

# Use of Obstetric and Gynecologic Hospitalists Is Associated With Decreased Severe Maternal Morbidity in the United States

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**Objectives:** This study aimed to evaluate the prevalence of obstetric and gynecologic (Ob/Gyn) hospitalists and determine if an association exists between the presence of Ob/Gyn hospitalists and severe maternal morbidity (SMM).

**Methods:** This observational study included data from hospitals listed in the *USA TODAY*'s 2019 article titled, "Deadly deliveries: Childbirth complication rates at maternity hospitals." Telephone and email surveys of staff in these hospitals identified the presence or absence of continuous providers in the hospital 24 hours, 7 days a week (24/7 coverage) and the types of providers who are employed, then compared these responses with the SMM cited by *USA TODAY*.

**Results:** Eight hundred ten hospitals were contacted, with participation from 614 labor and delivery units for a response rate of 75.8%. Fifty-seven percent of units were staffed with 24/7 coverage, with 46% of hospitals' coverage primarily provided by an Ob/Gyn hospitalist and 54% primarily by a nonhospitalist OB/Gyn provider. The SMM and presence of 24/7 coverage increased with the level of neonatal care and delivery volume. Of hospitals with 24/7 coverage, those that primarily used Ob/Gyn hospitalists had a lower SMM for all mothers (1.7 versus 2.0,  $P = 0.014$ ) and for low-income mothers (1.9 versus 2.30,  $P = 0.007$ ) than those who primarily used nonhospitalist OB/Gyn providers.

**Conclusions:** Severe maternal morbidity increases with delivery volume, level of neonatal care, and 24/7 coverage. Of hospitals with 24/7 coverage, units that staff with Ob/Gyn hospitalists have lower levels of SMM than those that use nonhospitalist Ob/Gyn providers.

**Key Words:** OB hospitalist, laborist, maternal morbidity, SMM, levels maternal care, ob coverage, obstetric emergency

(*J Patient Saf* 2023;00: 00–00)

An obstetric and gynecologic (Ob/Gyn) hospitalist is an Ob/Gyn provider who specializes in the practice of hospital-based Ob/Gyn care.<sup>1</sup> Those who primarily practice obstetrics are considered

obstetric hospitalists. Like the prevalence of internal medicine hospitalist programs, the prevalence of Ob/Gyn hospitalist programs is increasing, driven by the need to improve patient care, increase physician job satisfaction, and decrease medical liability.<sup>2</sup> Although there are many studies that document improved outcomes for patients cared for by medical hospitalists,<sup>3–8</sup> there are fewer studies assessing the impact of the Ob/Gyn hospitalist care model. The American College of Obstetricians and Gynecologists affirmed the continued development of the Ob/Gyn hospitalist model of care and encouraged outcomes research to determine its effect on the safety and quality of care.<sup>9</sup>

To date, studies assessing Ob/Gyn hospitalist care have shown a positive impact on patient outcomes. One study showed that implementation of the Ob/Gyn hospitalist model was associated with a significant reduction in labor induction rate and preterm birth.<sup>10</sup> Other studies have shown a decrease in cesarean delivery rates and an increase in vaginal birth after cesarean rates with hospitalist programs.<sup>11–14</sup> Another study demonstrated a decrease in obstetric safety events after implementation of an obstetric hospitalist program.<sup>15</sup> One area of concern in our specialty is the rising mortality rate in the United States, which seems to be rising fastest for women of color.<sup>16–18</sup> It has been postulated that Ob/Gyn hospitalists are well positioned to improve maternal mortality and its proxy, maternal morbidity.<sup>19</sup> There are no large-scale studies that have evaluated this outcome with respect to Ob/Gyn hospitalists.

In 2019, *USA TODAY* published the severe maternal morbidity (SMM) rate of every hospital that delivered more than 500 patients from 2014 to 2017 in 13 states.<sup>20</sup> Severe maternal morbidity is a Centers for Disease Control and Prevention (CDC)-derived marker for acuity in obstetric care whose use is supported in the literature.<sup>21</sup> Using *International Classification of Diseases, Ninth Revision (ICD-9)/ICD-10* codes, a score is calculated from diagnoses associated with maternal morbidity (Supplemental Table 1, <http://links.lww.com/JPS/A532>). We sought to use this data set to survey the same hospitals, querying their use of Ob/Gyn hospitalists. Our primary aim was to evaluate the use of Ob/Gyn hospitalists across the 13 states (representing nearly half of deliveries in the United States in the 4-year period) and, secondly, to evaluate any correlation between the use of Ob/Gyn hospitalists and SMM.

## METHODS

This national, multistate observational study includes data from maternity hospitals in the 13 states listed in the *USA TODAY*'s 2019 article titled, "Deadly deliveries: Childbirth complication rates at maternity hospitals." The hospital database used was obtained from the Web site <https://www.usatoday.com/maternal-mortality-harm-hospital-database>, which has listed the SMM of each hospital that provides OB services in 13 states. *USA TODAY* calculated the rates of severe childbirth complications for hospitals for which they were able to obtain hospital-level data supplied

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The authors disclose no conflict of interest.

Grant Support: REDCap (UL1TR002377).

Supplemental digital contents are available for this article. Direct URL citations appear in the printed text and are provided in the HTML and PDF versions of this article on the journal's Web site ([www.journalpatientsafety.com](http://www.journalpatientsafety.com)).

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to them by various state agencies. The states included California, Florida, Washington, Maryland, Texas, Kentucky, Louisiana, Pennsylvania, Nevada, New York, West Virginia, Vermont, and Rhode Island. To validate the rates reported in the *USA TODAY* article and used in this study, the Healthcare Cost and Utilization Project (HCUP) National Inpatient Sample (NIS) database was assessed for a nationwide rate of SMM along with a 95% confidence interval (CI) for the years of interest. The NIS is the nation's largest all payer inpatient claims database that is sponsored by Agency for Healthcare Research and Quality (AHRQ) (<https://www.hcup-us.ahrq.gov/nisoverview.jsp>) and partners with states to provide estimates at the national level of inpatient care at the state level. Severe maternal morbidity incidences within hospitalizations were identified using the CDC-recommended ICD-9/ICD-10 codes (<https://www.cdc.gov/reproductivehealth/maternalinfanthealth/smm/severe-morbidity-ICD.htm>).

