

## Maternal Obesity and its Impact on Neonatal Morbidity

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### Editorial

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### Editorial

Maternal obesity has long been perceived as a risk factor of neonatal morbidity and mortality [1]. Neonatal morbidity is defined as any adverse outcome in the first four weeks of an infant's life. Outcome measures often include events such as: birth injury, low Apgar scores, respiratory distress syndrome, bacterial sepsis, hypoglycemia, neonatal seizures, NICU admissions, and even neonatal death in their analysis. The lack of standardization of outcomes, however, has made it challenging to compare any neonatal morbidity studies, recognize trends, and identify solutions to improve neonatal morbidity outcomes.

The uncontrolled obesity epidemic among women of reproductive age and its effects on neonatal morbidity is of particular interest in this context. Currently, the most widely used measure to determine categories of body weight is the body mass index (BMI), defined as weight in kilograms divided by height in meters squared ( $\text{kg}/\text{m}^2$ ). An adult with a BMI of 18.5-24.9 is considered normal weight, while a BMI of 25.0-29.9 is considered overweight, and a BMI of 30.0 or greater is considered obese. The World Health Organization (WHO) further subdivides obesity into three different classes: obesity class I (BMI 30.0-34.9), obesity class II (BMI 35.0-39.9), and obesity class III (BMI 40.0 or greater) [1].

Several studies have demonstrated that infants delivered to women who enter pregnancy at a weight above normal (BMI of 25.0 or greater), are more likely to

experience adverse health outcomes [2-11]. More specifically, it has been shown that a higher maternal BMI is directly linked to increased risks of neonatal morbidity [2-4]. The risks are considerable in obese women (BMI 30 or greater), but are most profound in women diagnosed with class III obesity (BMI 40 or greater).

According to recent data provided by the National Vital Statistics System (NVSS), among US women giving birth between 2011-2015, 25.6% were obese and 25.8% were overweight before becoming pregnant [12]. More unsettling are the statistics provided by the Centers for Disease Control and Prevention (CDC) who demonstrated that obesity among reproductive age women (aged 18-44) has increased by almost 30% over the last decade, from 21.7% in 2006 to 27.5 % in 2016 [13]. Even though the trend of increasing obesity in the overall population seems to have leveled off more recently, the prevalence of class II (BMI 35.0-39.9) and class III obesity (BMI 40.0 or greater) is still rising in reproductive aged women [14]. Thus, with now more than 50% of women of childbearing age being declared obese or overweight, the number of women entering pregnancy with a BMI outside the normal range is at an all-time high and remains a significant public health concern.

It is already known that pregnancies of normal weight and overweight women are associated with lower neonatal morbidity rates compared to women of class I, class II, and class III obesity [2-11]. In particular, a large

retrospective study by Scott-Pillai, et al. studying the impact of BMI on maternal and neonatal outcomes in 30,298 singleton pregnancies over an 8-year period in 2004-2011, clearly demonstrated that being overweight or obese increases the risk of adverse maternal and neonatal outcomes when compared to normal weight women [2]. More specifically, the study also showed a direct relationship between increasing BMI and higher risks for neonatal morbidity.

Similarly, a recent, retrospective multi-center cohort study by Kim, et al. investigated neonatal morbidity rates in a cohort of obese women with singleton pregnancies and delivery BMI ranging from 30 to 82 [3]. The study was conducted at the University of Minnesota and the Hennepin County Medical Center in Minneapolis, Minnesota and included pertinent deliveries from January 2005 to April 2016. The primary outcome of the study was composite neonatal morbidity, which was defined as 5-minute Apgar score of less than 7, hospital stays greater than 5 days, admission to neonatal intensive care unit, and diagnosis of hypoglycemia, respiratory distress syndrome, sepsis, and neonatal death. Results demonstrated: (i) an overall composite neonatal morbidity rate of 24% in the cohort; (ii) a statistically significant increase in the incidence of composite neonatal morbidity with increasing BMI, with the highest rates among those with BMI 60 or greater (BMI 30-39 [17%], BMI 40-49 [19%], BMI 50-59 [22%] BMI 60 or greater [56%];  $P < .001$ ); and (iii) the adjusted odds of neonatal morbidity to be 4.47 times higher for neonates born to mothers with a BMI 60 or greater as compared to the BMI 30-39 group. Thus, the authors concluded that a BMI of 60 or greater at the time of delivery is significantly associated with increased neonatal morbidity. In addition, neonatal morbidity rates with BMI 60 or greater were almost five times higher when compared with women in any lesser obese BMI cohort between 30 and 59.

Taken together, the studies of normal weight, overweight, and obese women of childbearing age show a clear correlation between increasing maternal BMI and higher neonatal morbidity. In particular, they demonstrate that women at the extreme end of obesity (class III) display significantly higher neonatal morbidity rates than any other cohort of obese, overweight, or normal weight women.

Due to the ongoing and alarming trend of the obesity epidemic among women of childbearing age and the clear association between increasing BMI and neonatal morbidity, it seems sensible to address this risk early during reproductive planning and well before conception.

Obese and overweight women should be counseled on the benefits of pre-pregnancy weight loss and the maternal and neonatal risks associated with obesity in pregnancy [15,16]. To reach a healthier BMI before conception, weight loss regimens by nonsurgical means including behavioral modifications, dietary changes, and exercise should be discussed and implemented. In cases where a preconception BMI within the normal range seems difficult to attain, women should be counseled that even a small degree of weight loss may result in improved metabolic health, improved pregnancy outcomes, and lower neonatal morbidity rates. For women with a BMI of 40 or greater a referral for consultation with bariatric surgery may also be appropriate.

In conclusion, achieving weight loss and aiming for a BMI within normal range (between 18.5-24.9) before conception will result in a healthier pregnancy. At the same time, this may also decrease overweight-mediated adverse effects on the fetus and result in reduced neonatal morbidity outcomes.

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