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The Association of Age and Gestational Weight Gain

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The Association of Age and Gestational Weight Gain

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ABSTRACT

During pregnancy the risk for excessive weight gain is increased. Previous studies investigated the effects of age on gestational weight gain (GWG), but findings are inconsistent. This study evaluated this association while controlling for socio-economic status and parity and found no significant correlation. However, when parity and SES were not controlled for, older women gained more weight than younger women. Future research should attempt to determine if age increases the effects of parity and SES.

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PREVALENCE OF OBESITY AMONG WOMEN

Overweight and obesity are significant and costly problems in the United States. Body Mass Index is the form of measurement used to determine if an individual is overweight or obese. BMI is calculated by dividing an individual's weight in kilograms by their height in meters squared (CDC 2008). Adults are considered overweight when their BMI exceeds 25kg/m^2 (Flegal 2002), obese when they have a BMI of 30 or above, and are morbidly obese when their BMI reaches 40 or higher (Ogden et al 2006). BMI is a better indicator of obesity than weight alone because it includes height and is a better estimate of the percentage of fat in a person's body. An obese individual has a proportion of body fat that is higher than normal, which can be demonstrated by calculating BMI (CDC 2008).

The prevalence of overweight and obesity over the past few decades has increased greatly. In 2003 and 2004 the prevalence of obesity among US adults was 32.2 percent (Ogden et al 2006). According to Popkin (2004) in Europe and the United States, there has been a 0.3 to 0.5 percentage point increase in obesity annually. In a study by Flegal and colleagues (2002) it was found that in the United States the prevalence of overweight increased from 55.9 percent in the years 1988-1994 to 64.5 percent in 1999-2000. The prevalence of obesity also increased, from 22.9 percent to 30.5 percent (Flegal 2002). Mokdad and colleges (2001) cite a 61 percent increase in the prevalence of obesity from 1991 to 2000. Thus, obesity and overweight are a growing problem in the United States.

Hedley and colleagues (2004) found that the prevalence of obesity was significantly higher among women than men. According to Wang and Beydoun (2007) however, 68.8 percent of men and 61.6 percent of women were overweight from 2001-2002. Another study found that overweight was more prevalent among men while obesity was more prevalent among women (Paeratakul et al 2002). Therefore, there is a risk of excessive weight for both men and women, though men are more likely to be overweight and obesity is more prevalent among women. This paper is focused on the relationship between women and weight, and so, when examining consequences and at risk populations, the females within these populations will be discussed.

CONSEQUENCES OF OBESITY

The incidence of obesity is highly concerning due to the many health (Bray 2004; Calle et al 2003; Hall 2003; Li 2006; Nevitt 2002), psychosocial (Bray 2004; Fabricatore and Wadden 2004; Heo et al 2006; Stunkard et al 2003), and direct and indirect financial consequences associated with excess weight (Thompson et al 1999; Riley 2003). An obese individual is at a greater risk for mortality than normal weight individuals (Flegal 2005; Thompson et al 1999).

Health Consequences

There are several medical conditions associated with overweight and obesity including type 2 diabetes mellitus (Bray 2004; DPP Research Group 2004; Mokdad 2003), osteoarthritis (Bray 2004) (Nevitt 2002; Stein and Colditz 2004), hypertension (Hall 2003; Thompson et al 1999), coronary artery disease (Abbasi et al 002; Hu et al 2002; Li 2006; Thompson et al 1999) and cancer (Calle et al 2003).

Diabetes

Type 2 diabetes is associated with a sedentary, obese lifestyle. Individuals with this disease either do not produce enough insulin or their body does not recognize insulin, which is needed for the body to convert glucose to useful energy (ADA 2008). Approximately 8.1% of women suffer from diabetes. Diabetes in women is particularly concerning due to the effects the disease can have on unborn children and the increased risk of diabetes during pregnancy (ADA 2008). Diabetes mellitus is a greater risk for women of any ethnicity with a BMI between 22 and 35 than normal weight women. In fact, individuals with a BMI between 22 and 35 suffer a 4000 percent risk increase for diabetes (Bray 2004). Mokdad and colleagues (2003) found that the odds ratio for diabetes was 7. 37 for individuals with a BMI over 40 compared with normal weight individuals (OR=1). Weight gain of 20kg for an 18 year old is associated with a 15 fold increase in diabetes, while a 20kg decrease in weight reduces the risk of diabetes to almost nothing (Bray 2004). Stein and Colditz (2004) reported that obese individuals are 10 times more likely to develop diabetes. In fact, the Diabetes Prevention Program (DPP) a behavioral lifestyle program targeting diet and physical activity, demonstrated that a weight loss of 7 percent total body mass as a result of this program was associated with a 58 percent reduction in diabetes risk

(DPP Research Group 2004). Reduction in obesity would reduce the incidence of type 2 diabetes (Mann 2002), since, according to the research, there is a clear association between diabetes and obesity for women.

