The Epidemiology of Maternal Overweight in Dane County, Wisconsin

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ABSTRACT

Background: Research shows that maternal obesity leads not only to adverse pregnancy outcomes but also can act as a predictor of poor health of future generations. The Public Health Madison & Dane County Fetal and Infant Mortality Review Board observed poor health associated with prepregnancy BMI ≥ 25, prompting further exploration of this issue in the Dane County, Wisconsin population.

Objective: This is a descriptive epidemiologic study of the problem of maternal overweight defined as prepregnancy BMI ≥ 25 in Dane County.

Methods: Data were abstracted from the Secure Public Health Electronic Records Environment (SPHERE) on births in Dane County in 2011. Risk ratios were used to determine associations between race, education, parity, gravidity, and place of residence and maternal overweight. A *t* test was completed to determine differences in mean age of overweight and healthy weight mothers.

Results: Approximately half (50.6%) of Dane County mothers in 2011 were overweight or obese prepregnancy. Results showed increased risk of overweight for black mothers and multiparous/multigravidous mothers. There was no difference in mean age of overweight and healthy weight mothers. Overweight rates varied considerably by ZIP code of residence.

Conclusion: Rates of maternal overweight vary significantly in Dane County by social and demographic factors. This information can be used to design and target interventions and monitor trends over time.

INTRODUCTION

Associations between prepregnancy BMI ≥ 25 and pregnancy complication observed in the Public Health Madison & Dane County Fetal and Infant Mortality Review (FIMR) prompted further exploration of maternal overweight/obesity. The problematic health effects of maternal obesity on pregnancy, birth outcomes, and health of adult offspring are well established.

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Epidemiologic literature illustrates associations between maternal prepregnancy BMI ≥ 25 and adverse health effects on both the pregnancy and the infant, even into adulthood. Some of these adverse health effects include gestational diabetes,[1] hypertensive disorders of pregnancy, including preeclampsia;[1,2] planned and emergent C-sections; as well as stillbirth.[3] Furthermore, research suggests that prepregnancy and prenatal health and nutrition of the mother affect the health of children into adulthood, including glucose metabolism and cardiovascular disease.[4]

The purpose of this study is to describe the problem of maternal overweight in Dane County in terms of person and place. The data will inform public health interventions for Dane County by focusing attention on affected populations to determine root causes, and the study can be repeated in other communities to design and target intervention and monitor trends over time.

The following study included analysis of data from all births in Dane County in 2011 based on the information in terms of person and place stored in the Secure Public Health Electronic Records Environment (SPHERE) database to determine factors associated with maternal prepregnancy BMI ≥ 25. SPHERE is a unique use of an electronic health and public health records system that was developed to integrate medicine and public health. The SHERE database was modeled after a similar system in Minnesota as a reporting tool for 3 programs: Maternal Child Health, Reproductive Health/Family Planning, and Children and Youth with Special Health Care Needs. It includes information from medical and public health records: birth record data, maternal child health activities including case management and home visitation, referrals and outcomes, immunizations and standard prenatal, postpartum, home safety, and child passenger

seat assessments.[5] The study could be repeated in other communities for upstream definition of the obesity epidemic in Wisconsin.

METHODS

We queried the SPHERE database, including all births in Dane county in 2011. This database includes information from vital records of all births in Wisconsin. We determined the rate of prepregnancy overweight (BMI ≥ 25) among Dane County mothers in 2011. Note that overweight rates include obesity (BMI ≥ 30).

We also explored the variables of self-reported race, educational status, parity, gravidity, age, and place of residence. We defined place of residence as ZIP code of address listed on vital records. We explored both gravidity and parity, due to known limitations of SPHERE parity data.

Statistical analysis included bivariate analyses and *t* test analysis. The outcome for bivariate analyses was maternal prepregnancy BMI ≥ 25, and we completed these analyses for each of the determinant variables, except age. We compared mean age of overweight and healthy weight mothers using a *t* test. We compared ZIP codes with risk ratios of maternal overweight, using the county rate as reference and adjusting for small sample size with Empirical Bayes.[6] We repeated the analysis of ZIP codes correcting for race and educational status.

RESULTS

There were 6024 total births in Dane County in 2011; however, not all factors were recorded for each birth (Table 1). The research group was 73.2% white with the remainder equally split between black, Hispanic, and other races. Education distribution includes 61.2% college graduates and 9.4% without high school diplomas. The age distribution includes 2.9% under 20 years, 39.8% 20-29 years, 36.3% 30-34 years, and 21.0% 35 years or older. The distribution by BMI includes 51.0% with normal BMI (18-25), 2.3% underweight, 24.8% overweight (25-30), and 21.8% obese (>30) (Table 1).

Table 2 presents rates of overweight by race, education, parity, and gravidity. Numbers presented in Table 2 only include those births affected by maternal overweight. Rates of maternal obesity are higher among black and Hispanic women, and multiparous or multigravidous women. A *t* test analysis of age, comparing overweight mothers to those who were not overweight, shows an insignificant age difference (mean age of healthy weight mothers 30.3; mean age of overweight/obese mothers 30.1, *P* value 0.14, 95% CI -0.07, 0.47).

Rates of obesity varied considerably for the 32 ZIP codes of residence in Dane County, from a high of 72.4% in 53508 (Belleville) to a low of 31.1% in 53705 (Shorewood Hills, Spring Harbor, and Hill Farms neighborhoods) (Figure). Rates for ZIP codes with more than 100 affected births are listed in Table 2.

