

# Risk of First-Stage and Second-Stage Cesarean Delivery by Maternal Body Mass Index Among Nulliparous Women in Labor at Term

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**OBJECTIVE:** To estimate in a cohort of nulliparous women in labor at term whether cesarean delivery rates are increased in first and second stages of labor in overweight and obese women and whether being overweight or obese is an independent risk factor for cesarean delivery.

**METHODS:** Nulliparous women recruited to the prospective Screening for Pregnancy Endpoints study who went into labor after 37 weeks of gestation were categorized according to ethnicity-specific body mass index (BMI) criteria as normal, overweight, or obese. Normal BMI was the referent. Multivariable analysis, adjusting for known confounders for obesity and cesarean delivery, was performed to estimate if being overweight or obese was associated with an increased risk of cesarean in labor (all cesarean deliveries and in first stage of labor).

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**RESULTS:** Of 2,629 participants, 1,416 (54%) had normal BMIs, 773 (29%) were overweight, and 440 (17%) were obese. First-stage cesarean delivery was increased in overweight ( $n=149$  [19%]) and obese ( $n=137$  [31%]) women compared with normal-weight women ( $n=181$  [13%;  $P<.001$ ), whereas second-stage cesarean delivery was similar (normal BMI 76 [6.2%], overweight 45 [7.2%], obese 23 [7.6%],  $P=.87$ ). Being overweight or obese was an independent risk factor for all cesarean deliveries in labor with adjusted odds ratio (OR) of 1.34 (95% confidence interval [CI] 1.07–1.67) and 2.51 (95% CI 1.94–3.25), respectively. Similarly, being overweight (adjusted OR 1.39; 95% CI 1.09–1.79) or obese (adjusted OR 2.89; 95% CI 2.19–3.80) was associated with increased cesarean delivery during the first stage. Risks of cesarean delivery were similar regardless of whether ethnicity-specific or World Health Organization (WHO) BMI criteria were used.

**CONCLUSION:** Among nulliparous women in labor at term, being overweight or obese by either WHO or ethnicity-specific BMI criteria is an independent risk factor for cesarean delivery in the first stage but not the second stage of labor.

**CLINICAL TRIAL REGISTRATION:** Australian New Zealand Clinical Trials Registry, [www.anzctr.org.au](http://www.anzctr.org.au), ACTRN12607000551493.

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**LEVEL OF EVIDENCE: II**

Increasing maternal body mass index (BMI, calculated as weight (kg)/[height (m)]<sup>2</sup>) is associated with a dose-dependent increased risk of cesarean delivery, particularly emergency cesarean delivery in labor.<sup>1–4</sup> Cesarean delivery in obese women is associated with



increased rates of morbidity and mortality compared with cesarean delivery in women with normal BMIs and also with increased use of limited healthcare resources.<sup>2,5</sup> Potential limitations when defining obesity by standard World Health Organization (WHO) BMI criteria recently have been highlighted with both underrecognition of obesity in some ethnicities and overdiagnosis in other ethnic groups.<sup>6</sup> Ethnicity-specific BMI criteria have been developed to account for differing proportions of body fat between different ethnicities,<sup>6,7</sup> but these criteria have rarely been used to study the relationship between obesity and pregnancy outcome.<sup>8</sup>

Although indications for cesarean delivery in labor among obese women have often been reported,<sup>9,10</sup> few studies have reported the timing of cesarean delivery with respect to the first and second stages of labor.<sup>9,11-13</sup> The only prospective study of obese nulliparous women in labor at term reported a tendency to increased first- and second-stage cesarean delivery compared with women with normal BMIs, but this study was underpowered.<sup>9</sup> Because obese nulliparous women have a particularly high rate of caesarean delivery during labor, better understanding of whether cesarean delivery occurs during the first or second stage in these women would assist clinical management.

In this prospective study of nulliparous women in labor at term, we hypothesized that 1) cesarean delivery rates would be increased in the first and second stages of labor in overweight and obese women; and 2) being overweight or obese according to ethnicity-specific BMI criteria would be an independent risk factor for cesarean delivery in the first and second stages of labor.

