

An Assessment of the Association between Pre-pregnancy Body Mass Index, Chronic Disease, and Labor/Delivery Abnormalities with Length of Hospital Stay at Delivery, Michigan PRAMS 2004-2006

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Background

Past literature indicates that pre-pregnancy body mass index (BMI) is associated with poor birth outcomes and increased healthcare utilization including prolonged length of hospital stay at delivery.

Study Questions

In Michigan, is BMI associated with maternal length of hospital stay at delivery and is this relation mediated by chronic disease and/or labor/delivery abnormalities?

Methods

Data from the 2004-2006 Michigan Pregnancy Risk Assessment Monitoring System (PRAMS) and birth certificates were used for this study. We created a chronic disease composite variable comprised of hypertension or diabetes or both reported on the birth certificate. A woman was considered to have labor abnormalities if it was recorded on the birth certificate. A cumulative logit plot was used to visually inspect the relationship between BMI and length of maternal hospital stay since the proportional odds assumption was violated initially. The score test for the proportional odds assumption tends to reject the null hypothesis more often than is warranted, thus visual inspection is necessary in deciding what modeling strategy is most appropriate.

We constructed crude and adjusted ordinal logistic regression models of the association between BMI and length of hospital stay using the survey logistic procedure in SAS 9.1 (Cary, NC) to account for the survey design. Analyses were stratified by mode of delivery (vaginal vs. non-vaginal). Adjusted models included factors significantly associated in bivariate models. We assessed whether the impact of BMI on hospital stay was mediated by chronic disease (diabetes, hypertension) and/or labor/delivery abnormalities by entering each into our full model and evaluating the impact on point estimates.

Results

Table 1 presents the maternal demographics of the study population and the length of hospital stay. Nearly half of the women (47%) had normal BMI. Over 90% of women did not have chronic composite, and 95% had no labor abnormalities. Approximately 70% had a vaginal delivery. Three-quarters of the study population was non-Hispanic white, and 63% had private insurance.

As maternal BMI increased, the percent of women staying in the hospital 0-2 days decreased, indicating BMI was linearly related to length of hospital stay. Approximately 50% of women with no labor abnormalities stayed in the hospital 0-2 days compared to 16% of women with labor abnormalities. Women with no chronic composite were less likely to stay in the hospital 0-2 days compared to women with chronic composite (31% compared to 52%). Women who had a vaginal delivery were more likely to stay in the hospital 0-2 days compared to women with non-vaginal deliveries (62% compared to 22%). Non-Hispanic black women were most likely to stay in the hospital 5+ days compared to other races, as were women with Medicaid compared to women with private or no insurance.

Table 2 presents the length of hospital stay by maternal demographics, stratified by delivery type. Among both women with a vaginal delivery and women with a non-vaginal delivery, women with no chronic composite were significantly less likely to be discharged within 2 days of delivery compared to those with chronic composite.

Table 1. Population characteristics and maternal hospital length of stay

| Characteristic | N | % | 0-2 days | 3-4 days | 5+ days |
|--------------------------------|--------|------|----------|----------|---------|
| BMI | | | | | |
| <18.5 (underweight) | 25107 | 6.8 | 56.0 | 38.1 | 5.9 |
| 18.5-24.9 (normal) | 175176 | 47.2 | 53.4 | 39.2 | 7.4 |
| 25.0-29.9 (overweight) | 87307 | 23.5 | 48.5 | 42.4 | 9.1 |
| 30-34.9 (obese) | 45212 | 12.2 | 47.2 | 41.1 | 11.7 |
| 35+ (morbidly obese) | 38324 | 10.3 | 38.2 | 49.9 | 11.9 |
| Chronic composite | | | | | |
| Chronic composite | 33751 | 9.1 | 52.0 | 40.5 | 7.5 |
| No chronic composite | 337375 | 90.9 | 31.3 | 47.9 | 20.8 |
| Labor abnormalities | | | | | |
| Labor abnormalities | 19077 | 5.1 | 16.0 | 62.3 | 21.7 |
| No labor abnormalities | 354043 | 94.9 | 51.9 | 40.1 | 8.0 |
| Delivery | | | | | |
| Vaginal | 260556 | 70.2 | 62.0 | 32.4 | 5.6 |
| Other | 110570 | 29.8 | 22.0 | 62.2 | 15.8 |
| Race | | | | | |
| Non-Hispanic white | 226385 | 74.3 | 52.5 | 40.7 | 6.8 |
| Non-Hispanic black | 62112 | 17.3 | 37.4 | 46.0 | 16.6 |
| Hispanic | 18758 | 5.2 | 49.0 | 41.7 | 9.3 |
| Other | 11561 | 3.2 | 58.0 | 32.3 | 9.7 |
| Pre-pregnancy insurance | | | | | |
| Private | 232867 | 62.6 | 49.8 | 42.5 | 7.7 |
| Medicaid | 59568 | 16.0 | 47.0 | 40.0 | 13.0 |
| None | 79713 | 21.4 | 53.2 | 38.3 | 8.5 |