Osteoarthritis

Osteoarthritis (OA) is a disease in which the cartilage surrounding joints in the body wears away. This causes pain and overtime results in bone spurs from bone rubbing on bone (Joseph 2008). Women have a significantly higher incidence of knee osteoarthritis than men, but not hip or hand OA (CDC 2008). The strongest evidence is for the association of knee osteoarthritis and obesity (Nevitt 2002), though there is evidence for an association between hip osteoarthritis and obesity as well (Gelber 2003). According to a study done by Stein and Colditz (2004), obesity is associated with osteoarthritis in the knee and increases the likelihood that an individual will require a knee replacement. Women between the ages of 20 and 89 had a 9-fold increase in the likelihood of being diagnosed with knee osteoarthritis if they had a BMI above 30 kg/m^2. The Increase was 4-fold for women with a BMI between 25 and 30 (Nevitt 2002). In a study done to determine the effect of weight loss on osteoarthritis of the knee, it was found that weight loss of 10 percent resulted in 28 percent function improvement (Christensen 2004). In another study it was found that when women with a BMI above 25 kg/m^2 lost about 5kg over ten years there was a 50 percent decrease in the incidence of new knee OA diagnoses (Felson 1996). Stein and Colditz suggest that obese individuals are twice as likely to suffer from osteoarthritis of the hip when compared with normal weight individuals. Karlson and colleagues (2003) found in a study of 93,000 women that BMI was positively associated with hip replacement from osteoarthritis. Gelber (2003) speculates that the elimination of obesity would result in a 25 percent decrease in the prevalence of osteoarthritis of the hip. The extra weight of an obese individual puts additional pressure on joints, which is why obesity is associated with OA (Bray 2004). Thus, obese and overweight women are clearly at risk for developing osteoarthritis.

Hypertension

Hypertension, or high blood pressure, occurs when the pressure created by the heart beating, systolic pressure, is over 140, or the pressure in the blood vessels at rest is over 90

(Weinrauch 2008). Weight gain has been found to be associated with increased blood pressure; while weight loss is associated with a decrease in blood pressure (Hall 2003). Wolk and colleagues (2003) found that overweight and obesity are associated with an increased risk for hypertension and Huang and colleagues (1998) observed this trend specifically in women. The Nurses' Health Study shows that the risk of hypertension for obese individuals is 43.1 percent (BMI of 37.5) compared with 14.3 percent for women at a BMI of 22.5 (Thompson et al 1999). In fact, according to the Framingham Heart Study, between 65 percent and 75 percent of the risk for hypertension is associated with being overweight or obese. Much research is in agreement that excess weight is associated with hypertension in women (Hall 2003).

Coronary Heart Disease

Coronary Heart Disease (CHD) occurs when small blood vessels narrow which slows the progress of blood and oxygen to the heart (Gandelman 2008). CHD is the leading cause of mortality in many developed countries and is on the rise (Hu et al 2002), and the leading cause of death for women in the United States (Bedinghaus 2001). Obesity is associated with the occurrence of CHD (Abbasi et al 002). One study found that the risk of CHD for obese women was 3.44 in relation to normal weight women. Additionally, the risk of CHD increased 27 percent when women gained between 4kg and 10kg during adulthood (Li 2006). According to Wilson and colleagues (2002), overweight was associated with 15 percent CHD in women. Reduction of the incidence of obesity would likely reduce the incidence of CHD (Mann 2002). A high in fat diet has been found to be associated with the occurrence of CHD, and so reduction of fat in a person's diet, which is also recommended for reduction of obesity, can help reduce the incidence of CHD (Hu et al 2002). Excessive weight, therefore, increases the risk of CHD for women, which is concerning due to the incidence of this disease among women.

Cancer

Various cancers have also been found to be associated with obesity and overweight. According to a study by Calle and colleagues (2003) women in the US with a BMI over 40 kg/m^2 had death rates from cancer that were 62 percent higher than normal weight women and approximately 20 percent of all female deaths from cancer are related to overweight and obesity.

