. These lessons may well prove valuable after the peak of the crisis has passed.

Keywords: COVID-19; coronavirus in pregnancy; large health system.

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Introduction

Northwell Health is the largest health system in the north-east, comprised of 23 hospitals. Annually, over 30,000 babies are delivered at hospitals in the organization. The 10 hospitals providing obstetrical care range in size and scope from community hospitals delivering 350 babies annually, to tertiary care centers, in which close to 8000 babies are delivered every year. Locations of the hospitals range from densely populated urban centers, to rural or suburban/exurban environments.

Our hospitals, all located in the metropolitan New York area, are in the epicenter of the coronavirus disease 2019 (COVID-19) pandemic in the United States. A coordinated response was essential because of the large number of obstetrical patients, the demographic and clinical diversity of the hospitals, and the great impact of the developing COVID-19 medical crisis. We describe here the experience and lessons learned from our hospital system OBGYN Service Line's response to the challenges of the COVID-19 pandemic, all occurring in the short time frame from early March to the end of April 2020, the time of this report. The challenges of the pandemic remain ongoing.

The first two patients with COVID-19 were diagnosed in New York City by March 3, 2020. With these first cases, although non-obstetrical, we recognized the urgent need to prepare our staff, patients, and facilities in both the ambulatory and inpatient settings, for the potential impact on the obstetrical service.

The impact of the regional effects of the crisis was recognized soon thereafter, and by April 1, there were 2426 patients with coronavirus admitted to hospitals within the Northwell Health System, 27% of whom required care in intensive care units (ICUs) (Northwell Health data).

Although pregnant women appear to have similar clinical sequelae of COVID-19 infection as seen in non-pregnant women [1, 2], the data are limited [3]. Because of the speed and spread of the pandemic and the prevalence of COVID-19 infection in our communities, care of pregnant women in our area required a unique and coordinated response. With time, most of our hospitals became majority "COVID hospitals", with 90% of inpatients positive for COVID-19, and the greatest numbers of other inpatients having obstetrical diagnoses. The demand for hospital beds and space increased rapidly,

with considerable impacts on the functionality of the obstetrical service.

Strategies for the prenatal, triage, labor and delivery, and the postpartum periods were developed to respond to the needs and safety of this particular group of women and their newborns. These progressive efforts are described below, and are illustrated in the timelines in Figure 1.

Communication

We learned early in the crisis the importance of close and frequent communication with patients and with staff members. Communication needed to be simultaneously educational, logistic, strategic, and supportive, because we were dealing with two epidemics: COVID-19 and the resulting fear. Both represented significant, new challenges. The obligation to provide safe and effective patient care, while responding to the understandable fears of both staff and patients, informed our responses in communication, testing, and scheduling work hours and patient visits. Expedited remote access for staff was an early response to the crisis. In mid-March, non-essential staff were asked to work from home, and they continue to do so at the time of this report.

In early March all meetings became virtual, using either the ZOOM or MICROSOFT TEAMS platforms. Interactions via remote communication were held each morning with the Chairs of Obstetrics and Gynecology and the Directors of Maternal-Fetal Medicine (MFM) for each hospital. These meetings were physicians only while most others were multidisciplinary, as nursing leadership and participation were critical. Statistics for COVID-19 patients were reported, including the total number of patients admitted to each facility, as well as any COVID-positive obstetrical admissions, whether they were antepartum, or patients admitted for delivery.

These virtual sessions were used to develop strategies for a standardized system-wide approach to the clinical management of COVID-positive pregnant patients. To address the varying capabilities and needs of each department, guidelines were vetted with Infection Control and Nursing Leadership. Our pre-COVID communication strategies, embedded in our OBGYN Service

