# Pre-pregnancy Obesity and Peripartum Cardiomyopathy


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## Introduction

Peripartum cardiomyopathy is a life-threatening condition for pregnant and postpartum patients. It is defined as a left ventricular systolic dysfunction corresponding to a cardiac ejection fraction (EF) of less than 45%[1]. It develops in the last month of pregnancy or within 5 months after delivery[2]. Symptoms can vary from mild to severe, and patients present with shortness of breath, chest pain, orthopnea etc[3]. The clinical outcome is diverse ranging from complete recovery to death. The overall incidence is estimated to be at 0.1% but is associated with a high rate of morbidity and mortality ranging from 7% to 50%[4].

Research has shown that pre-pregnancy obesity is associated with an increased risk of pregnancy complications such as pregnancy loss, preeclampsia, preterm delivery, cesarean delivery, and postpartum anemia[5]. However, there have **not** been many studies that focus on the risk-relationship between obesity and peripartum cardiomyopathy specifically.

The aim of this project is to determine the relationship between body mass index (BMI) at the time of pregnancy and the risk of developing peripartum cardiomyopathy. This project also seeks to evaluate the relationship between the incremental BMI classes and the severity of peripartum cardiomyopathy (defined as lower EF).

**Hypothesis:** There exists a positive dose-response relationship between the categories of BMI and the increased prevalence and severity of peripartum cardiomyopathy.

## Aims and Objectives

**Aim:** To determine if there is a relationship between pre-pregnancy BMI and the risk of developing peripartum cardiomyopathy.

- **Objective/Outcome #1*:*** Determine the overall prevalence of peripartum cardiomyopathy in the cohort and stratify this prevalence by BMI.
- **Objective/Outcome #2*:*** Determine the relationship between the pre-pregnancy BMI categories and the risk of developing peripartum cardiomyopathy.
- **Objective/Outcome #3:** Evaluate the relationship between the incremental obesity BMI categories and the severity of peripartum cardiomyopathy (defined by worsening EF of left ventricular systolic function)
- **Objective/Outcome # 4:**Evaluate racial, socioeconomic, and health related factors that may be associated with the occurrence of peripartum cardiomyopathy

## Methods

We conducted a retrospective cohort study identifying patients that were diagnosed with peripartum cardiomyopathy and were delivered at Corewell Health William Beaumont University Hospital. The study was approved by the Institutional Board review (IRB) at Corewell Health William Beaumont University Hospital in Royal Oak. The study time period included in the chart review extended from January 1st, 2015 through September 12th, 2024.

The study included patients with a diagnosis of peripartum cardiomyopathy based on an EF of less than 45% and a heart failure diagnosis that is made within 1 month prior to delivery and up to 5 months after delivery. Women who delivered at <23 0/7 weeks gestational age and were < 18 years of age were excluded from the study.

Data that was abstracted included baseline demographics, preexisting medical conditions, pregnancy, and labor outcome data. Delivery BMI was used as a surrogate for pre-pregnancy BMI. Due to the diversity of obstetrical practice groups and the lack of a unified electronic medical record system (EPIC) across all sites, obtaining pre-pregnancy BMI for every patient was not feasible. Given that weight gain is expected during pregnancy, delivery BMI was used as a surrogate measure.

Patients that met the inclusion criteria were divided into two groups. Group 1 had a BMI < 35 kg/m2 and Group 2 had a BMI ≥ 35 kg/m2.

Statistical analysis was performed using Fisher's Exact Test and the two sample t-test. Statistical significance was defined as p-value less than 0.05.