The total number of hospitals in the *USA TODAY* report was 951. Because of time constraints and based on the availability of volunteers, a random sample of hospitals with still active obstetric units were surveyed. Assuming a potentially low response rate, 85% of hospitals in the original *USA TODAY* article were contacted. The study team constructed a 13-question survey where all the data were entered into a REDCap database (Supplemental Digital Content, <http://links.lww.com/JPS/A531>).

Before contacting the cohort of hospitals, a pilot study was initiated in one state to identify the best method of data collection. Given the difficulty in obtaining email addresses for specific hospital contacts, it was determined that using a telephone survey, followed by an email survey if the telephone survey was not completed, would be the most efficient method of administering the survey.

Ten teams were formed to perform the surveys, consisting of a team lead and 2 to 5 physician volunteers. Training sessions for volunteers and team leads provided instruction on how to conduct interviews. After identifying each hospital's telephone number from their Internet web page, volunteers contacted the labor and delivery (L&D) unit at each hospital and attempted to speak directly to or obtain the telephone number or email address of the nurse manager, charge registered nurse, OB unit floor nurse, medical director, or hospitalist on call that day. There was no specified time of the day during which the telephone calls were made. The volunteer identified themselves as a physician engaged in research regarding the prevalence of hospitalists. Verbal consent was obtained, and the 13-question survey was administered by telephone or sent to their email for completion. The Mayo Clinic Institutional Review Board examined the study protocol and considered it exempt.

## Survey

The survey included questions about the hospital's level of maternal and neonatal care, the provider staffing model, including the use of Ob/Gyn hospitalists and midwives, and the presence of trainees. The choice of neonatal care unit (NICU) offered during the survey was levels I to III. Recently, level IV NICUs have been designated, but these were combined within the level III category and the data were not separately collected on level IV units because of their recent introduction and uneven implementation.

The survey was developed as an iterative process among the group of investigators and can be found in the supplement information. In the survey, an Ob/Gyn hospitalist was defined as an Ob/Gyn physician who specializes in the practice of hospital Ob/Gyn care. For the purpose of reporting, providers who covered the unit and were not considered Ob/Gyn hospitalists are referred to as nonhospitalist Ob/Gyn providers.

## Statistical Methods

The survey response rate by state was determined along with comparisons of nonresponders with responders of information reported in the *USA TODAY* article. For data collected, continuous variables are reported using mean  $\pm$  SD or median (range) and are compared using the Student *t* test or rank sum test as appropriate. Categorical variables are presented as numbers (%) and compared using the  $\chi^2$  test.

Hospitals with a change in the staffing model with regard to the presence or absence of Ob/Gyn hospitalists since 2017 were excluded from the analysis, with SMM as their current information would not be reflected in the 2017 SMM data. All analyses were performed independently by the authors using SAS version 9.4 (Cary, North Carolina).

## RESULTS

From September 1 to December 31, 2020, of the 838 hospitals randomly selected, 20 units had closed, and therefore, 810 hospitals were contacted with 614 (76%) completing the survey, which represents 65% of the hospitals reported in the *USA TODAY* article (response by state in Supplement 2, <http://links.lww.com/JPS/A533>). Staff members from these 614 hospitals completed the survey, with an overall response rate of 75.8%, 433 (70.5%) by telephone and 181 (29%) by email (Fig. 1). Of these, 94 had a change in the staffing model since the *USA TODAY* obtained the data for the article and are not included in the analysis because the survey responses would not reflect what had been reported. Of the 520 hospitals included in the analysis, most of the respondents were nurses (75.3%). Additional respondents included physicians (18.7%) and other staff (5.2%). For levels of neonatal care, 40.8% supported a level III/IV NICU; 30.3%, a level II NICU; and 26.2%, a level I NICU (Table 1).

Fifty-seven percent of units (298 of 520) were staffed 24/7 with a provider whose duties included being available for emergencies and providing care for women who presented without an identified provider (Table 1). Of hospitals with 24/7 coverage, 46% reported that coverage was primarily provided by someone considered to be an Ob/Gyn hospitalist. Fifty percent of the hospitals who did not have 24/7 coverage supported level I NICUs, whereas 34% were level II and 14% were level III (Table 1).

The question assessing levels of maternal care had a low response rate, with 55% of respondents not answering the question, disallowing further meaningful analysis with regard to reported level of maternal care.

Severe maternal morbidity reported by *USA TODAY* are congruent to SMM calculated using the NIS data and within the calculated CIs for all and low-income women (mean SMM *USA TODAY*, 1.73 [95% CI, 1.65–1.80]; mean SMM NIS, 1.74 [95% CI, 1.71–1.77]). SMM for Black women is underestimated in the *USA TODAY* data compared with that calculated from the NIS data (Fig. 2).

For the cohort of hospitals with 24/7 coverage, those which primarily use Ob/Gyn hospitalists had a lower mean SMM for all, Black and low-income mothers than hospitals that primarily use nonhospitalist Ob/Gyn providers to staff their L&D, regardless of volume (Table 2; Figs. 3–5).