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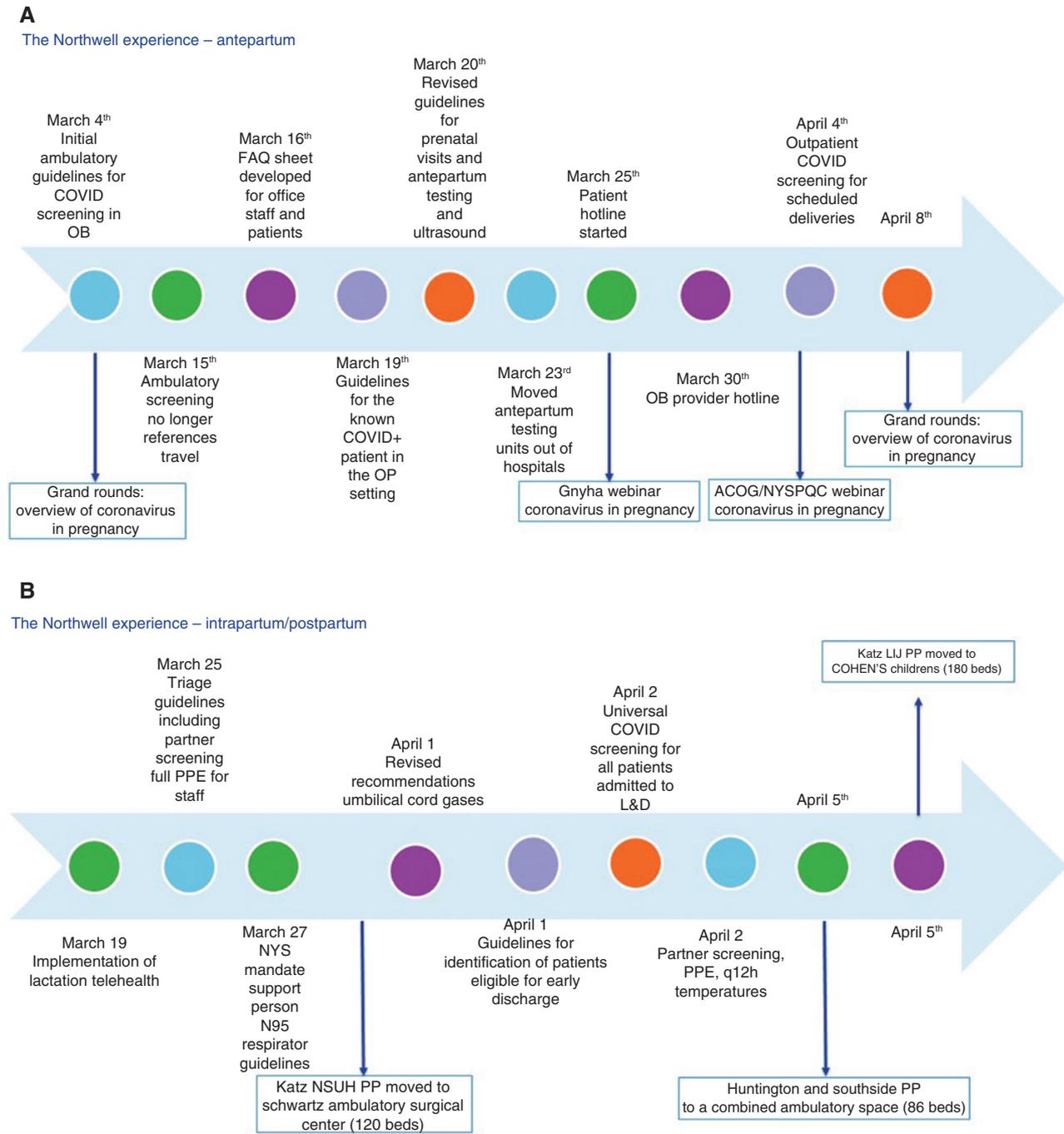


Figure 1: The Northwell experience. (A) The Northwell experience: antepartum. (B) The Northwell experience: intrapartum/postpartum.

Line, facilitated formal daily communication, with the ability to report accurate data in real time. Structurally, prior to the pandemic, the OBGYN service line leadership teams participated in a multidisciplinary weekly Safety Call with physician and nursing leadership from each hospital; a monthly Chairs’ and OB Leadership meeting; system-wide monthly quality improvement meetings; and a network of electronic mail, widely used for critical

information sharing. These preexisting platforms made the structure and process of accurate communication sharing less complex, and were readily in place when needed when the pandemic began to greatly affect our area. With the continuously evolving nature of the pandemic, guidelines required frequent revision, sometimes daily. The availability of appropriate personal protection equipment, viral polymerase chain reaction (PCR)

testing, and testing of asymptomatic patients presenting for delivery were examples of constantly evolving practices making the need for rapid communication and dissemination of new information essential.