## Results

- 20 patients met the inclusion criteria for peripartum cardiomyopathy within the time-period from January 1, 2015, through September 12th, 2024. Out of the 20 patients, 7 patients had a BMI < 35 and 13 patients had a BMI ≥ 35.
- The mean BMI in Group 1 was 30.5 kg/m2 and Group 2 was 44.1 kg/m2.
- Baseline demographics including race, marital status, insurance, smoking and marijuana use, chronic hypertension, pregestational diabetes and twin gestations did not differ significantly between the 2 groups. (Table 1)
- None of the patients in the cohort who developed peripartum cardiomyopathy underwent In-Vitro Fertilization
- Pregnancy outcomes including gestational age at delivery, route of delivery, aspirin use, maternal anemia, postpartum hemorrhage, gestational diabetes, and preeclampsia were not statistically different between the 2 groups. (Table 2)

**Table 1: Baseline Demographics of Patients with Peripartum Cardiomyopathy Stratified by BMI**

| | Group 1 BMI <35 | Group 2 BMI ≥ 35 | Total | P-value |
|---|---|---|---|---|
| | (N=7) | (N=13) | (N=20) | |
| **BMI** | | | | |
| Mean (SD) | 30.5 (3.5) | 44.1 (8.4) | 39.3 (9.6) | |
| **Marital Status, n (%)** | | | | 1.0000[1] |
| Married | 5 (71.4%) | 8 (61.5%) | 13 (65.0%) | |
| Single | 2 (28.6%) | 5 (38.5%) | 7 (35.0%) | |
| **Race, n (%)** | | | | 0.5481[1] |
| African American | 4 (57.1%) | 10 (76.9%) | 14 (70.0%) | |
| White | 2 (28.6%) | 3 (23.1%) | 5 (25.0%) | |
| Asian | 1 (14.3%) | 0 (0.0%) | 1 (5.0%) | |
| **Insurance, n (%)** | | | | 1.0000[1] |
| Medicaid | 3 (42.9%) | 5 (38.5%) | 8 (40.0%) | |
| Medicare | 0 (0.0%) | 1 (7.7%) | 1 (5.0%) | |
| Private insurance | 4 (57.1%) | 7 (53.8%) | 11 (55.0%) | |
| **Smoke, n (%)** | | | | 0.1478[1] |
| Yes | 0 (0.0%) | 2 (15.4%) | 2 (10.0%) | |
| No | 7 (100.0%) | 7 (53.8%) | 14 (70.0%) | |
| Unknown | 0 (0.0%) | 4 (30.8%) | 4 (20.0%) | |
| **Marijuana, n (%)** | | | | 0.37421[1] |
| No | 5 (71.4%) | 6 (46.2%) | 11 (55.0%) | |
| Unknown | 2 (28.6%) | 7 (53.8%) | 9 (45.0%) | |
| **Chronic Hypertension, n (%)** | | | | 0.3498[1] |
| Yes | 2 (28.6%) | 8 (61.5%) | 10 (50.0%) | |
| No | 5 (71.4%) | 5 (38.5%) | 10 (50.0%) | |
| **Pregestational Diabetes, n (%)** | | | | 0.27021[1] |
| Yes | 2 (28.6%) | 1 (7.7%) | 3 (15.0%) | |
| No | 5 (71.4%) | 12 (92.3%) | 17 (85.0%) | |
| **Twins, n (%)** | | | | 1.0000[1] |
| Yes | 1 (14.3%) | 2 (15.4%) | 3 (15.0%) | |
| No | 6 (85.7%) | 11 (84.6%) | 17 (85.0%) | |