There was an association between type of L&D staffing model and delivery volume. The hospitals without 24/7 staffing reported the lowest delivery volume (median, 3836). For hospitals with 24/7 coverage, staffing with Ob/Gyn hospitalists was associated with higher delivery volume (median, 11,342) versus staffing with nonhospitalist providers (median delivery volume of 8483; Table 2). The type of L&D staffing model was also associated with the average SMM. For hospitals without 24/7 coverage, the mean SMM was 1.6. For hospitals with 24/7 coverage, the mean

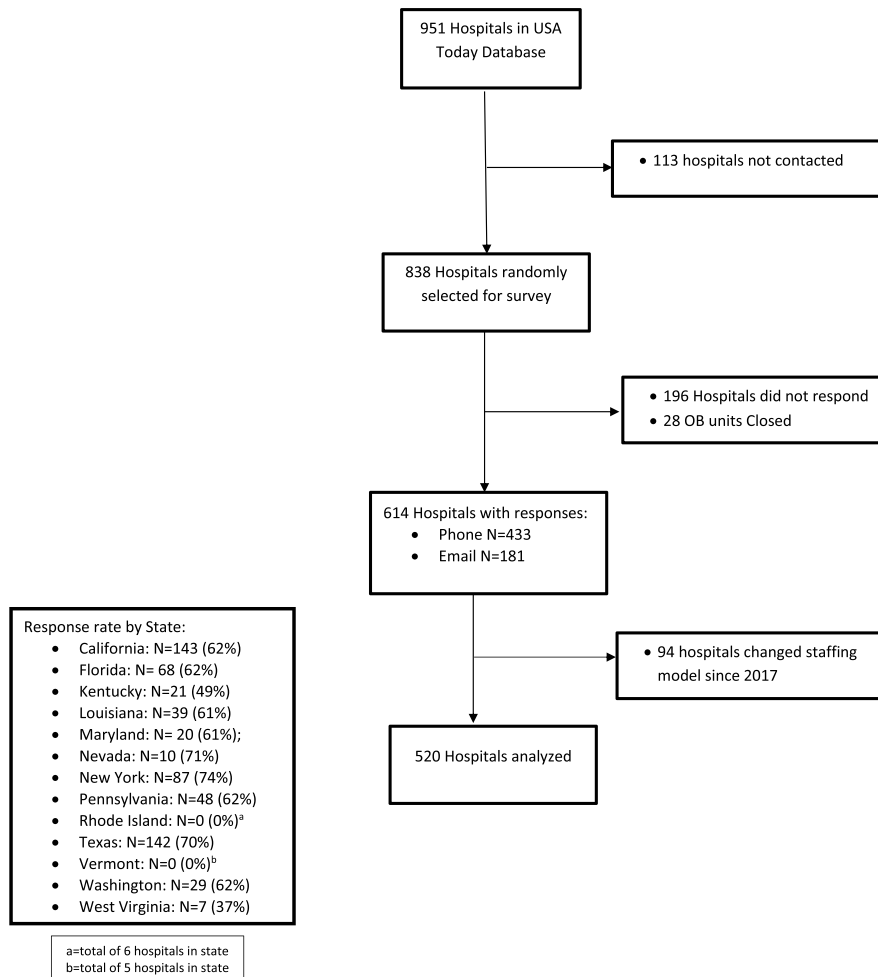


FIGURE 1. Flowchart of hospital responses.

TABLE 1. Survey Responses by 24/7 and Ob/Gyn Hospitalist Coverage

|                                    | Type of Provider              |   |  | Total<br>(N = 520) | P        |
|------------------------------------|-------------------------------|---|--|--------------------|----------|
|                                    | No 24/7 Coverage<br>(n = 222) | 24/7 Coverage With Nonhospitalist<br>OB/GYN (n = 161) | 24/7 Coverage With OB/Gyn<br>Hospitalist (n = 137) |                    |          |
| Primary role of responder          |                               |   |  |                    | <0.0001* |
| Nurse                              | 116 (52%)                     | 59 (37%)  | 51 (37%)   | 226 (43%)          |          |
| Nurse manager                      | 91 (41%)                      | 49 (30%)  | 37 (27%)   | 177 (34%)          |          |
| Physician                          | 5 (2%)                        | 33 (20%)  | 38 (28%)   | 76 (15%)           |          |
| Physician manager                  | 1 (0%)                        | 4 (2%)  | 4 (3%)   | 9 (2%)             |          |
| CNM                                | 2 (1%)                        | 2 (1%)  | 1 (1%)   | 5 (1%)             |          |
| CNM manager                        | 0 (0%)                        | 0 (0%)  | 1 (1%)   | 1 (0%)             |          |
| Other                              | 7 (3%)                        | 14 (9%)   | 5 (4%)   | 26 (5%)            |          |
| Level of neonatal care at hospital |                               |   |  |                    | <0.0001* |
| Level 1                            | 111 (50%)                     | 19 (12%)  | 5 (4%)   | 135 (26%)          |          |
| Level 2                            | 76 (34%)                      | 49 (31%)  | 32 (23%)   | 157 (30%)          |          |
| Level 3                            | 31 (14%)                      | 88 (55%)  | 94 (69%)   | 213 (41%)          |          |
| I don't know                       | 4 (2%)                        | 4 (3%)  | 6 (4%)   | 14 (3%)            |          |
| Missing                            | 0                             | 1   | 0  | 1                  |          |

\*Kruskal-Wallis P value.

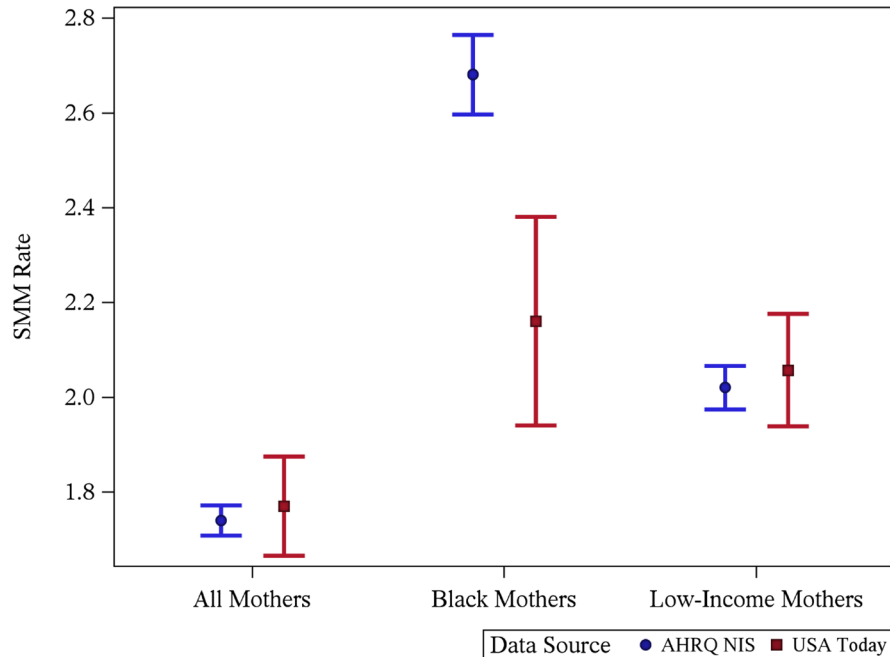


FIGURE 2. The AHRQ NIS SMM versus USA TODAY SMM.

