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research article

## Eating For Two: A Study of the Effects of Obesity upon the Health of Pregnant Women and their Infants

—Michael Cochran-Boucher (Edited by Jennifer Lee)

My senior capstone research project for my degree in biology started out, like most, as a comprehensive literature review. My research paper dealt with a broad question, “the state of affairs in obstetrics,” and covered content from over sixty current journal articles relating to the most relevant topics of today. Meanwhile, since I was headed for a Physician’s Assistant program, my shadowing internship was comprised of time spent accompanying two physicians, at separate times, both on the labor and delivery floor and in the operating room for cesarean section births at the Lowell (Massachusetts) General Hospital. By the midpoint of my literature review and shadowing experience, I had found my specific research topic: the effects of obesity in pregnant women upon both their and their infant’s health, the birthing process and beyond.

The World Health Organization has designated the rising rate of obesity as one of the current most important global health threats facing civilization and has suggested that half of the US population will be obese by the year 2020 (Chu, 2008). An expanding body of recent research concerning pregnant women indicates that any degree of obesity confers an increased risk of health complications on both a mother and her baby during pregnancy, delivery and beyond. The medical community is showing increased concern over this growing problem. Articles, such as the one in the February 2011 issue of *The American Board of Family Medicine Journal*, detail the higher risks of diabetes, coronary artery disease, hypertension and cancers in obese pregnant women, along with increased complications of delivery and neonatal mortality and malformations; and, once the baby is born, decreased duration of breastfeeding (Kulie et al, 2011). The answer to the question, “Should pregnant women be ‘eating for two’?” is a clear and resounding “No.”

Given the huge body of research available, I realized the need to narrow the subject and purpose of my research. Using data from a local area, I would look for statistical correlations between a woman’s weight during pregnancy and the incidence of the four most common pregnancy complications or disease states: anxiety/depression, preeclampsia, chronic hypertension, and gestational diabetes mellitus (GDM). Preeclampsia, or toxemia, is characterized by high blood pressure and proteinuria, the presence of protein molecules in urine during pregnancy. GDM is diabetes confined to pregnancy.

Based on my literature review, my hypothesis would be that there would be higher rates of these disease states in overweight and obese pregnant women. In addition to learning more about obesity and these four disease states, I would compare my results with rates of obesity in the Boston Metro West area published by the Massachusetts Department of Health.



*The author on the Lowell General Hospital labor floor.*

## Obesity and What the Literature Says

Obesity is a condition marked by disproportionate fat stores. Body mass index (BMI) tends to be used worldwide to define obesity (Rosenn, 2008). To calculate a person's BMI, divide his/her weight in kilograms by his/her height in meters, then square the result. The number arrived at reflects a person's degree of "fatness" and not just a person's raw weight. Adult women with BMIs of <19 or between 19 and 24.9 are defined as *underweight* and *normal weight*, respectively. A woman with a BMI of 25-29.9 is defined as *overweight*. A woman whose BMI is > 30 is called *obese*. Recently, *obese* has been divided into three categories: *obese*, which is defined as having a BMI of 30.0-34.9; *very obese*, which is having a BMI of >35.0-39.9; and *extremely obese*, having a BMI of >40. The last was formerly called *morbidly obese* (Chu et al, 2007).

Obesity and accompanying birth complications are well described in the literature and are, I believe, an issue which is critical for our society to address. The ill effects of obesity start well before a woman actually becomes pregnant, which underlines the need for women of child-bearing years to limit weight gain if at all possible. Obese women have a 2.7 times higher risk of infertility and amenorrhea (lack of menstrual cycle) (Linne, 2004). Furthermore, obese patients have a 25–37% higher risk of miscarriage before the first live birth (Linne, 2004).

Increased risk of fetal anomalies were the chief concern of Stothard (2009), who suggested that there exists a significant association between maternal obesity and many congenital abnormalities. The researchers also found a statistical correlation between maternal obesity and neural tube/spinal defects, cardiovascular defects and oral/facial clefts. Furthermore, Dahe et al. (2009) reported that the ability for fetal abnormalities to be diagnosed using ultrasound is impaired by a mother's elevated BMI.

Maternal obesity has been associated with increases in the most common and dangerous complications of pregnancy and delivery: gestational diabetes, pregnancy-related hypertension, preterm birth, cesarean delivery and macrosomia (large/heavy newborn). When an infant is too large to fit easily through the birth canal, the extra maneuvering required of the attending physician can lead to shoulder dystocia, damage not only to the shoulders but often—and more importantly—to the nerve roots in the neck and shoulder regions of the newborn. This damage is grounds for many lawsuits in obstetrics and lifelong impairments for the child.