Weekly calls were held with the members of the MFM divisions throughout Northwell. The objective was to develop clinical protocols for the care of pregnant women and consistent guidelines for antenatal care and prenatal diagnosis. Specific cases, including pregnant and postpartum women who were critically ill, were presented to share in our developing knowledge of the natural history of COVID-19 in pregnancy.

The system for maternal transports, coordinated through the Northwell Transfer Center, as part of our function as New York State Regional Perinatal Centers, continued to facilitate the maternal-fetal transport process during the crisis. The Northwell Transfer Center serves all of our hospitals and provides comprehensive services including the initial call, conference calling among nurses and physicians at the sending and receiving sites, and dispatching Northwell ambulances with an emergency medical team (EMT). The existing algorithm for maternal transports during the pandemic was revised to incorporate input from critical care and infectious disease specialists. Critically ill pregnant women were also transferred from overwhelmed ICUs to other ICUs in hospitals where the appropriate services were available with less resource strain.

From the beginning of the pandemic, weekly virtual meetings were held for the entire obstetrical staff, including both Northwell employed and private faculty, to ensure that all were fully aware of the current environment and clinical management recommendations, and to provide ample opportunity for sharing concerns. Agendas included patient care guidelines, recommendations for use of personal protective equipment (PPE), and physician staffing allocation and redeployment to rapidly address changing needs.

A patient hotline was created to address concerns of expectant mothers in the community, available to all, whether registered to deliver in a Northwell facility, or not. More than 40 volunteers, comprised of nurses, physicians, physician assistants, midwives, and nurse practitioners, were trained to answer calls. A sheet of “frequently asked questions” (FAQs) was developed, updated every few days and was also available on the Northwell website. The hotline was active by March 24, and by April 17, 2020, over 300 calls from patients have been received.

By the third week of the crisis, a physician hotline was also developed. A 24/7 call schedule was created in which an MFM specialist was identified at each hospital as a resource to answer questions from obstetricians in each community regarding COVID-19 in pregnancy.

In order to quickly address changing guidelines and evolving information, a variety of communication strategies were implemented including OBGYN service line email status updates and an OBGYN App, a digital repository of guidelines, educational resources, and Just-in-Time Updates. Individual hospitals developed their own innovative ways of updating staff; for example, a “Town Square” monitor in one labor and delivery lounge broadcasts new information to the obstetrical staff.

Virtual Obstetrical Grand Rounds, held over the ZOOM platform, were dedicated to discussing management of challenging cases of COVID-19 in pregnancy and any changes in Northwell obstetrical guidelines or logistics. Interestingly, there were over 250 attendees (physicians, nurses, physician assistants, nurse practitioners) for these virtual meetings, far exceeding attendance at previously held “in person” Grand Rounds, which had averaged approximately 70 staff members per session. Increased physician and staff engagement may be one positive outcome of this crisis – if virtual grand rounds prove more satisfactory to clinicians, these may continue even after social distancing protocols are relaxed.

With over 400 physicians and ambulatory and hospital staff providing obstetrical care in our health system, constant, factual, and transparent communication was essential. This was enhanced by collaboration with regional MFM physicians, local hospital associations, and professional organizations including the Greater New York Hospital Association (GNYHA), District II of the American College of Obstetrics and Gynecology (ACOG), and the New York State Perinatal Quality Collaborative. Northwell physicians from the Obstetrical and Maternal-Fetal Medicine services shared our experiences, and learned from those of others in the area, in a series of webinars given by ACOG District II and the GNYHA. These collaborations are ongoing as the presence of COVID-19 in other areas of the United States begins to peak and practices are shared to promote patient and staff safety.

General guidelines for staff and patient protection

OBGYN System Guidance regarding screening and isolating potentially COVID-19 infected patients was first implemented on March 4, 2020. Screening was initially focused on travel history and contacts, and an “Ask and Mask” protocol was implemented. By March 15, the process was changed to “Mask and Mask” as travel and contact history became less relevant, and as locally identified cases

suggested community spread, and once asymptomatic transmission was suspected. The new policy required all staff and patients to wear surgical masks. Clinical screening was implemented in both hospital and ambulatory care settings, focusing on symptomatology consistent with COVID-19 disease [4].