SMM was lower in hospitals with versus without an Ob/Gyn hospitalist providing the 24/7 coverage (mean SMM, 1.7 versus 2.0; Table 2; Figs. 3–5).

We further evaluated the association of delivery volume on mean SMM in hospitals with and without 24/7 coverage. The median delivery volume for 4 years of all hospitals in the cohort was 5713.5, with a minimum of 502 and maximum of 56,397. For hospitals without 24/7 coverage, the mean SMM for all mothers was highest in the hospitals with the lowest and highest delivery volumes by quartiles (first quartile, 502–2670 deliveries; second,

2671–5305; third, 5308–9889; fourth, >9890), with SMM of 1.8, 1.37, 1.37, and 1.61 respectively ( $P = 0.0004$ ; Table 3). The mean SMM for Black mothers increased steadily with increasing delivery volumes (0.57, 1.67, 2.16, 2.90;  $P < 0.0001$ ), whereas the SMM for low-income mothers again had the highest means in the hospitals with the lowest and highest volumes (2.36, 1.64, 1.59, 2.37;  $P = 0.0004$ ; Table 3). For the hospitals with 24/7 coverage, the difference in SMM for all mothers, Black mothers, and low-income mothers did not reach statistical significance based on delivery volumes (Table 4).

TABLE 2. SMM By Hospitals With and Without 24/7 Coverage

|                            | Type of Provider           |  |   | P        |
|----------------------------|----------------------------|--|---|----------|
|                            | No 24/7 Coverage (n = 222) | 24/7 Coverage With Nonhospitalist OB/GYN (n = 161) | 24/7 Coverage With OB/Gyn Hospitalist (n = 137) |          |
| Total births               |                            |  |   | <0.0001* |
| Mean (SD)                  | 3836 (2865)                | 8483 (7598)  | 11,342 (6993)                                   |          |
| Median (range)             | 3013 (627–195,210)         | 6310 (502–56,397)                                  | 10,378 (678–44,015)                             |          |
| SMM for All mothers        |                            |  |   | 0.0139*  |
| Mean (SD)                  | 1.6 (1.20)                 | 2.0 (1.36)   | 1.7 (1.00)                                      |          |
| Median (range)             | 1.4 (0.3–11.6)             | 1.6 (0.3–7.5)                                      | 1.6 (0.2–7.4)                                   |          |
| SMM for Black mothers      |                            |  |   | <0.0001* |
| Mean (SD)                  | 1.4 (2.03)                 | 2.7 (2.04)   | 2.5 (1.61)                                      |          |
| Median (range)             | 0.0 (0.0–14.4)             | 2.4 (0.0–9.1)                                      | 2.3 (0.0–7.5)                                   |          |
| Missing                    | 102                        | 52   | 46  |          |
| SMM for low-income mothers |                            |  |   | 0.0065*  |
| Mean (SD)                  | 1.9 (1.26)                 | 2.3 (1.39)   | 1.9 (1.03)                                      |          |
| Median (range)             | 1.7 (0.4–10.1)             | 1.9 (0.3–7.3)                                      | 1.7 (0.4–7.3)                                   |          |
| Missing                    | 58                         | 20   | 8   |          |

\*Kruskal-Wallis P value.

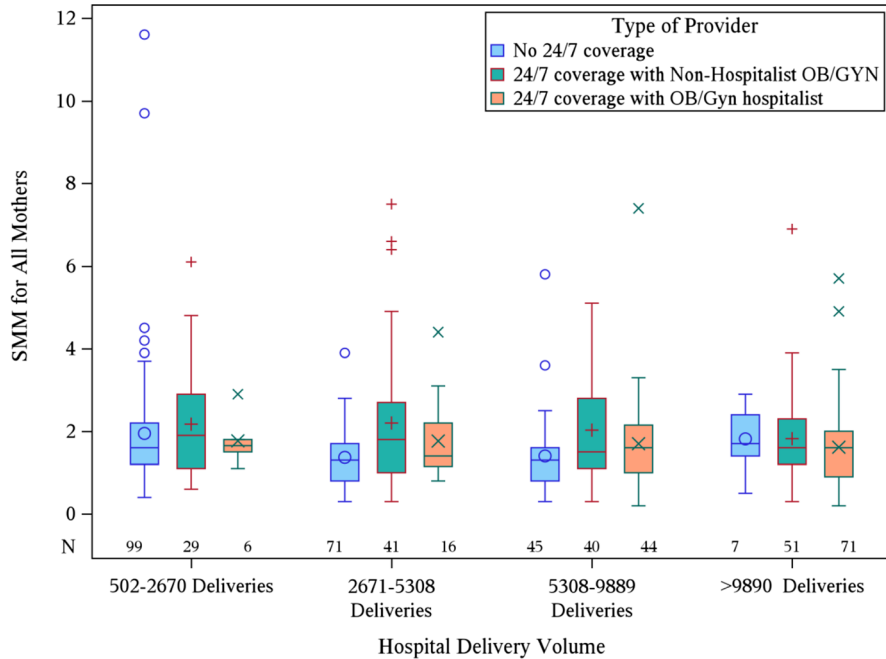


FIGURE 3. The SMM of all mothers by hospitalist/nonhospitalist by delivery volume.

The level of neonatal care was well identified by respondents and seems to correlate with SMM. Similarly to delivery volumes, level 1 and level 3 hospitals had higher SMM than level 2 hospitals. Hospitals with level 3 NICUs were more likely to employ OB/Gyn hospitalists compared with level 1 and level 2 hospitals. Given that the acuity is higher in a level 3 NICU, an increasing SMM is found with OB/Gyn hospitalists. When adjusting for level of neonatal care, the mean SMM for hospitals that primarily staff with Ob/Gyn hospitalists for their 24/7 coverage was 1.70,

whereas the SMM for hospitals that primarily use nonhospitalist Ob/Gyn providers was 2.11 ( $P = 0.001$ ). The difference can be seen in the boxplot in Figure 6.

