Obstetric Anesthesiology in the United States: Current and Future Demand for Fellowship-Trained Subspecialists

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The United States continues to have one of the highest maternal mortality rates in the developed world, and both morbidity and mortality have been rising, increasing 26.6% from 2000 to 2014.[1] Severe maternal morbidity alone rose almost 300% from 1993 to 2014 to 142 incidents per 10,000 deliveries.[2] Increasing age,[3] obesity,[4] and comorbidities[5] among parturients have increased the acuity of maternal (and fetal) inpatient care in recent years. Furthermore, the cesarean delivery rate reached 32% nationally by 2015, with an ever-growing proportion of these deemed high risk.[3] Over 40% of maternal deaths are judged by experts to be preventable, especially those related to obstetric hemorrhage and preeclampsia, with the most important factor being quality of in-hospital medical care.[6] For example, severe maternal morbidity from intrapartum hypertension was significantly lower in hospitals with level IV (highest level) neonatal care compared to lower acuity and lower delivery volume hospitals.[7] The rate of uterine rupture (in trial of labor after cesarean patients) is higher in low-volume hospitals doing <500 deliveries per year.[8] Thus, the literature suggests better outcomes in larger delivery units and units with higher levels of medical services.

In 2015, a first-ever consensus document for improved referral and regionalization of high-risk obstetric services (antepartum through postpartum care) was proposed by the American College of Obstetricians and Gynecologists (ACOG) and the Society for Maternal Fetal Medicine (SMFM).[9] The levels of maternal care include level I (birth centers, basic care), level II (specialty care), level III (subspecialty care), and level IV (regional perinatal health care centers). Levels II–IV centers require "anesthesia services are available at all times." Furthermore, level II centers need a "board-certified anesthesiologist with special training or experience in obstetrics, available for consultation," and for levels III and IV, a "board-certified anesthesiologist with special training or experience in obstetrics is in charge of obstetric anesthesia services." Subspecialty training may improve patient outcomes; a higher density of maternal-fetal medicine specialists resulted in a 27% reduction in the risk of maternal death in those regions.[10]

Serious nonanesthetic complications rose 47% to affect 1.13% of deliveries in 2012, with severe maternal morbidity increasing by 75% over a 10-year period ending in 2009.[11] Obstetric Anesthesiologists represent a key stakeholder group in the peridelivery period to reduce maternal morbidity and mortality of medically complicated pregnancies and unexpected complications by helping to manage critical care aspects, implementing interdisciplinary patient safety bundles (eg, from the Council for Patient Safety in Women's Health) and providing interdisciplinary facility-based review of severe maternal morbidity as recommended by the Centers for Disease Control and Prevention.[11] Having significantly reduced maternal mortality from anesthesia,[12] anesthesiologists remain important in "… the prevention of non–anesthesia-related direct and indirect maternal deaths, such as those caused by hemorrhage, hemodynamic instability, critical illness, and sepsis."[13]

The Obstetric Anesthesiology Fellowship became officially recognized and accredited by the Accreditation Council for Graduate Medical Education (ACGME) in 2012. Fellows receive advanced training not only in anesthetic management of the high-risk parturient but also time-sensitive medical management of critically ill parturients and neonates. Graduates of this Fellowship offer a unique skillset within the field of anesthesiology to be "peri-delivery physicians," providing a high level of care and medical expertise to the obstetric patient, champion obstetric anesthesia services, and guide system changes to improve maternal and neonatal outcomes.[14]

The author (M.I.Z.) receives multiple contacts for job openings requesting obstetric anesthesiology fellows for an obstetric anesthesia service. Therefore, we sought to estimate the workforce demand for fellowship-trained obstetric anesthesiologists (FTOAs). Previous studies examining practices in obstetric anesthesia and workforce coverage have been 10-year national surveys.[15] Taken together, these reports have documented a move toward consolidation of obstetric services, that is, fewer hospitals doing more deliveries. They also indicate that the demand for obstetric anesthesia services has increased dramatically over the past few decades. The use of regional anesthesia for labor has increased over the past 30 years across hospitals, regardless of the number of deliveries. An impressive 86.3% of

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Table 1. Fellowship Obstetric Anesthesiology Staff FTE Estimator Model, FTE

Delivery Volume	Low Model	Intermediate Model	High Model
10,000	4	6	7
9000	3.5	4.5	6
8000	3	4	5
7000	2.5	3.5	4
6000	2	3	3
5000	1.5	2	2
4000	1	1	1
2000–3999	AHA level III ≥1	1	1
1500–1999	0	AHA level III ≥1	1
<1500	0	0	AHA level III ≥1

Number of Fellowship Trained Obstetric Anesthesiologists FTE by hospital delivery volume using low-, intermediate-, and high-model estimates. AHA hospital obstetric level III indicates care for "all serious illnesses and abnormalities."

