The Center for Peripartum Optimization:

An Innovative Approach to Care Coordination

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Precis

This article describes an innovative approach to coordinating care and improving maternal outcomes in a hospital system and the surrounding community.

ABSTRACT

Objective: Over the last 30 years, pregnancy-related deaths have more than doubled in the United States secondary to more parturients with complex medical comorbidities. We aim to provide care for all high-risk obstetric patients and patients with complex anesthetic histories at our institution.

Methods: We developed a Center for Peripartum Optimization (CPO) using a two-stage process mapping procedure. In the first stage, the departments of Anesthesiology, Gynecology and Obstetrics, Hematology, and Cardiology synchronized patient scheduling and developed a process for transfer of administrative and clinical information. In the second stage, the administrative team established a process map for patient progress through the system. Finally, we benchmarked resource requirements and clinical work outputs for each provider.

Results: Our CPO became operational in January 2017. High-risk patients are identified based on specific criteria and are seen in one of our outpatient clinics. Based on the patient's medical issues and needs, care is coordinated with the Obstetrics and Gynecology team and/or other specialties and may include additional testing, evaluation, and subspecialty consultation before admission. After all necessary information has been obtained, the CPO and obstetric team formulate a roadmap for the labor and delivery team, including obstetricians, anesthesiologists, and nurses, to reduce the risk from poor continuity of care often associated with handoffs.

Conclusion: We anticipate that optimizing a patient's clinical status in an outpatient setting will minimize unnecessary laboratory tests and studies, costly inpatient consultations, and inpatient admissions and reduce the likelihood of post-surgical adverse events, escalations in level of care,

and readmissions for certain patient populations. We also anticipate reductions in opioid utilization and improved patient and family satisfaction. We intend to extend the program into the surrounding health communities to coordinate care, reduce unnecessary outside hospital transfers, and facilitate early transfer of antepartum patients who require higher levels of care.

INTRODUCTION

Over the last 30 years, pregnancy-related deaths have more than doubled in the United States, from 7.2 per 100,000 live births in 1987 to 28 per 100,000 live births in 2013.[1] Reasons for this overall increase are unclear; however investigations have shown an increase in the number of pregnancies complicated by chronic health conditions.[2] Recently, Molina and colleagues[1] reported that maternal mortality is higher in the United States than in most high-income countries such as Canada (11 maternal deaths per 100,000 live births in 2013). The authors postulated that the most important cause of these findings may be the changing demographic and clinical characteristic of pregnant women, including increasing maternal age at first birth and changing prevalence of obesity, hypertension, and diabetes.[1] Hypertension, diabetes, heart disease, neurologic conditions, and bleeding disorders can be exacerbated and are often difficult to manage in conjunction with the physiologic changes associated with pregnancy.[3]

Traditionally, anesthesiologists have not seen their obstetric patients before their labor admission, and they seldom collaborate with obstetric colleagues to contribute to care coordination. It has been recommended that parturients, especially those with high-risk pregnancies, undergo antenatal anesthesia consultation to address options for delivery and peripartum comorbidity management. These clinic visits prove beneficial to the parturient, obstetrician, and anesthesiologist[3-5] by serving as a venue for patient education, improving preparation, and enabling providers to develop a coordinated care plan. A recent article by Shatalin and colleagues reported that among 241 patients who went to an anesthesia antenatal

high-risk consult clinic, 95% had their delivery management carried out as planned.[6] However, worldwide, the concept of coordinated care through high-risk antenatal anesthesia clinics has not been broadly adopted. A survey of practice in the United Kingdom revealed that only 30% of obstetric practices had dedicated antenatal high-risk pre-evaluation,[7] and in the United States, only 38% of respondents had an obstetric anesthesia clinic at their institution. Notably, most patients were referred to the anesthesia clinics by obstetricians.[8]