### DISCUSSION

This study found that in 2017, 56.8% of hospitals provided 24/7 coverage for their L&D units, and of those, 45.6% primarily

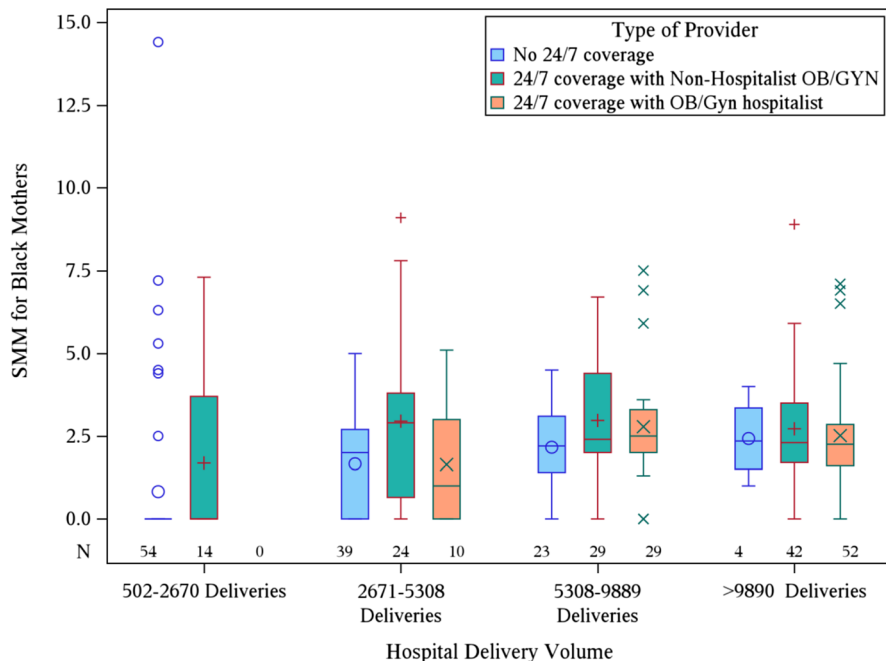


FIGURE 4. The SMM of Black mothers by hospitalist/nonhospitalist by delivery volume.

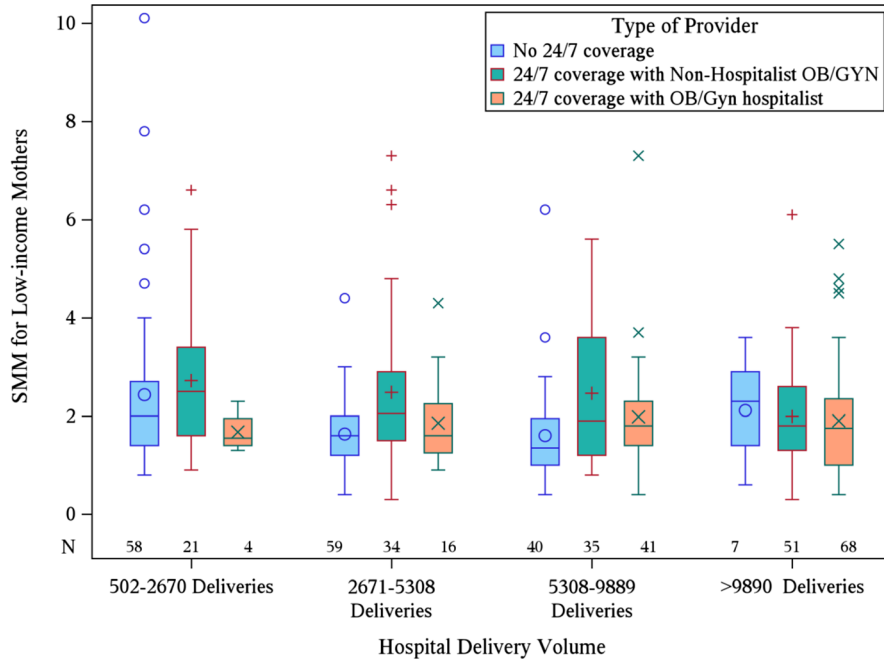


FIGURE 5. The SMM of low-income mothers by hospitalist/nonhospitalist by delivery volume.

used Ob/Gyn hospitalists, a provider who specializes in the practice of hospital Ob/Gyn care.<sup>1</sup>

In searching the literature using the following search terms: hospitalists, Ob hospitalists, Ob/gyn hospitalist, laborist, maternal morbidity, SMM, and maternal mortality, this study seems to be one of the first to link Ob/Gyn hospitalist usage with SMM. Severe maternal morbidity has been validated in several studies as a reasonable measurement of morbidity using ICD-9 codes.<sup>22,23</sup> Maternal levels of care would seem to be the best correlate for SMM outcomes. In our study, this could not be fully assessed because many of the respondents were unsure of their hospital's

level of maternal care. Furthermore in 2017, this designation was relatively new and identifying the hospital level at that time may be less accurate, whereas neonatal levels of care have been around for a much longer time and are familiar to most staff.