## MATERIALS AND METHODS

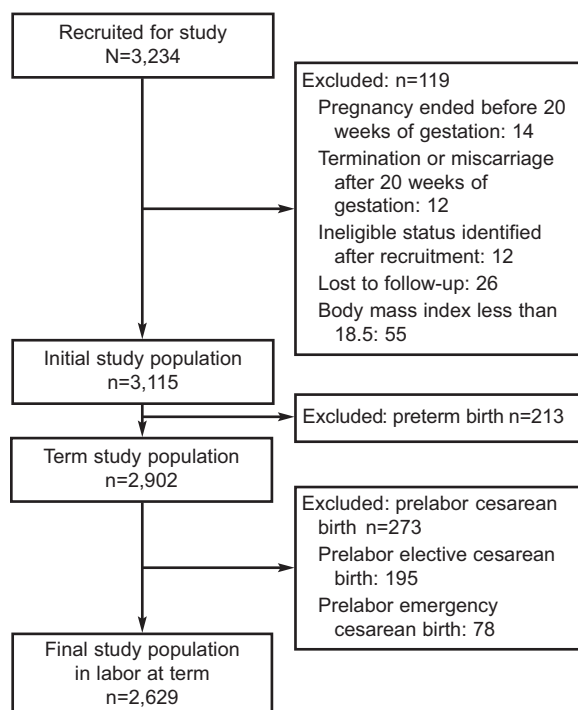
Participants were healthy, nulliparous women recruited to the Screening for Pregnancy Endpoints Study from Auckland, New Zealand, and Adelaide, Australia, between November 2004 and October 2008. The Screening for Pregnancy Endpoints study is a multicenter prospective cohort study with the primary aim of developing screening tests for prediction of preeclampsia, spontaneous preterm birth, and small-for-gestational-age neonates. Ethical approval was obtained from local ethics committees (New Zealand AKX/02/00/364, Australia REC 1712/5/2008) and all women provided written informed consent. Detailed methods have been described previously.<sup>14</sup> The final study population comprised women who labored at term (Fig. 1).

Because the focus of the current study was obesity, underweight women (BMI less than 18.5) were

excluded. Maternal BMI was calculated using maternal height and weight, measured to the nearest centimeter and kilogram, respectively, by research midwives at 15±1 weeks of gestation. Women were classified into normal, overweight, and obese groups according to conventional WHO<sup>15</sup> and ethnicity-specific criteria.<sup>6,7</sup> WHO criteria were 18.5–24.9 (normal), 25–29.9 (overweight), and 30 or greater (obese). In the ethnicity-specific classification, different criteria were used for Asian (normal, 18.5–22.9; overweight, 23 or greater; obese, 27.5 or greater) and Pacific Island or Maori women (normal, 18.5–25.9; overweight, 26 or greater; obese, more than 32). For women who were not of Asian, Pacific Island, or Maori ethnicity, WHO criteria were used. Normal BMI was the referent.

The primary outcome measure was cesarean delivery in labor at term further classified as cesarean delivery in first and second stages of labor. Secondary outcomes were gestation at delivery, delivery gestation 41 weeks or greater, induction of labor, and duration of labor.

Estimated date of delivery was calculated from a certain last menstrual period date and only adjusted if either an ultrasonographic scan at less than 16 weeks of gestation found a difference of 7 or more days



**Fig. 1.** Recruitment flow chart.

Fyfe. Maternal BMI and Risk of Cesarean Delivery. *Obstet Gynecol* 2011.