Preoperative consultation for high-risk patients before general surgery is common and has shown benefits for patient education in regard to perioperative medication and comorbidity management and expectations of perioperative pain and health-related quality of life in the post-recovery phase. Additional benefits include improved patient satisfaction[9] and optimization of communication between anesthesiologists and surgeons regarding patient care.[10-12] Though the benefits of perioperative consultation clinics in the general surgical population have been demonstrated in many studies,[7,10,13-19] no care model has yet focused on mitigating peripartum morbidity, reducing mortality risk, and enhancing care coordination in high-risk obstetric patients. It is challenging even to define what constitutes a "high-risk" obstetric patient. The National Institute of Child Health and Development defines a high-risk pregnancy as "one that threatens the life of the mother or the fetus."[20]

To address areas for improvement and coordination at the Johns Hopkins Hospital, the Division of Obstetric Anesthesia and the Department of Gynecology and Obstetrics created a unique coordinated care model designed to identify high-risk obstetric patients and ensure comprehensive peripartum care planning. Our Center for Peripartum Optimization (CPO) is a

comprehensive multidisciplinary clinic with the primary goal of improving care coordination and peripartum outcomes for our high-risk obstetric patients.

METHODS

Phase I of the Johns Hopkins Hospital's CPO was initiated in January 2017 with the goal of reaching 100% of high-risk obstetric patients with one or more conditions detailed in the inclusion criteria (**Table 1**) and those with a history of complications associated with prior anesthetic agents. Phase II extended the program into the Johns Hopkins Health System community by providing multidisciplinary consultation services to high-risk obstetric patients in an effort to partner in care coordination, reduce unnecessary outside hospital transfers, and facilitate early transfer of antepartum patients who require higher levels of care.

From the beginning, we understood that developing a peripartum operational clinical practice would require a collaborative cross-functional and multidisciplinary approach. From an operations management standpoint, we were able to determine how projected patient volumes in the outpatient clinic (ambulatory) setting were key to ensuring financial viability.

Our approach involved a two-stage process mapping procedure. The first stage required administrative collaboration across several departments (Anesthesiology, Gynecology and Obstetrics, Hematology, and Cardiology) to synchronize patient scheduling and develop a process for transfer of administrative and clinical information (**Figure 1**). This stage provided an overview of the process of synchronized patient care that involved a cyclical processing of the patient by each specialist/department (i.e., a process in which the patient cycles sequentially from

one specialist to the next based on care needs). The second stage required the administrative team to establish a process map for patient travel from "check-in to check-out to admission" (**Figure 2**). For this stage, we outlined the serial processing of the patient within the multidisciplinary outpatient (ambulatory) clinic setting (i.e., the patient moves serially from the obstetrician to the obstetric anesthesiologist in the same clinic setting and eventually to day of hospital admission).[21]

After our two-stage process mapping exercise, we benchmarked resource requirements and clinical work outputs for each provider (**Figures 1-2**). For Phase I, we determined that the clinic would require one obstetric anesthesiologist and one exam room for two sessions (one session = 4 hours) per day. Our obstetric colleagues provided the clinic space, registration staff, and medical staff for Phase I. With those resources in place, the Anesthesiology Department's administrative team conducted a financial analysis to include a break-even on number of consults to be seen per two-session clinic day.

The Anesthesiology Department's administrative team worked closely with Obstetrics administration on logistical details of setting up the clinic within the Johns Hopkins Electronic Health Record. Technical considerations included setting up the provider (to include 2 days' Epic Care Ambulatory training), provider schedule, and consult note templates, and establishing billing areas that would route to the correct billing department.

One month before the clinic's launch, we instituted marketing campaigns on multiple platforms: advertisements on hospital-wide television monitors, printed flyers, and brochures. The Division Chief of Obstetric Anesthesiology and departmental administrators shared the

printed flyers and brochures with the obstetricians and perioperative administration, who disseminated information via e-mail to their distribution lists. These lists included obstetricians, specialty surgeons, and general surgeons. We held meetings with the medical office coordinators who schedule for the surgeons and the Anesthesiology Preoperative Evaluation Center to promote a seamless referral to the CPO. To maximize efficiency and patient convenience, we decided to offer the clinic three full days a month on days corresponding with the high-risk obstetric clinical services.