This study highlights that for hospitals that provide 24/7 coverage, those who primarily use Ob/Gyn hospitalists rather than nonhospitalists providers have a lower SMM for all mothers. This difference is maintained when adjusting for level of neonatal care. In addition to having an Ob/Gyn physician immediately available to respond to emergencies, there may be factors specific to the hospitalist role that explain this difference. Some

TABLE 3. SMM By Delivery Volume in Hospitals Without 24/7 Coverage

|                            | Delivery Quartiles           |                               |                               |                          | Total (N = 218) | P        |
|----------------------------|------------------------------|-------------------------------|-------------------------------|--------------------------|-----------------|----------|
|                            | 502–2670 Deliveries (n = 97) | 2671–5308 Deliveries (n = 71) | 5308–9889 Deliveries (n = 44) | >9890 Deliveries (n = 6) |                 |          |
| SMM for all mothers        |                              |                               |                               |                          |                 | 0.0004*  |
| Mean (SD)                  | 1.86 (1.17)                  | 1.37 (0.69)                   | 1.37 (0.93)                   | 2.03 (0.62)              | 1.61 (1.00)     |          |
| Median                     | 1.6                          | 1.3                           | 1.3                           | 2.05                     | 1.4             |          |
| Range                      | 0.40–9.70                    | 0.30–3.90                     | 0.30–5.80                     | 1.40–2.90                | 0.30–9.70       |          |
| SMM for Black mothers      |                              |                               |                               |                          |                 | <0.0001* |
| n                          | 53                           | 39                            | 23                            | 3                        | 118             |          |
| Mean (SD)                  | 0.57 (1.69)                  | 1.67 (1.41)                   | 2.16 (1.31)                   | 2.90 (1.01)              | 1.30 (1.66)     |          |
| Median                     | 0                            | 2                             | 2.2                           | 2.7                      | 0               |          |
| Range                      | 0.00–7.20                    | 0.00–5.00                     | 0.00–4.50                     | 2.00–4.00                | 0.00–7.20       |          |
| SMM for low-income mothers |                              |                               |                               |                          |                 | 0.0004*  |
| n                          | 56                           | 59                            | 39                            | 6                        | 160             |          |
| Mean (SD)                  | 2.36 (1.53)                  | 1.64 (0.72)                   | 1.59 (1.04)                   | 2.37 (0.82)              | 1.91 (1.19)     |          |
| Median                     | 2                            | 1.6                           | 1.3                           | 2.35                     | 1.7             |          |
| Range                      | 0.80–10.10                   | 0.40–4.40                     | 0.40–6.20                     | 1.40–3.60                | 0.40–10.10      |          |

\*Kruskal-Wallis P value.



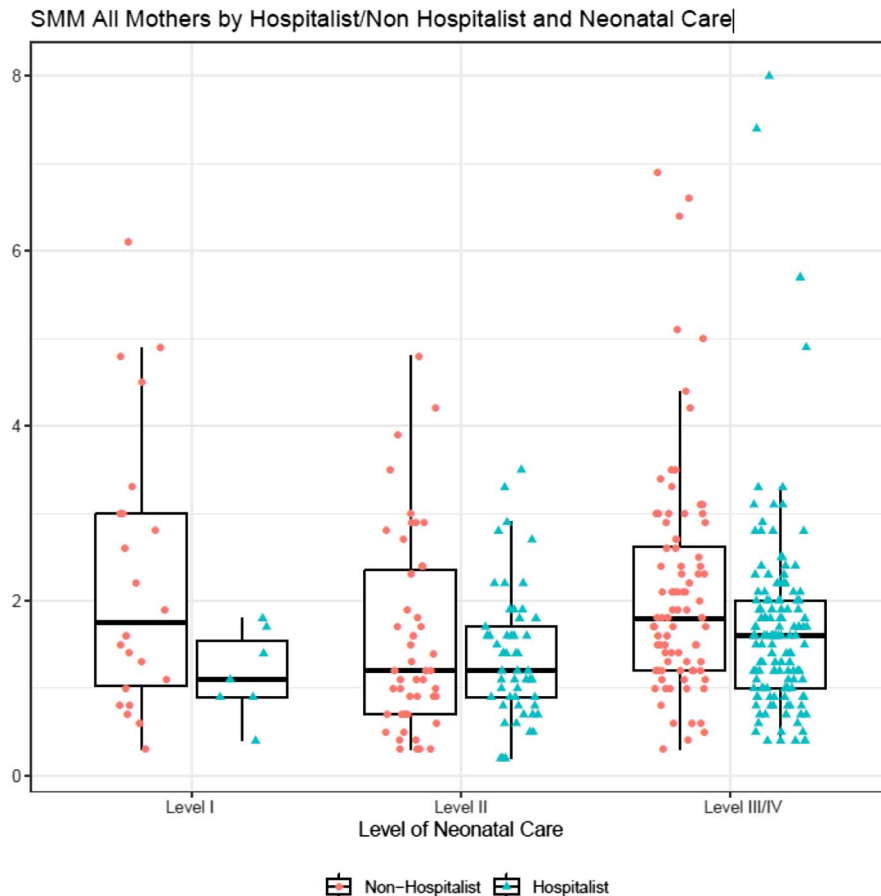
**TABLE 4.** SMM By Delivery Volume in Hospitals With 24/7 Coverage

|                            | 502–2670 Deliveries<br>(n = 30) | 2671–5308 Deliveries<br>(n = 55) | 5308–9889 Deliveries<br>(n = 82) | >9890 Deliveries<br>(n = 120) | Total<br>(N = 287) | P       |
|----------------------------|---------------------------------|----------------------------------|----------------------------------|-------------------------------|--------------------|---------|
| SMM for all mothers        |                                 |                                  |                                  |                               |                    | 0.4729* |
| n                          | 30                              | 55                               | 82                               | 120                           | 287                |         |
| Mean (SD)                  | 2.13 (1.34)                     | 1.96 (1.27)                      | 1.85 (1.28)                      | 1.70 (1.02)                   | 1.84 (1.18)        |         |
| Median                     | 1.7                             | 1.7                              | 1.6                              | 1.6                           | 1.6                |         |
| Range                      | 0.60–6.10                       | 0.30–6.60                        | 0.20–7.40                        | 0.20–6.90                     | 0.20–7.40          |         |
| SMM for Black mothers      |                                 |                                  |                                  |                               |                    | 0.1414* |
| n                          | 12                              | 32                               | 56                               | 93                            | 193                |         |
| Mean (SD)                  | 1.70 (2.65)                     | 2.41 (2.22)                      | 2.87 (1.74)                      | 2.61 (1.55)                   | 2.59 (1.82)        |         |
| Median                     | 0                               | 2.6                              | 2.45                             | 2.3                           | 2.4                |         |
| Range                      | 0.00–7.30                       | 0.00–9.10                        | 0.00–7.50                        | 0.00–8.90                     | 0.00–9.10          |         |
| SMM for low-income mothers |                                 |                                  |                                  |                               |                    | 0.3502  |
| n                          | 20                              | 48                               | 74                               | 117                           | 259                |         |
| Mean (SD)                  | 2.58 (1.60)                     | 2.17 (1.26)                      | 2.20 (1.26)                      | 1.94 (1.06)                   | 2.11 (1.21)        |         |
| Median                     | 2.25                            | 1.9                              | 1.9                              | 1.8                           | 1.9                |         |
| Range                      | 0.90–6.60                       | 0.30–6.60                        | 0.40–7.30                        | 0.30–6.10                     | 0.30–7.30          |         |