Initially, based on the Center for Disease Control (CDC) guidance, a 14-day quarantine was required for staff directly exposed (within 6 feet for more than 10 min) to PCR-positive COVID-19 patients, whether or not the staff member was visibly ill, febrile, symptomatic, or asymptomatic. After universal masking of patients and staff, the quarantine policy was revised, based on revised information from the CDC. Exposed staff were no longer asked to quarantine. Staff who developed COVID-19 infection could return to work 7 days after diagnosis or onset of symptoms, if they were afebrile and had improving symptoms for at least 72 h [5].

Prenatal care

In order to reduce potential exposures to staff and patients, changes were made to the guidelines for frequency of prenatal visits, ultrasound examinations, and antepartum testing [4, 6, 7]. These guidelines were individualized for patients based upon their history and co-morbidities, as well as institutional practices. Although available services and access to providers may have varied at each site, conformity to revised guidelines was emphasized. Social distancing was reinforced for staff and patients at all sites.

Telehealth and telemedicine in the COVID-19 area have been described [8], and were integrated into OBGYN practices early on, in response to the needs of our patients for prenatal visits and MFM consults. Counseling resources were “fast-tracked” so that all genetic counseling and diabetes education sessions are currently performed via telehealth. Since March 16, there have been 250 tele-diabetes and 36 tele-genetics consultations.

At two tertiary care facilities, the prenatal diagnostic centers were located in the hospital. In response to the need for hospital space for COVID-19 patients, these centers were relocated to ambulatory sites. Although this required a significant amount of logistic support and manpower, it allowed the vacated spaces to be converted to surge units for COVID-19 patients. A positive outcome resulted from this move, as pregnant patients fearful of entering hospitals could now receive the care they required in a setting that felt less threatening to them, outside of the hospital.

Ultrasound schedules were reviewed in advance of visits, to enhance conformity with established guidelines revised for use during the pandemic. Changes in

obstetrical ultrasound scheduling were based on identifying an appropriate frequency of evaluation, combining ultrasounds with office visits, and eliminating ultrasound examinations when alternative information was obtainable. For example, patients were offered the option of non-invasive prenatal screening in lieu of a nuchal translucency ultrasound, provided that a first trimester dating ultrasound had been performed. Previously, all patients had transvaginal sonographic (TVS) cervical lengths at the time of the 20-week ultrasound. To reduce time spent in the ultrasound unit, and traffic between rooms, the approach to cervical length was modified to a contingent process, in which TVS was performed only in selected cases, based on patient history and concerning cervical findings on transabdominal ultrasound. Revised guidelines for fetal anatomical surveys were based on recommendations developed by the Society for Maternal-Fetal Medicine (SMFM) and American Institute of Ultrasound in Medicine (AIUM) [9]. Serial fetal growth studies were performed every 6 weeks, rather than the previous interval of every 4 weeks, when it was felt safe to do so based on the patient’s condition. After a review of outcome analysis of these revisions in our guidelines, these changes may become a permanent part of our scheduling protocols for prenatal diagnosis. It is also probable that the free standing prenatal diagnostic centers will remain a viable and preferable option, more convenient for patients, and less costly than a center occupying hospital space.

Because of the length of many obstetrical ultrasound procedures, proximity to patients, and the high prevalence of asymptomatic COVID-19 in patients in our communities, from mid-March, all of our sonographers wore N95 masks and gloves.

Similarly, we adopted changes in our paradigm for antepartum testing. We reviewed the frequency of testing based on indications and level of risk. Wherever possible, biophysical profile testing was selected over non-stress testing and once weekly was preferred over twice weekly testing, when it was determined to be safe to do so [6]. A separate area for the performance of ultrasounds and antepartum testing was identified for patients with known COVID-positive status.

The emergency departments of our hospitals were filled with patients with symptoms of COVID-19, which presented challenges for obstetrical patients who required urgent evaluation and care for obstetrical or other complaints. In response to the concern of exposure of obstetrical patients to these crowded and sometimes chaotic environments, regional OBGYN urgent care centers were established in OBGYN offices across the system to decant the emergency room volume and provide a location where

care could be rendered for the obstetrical population. These urgent care centers were staffed by OBGYN physicians and ambulatory staff.