The development of an electronic medical records platform to facilitate real-time communication between providers was key to enabling the coordination of care between the remote team members. All information, including treatment received and the peripartum care plan, is documented in the electronic medical records, clearly identified, and readily accessible by the labor and delivery team at the time of delivery. We established a contact list for those cases requiring subspecialty intervention, the appointments made, and recommended treatment completed prior to admission for delivery.

Of note, no validated assessments are available to identify patients at high risk for complications related to delivery. The CPO is in the process of implementing a peripartum screening tool designed to not only identify at-risk patients but to stratify and triage those patients to ensure timely and efficient evaluation and coordination of intrapartum and postpartum care plans. In addition, patients are identified through both direct referral and screening mechanisms. We deployed universal screening tools and processes to identify patients appropriate for preoperative clinic visits, testing, phone calls, and virtual education. We utilized

obstetric and fetal therapy clinic visits and virtual communications to optimize expectations and planning for delivery. Moreover, we utilized preoperative screening, visits, and virtual communications to optimize postpartum care, expectations, and pain management.

RESULTS

The CPO consultation service provides the obstetric anesthesiologist an opportunity to review the medical record and antepartum obstetric plan. With this information, he/she develops a tailored peripartum anesthetic and comorbidity management plan and facilitates the triage of patients who are in need of further testing, imaging, or consultative services.

The CPO model collocates care in the same outpatient clinic setting as the obstetric services. Once the obstetric anesthesia team has evaluated the patient, the anesthesiologist discusses patient-centered peripartum plans with the obstetricians and determines the required steps for patient optimization and specialty resource requirements. If additional subspecialty consultation is needed, it is scheduled at that clinic visit. Once all appropriate medical information is synthesized, the anesthesiologist develops a coordinated plan and informs the nursing coordinators to ensure that plans of care are within the expertise of the labor and delivery staff. Communication is efficiently achieved through the electronic medical record or Health Insurance Portability and Accountability (HIPPA)-protected email system. When large-scale coordination of multiple disciplines is required, a formal multidisciplinary conference is convened to ensure effective coordination of care. In all cases, the obstetricians, obstetric anesthesiologist, and nursing providers collaborate to develop a safe and effective peripartum

care plan. Though collaboration begins in the outpatient clinic setting during antepartum evaluation, the team seamlessly transitions to the labor and delivery setting for intrapartum and postpartum management.

Although guidelines exist for comorbidity management of specific medical conditions, special consideration is necessary when applying management protocols to the high-risk obstetric patient. For example, parturient physiology changes with each phase of pregnancy. In addition, practitioners need to carefully consider the influence of medications, anesthetic choice, and management strategies on the fetus.

Peripartum Planning

Patients are referred to the CPO directly by obstetric and surgical providers. They are identified based on the presence of high-risk comorbidities and are triaged based on gestational age, proximity to delivery date, and complexity of comorbidities. In most cases, patients are scheduled for consultation after viable gestational age has been achieved. For our institution this has been defined as 24 weeks and beyond. The exceptions to this rule include obstetric patients who need nonobstetric surgical clearance or fetal therapy, and patients whose disease process is severely impacted by the physiologic changes of pregnancy prior to viability and for whom termination of pregnancy or periviable delivery may be warranted for maternal indications.

For those obstetric patients who require evaluation for nonobstetric surgery, the CPO evaluates the patient and coordinates services, including obstetrics evaluation when necessary,

fetal monitoring, postoperative evaluation, and monitoring and counseling for anesthesia and pregnancy.