between the scan gestation and that calculated by the last menstrual period or at a 20-week scan a difference of 10 or more days was found between the scan gestation and that calculated from the last menstrual period. If the last menstrual period date was uncertain, scan dates were used to calculate the estimated date of delivery.<sup>16</sup> Socioeconomic index was a measure of socioeconomic status derived from maternal occupation.<sup>17</sup> Active labor was defined as regular, painful uterine contractions with progressive cervical effacement and dilation and cervical dilatation 3 cm or more.<sup>18</sup> Prelabor elective cesarean delivery was a planned procedure before the onset of labor or after the onset of labor, when the decision for cesarean delivery was made before labor.<sup>19</sup> Prelabor emergency cesarean delivery was a delivery required because of an emergency situation (eg, fetal distress) before the onset of active labor when the cesarean delivery was performed having not been previously considered necessary. Emergency cesarean delivery in labor was delivery required because of an emergency situation in active labor (eg, obstructed labor, fetal distress) when the cesarean delivery was performed having not been previously considered necessary.<sup>19</sup> Duration of the first stage labor was from the onset of active labor to full cervical dilatation.<sup>18</sup> Duration of the second stage of labor was from full cervical dilatation until delivery of the neonate.<sup>18</sup> Term delivery was delivery at 37 or greater gestational weeks. Preeclampsia was defined as gestational hypertension (systolic blood pressure 140 mm Hg or higher, diastolic blood pressure 90 or higher, or both on at least two occasions four hours apart either after 20 weeks of gestation but before the onset of labor or postpartum) with proteinuria (300 mg or greater per 24 hours or spot urine protein:creatinine ratio 30 mg/mmol or greater creatinine or urine dipstick protein 2+ or greater) or any multisystem complication of preeclampsia.<sup>16</sup> A small-for-gestational-age neonate had a birth weight less than the 10th customized centile (adjusted for neonatal sex, gestation at delivery, and maternal characteristics: parity, ethnicity, height, and booking weight).<sup>20</sup> A large-for-gestational-age neonate had a birth weight more than the 90th customized centile (adjusted for neonatal sex, gestation at delivery, and maternal characteristics: parity, ethnicity, height, and booking weight).<sup>20</sup>

Data were entered into an Internet-accessed, auditable database. Data analysis was performed using the statistical software package SAS 9.1. Univariable analysis was performed to compare maternal characteristics and pregnancy and birth outcomes

among ethnicity-specific BMI groups. "Normal BMI" was the referent group.

The chi-square test was used for analysis of categorical variables. Analysis of variance and Dunnett's test were performed to compare continuous variables as appropriate. Multivariable analysis was performed to estimate whether being overweight or obese are independently associated with risk of cesarean delivery (all cesarean deliveries and in first stage of labor) after adjusting for confounders associated with cesarean, obesity, or both. The covariates adjusted for were maternal age, height, socioeconomic index, smoking, conception with artificial reproductive technology, gestational hypertension, preeclampsia, gestational diabetes, induction of labor, gestation at delivery, maternity care provider (public or private), small for gestational age, and large for gestational age. Ethnicity-specific BMI criteria and then WHO BMI criteria were used to define overweight and obesity in the multivariable analysis.

## RESULTS

Between November 2004 and October 2008, 3,234 women were recruited to the Screening for Pregnancy Endpoints study in Auckland and Adelaide and follow-up was complete in 99% of participants (Fig. 1). The initial study population (n=3,115) included 213 (6.8%) women with preterm births and 273 (8.8%) prelabor cesarean deliveries performed at any gestation. The overall rate of preterm birth did not differ between BMI groups (normal 106 [6.4%], overweight 64 [7.0%], and obese 43 [7.9%];  $P=.49$ ) nor did the type of preterm birth, either spontaneous (normal 76 [4.6%], overweight 47 [5.1%], obese 26 [4.8%];  $P=.82$ ) or iatrogenic (normal 30 [1.8%], overweight 17 [1.9%], obese 17 [3.1%];  $P=.41$ ). Prelabor cesarean delivery was higher in obese women (normal 133 [8.6%], overweight 76 [8.9%], and obese 64 [12.6%];  $P=.02$ ) as a result of a higher rate of prelabor emergency cesarean delivery (normal 29 [1.9%], overweight 21 [2.5%], and obese 28 [5.6%];  $P<.001$ ). Elective prelabor cesarean rates were similar across BMI groups.