Obstetric triage

To reduce exposures for patients and triage staff, protocols for COVID-19 screening, isolation, testing, and use of PPE in the obstetrical triage unit were established early (Figure 2). Once there was evidence of community transmission, screening focused on symptoms of respiratory disease and fever. As information suggested a high prevalence of asymptomatic carriers, on April 2, we began a program of COVID-19 PCR testing for all women presenting to our hospitals for delivery. In the first week of testing, over 300 women were tested. In one tertiary hospital, in an urban environment, 22% of patients tested positive for COVID-19, of whom 24% were symptomatic on presentation. At a nearby, but more suburban tertiary hospital, 11% of patients tested positive, of whom 36% were symptomatic on presentation (unpublished data). The apparent differences in prevalence are likely due to differences in patient demographics, such as race and population density. The awareness of a not insignificant false-positive rate led us to continue the “mask and mask” policy, even in patients who were tested PCR negative.

The start of the screening program was useful in allaying staff fears, in conservation of limited PPE supplies, and in appropriately cohorting COVID-positive patients in the postpartum area, particularly after patients were moved to an area outside the main hospital in the immediate postpartum period.

Labor and delivery

Our main concern has been providing a safe environment for patients and staff with appropriate use of PPE. There has been some controversy as to whether or not the second stage of labor represented an aerosolizing event [9, 10]. This concept was highlighted in a letter to the CDC from ACOG, SMFM, and other societies, advocating the use of full PPE in the second stage of labor. To reduce this potential risk, at Northwell hospitals, all staff present during labor and delivery wore full PPEs, including N95 masks. Once COVID-19 testing was universal, the use of full PPE could be more selective, based on symptoms, fever, and COVID-19 PCR results.

The issue of visitors during labor and delivery has been controversial. Decision making regarding allowing the presence of visitors was initially individualized based on institutional concerns and capacity. In most of our institutions, labor and delivery excepted, no visitors were allowed. On March 27, the Governor of New York and the