Risk Assessment, Optimization, and Care Coordination

Based on the presenting complaint, patients are evaluated for antepartum, intrapartum, and postpartum risk. Plans of care are focused on anticipating risk and optimizing medical status before delivery. Once the patient has been evaluated, the CPO in direct collaboration with the obstetric team forms a coordinated plan of care. The plan addresses not only the anesthetic management in the intra- and postpartum periods but also develops approaches to minimize potential harm in anticipation of potential complications and risk. This detailed coordinated care plan serves as a roadmap for the labor and delivery team including the obstetricians, anesthesiologists, and nurses. The plan is meant to not only minimize redundant work and testing, but also provide an effective summary of findings and consultative recommendations. Moreover, having a plan in place alleviates the risk associated with the poor continuity of care often encountered on labor and delivery units, where providers sign off in shifts and care plans may not be communicated clearly between the outpatient providers and the labor and delivery team. The care plan should provide guidance but should not limit providers or commit them to absolute management decisions.

DISCUSSION

The obstetric care setting is a unique clinical environment in that medical necessity involves a wide range of providers, including obstetricians, obstetric anesthesiologists, obstetric and perinatal nurses, neonatologists, and, not infrequently, subspecialty medical and surgical disciplines. These multidisciplinary teams provide care in the in-patient setting at the time of delivery. The focus is on intrapartum management, including obstetric emergencies, as measured by team assessment tools such as the Multidisciplinary Obstetric Simulated Emergency Scenarios (MOSES) and Perinatal Emergency Team Response Assessment (PETRA).[22,23] To our knowledge, no coordinated outpatient multidisciplinary obstetric teams currently exist.

The CPO is a novel concept because it involves a multidisciplinary team that coordinates longitudinal care among all stakeholder providers: from inpatient and outpatient antepartum settings to intrapartum and postpartum inpatient settings. The CPO is also unique with respect to goals of care in that it is intended to minimize peripartum risk through ongoing collaborative prenatal care of coexisting chronic diseases.

The interface of the CPO with patients and their families early in the gestational course allows for optimal patient care coordination and adds value. The CPO model has the potential to reduce healthcare waste from unnecessary laboratory tests, imaging studies, consultations, emergency triage, and inpatient admissions. Furthermore, by anticipating the patient's comorbidity and optimizing her clinical status before admission, practitioners can reduce the likelihood of postsurgical adverse events, escalations in level of care, intensive care unit admission, prolonged length of stay, hospital readmissions, and prolonged neonatal ICU length of stay for certain patient populations. Lastly, advanced planning and optimization of health

status prior to delivery allows for provision of intrapartum and postpartum care that engages the patient and her family, enables optimization of peripartum pain management that could potentially reduce opioid utilization, improves patient and family satisfaction, and reduces patient complaints and future liability claims.

To optimize patient safety and minimize costly urgent transfers of care, it is important to objectively identify resource availability within the hospital system. Based on the patient's medical status, risk assessment, and resource availability, a plan is devised to ensure safe intrapartum and postpartum management. Such a plan is critically important for patients who may require higher levels of care or advanced resources in the intrapartum or postpartum periods. Although our center is based in a large academic hospital with vast resources, our hospital system includes numerous community hospitals and satellite referral centers. Those community-based hospital systems have limited resources with regard to anesthesia providers, specialized in-house physicians, intensive care units, blood bank, interventional radiology, cardiac surgery, and more. Availability of these resources requires special consideration before delivery and is important in peripartum planning. Coordination of resources and planning is essential to ensuring appropriate and timely transfers, and avoiding late or unnecessary transfers of care.

Appropriate outpatient consultation and medical optimization should decrease hospital admission for unanticipated medical decompensation and improve medical status at the time of delivery. Furthermore appropriate planning and medical optimization decreases medical complications and exacerbations of comorbidities, thereby decreasing hospital length of stay and

escalations to higher levels of care (i.e., intensive care unit).[24] For these reasons the team defines success as reductions in hospital length of stay, cost of admission, and number of ICU admissions (**Appendix A).** Measuring clinical significance of this innovative model will involve the development of clinical metrics to measure impact on medical morbidity and mortality as well as financial implications of medical optimization, healthcare resource utilization, and patient satisfaction.