The final study population (n=2,629) comprised women who labored at term either spontaneously (n=1,832) or after induction of labor (n=797). Overweight and obese women differed in a number of demographic characteristics compared with those with normal BMIs (Table 1). Obese women were younger, shorter, had lower socioeconomic indices, and were more likely to be single, to smoke, and to receive public antenatal care. Hypertensive disorders of pregnancy and gestational diabetes were also more common.



**Table 1. Maternal Characteristics and Antenatal Outcomes for Nulliparous Women in Labor at Term**

	Body Mass Index (kg/m <sup>2</sup> )			P
	Normal (n=1,416)	Overweight (n=773)	Obese (n=440)	
Maternal characteristic				
Ethnicity				<.001
European	1,242 (87.7)	651 (84.2)	385 (87.5)	
Asian	70 (4.9)	34 (4.4)	15 (3.4)	
Maori or Pacific	41 (2.9)	47 (6.1)	15 (3.4)	
Indian	24 (1.7)	27 (3.5)	10 (2.3)	
Other	39 (2.8)	14 (1.8)	15 (3.4)	
Age (y)	27.9±5.8	27.9±5.7	26.7±5.5	<.001
Height (cm)	165.7±6.5	164.9±6.6	164.5±6.3	<.001
Primigravid	1,088 (76.8)	586 (73.5)	321 (73.0)	.052
Unmarried	101 (7.1)	52 (6.7)	44 (10.0)	.003
Socioeconomic index	43±17	41±16	35±15	<.001
Smoking at 15 wk	140 (9.9)	69 (8.9)	71 (16.1)	<.001
Public obstetric care	1,166 (82)	672 (87)	409 (93)	<.001
Pregnancy complications				
Gestational hypertension	57 (4.0)	74 (9.6)	57 (13.0)	<.001
Preeclampsia	39 (2.8)	34 (4.4)	38 (6.7)	<.001
Gestational diabetes*	17 (1.2)	14 (1.8)	31 (7.0)	<.001

Data are n (%) or mean±standard deviation unless otherwise specified.

P values are for comparisons between all body mass index groups.

\* Unknown n=159.

There was no difference in mean gestation at delivery across BMI groups and no increase in prolonged pregnancy (41 weeks or greater) among obese women (Table 2). Induction of labor was more common in overweight and obese women. The rate of cesarean delivery in labor also increased with increasing maternal BMI (Fig. 2). Obese women were twice as likely to have cesarean delivery in labor compared with women with normal BMIs as a result of an increased rate of cesarean in the first stage of labor

(Table 2). In contrast, the rate of cesarean delivery in the second stage of labor was similar across BMI groups.

After adjusting for potential confounding factors for both BMI and cesarean delivery, being overweight or obese were independent risk factors for all cesarean deliveries in labor and cesarean delivery in first stage of labor (Table 3). The results were similar whether ethnicity-specific or WHO BMI criteria were used to define obesity. Other independent risk factors