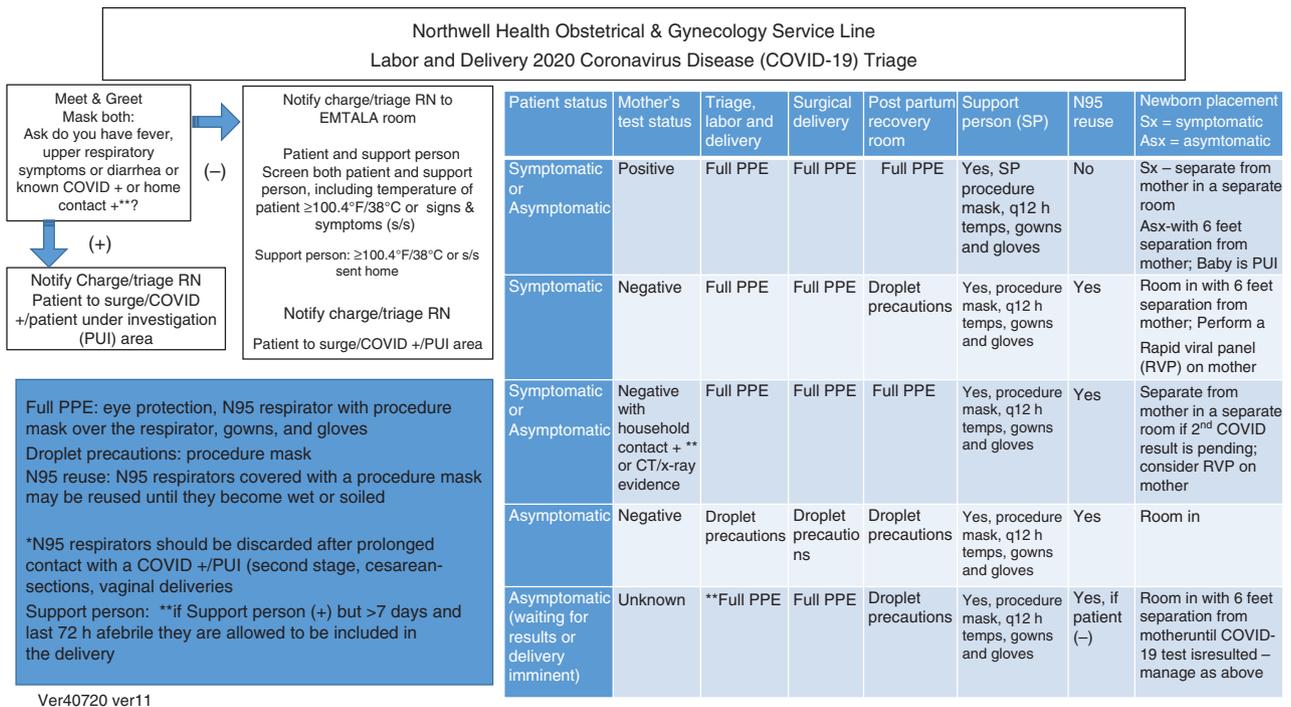


Figure 2: Triage algorithm for PPE for staff on labor and delivery – April 7, 2020.

NYS Department of Health mandated that patients were allowed one support person, for labor, delivery, and the immediate post-partum period [11]. For weeks, a labor support person was the only visitor allowed in any of our hospitals.

The primary aim of many of our actions was to limit traffic on our units, and to reduce the number of practitioners involved in each case. This was true for all personnel, including the anesthesia support team [12], medical students, and other trainees.

Concordant with this philosophy, several of our obstetrical units adopted a new coverage model, first occurring at one of our tertiary hospitals on March 21. Prior to that time, obstetrical care was delivered by a hybrid model of voluntary and full-time faculty obstetricians who delivered their “own” patients. Voluntary obstetricians are community physicians working in a “fee for service” model. Full-time faculty obstetricians are salaried clinical and teaching employees of Northwell, who see patients with either private or public insurance, and who may also oversee resident clinics as part of their responsibilities. Subsequent to this change in obstetrical coverage, a team of three obstetricians, now serving as laborists, delivered all patients regardless of where they received prenatal care, and independent of insurance coverage. This reduced the on-call frequency for each obstetrician compared with the previous model, and limited traffic on labor and delivery. The timing of the initiation of the laborist coverage model was fortuitous, as it coincided with the necessary redeployment of obstetrical residents and fellows.

Each one of the Labor and Delivery units identified an operating room on labor and delivery that was dedicated to the care of COVID-19-positive women. Labor-delivery-recovery (LDR) and operating rooms were terminally cleaned after each delivery of a COVID-positive patient.

Postpartum care

As our hospitals became increasingly filled (~90%) with COVID-19 patients, the demand for bed capacity resulted in a rapid, progressive diminution of almost all postpartum beds. To put this in perspective, at one tertiary hospital, with 6700 annual deliveries, bed capacity was reduced from 73 to only 13 beds. This required urgent and effective action. We established, in discussion with our pediatric colleagues, practices related to infection control, infant distancing, appropriate PPE, and lactation support in addition to expediting early discharges – at 24 h for uncomplicated vaginal deliveries and 48 h for cesarean

deliveries. Due to requirements for newborn hearing tests, bilirubin, and congenital heart disease screening, discharge prior to 24 h was not feasible. Maternal and neonatal criteria checklists for early discharge were established (Tables 1 and 2).

However, early discharge soon became insufficient to meet the capacity demands of our large obstetrical service, necessitating a move of the majority of postpartum patients to another site on campus. On March 31, mothers were moved offsite with their babies by ambulette, at about 3 h postpartum. Only COVID-19 PCR-negative patients were transferred. The criteria described above for early postpartum discharge were modified and further restricted for patients who were to be moved out of hospital. The initial move done at one of our hospitals was followed shortly thereafter by moves of postpartum patients at three others. The modified repurposed locations varied from ambulatory surgery and endoscopy centers (which were unused during the pandemic) to space in a children’s hospital on campus.

In order to promote safety after early postpartum discharge, a system was instituted in which patients would be called on day 1 or 2 after discharge. A telehealth program for postpartum patients was developed using furloughed nurse practitioners and nurses. The telehealth program included traditional telephone calls and video visits for both postpartum mothers and newborns. An existing program which was initially developed for transition from hospital to home for older adults with specific diagnoses was revised to establish follow-up programs for the COVID-positive postpartum population. This remote postpartum program was utilized to address additional concerns around wellness, reinforcing infection control practices, lactation, and coordination of follow-up visits. Of course, for patients with postpartum issues requiring physical exam, an in-person office visit is arranged.