CONCLUSION

Because of increases in morbidity and mortality in the United States, we have implemented a new and innovative approach to coordinating care with the goal of improving maternal outcomes and adding value to our patients, families, and hospital. The CPO partners with our obstetricians and serves as a facilitator for coordinated care efforts. Our institution has a unique opportunity to provide a critical and coordinating role in the care and delivery of complicated high-risk obstetric patients within the hospital system and the surrounding community. With the success of this pilot, our next goal is to improve methods of identifying patients and classifying high-risk maternal indicators to capture 100% of our high-risk population.

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Table 1. High-risk conditions that warrant a Center for Peripartum Optimization consultation

Condition	Examples
Complex spine pathologies	Scoliosis, vertebral fusion, disc disease, spinal canal defects, neuropathies, nerve disease
Neurological pathology	Cerebral ischemia, tumor, increased intracranial pressure, cerebral vascular disease
Cardiac disease	Congenital, valvular, pulmonary hypertension, cardiomyopathy, ischemic disease, arrhythmia
Pulmonary disease	History of pulmonary embolism, interstitial lung disease, severe asthma, cancer
Morbid obesity	Obstructive sleep apnea, equipment considerations
Hematologic disorders	Thrombophilias, coagulopathies, patients on anticoagulation
Cancer	
Abnormal placentation	Previa, accreta / increta / percreta
Anesthetic concerns	Airway abnormalities, history of adverse anesthetic reactions or experiences (e.g., recall, anaphylaxis)
Fetal therapy patients requiring specialized management	Ex utero intrapartum treatment (EXIT), fetoscopic endotracheal occlusion (FETO), twin-to-twin transfusion syndrome (TTTS), percutaneous umbilical blood sampling (PUBS)
Chronic pain	

Table 2. Outcome measurements and measurement tools for the Center for Peripartum Optimization

Outcome Metrics	Definition / Measurement Tool
Tailored coordinated care plan developed	EPIC data
Hospital transfers	Patient-specific EPIC data
Peri- and postpartum adverse events	Patient-specific EPIC data
Intensive care unit admission	Patient-specific EPIC data
Opioid use/pain	Patient specific entries -EPIC
Length of hospital stay	Hospital finance/health insurance claims data
Patient satisfaction	HCAHPS scores; patient satisfaction surveys
Cost of hospital care	Hospital finance/health insurance claims data
Hospital readmissions	Hospital finance/health insurance claims data

HCAHPS, Hospital Consumer Assessment of Healthcare Providers and Systems.

Figure Legends

Figure 1. Multidisciplinary collaboration for coordinated management of the high-risk obstetric patient. CPO, Center for Peripartum Optimization; EHR, electronic health record.

Figure 2. Operational workflow for the Center for Peripartum Optimization. EMR, electronic medical record; MFM, Maternal Fetal Medicine.