Abbreviations: AHA, American Hospital Association; FTE, full-time equivalent.

Table 2. Number of Hospitals by Delivery Volume, 2015

Deliveries/Year 2015	No. Hospitals, Cumulative
10,000	9
9000	12
8000	22
7000	26
6000	46
5000	91
4000	167
3000	324
2000	628
1500	848
1000	1248
500	1884
100	2826
1–99	3081
0	6251

American Hospital Association 2015 database survey.

the stratum I hospitals doing >1500 births per year have 24-hour in-house obstetric anesthesia coverage.[15]

We used the 2015 American Hospital Association (AHA) Annual Survey Database to look at distribution of births at hospitals across the United States, consolidation trends to larger high-risk services, and estimated the need for FTOAs at larger hospitals and referral centers. The AHA survey also includes a question on Obstetric Level of Care, quite similar to the levels outlined by the ACOG/SMFM consensus document, defined as level 1 takes care of "uncomplicated" patients; level 2 indicates the facility takes care of "uncomplicated and most complicated cases;" and level 3 indicates care for "all serious illnesses and abnormalities."

The national need for FTOAs was estimated using low-, intermediate-, and high-staffing models based on the following assumptions (Table 1). The low estimate assumptions were as follows: (1) hospitals doing >4000 deliveries per year (ie, averaging >10 deliveries per day), need ≥1 FTOA plus additional staffing for higher volume services; and (2) hospitals doing 2000–3999 deliveries per year that have self-designated to be obstetric level 3 also need a FTOA on staff. The intermediate estimate assumptions were as follows: (1) hospitals doing >2000 deliveries per year need a FTOA on staff plus additional staffing for high-volume services; and (2) hospitals doing 1500–1999 deliveries that have self-designated to be obstetric level 3 also need a fellowship-trained anesthesiologist on staff. Of note, 2000 deliveries per year are about the lower limit for which an institution can develop and support an obstetric anesthesiology fellowship program. The high estimate assumptions were as follows: (1) hospitals doing >1500 deliveries per year need a FTOA on staff; and (2) all hospitals doing <1500 deliveries that have self-designated to be obstetric level 3 also need a FTOA on staff. The hospitals with obstetric level 3 (delivering women with all serious illnesses) should have FTOA in charge of obstetric anesthesia services, for reasons noted previously. The additional full-time equivalent modifier for high delivery volume hospitals was based on familiarity with current staffing models and estimated using low-, intermediate-, and high-staffing models to estimate the need for FTOAs (Table 1).

The 2015 AHA database showed 2826 hospitals in the United States that perform ≥100 births per year, of which 2323 (82%) reported an obstetric care level, with 589 hospitals being obstetric level 3 and 167 hospitals reporting ≥4000 deliveries in 2015 (Table 2). The estimated number of FTOAs needed to staff hospitals responding to the 2015 AHA survey is 517, 871, and 1216 according to the low-, intermediate-, and high-staffing models, respectively.

The 2017–2018 academic year has 32 ACGME-accredited obstetric anesthesiology fellowship programs with 54 positions and an additional 19 non-ACGME fellowship positions in the United States.[16]

The ultimate goal of regionalized maternal care is to reduce maternal morbidity and mortality in the United States and to ensure that high-risk pregnant women receive care in appropriate facilities that are "prepared to provide the required level of specialized care."[9] Just as large, level I trauma centers have 24/7 highly subspecialized trauma services available, hospitals with significant volume and acuity of parturients should have the benefit of a FTOA available to them at all times, as suggested by ACOG/SMFM.[9] A number of other specialties in medicine have improved outcomes by consolidating care to regionalized referral centers, including trauma,[17] stroke,[18] and burn centers.[19] Perhaps, consolidation of maternal care can similarly improve outcomes.

In conclusion, the 2012 ACGME recognition of obstetric anesthesiology as a subspecialty and accreditation of fellowships have created a new, higher level obstetric anesthesiologist to care for medically complex obstetric patients, serve as director of obstetric anesthesia services, and help lead patient safety efforts. The demand for ACGME Obstetric Anesthesiologist Fellowship graduates has not previously been estimated. With ACGME FTOA training capacity at just over 50 fellows per year, yet 602 hospitals self-reporting as taking care of "all serious illnesses and abnormalities," 628 hospitals doing >2000 deliveries per year, the trend toward regionalization of care, and marketplace forces for fellowship-trained specialists, the demand for ACGME FTOAs appears very strong. Our estimates suggest that demand exceeds supply for several years. We hope that the new generation of FTOAs will lead the anesthesia services in the peripartum period and improve patient safety and maternal outcomes.

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Contribution: This author helped with conception and design of the project, helped collect, analyze, and interpret the data, and helped oversaw all aspects of the writing/edit the manuscript.
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