Table 1. Frequency Distribution

	Count	Percent of Total
Race		
White	4410	73.2%
Black	479	8.0%
Hispanic	583	9.7%
Other	552	9.2%
Total (N)	6024	100%
Education		
<High school graduate	562	9.4%
High school graduate	916	15.2%
Some college	854	14.2%
College degree	3676	61.2%
Total (N)	6008	100%
Age		
<20	174	2.9%
20-29	2398	39.8%
30-34	2186	36.3%
≥35	1266	21.0%
Total (N)	6024	100%
Parity		
Multiparous	3270	55.1%
Primaparous	2668	44.9%
Total (N)	5938	100%
Gravidity		
Multigravid	3697	62.3%
Primagravid	2241	37.7%
Total (N)	5938	100%

Distribution of race, age, education, parity and gravidity among women delivering children in 2011 in Dane County, Wisconsin.

Analysis of ZIP code when corrected for race and education through multiple regression reveal that variations persist (data not presented).

DISCUSSION

The results show that maternal overweight/obesity is a significant problem in Dane County, with nearly half of mothers in 2011 having BMI ≥ 25 prior to pregnancy. It must be noted that prepregnancy BMI from vital records often is taken from the medical record flow sheet, which either contains the weight at the first prenatal visit or a self-reported prepregnancy weight. These 2 numbers could cause overestimations or underestimations of the true maternal prepregnancy obesity rate. Despite the limitations of these data, they are the most reliable, accessible information, and the analysis completed is very informative. There was variation in maternal overweight with race, education, parity, gravidity, and place of residence. Age does not appear to be a contributing factor.

Several sociodemographic variables were associated with maternal overweight. Black mothers were more likely to be overweight than white mothers, which is a similar disparity to maternal mortality rates and other studies of overweight and obesity.[7]

cal colleges. As such, the population is relatively highly educated, with approximately 75% of women delivering in 2011 having college degrees or some college education. According to national demographic data, there has been a trend toward increasing maternal age and higher education of mothers—up to 54% with some college in 2008.[10] In addition, Dane County has a lower rate of births among teens compared to the rest of the state (19.4 vs 30.6 births/1,000 teens, respectively).[11] These characteristics may explain differences between the overall rates of maternal obesity in Dane County, compared with other communities in Wisconsin.

Other researchers have emphasized the contribution of place in the obesity epidemic, which makes the observed variation in risk ratio of maternal BMI ≥25 by ZIP code particularly interesting.[12] Though many have observed and recognized the importance of variation in health determinants by place at the county level,[13] variation on a smaller scale emphasizes the importance of local community health factors, such as food and exercise resource availability. The evidence for place contributing to health is strengthened by variations that persist despite race and educational status. Surveillance data are useful for targeting interventions in those neighborhoods with the highest risk and monitoring trends over time. Despite the limitations of ZIP codes, which generally do not define social communities, ZIP code is an accessible identifier of at risk populations to help guide public health resource allocation and connect databases such as SPHERE and medical records.

The research necessary for explanation and application of these findings to public health interventions is currently underway, and despite the ease with identifying race in data it seems likely to be affected by many confounding social factors.[8] Education is the only component of socioeconomic status available on the SPHERE database to link to BMI. The variation with education was not statistically significant, nor was it linear, and is therefore difficult to interpret. We suspect that the data are complicated by confounding factors such as the factors that determine completion of a college degree. Finally, multiparity and multigravidity were associated with increases in maternal overweight rates in our study. Though there is a more specific definition among obstetricians,[9] parity in SPHERE data includes only live births and late fetal deaths, without specifics. Similar findings with gravidity strengthen the association and have implications for interpartum weight counseling.

It is important to note the unique demographics of the population of women giving birth in Dane County. The county is home to a large university, a private 4-year college and multiple techni-

CONCLUSION

This study identified 3 factors associated with maternal overweight in race, parity/gravidity, and place of residence. This study group and Public Health Madison & Dane County Fetal and Infant Mortality Review focused efforts on exploring ZIP code as a contributor of health by exploring sociodemographic factors of 1 ZIP code. We have designed an interview study of women in the community to increase understanding of the life experience of the community members in an attempt to identify modifiable contributors.

Electronic health records have been implemented widely in efforts to track quality care measurements, such as those set by the

Wisconsin Collaborative for Healthcare Quality. The SPHERE database integrates measures of health care quality as well as public health initiatives and demographic information, allowing for a more comprehensive understanding of contributors to health. It can be used widely to improve understanding of community health. Thus far, few studies have been published illustrating the uses of the SPHERE database. This study serves as an example of 1 application of the data collected. The use of the SPHERE database can be applied across the state for a new approach to defining the obesity epidemic and designing successful public health interventions by improving health from the beginning of life.

Figure. Rates of Maternal Prepregnancy Overweight[a] by ZIP Code

Rates of Pre-pregnancy Overweight

<38%   Insufficient Data
38%-53%   Lake
>53%

[a]Maternal overweight is defined as prepregnancy BMI ≥25.

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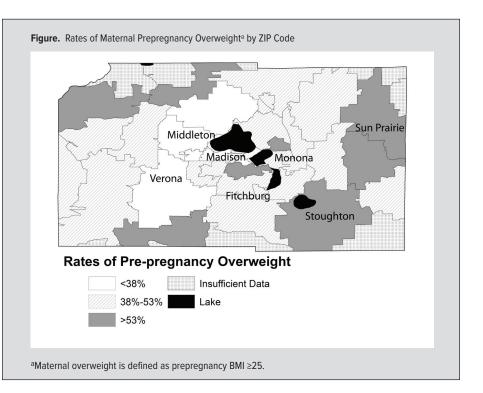
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