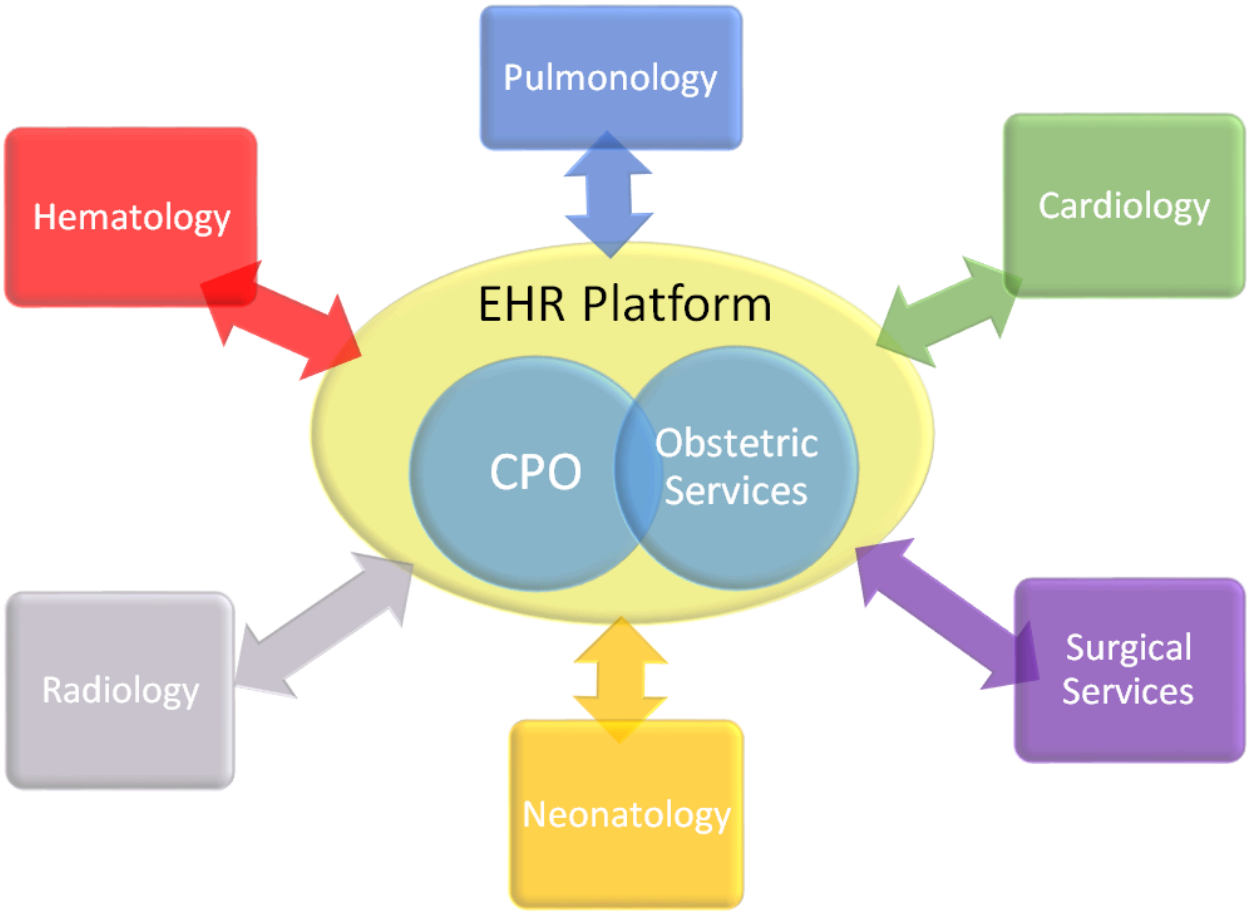
Pulmonology
Hematology
Cardiology
EHR Platform
CPO
Obstetric Services
Radiology
Surgical Services
Neonatology

Figure 1.