**Table 2. Labor and Delivery Outcomes for Nulliparous Women in Labor at Term**

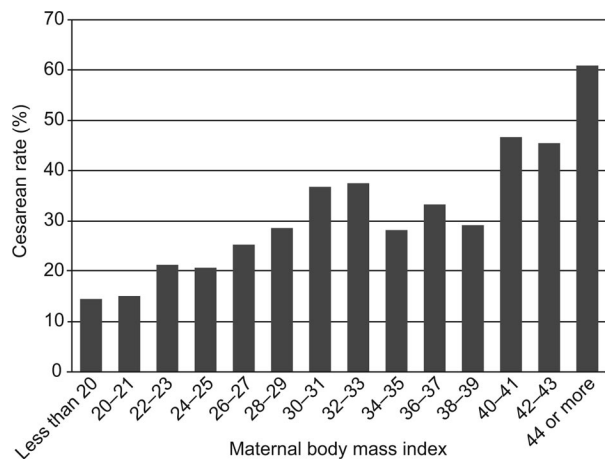
Outcome	Body Mass Index (kg/m <sup>2</sup> )			P
	Normal (n=1,416)	Overweight (n=773)	Obese (n=440)	
Gestation at delivery (wk)	40.0±1.2	40.1±1.2	40.0±1.2	.48
Delivery gestation 41 wk or more	349 (24.7)	216 (27.9)	115 (26.1)	.24
Duration of labor				
Vaginal birth (min)				
Duration first stage	429±238	432±264	424±258	.90
Duration second stage	78±55	82±59	69±54	.007
Total duration	507±253	515±281	493±272	.53
Mode of delivery				
Vaginal (n=2,018)	1,159 (81.8)	579 (74.9)	280 (63.6)	<.001
Spontaneous (n=1,405)	795 (56.1)	394 (50.1)	216 (49.1)	<.001
Operative (n=613)	364 (25.7)	185 (23.9)	64 (14.6)	<.001
Cesarean delivery in labor (n=611)	257 (18.1)	194 (25.1)	160 (36.4)	<.001
First-stage cesarean	181 (12.7)	149 (19.3)	137 (31.1)	<.001
Second-stage cesarean	76 (5.4)	45 (5.8)	23 (5.2)	.99

Data are mean±standard deviation or n (%) unless otherwise specified.

P values are for comparisons among all body mass index groups.







**Fig. 2.** Rate of cesarean delivery in labor at term by maternal body mass index.

Fyfe. Maternal BMI and Risk of Cesarean Delivery. *Obstet Gynecol* 2011.

for all cesarean deliveries in labor at term and cesarean delivery in the first stage of labor included maternal age, height, gestational hypertension, induction of labor, final gestation at delivery, and a large-for-gestational-age neonate. An additional risk factor for cesarean delivery in the first stage of labor was preeclampsia. In a secondary analysis, women who had labor induced were excluded ( $n=797$ ). Independent risk factors for cesarean delivery among women who went into spontaneous labor ( $n=1,832$ ) were the same with a similar magnitude of effect, except gestational hypertension, which was not significant (Table 4).

Because there was no significant difference in the rates of second-stage cesarean delivery between BMI groups, no multivariable analysis was performed. A subgroup analysis was performed to compare birth outcomes by BMI groups in women who reached the second stage of labor (Table 5). Of note, obese women who reached the second stage had a higher rate of spontaneous vaginal birth than did those in the control population with normal BMIs.

## DISCUSSION

We have demonstrated that nulliparous women in labor at term who were overweight or obese, by either WHO or ethnicity-specific BMI criteria, had an increased risk of cesarean delivery independent of other recognized risk factors for cesarean delivery. The novel and clinically important finding is that this elevated risk of cesarean delivery in labor among overweight and obese women was confined to the first stage.

Our findings are consistent with previous publications reporting increased risk of cesarean delivery

**Table 3.** Independent Risk Factors for Cesarean Delivery in Labor at Term

Risk Factor	Ethnicity-Specific Body Mass Index	World Health Organization Body Mass Index
All cesarean deliveries in labor		
Obesity	2.51 (1.94–3.25)	2.54 (1.96–3.30)
Overweight	1.34 (1.07–1.67)	1.29 (1.03–1.61)
Maternal age (per 5 y increase)	1.44 (1.29–1.60)	1.44 (1.29–1.60)
Maternal height (per 1 cm decrease)	1.08 (1.06–1.09)	1.08 (1.06–1.09)
Gestational hypertension	1.50 (1.05–2.15)	1.49 (1.04–2.13)
Induction of labor	1.63 (1.32–2.01)	1.63 (1.32–2.01)
Final gestation at delivery (per 1 wk increase)	1.27 (1.16–1.38)	1.27 (1.16–1.38)
Large-for-gestational-age neonate	2.80 (2.05–3.83)	2.81 (2.06–3.83)
Cesarean delivery in first stage of labor		
Obesity	2.89 (2.19–3.80)	2.94 (2.23–3.87)
Overweight	1.39 (1.09–1.79)	1.40 (1.09–1.80)
Maternal age (per 5 y increase)	1.31 (1.17–1.48)	1.31 (1.17–1.47)
Maternal height (per 1 cm decrease)	1.08 (1.01–1.064)	1.09 (1.07–1.10)
Gestational hypertension	1.63 (1.12–2.36)	1.61 (1.11–2.33)
Preeclampsia	1.67 (1.03–2.70)	1.63 (1.00–2.64)
Induction of labor	1.77 (1.41–2.22)	1.76 (1.41–2.21)
Final gestation at delivery (per 1 wk increase)	1.25 (1.14–1.37)	1.25 (1.14–1.37)
Large-for-gestational-age neonate	3.09 (2.23–4.28)	3.10 (2.24–4.29)