The researchers indicated that the increased rate of gestational diabetes stands out as having the greatest health impact both on mother and baby during pregnancy, delivery and postpartum. Babies of mothers with diabetes have higher risks of anomalies, tend to be larger at birth and have a higher risk of later diabetes and metabolic syndrome (Grundy et al., 2008). Obese patients may have difficulty delivering these larger babies, who themselves have increased risks, due to their size and/or diabetes, of head trauma, shoulder dystocia, brachial plexus lesions and fractured clavicle (Soens et al., 2008). Comprehensive research has also shown an association between obesity and preeclampsia, with Wu et al. (2009), in a study of 1.6 million cases, finding that hospitalizations are increased for both mother and baby.

In the delivery room, obese women have fewer contractions and fail more often to go into spontaneous labor than do their normally weighted counterparts (Ehrenberg et al., 2009). This means that induced labor or cesarean section is more often required (Ehrenberg, 2009; Grundy, 2008). The risks of surgically removing the baby include infection in the incision (Vuolo, 2006). Anesthesia carries inherent risks, but whether the birth is by cesarean section or vaginal, obesity was considered by Soens et al., (2008) and by Shiener et al. (2004) to be an independent risk factor for increased surgical complications, whether general or epidural anesthesia is used.

## Bringing the Research Home

My research would focus on a local area and the correlation between obesity in the pregnant woman and the statistical presence of the four disease states common during pregnancy: gestational diabetes mellitus, anxiety/depression, preeclampsia, and chronic hypertension.

A large electronic medical records database was made available to me by a single Obstetrical and Gynecological (OB/Gyn) practice serving the greater Lowell, Massachusetts, area. The records of 691 patients included 800 births during the years 2006 to 2010. The information provided by the individual charts was manually transcribed into an Excel spreadsheet. In this way, all identifying marks were removed, making the information anonymous in accordance with the

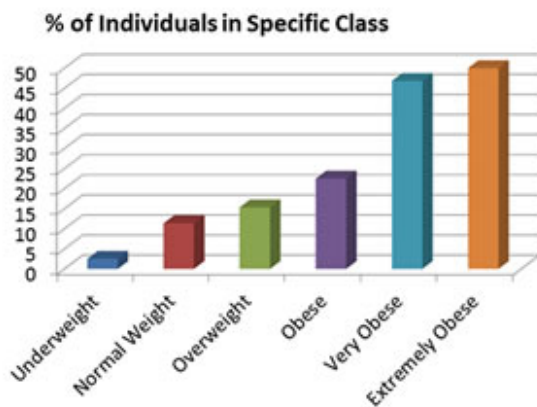
regulations of the national Health Insurance Portability and Accountability Act (HIPAA). Permission to access the database was granted by the practice’s medical director. (The HIPAA of 1996 changed the landscape of medicine by ensuring patient confidentiality and privacy of medical records as well as portability of coverage.)

BMI data, as well as the indication of the presence of one or all of the four disease states selected, were manually collected by me and my practice assistant and then compiled into the spreadsheet mentioned. The BMI findings were calculated for statistical percentage, or rate of occurrence, at the following commonly used intervals: patient pre-pregnancy, new OB/Gyn patient (6–12 weeks), patient at 28 weeks of pregnancy, last week of pregnancy and 6-week post-partum visit or post-pregnancy. This BMI data was compared to that of the Boston Greater Metro West adult population, chosen for its proximity to the study practice and for its online public statistics. The results obtained from my study matched the Boston statistics: overweight and obese individuals made up 49.7% of the total studied.

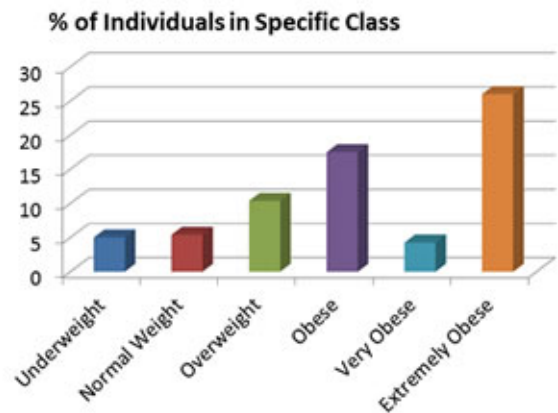
Data for the four disease states I studied were not available for the Boston area; therefore, no comparisons could be made. In my cohort in the Greater Lowell area, my hypothesis was supported in three of the four disease states. The incidence of gestational diabetes mellitus (GDM) in the *very obese* and *extremely obese* populations was most striking, demonstrating a 50.0% rate of incidence. Meanwhile, cases in the *overweight* and *obese* categories combined had only a 13.4% incidence of GDM. For normal weight or underweight cases, the incidence dropped even further. (See figure 1) This finding clearly demonstrated a positive correlation between lower BMI and a drastically lower incidence of GDM.