*all Wald Chi-square p-values of variables in table are highly significant

Results Continued

Among women with a non-vaginal delivery, those with no labor abnormalities were significantly more likely to spend 0-2 days in the hospital compared to women with labor abnormalities. Among women with a vaginal delivery, labor abnormalities were not associated with length of hospital stay. Non-Hispanic white women were significantly less likely than black women to spend 5+ days in the hospital among both women with vaginal deliveries and women with non-vaginal deliveries.

BMI was not significantly associated with length of hospital stay in either crude or adjusted models in both vaginal and non-vaginal deliveries. Adjustment by race, Medicaid insurance, and parity attenuated the relationship between BMI and length of hospital stay, although the relationship between BMI and hospital stay remained statistically insignificant. Addition of chronic disease (diabetes and/or hypertension) and/or labor/delivery abnormalities did not significantly alter the point estimates nor did it impact the statistical significance of the association between BMI and length of hospital stay when added to the adjusted models other than in morbidly obese (BMI ≥ 35) women with non-vaginal deliveries.

*Note: Results from multivariate models were lost due to information technology issues

Table 2. Population characteristics and maternal hospital length of stay, by delivery type

| Characteristic | Vaginal Delivery | | | Non-vaginal Delivery | | |
|--------------------------------|------------------|----------|---------|----------------------|----------|---------|
| | 0-2 days | 3-4 days | 5+ days | 0-2 days | 3-4 days | 5+ days |
| BMI | | | | | | |
| <18.5 (underweight) | 65.0 | 31.0 | 4.0 | 22.7 | 64.6 | 12.7 |
| 18.5-24.9 (normal) | 64.1 | 30.8 | 5.1 | 21.7 | 64.0 | 14.3 |
| 25.0-29.9 (overweight) | 59.4 | 35.0 | 5.6 | 25.0 | 58.5 | 16.5 |
| 30-34.9 (obese) | 59.4 | 32.2 | 8.4 | 25.0 | 57.4 | 17.6 |
| 35+ (morbidly obese) | 56.8 | 36.3 | 6.9 | 14.7 | 67.2 | 18.1 |
| Chronic composite | | | | | | |
| Chronic composite | 62.7* | 31.8 | 5.5 | 24.3* | 63.1 | 12.6* |
| No chronic composite | 51.8* | 39.8 | 8.3 | 8.7* | 56.8 | 34.5* |
| Labor abnormalities | | | | | | |
| Labor abnormalities | 62.5 | 31.1 | 6.4 | 7.5* | 68.0 | 24.5* |
| No labor abnormalities | 62.0 | 32.4 | 5.6 | 24.4* | 61.2 | 14.4* |
| Race | | | | | | |
| Non-Hispanic white | 65.3* | 30.4* | 4.3* | 22.0 | 65.1 | 12.8* |
| Non-Hispanic black | 44.4* | 43.9* | 11.7* | 20.6 | 51.0 | 28.4* |
| Hispanic | 62.8 | 31.1 | 6.1 | 17.0 | 66.4 | 16.6 |
| Other | 74.4 | 20.8 | 4.7 | 24.4 | 55.7 | 19.9 |
| Pre-pregnancy insurance | | | | | | |
| Private | 62.5 | 33.4 | 4.2* | 22.2 | 62.3 | 15.4 |
| Medicaid | 56.7 | 33.8 | 9.5* | 21.8 | 56.2 | 22.0 |
| None | 64.2 | 28.7 | 7.1 | 21.5 | 66.0 | 12.5 |

* 95% CI for row percent among strata do not overlap

Conclusions

Our study indicates that in Michigan, BMI is not associated with length of hospital stay. The relationship between BMI and hospital stay appears not to be mediated by chronic disease (diabetes/hypertension) and/or labor/delivery abnormalities other than in the morbidly obese delivered by c-section.

Public Health Implications

Further research is necessary to investigate why obese women in Michigan do not have longer durations of hospital stays given they are significantly more likely to have chronic diseases and labor/delivery complications associated with poor perinatal outcomes. Maternal BMI and length of hospital stay following delivery should be frequently assessed to improve health outcomes.