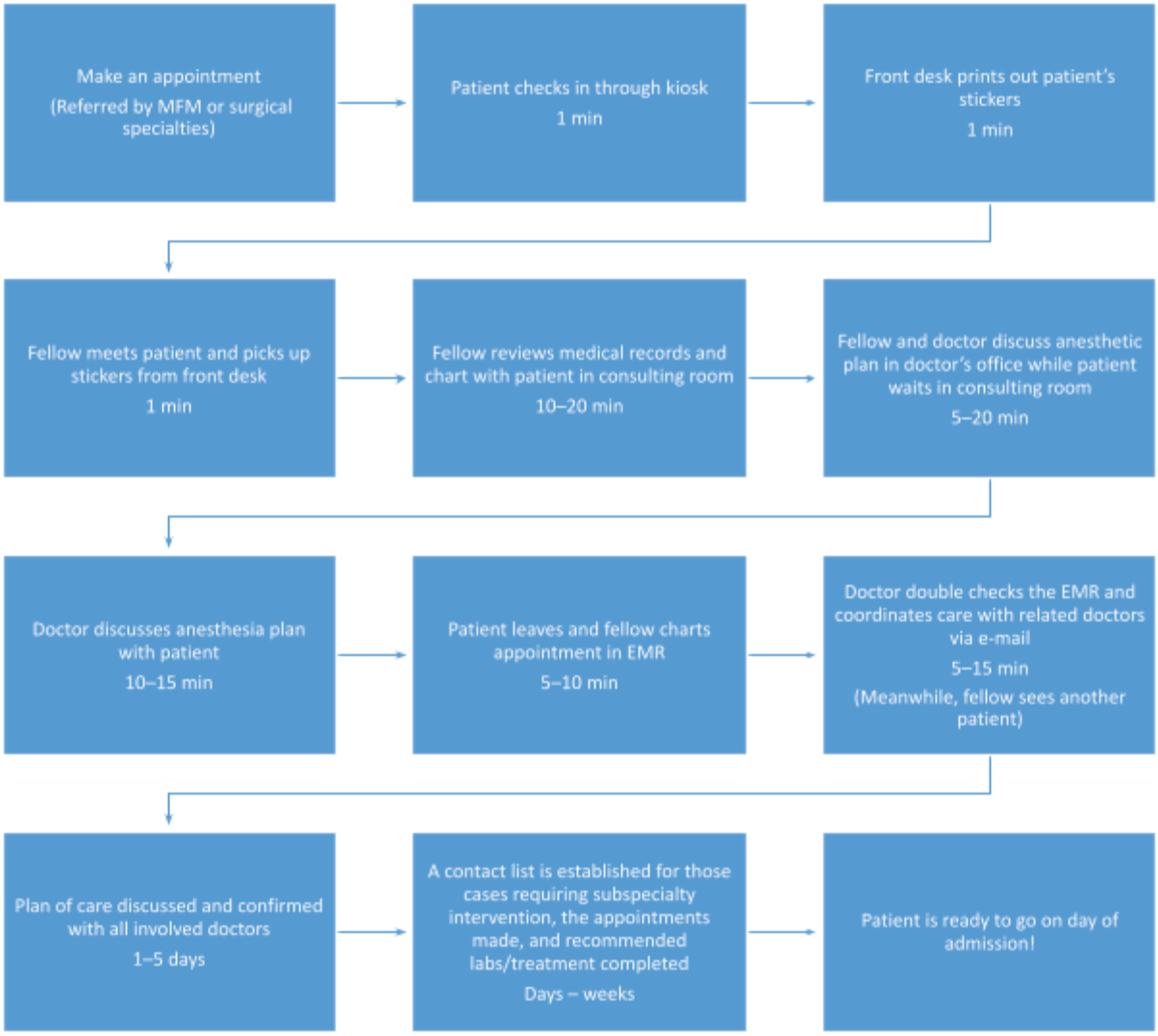
Make an appointment
(Referred by MFM or surgical specialties)
Patient checks in through kiosk
1 min
Front desk prints out patient's stickers
1 min
Fellow meets patient and picks up stickers from front desk
1 min
Fellow reviews medical records and chart with patient in consulting room
10–20 min
Fellow and doctor discuss anesthetic plan in doctor's office while patient waits in consulting room
5–20 min
Doctor discusses anesthesia plan with patient
10–15 min
Patient leaves and fellow charts appointment in EMR
5–10 min
Doctor double checks the EMR and coordinates care with related doctors via e-mail
5–15 min
(Meanwhile, fellow sees another patient)
Plan of care discussed and confirmed with all involved doctors
1–5 days
A contact list is established for those cases requiring subspecialty intervention, the appointments made, and recommended labs/treatment completed
Days – weeks
Patient is ready to go on day of admission!

Figure 2.

Appendix A. Definitions

Hospital Length of Stay

Hospital length of stay was defined as date of hospital admission until discharge after delivery. Coordinated plans of care and appropriate optimization plans ensure that patients are more likely to have uncomplicated deliveries and postpartum courses and therefore are discharged within the normal period of recovery.

Intensive Care Admission

Optimization of medical comorbidities before hospital admission reduces the likelihood of clinical decompensation and thus admission to higher levels of care in intensive care units.

Cost of Admission

Outpatient medical optimization reduces the need for costly urgent/emergent or non-routine inpatient testing. Reductions in unnecessary testing coupled with reduced length of stay and avoidance of costly ICU care are proposed to have significant impact on the overall cost of admission to patients as well as fiscal intermediaries and third-party payors.