OBGYN service line contribution to Northwell and its general population of patients

Unlike other inpatient services, Obstetrics continued to function even as the COVID census across the hospital system increased at a pace exceeding available resources such as bed space and laboratory testing. The OBGYN Department was asked to contribute resources to support the strain on the system. This was accomplished by evaluating the necessity of our standard practices including

Table 1: Obstetric protocols for early postpartum discharge (EPD): NSVD checklist.

Question	Yes	No
Preterm delivery <37 weeks?		
Chorioamnionitis or fever >100.4 at any time during hospitalization?		
Any blood pressures $\geq 140/90$?		
Estimated blood loss >500 mL?		
Perineum/uterine/breast examination abnormal?		
Any requirement for IV medication for pain control?		
Any issues with voiding/ambulating/tolerating regular diet?		
If GDM – Did antenatal glucose control require insulin or oral hypoglycemic medications?		
History of chronic hypertension, pre-gestational diabetes, or significant medical history?		
Ever required BP medication or magnesium sulfate?		
Hemoglobin <9 g/mL?		
Pre-pregnancy BMI >40 kg/m ² ?		

If any of the above responses are **yes**, it is **possible** that the patient may not be a candidate for discharge at 24 h post NSVD, and **further evaluation and individualization is warranted**. These questions are meant as guidelines only, and are not meant to replace sound clinical judgment by the attending physician. NSVD, normal spontaneous vaginal delivery; GDM, gestational diabetes mellitus; BMI, body mass index.

Table 2: Newborn protocol for early discharge: checklist.

Question	Yes	No
Full-term delivery?		
EOS Score ≤ 1 , and no maternal fever ≥ 100.4 during the labor/delivery?		
Has had at least 1 void and 1 stool?		
Has had 2 successful feedings (either breast or formula)?		
Weight loss $\leq 5\%$?		
Temperature and vital signs normal in the past 12 h?		
Normal physical exam, or minor abnormality that doesn't require further hospitalization?		
If on glucose protocol, has had 5 glucose checks, with the last 3 glucose checks ≥ 46 ?		
No bleeding at circumcision site within the past 2 h?		
The following has all been given: Vit K, eye ointment. Hepatitis B vaccine (with consent)?		
No social concerns?		
Outpatient pediatrician identified and plan for follow-up made?		

If any of the above responses are no, the patient **may** not be a candidate for discharge at 24 h post normal spontaneous vaginal delivery (NSVD), and **further evaluation is warranted**. These questions are meant as guidelines only, and are not meant to replace sound clinical judgment by the attending physician. EOS, early-onset sepsis.

length of stay, routine blood work, and follow-up. To eliminate laboratory burden, guidelines for routine cord blood gases were revised to certain clinical indications. Routine complete blood counts done on day 1 after uncomplicated vaginal deliveries were eliminated. These changes required careful evaluation of maintaining patient safety and security for both the mothers and newborns.

Summary

The unusual and significant demands of the COVID-19 pandemic required a rapid, flexible response from our large health system. The ability to quickly and effectively meet

these challenges and to respond with major changes in short time intervals was promoted by a multidisciplinary approach and frequent and effective communication. The already established lines of communication among hospitals, shared guidelines, maternal transport mechanisms, and the range of support of tertiary hospitals for regional community hospitals facilitated our rapid and organized response.

Lessons learned in the course of responding to this challenge will likely be valuable in the post-COVID-19 period and should guide responses by obstetric services to future pandemics, or to other unexpected crises. Early postpartum discharge guidelines with appropriate planning and patient selection may be a safe and desirable practice that becomes the new standard of care. Our skill

set in telehealth was advanced out of necessity, but may become a standard for efficiency and patient convenience and satisfaction going forward. The unexpected and rapid creation of a laborist model was also born out of necessity. Common in many centers, but new to many of our hospitals, this model may persist in our health system, as an efficient approach to women during the labor and delivery process and serve as a means of reducing unnecessary variation in obstetrical care. The most important and enduring lesson that we learned during this crisis was the value of working as a multidisciplinary team in a large, coordinated health system, which was valuable to us in optimizing a rapid, efficient, and safe system-wide response.

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