\*Kruskal-Wallis P value.

plausible reasons for this difference include quality and safety procedures and protocols that are in place in hospitals that use Ob/Gyn hospitalists. The nature of a hospitalist’s job description lends itself to implementation of systems changes

leading to improvement in patient safety. Another possibility is that the increased clinical time within the inpatient practice leads to improved functional communication with other members of the multidisciplinary team.



**FIGURE 6.** The SMM of nonhospitalists/hospitalists controlled by level of neonatal care.

This decrease in SMM in hospitals that provide 24/7 coverage primarily with Ob/Gyn hospitalists is also true for the subset of low-income and Black mothers. There are several studies that catalog the increase in maternal morbidity and mortality in Black mothers<sup>24,25</sup> with very few solutions studied to remedy the discrepancy,<sup>26</sup> and this finding could be studied as a model to decrease SMM in this vulnerable group.

We found that SMM varied with the level of neonatal care and the presence of 24/7 coverage. Specifically, as the level of neonatal care increased, there was a corresponding increase in SMM. This is not surprising because the increase in level of neonatal care is likely a marker for acuity of not only the neonate but also the mother. Another variable that is linked with SMM appears to be the presence of 24/7 coverage. When comparing hospitals with and without 24/7 provider coverage, those hospitals with 24/7 coverage had higher SMM. This was significant for all, Black, and low-income mothers. Likely, the presence of a provider in the hospital 24/7 is not a cause for increased SMM but results from those practices that have higher acuity being more likely to use 24/7 coverage.

Severe maternal morbidity for all mothers is increased for the hospitals with the lowest and highest delivery volumes, and the SMM for Black mothers increases steadily with delivery volumes. However, hospitals with 24/7 coverage do not show increased SMM with increasing volumes. Thus, the presence of 24/7 coverage seems to blunt the impact of volume on SMM.

Prior studies evaluating the impact of OB/Gyn hospitalists have focused on specific fetal and maternal outcomes such as vaginal birth after cesarean rates and cesarean rates. For example, one study examined the outcomes of 550,000 women from 24 hospitals and found that implementation of a laborist program was associated with fewer labor inductions and a decreased rate of preterm birth.<sup>10</sup> Another retrospective study found that a full-time laborist program providing continuous in-hospital coverage was associated with a decrease in cesarean rates from 39.2% to 33.2%, whereas the same coverage provided by community staff did not lead to a significant difference.<sup>12</sup> In this study, we correlated overall maternal morbidity with the presence of Ob/Gyn hospitalists. Future studies looking at the correlation between SMM and Ob hospitalists will be useful to identify the causes.

Given the decreased SMM in hospitals with Ob/Gyn hospitalists, hospital systems should consider whether implementation of these programs would be of benefit in specific hospitals.

One strength of this study is the large number of hospitals surveyed. The hospital cohort in this survey represents all hospitals within 13 states and includes a diverse representation of community, academic, and low- and high-acuity centers. The authors report that the deliveries in the cohort represent close to half of all deliveries in the United States at that time.<sup>19</sup> In addition, we were able to independently validate the data and SMM reported by *USA TODAY* with an independent source, namely, the NIS database. Furthermore, this is the largest study to date that identifies the use of Ob/Gyn hospitalists by hospitals. Srinivas et al<sup>2</sup> surveyed 76 hospitals in 2013 to identify which hospitals were employing Ob/Gyn hospitalists. Our study included 614 hospitals that offer obstetric care and reported which hospitals were primarily using Ob/Gyn hospitalists. Another strength of this study was our ability to link reportable outcomes with the employment of Ob/Gyn hospitalists. Whereas other studies have investigated cesarean delivery rates and models of maternal care, our study used the much broader index of SMM.

Limitations of this study include that only 13 of 52 states were represented, which could cause a geographical bias if other states or regions in the country have different rates of Ob/Gyn hospitalist utilization from our study population. However, given that the

deliveries in this data set represented nearly half of all deliveries in the United States and the variance of usage of hospitalist coverage in states within the study, this is likely a close representation of the country. In addition, the survey developed for this study was not previously validated; however, most of the questions were seeking fact based or quantitative answers versus perception or opinion and should have yielded objective answers. Another limitation is that the division of hospitals into staffing categories was based on a survey administered in 2020 about 2017 staffing, whereas the SMM data were from 2014 and 2017. If a hospital changed its staffing during the 2014–2017 period, allocation to type of provider may be skewed. Finally, the survey did not directly address MFM providers, which is an important element for the determination of the maternal level of care, and as such, the findings of this study may be confounded by the absence or presence of MFM providers.

## CONCLUSIONS

This study adds important information to the rapidly growing practice focus of Ob/Gyn hospital medicine. Although the presence of an Ob/Gyn provider on site would improve the safety of obstetric care, the improvement of SMM in hospitals that primarily use Ob/Gyn hospitalist providers indicates that there is value added beyond the simple presence of an obstetrical provider. One value may include decreasing SMM in vulnerable populations such as Black and low-income women. Delineating what aspect of the practice of dedicated Ob/Gyn hospitalists leads to improved outcome can help to focus training and continue to improve those outcomes. The solution to America's maternal mortality problem lies first in improving maternal morbidity and is likely multifactorial. Obstetric and gynecologic hospitalists can play a key role in this important endeavor by serving as consistent providers focused on the L&D front lines.<sup>27</sup>