Similar trends for both chronic hypertension and preeclampsia were noted; that is, incidence of these disease states increased with increased weight. However, there was no clear association between elevated BMI and anxiety/depression, which went absolutely against my initial hypothesis that both anxiety and depression should have a greater occurrence in the overweight and obese populations. (See figures 2, 3 and 4)

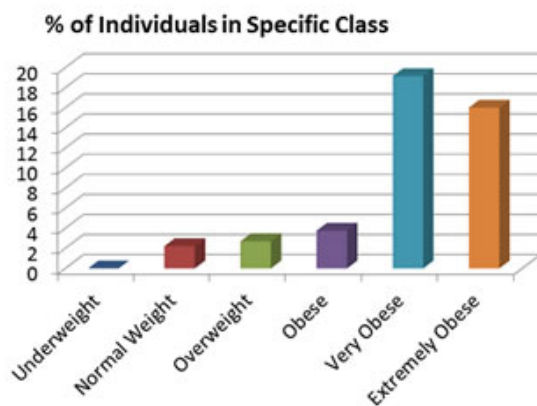
### Gestational Diabetes Mellitus



### Preeclampsia



### Chronic Hypertension



### Anxiety/Depression

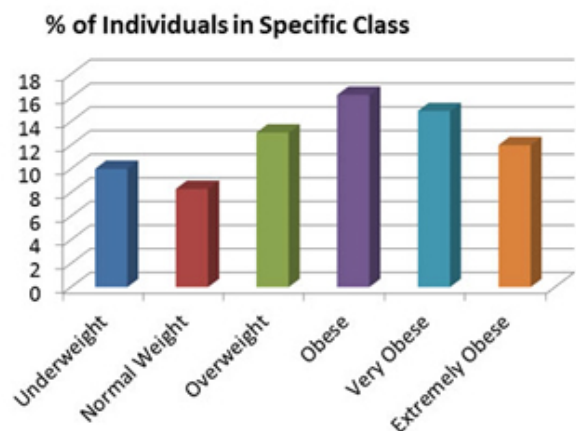


Fig. 1: Percentage of pregnant women in each weight class with GDM  
 Fig. 2: Percentage of pregnant women in each weight class with preeclampsia  
 Fig. 3: Percentage of pregnant women in each weight class with hypertension  
 Fig. 4: Percentage of pregnant women in each weight class with anxiety/depression

The results of my case study in the Greater Lowell area appear to replicate the results of the current research covered in my initial literature review, which indicated the increased incidence of GDM, chronic hypertension and preeclampsia in obese pregnant women. An increasing body of research clearly documents the negative impact of obesity on the health of both mother and baby during pregnancy, delivery and beyond. These findings emphasize the need for physicians to encourage women to attain a healthy weight before becoming pregnant in order to minimize health risks for both mother and child.

*I would first like to thank my faculty mentor, Dr. Patricia A. Halpin, who has worked with me on this study for the past few years and has proven to be a tireless supporter. To my advisor and chair of the Science Department at UNH Manchester, Dr. Stephen Pugh: thank you for your words of wisdom, sound advice and belief in my life's biggest "pipe dream," going from being a plumber to becoming a Physician's Assistant student. Finally, thank you to my sponsoring obstetrical practice and its employees who donated their time and to Lowell General Hospital, where I performed my shadowing internship.*

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### ***Author Bio***

*In 2011 **Michael Cochran-Boucher** will receive a Bachelor of Science in biology from the University of New Hampshire. He is a student at the Manchester campus. Currently, he is enrolled in a Physician's Assistant program in Las Vegas.*

### ***Mentor Bio***

*Dr. **Patricia A. Halpin** is a lecturer in the biological sciences at the University of New Hampshire at Manchester. She has been with UNH for eleven years. Dr. Halpin had not been a mentor before Michael approached her with ideas for his senior capstone project. "It was fun," she said, "to see Michael's enthusiasm for his project." Learning to write for a wider audience like *Inquiry's* is, she feels, useful for a student. She has been part of the long revision process for Michael's article and said, "I look forward to seeing it in print."*