[1] Fisher Exact p value, [2]Equal variance two sample t-test

**Table 2: Pregnancy Outcome of Patients who Developed Peripartum Cardiomyopathy stratified by BMI**

| | Group 1 BMI <35 | Group 2 BMI ≥ 35 | Total | P-value |
|---|---|---|---|---|
| | (N=7) | (N=13) | (N=20) | |
| **GA_wks** | | | | 0.1967[2] |
| Mean (SD) | 37.6 (1.9) | 35.8 (3.2) | 36.4 (2.9) | |
| **Route of Delivery, n (%)** | | | | 0.1736[1] |
| Vaginal Delivery | 4 (57.1%) | 3 (23.1%) | 7 (35.0%) | |
| C-Section | 3 (42.9%) | 10 (76.9%) | 13 (65.0%) | |
| **Aspirin During Pregnancy, n (%)** | | | | 0.5735[1] |
| Yes | 2 (28.6%) | 1 (7.7%) | 3 (15.0%) | |
| No | 2 (28.6%) | 4 (30.8%) | 6 (30.0%) | |
| Unknown | 3 (42.9%) | 8 (61.5%) | 11 (55.0%) | |
| **Anemia During Pregnancy, n (%)** | | | | 0.1756[1] |
| Yes | 3 (42.9%) | 4 (30.8%) | 7 (35.0%) | |
| No | 4 (57.1%) | 4 (30.8%) | 8 (40.0%) | |
| Unknown | 0 (0.0%) | 5 (38.5%) | 5 (25.0%) | |
| **Post Partum Hemorrhage,n (%)** | | | | 0.5211[1] |
| Yes | 0 (0.0%) | 2 (15.4%) | 2 (10.0%) | |
| **Gestational Diabetes, n (%)** | | | | 0.2702[1] |
| Yes | 2 (28.6%) | 1 (7.7%) | 3 (15.0%) | |
| **Preeclampsia, n (%)** | | | | 0.6126[1] |
| Yes | 1 (14.3%) | 4 (30.8%) | 5 (25.0%) | |

[1] Fisher Exact p value, [2]Equal variance two sample t-test

- Table 3 shows the cardiac variables for patients with peripartum cardiomyopathy stratified by BMI. Patients in Group 1 had a higher mean EF (34.6%) compared with patients in Group 2 (mean EF 29.3%), although the difference was not statistically significant.
- Out of those with a BMI ≥ 35, 38.5% had a severe EF defined as ≤ 29%, while only 14.3% of patients with BMI < 35 had an EF ≤ 29%, although again the difference was not statistically significant.

**Table 3: Cardiac Variables for Patients with Peripartum Cardiomyopathy Stratified by BMI**

| | Group 1 BMI <35 | Group 2 BMI ≥ 35 | Total | P-value |
|---|---|---|---|---|
| | (N=7) | (N=13) | (N=20) | |
| **Ejection Fraction** | | | | 0.1000[2] |
| Mean (SD) | 34.6 (5.6) | 29.3 (6.9) | 31.2 (6.8) | |
| **Ejection Fraction Categories, n (%)** | | | | 0.3544[1] |
| EF of 30-44 | 6 (85.7%) | 8 (61.5%) | 14 (70.0%) | |
| EF ≤29 | 1 (14.3%) | 5 (38.5%) | 6 (30.0%) | |

[1] Fisher Exact p value, [2]Equal variance two sample t-test

## Limitations

- Our small sample size prevented achieving statistical significance because of the lack of sufficient power to detect true effects.
- We could not obtain the prevalence of the peripartum cardiomyopathy in the total cohort and BMI groups.

## Conclusions

- Obtaining an adequate sample size to achieve power was challenging due to the rarity of peripartum cardiomyopathy.
- Despite the small sample size, a positive dose response relationship between higher BMI categories and worsening severity of the EF could be detected.
- To strengthen the hypothesis and refine recommendations, future studies should use a larger sample size and an extended time frame.

## References


1. Mubarik A, Chippa V, Iqbal AM. Postpartum Cardiomyopathy. [Updated 2022 Aug 8]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan.https://www.ncbi.nlm.nih.gov/books/NBK534770/
2. Rodriguez Ziccardi M, Siddique MS. Peripartum Cardiomyopathy. [Updated 2025 Feb 20]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK482185/
3. Carlson S, Schultz J, Ramu B, Davis MB. Peripartum Cardiomyopathy: Risks Diagnosis and Management. *J Multidiscip Healthc*. 2023;16:1249-1258. Published 2023 May 3. doi:10.2147/JMDH.S372747
4. Okeke T, Ezenyeaku C, Ikeako L. Peripartum cardiomyopathy. *Ann Med Health Sci Res*. 2013;3(3):313-319. doi:10.4103/2141-9248.117925
5. Haq N, Chamarthi VS, Ayabe A. Obesity in Pregnancy. [Updated 2025 Dec 14]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK572113/


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