## ACKNOWLEDGMENTS

*The authors would like to acknowledge and thank the Board of the Society of OB/Gyn Hospitalists for their support of this work with review of the manuscript as well as administrative help and cheerleading. The authors would also like to acknowledge the Kern Center for support for access to the National Inpatient Sample database. A big thank you to the Society of OB/Gyn Hospitalists Research Committee from which several of the authors belong and their shepherding of this work. Lastly, without the boots on the ground hard work of the following volunteers, this work would have not moved forward: Enid Rivera-Chiauszi, MD; Daryl Stoner, MD; Kellie DeLozier, MD; Kiran Kavipurapu, DO, JD, MPH; Oroma Nwanodi, MD; Macy Fox, MD; Rula Fuertez, MD; Lisa Galbraith, MD, MPH; Robert B. Olson, MD; Eileen Reardon, MD; and Becky Graham, DO.*

## REFERENCES

- McCue B, Fagnant R, Townsend A, et al. Definitions of obstetric and gynecologic hospitalists. *Obstet Gynecol*. 2016;127:393–397.
- Srinivas S, Shocksniiddr J, Caldwell D, et al. Laborist model of care: who is using it? *J Matern Fetal Neonatal Med*. 2012;25:257–260.
- Wachter RM, Goldman L. The hospitalist movement 5 years later. *JAMA*. 2002;287:487–494.
- White HL, Glazier RH. Do hospitalist physicians improve the quality of inpatient care delivery? A systematic review of process, efficiency and outcome measures. *BMC Med*. 2011;9:58.
- Jungerwirth R, Wheeler SB, Paul JE. Association of hospitalist presence and hospital-level outcome measures among Medicare patients. *J Hosp Med*. 2014;9:1–6.



6. Meltzer D, Manning WG, Morrison J, et al. Effects of physician experience on costs and outcomes on an academic general medicine service: results of a trial of hospitalists. *Ann Intern Med.* 2002;137:866–874.
7. Lindenauer PK, Rothberg MB, Pekow PS, et al. Outcomes of care by hospitalists, general internists, and family physicians. *N Engl J Med.* 2007;357:2589–2600.
8. Ryskina KL, Yuan Y, Polsky D, et al. Hospitalist vs. non-hospitalist care outcomes and costs for Medicare beneficiaries discharged to skilled nursing facilities in 2012–2014. *J Gen Intern Med.* 2020;35:214–219.
9. American College of Obstetricians and Gynecologists' Committee on Patient Safety and Quality Improvement; American College of Obstetricians and Gynecologists' Committee on Obstetric Practice. Committee Opinion No. 657 Summary: The Obstetric and Gynecologic Hospitalist. *Obstet Gynecol.* 2016;127:419.
10. Srinivas SK, Small DS, Macheras M, et al. Evaluating the impact of the laborist model of obstetric care on maternal and neonatal outcomes. *Am J Obstet Gynecol.* 2016;215:770.e1–770.e9.
11. Iriye BK. Impact of obstetrician/gynecologist hospitalists on quality of obstetric care (cesarean delivery rates, trial of labor after cesarean/vaginal birth after cesarean rates, and neonatal adverse events). *Obstet Gynecol Clin North Am.* 2015;42:477–485.
12. Iriye BK, Huang WH, Condon J, et al. Implementation of a laborist program and evaluation of the effect upon cesarean delivery. *Am J Obstet Gynecol.* 2013;209:251.e1–251.e6.
13. Anil G, Hagen TM, Harkness LJ, et al. Midwife laborist model in a collaborative community practice. *Mayo Clin Proc Innov Qual Outcomes.* 2019;4:3–7.
14. Feldman DS, Bollman DL, Fridman M, et al. Do laborists improve delivery outcomes for laboring women in California community hospitals? *Am J Obstet Gynecol.* 2015;213:587.e1–587.e13.
15. Decesare JZ, Bush SY, Morton AN. Impact of an obstetrical hospitalist program on the safety events in a mid-sized obstetrical unit. *J Patient Saf.* 2020;16:e179–e181.
16. Lu MC. Reducing maternal mortality in the United States. *JAMA.* 2018;320:1237–1238.
17. Creanga AA, Berg CJ, Syverson C, et al. Pregnancy-related mortality in the United States, 2006–2010. *Obstet Gynecol.* 2015;125:5–12.
18. Wang E, Glazer KB, Howell EA, et al. Social determinants of pregnancy-related mortality and morbidity in the United States: a systematic review. *Obstet Gynecol.* 2020;135:896–915.
19. Stevens TA, Swaim LS, Clark SL. The role of obstetrics/gynecology hospitalists in reducing maternal mortality. *Obstet Gynecol Clin North Am.* 2015;42:463–475.
20. Kelly J, Young A. The secret number maternity hospitals don't want you to know and why we're revealing it. *USA TODAY.* Published 8:25 a.m. ET March 7, 2019. Available at: <https://www.usatoday.com/maternal-mortality-harm-hospital-database>.
21. Easter SR, Bateman BT, Sweeney VH, et al. A comorbidity-based screening tool to predict severe maternal morbidity at the time of delivery. *Am J Obstet Gynecol.* 2019;221:271.e1–271.e10.
22. Main EK, Abreo A, McNulty J, et al. Measuring severe maternal morbidity: validation of potential measures. *Am J Obstet Gynecol.* 2016;214:643.e1–643.e10.
23. Gibson C, Rohan AM, Gillespie KH. Severe maternal morbidity during delivery hospitalizations. *WMI.* 2017;116:215–220.
24. Crandall K. Pregnancy-related death disparities in non-Hispanic Black women. *Womens Health (Lond).* 2021;17:17455065211019888.
25. Joseph KS, Boutin A, Lisonkova S, et al. Maternal mortality in the United States: recent trends, current status, and future considerations. *Obstet Gynecol.* 2021;137:763–771.
26. Garcia R, Ali N, Papadopoulos C, et al. Specific antenatal interventions for Black, Asian and Minority Ethnic (BAME) pregnant women at high risk of poor birth outcomes in the United Kingdom: a scoping review. *BMC Pregnancy Childbirth.* 2015;15:226.
27. Levels of maternal care: obstetric care consensus no. 9. *Obstet Gynecol.* 2019;134:e41–e55.