Data are adjusted odds ratio (95% confidence interval).

Referent group is vaginal birth at term. Logistic regression analyses are adjusted for maternal age, height, socioeconomic index, smoking, assisted reproductive technology, gestational hypertension, preeclampsia, induction of labor, gestational diabetes, gestation at delivery, small for gestational age, large for gestational age, and type of obstetric care.

in labor among nulliparous women with increased BMIs.<sup>21–23</sup> However, few previous reports have prospectively studied low-risk nulliparous women in labor at term<sup>1,9</sup> or presented findings regarding timing of cesarean delivery.<sup>9</sup> Bergholt<sup>1</sup> reported that overall most cesarean deliveries were performed in the first stage of labor (82%) but did not analyze the risk by BMI group. A smaller study reporting a tendency to



**Table 4. Independent Risk Factors for Cesarean Delivery in Spontaneous Labor at Term**

Risk Factor	Ethnicity-Specific Body Mass Index	World Health Organization Body Mass Index
Obesity	2.27 (1.62–3.17)	2.32 (1.66–3.24)
Overweight	1.51 (1.14–2.00)	1.40 (1.06–1.86)
Maternal age (per 5 y increase)	1.39 (1.21–1.60)	1.39 (1.21–1.60)
Maternal height (per 1 cm decrease)	1.08 (1.06–1.10)	1.08 (1.06–1.10)
Final gestation at delivery (per 1 wk increase)	1.28 (1.14–1.44)	1.27 (1.13–1.43)
Large-for-gestational-age neonate	3.18 (2.18–4.65)	3.12 (2.18–4.64)

Data are adjusted odds ratio (95% confidence interval). Referent group is vaginal birth at term. Logistic regression analyses are adjusted for maternal age, height, socioeconomic index, smoking, assisted reproductive technology, gestational hypertension, preeclampsia, gestational diabetes, gestation at delivery, small for gestational age, large for gestational age, and type of obstetric care.

**Table 5. Delivery Outcomes in Women Who Reached the Second Stage of Labor**

Outcome	Body Mass Index (kg/m <sup>2</sup> )			P
	Normal (n=1,235)	Overweight (n=624)	Obese (n=303)	
Vaginal birth				
Spontaneous (n=1,405)	795 (64)	394 (63)	216 (71)	<.001
Operative (n=613)	364 (29.5)	185 (29.6)	64 (21.1)	.04
Cesarean delivery in second stage (n=144)	76 (6.2)	45 (7.2)	23 (7.6)	.87

Data are n (%) unless otherwise specified. P values are for comparisons among all body mass index groups.

increased risk of cesarean delivery in the first and second stages in obese women compared with those with normal BMIs only analyzed the risk for cesarean delivery in the first stage of labor. Our findings suggest that labor dysfunction in overweight and obese women predominantly occurs in the first stage.

Among women who reached the second stage of labor, obese women had a higher rate of spontaneous vaginal birth and fewer operative vaginal births compared with women with normal BMIs. The relevance to clinical care is that once obese nulliparous women progress to the second stage of labor, they are just as likely to birth vaginally as women with normal BMIs.

The implications of our findings, regarding the elevated risk for cesarean delivery in the first stage of labor in overweight and obese women, are that obstetricians need to plan in advance for these more complicated and high-risk procedures. With the burgeoning epidemic of obesity, maternity units need to implement their own obesity birthing protocols, including specialized equipment, and the presence of senior obstetric, surgical, and anesthetic staff. Importantly, if obese women reach the second stage, the increased anticipation and planning required for potentially challenging high-risk cesarean delivery, particularly for morbidly obese women, can be down-scaled and a spontaneous vaginal birth can be anticipated as the most likely outcome. The underlying mechanisms for increased cesarean delivery rates among obese women are currently unknown but there are data suggesting a dose-dependent reduction in uterine contractility occurs, at least in vitro, with increased BMI.<sup>13</sup> If this is so, the effect of impaired contractility on the first stage of labor may be so profound that full dilation is not achieved, presenting as dystocia in the first stage of labor. Maternal expulsive effort is unlikely to be compromised in obese women because second-stage intrauterine pressure during active pushing has been reported to be equivalent between BMI groups.<sup>24</sup> There is a possibility that practitioner decision-making with regard to timing of cesarean delivery in obese women influenced our findings. However, it has been reported that practitioners wait longer in overweight and obese women than they do in normal-weight women before performing cesarean delivery for labor dystocia, so this is unlikely to have a major influence on our findings.<sup>25</sup>

A novel aspect of our study was the use of ethnicity-specific BMI categories in our multiethnic study population. Our cohort included women of Maori or Pacific and Asian descent who have lower and higher percentages of body fat, respectively, than European women at an equivalent BMI, resulting in recommendations for increased and decreased BMI thresholds for definitions of overweight and obesity.<sup>6,7,26</sup> Use of ethnicity-specific criteria to classify BMI confirmed the increased risk of cesarean delivery among obese women similar to that seen when WHO criteria were applied.

We found no difference in gestation at delivery or postterm delivery in overweight and obese women. Earlier studies have reported an inconsistent relationship between postdates pregnancy and maternal BMI.<sup>3,27</sup> Few previous studies have defined how the estimated date of delivery was calculated, raising



questions about the reliability of measures of gestation at delivery in some of these earlier studies.<sup>27,28</sup>

Strengths of our study include the prospective study design, which included only nulliparous women at term and the application of predetermined definitions for active labor, prelabor elective, and prelabor emergency cesarean delivery. This approach ensured that our final study population only included women in established labor. Our estimation of BMI was accurate because maternal height and weight were measured in early pregnancy rather than using less reliable self-reported measures.<sup>1,29</sup> Normal BMI was our referent group. In contrast, several previous studies used or included low BMI or overweight as the referent group potentially resulting in either over- or underestimation of risk for cesarean delivery, respectively.<sup>22,23</sup>

Because we did not have information about augmentation of labor or epidural use, a potential limitation is we were unable to include these in our model. Although early augmentation of spontaneous labor with amniotomy and oxytocin to either prevent delay in labor progression or treat mild delay has been associated with a modest reduction in cesarean delivery rates compared with standard care,<sup>30</sup> no effect was found in a systematic review when augmentation was implemented for established delay in active labor.<sup>30</sup> There are conflicting data from randomized controlled trials regarding the association between use of epidural analgesia and increased rate of cesarean delivery.<sup>31,32</sup> Recent systematic reviews again suggest that epidural use does not independently affect the rate of cesarean delivery.<sup>33-35</sup>

Epidural use is associated with longer duration of the second stage and increased rates of operative vaginal delivery.<sup>33,35</sup> We cannot exclude the possibility that differing rates of epidural analgesia use among women of differing BMIs may have confounded our finding of reduced duration of the second stage of labor and reduced operative vaginal delivery rates in obese women. We were unable to control for any possible effect of weight gain in pregnancy in our model because these data were not available.

Future research is needed to investigate the mechanisms underlying the association between increased BMI and cesarean delivery, and in particular why obese women fail to progress in the first stage of labor leading to increased cesarean delivery. If others confirm that the increased cesarean delivery rate in overweight and obese women is confined to the first stage, then clinical trials can be designed to optimize first stage management for this rapidly expanding group of pregnant women.

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