BMI was found to be positively associated with death from colon, esophagus, rectum, liver, gallbladder, pancreas, and kidney cancer in men and women. For women specifically, death from breast cancer, cancer of the uterus and cervix and ovarian cancer were associated with BMI (Calle et al 2003). In another US study obesity was found to be associated with an increased risk of pancreatic cancer (Patel et al 2005). Bianchini and colleagues (2002) found that women in the US with a BMI of 25kg/m2 or higher have an increased risk for colon cancer. Calle and colleagues (2003) concluded that research on cancer and obesity is not entirely consistent, with some studies finding no or an inverse relationship between obesity and ovarian (Fairfield et al 2002) and pancreatic (Berrington de Gonzalez et al 2003) cancer.

Breast cancer is of particular concern due to the fact that, according to the National Cancer Institute (2008), approximately 12.1% of women born in the United States today will be diagnosed with breast cancer at some point during their lives. According to one study, there is an inverse relationship between premenopausal breast cancer and BMI, but BMI is positively associated with postmenopausal breast cancer (Carmichael 2003; Morimoto et al 2002). Additionally, high BMI is associated with inflammatory breast cancer in both pre and postmenopausal women. Inflammatory cancer is the most deadly form of breast cancer (Carmichael 2003). A BMI as low as 25kg/m^2 has been found to be associated with postmenopausal breast cancer (Bianchini et al 2002). There is clearly an association between some types of cancer and BMI and so it is important to address the problem of obesity for women in the United States in order to reduce the incidence of these cancers.

Mortality

Obesity is associated with an increased risk of mortality (Adams 2006), resulting in more than 300,000 deaths per year (Goodman et al 2003). In the Nurses' Health Study it was found that women with a BMI of 32 or greater had mortality rate that more than doubles the mortality rate of women with a BMI below 19 (Thompson et al 1999). Life risks increases from 25.5 percent for women at a BMI of 22.5 to 37.1 percent for women with a BMI of 37.5 (Thompson et al 1999). Flegal and colleagues (2005) estimated based on survey data from NHANES I, NHANES II, and NHANES III that obesity was associated with 111,909 excess deaths compared with normal weight individuals. Overweight and obesity are associated with a severe reduction in

life expectancy, and so it is important to reduce the prevalence of these diseases (Fontaine et al 2003).

Psychosocial Consequences

In addition to health risks, obesity is associated with various psychosocial problems. Women report more psychosocial problems related to weight than men (Karlsson et al 2003). An obese individual may suffer from embarrassment, shame, and guilt, which may increase risk for psychiatric conditions such as affective disorders (Goodman et al 2003). Studies have shown that obesity and overweight are associated with reduced quality of life (Bray 2004; Fontaine and Barofsky 2001; Hassan 2003), depression (Heo et al 2006) (Richardson et al 2003; Stunkard et al 2003), low self-esteem (Klaczynski 2004; Myers and Rosen 1999; Schwartz and Brownell 2004), and discrimination (Fabricatore and Wadden 2004; O'Dea 2005; Schwartz and Brownell 2004).

Quality of Life

The physical health problems of obese and overweight people can affect their health related quality of life (HRQL). HRQL is defined as the effects a medical condition has on the well-being and physical and mental functioning of an individual (Hassan 2003). HRQL is self-reported by the individual suffering from the medical condition. Thus, the health problems associated with being obese or overweight have been shown to be associated with diminished quality of life for the individuals with these medical conditions (Bray 2004; Fontaine and Barofsky 2001; Hassan 2003). In a study of obese women, these levels improved to be equal to or better than those of normal weight individuals following weight loss of 43kg via gastric bypass surgery (Bray 2004). Hassan and colleagues (2003) found that increasing BMI was associated with lower HRQL scores. Individuals who were attempting to lose weight through diet and exercise had higher HRQL (Hassan 2003). Another study found that severely obese individuals experienced an increase in HRQL after weight loss through gastric bypass, and mild to moderately obese individuals experienced a significant increase in HRQL with an average loss of 8.6 kg (Fontaine and Barofsky 2001). Overweight and obesity among women, it has been found, are associated with a significantly greater decrease in HRQL compared with overweight

and obese men (Kolotkin 2002; Muenning et al 2006). Therefore, weight reduction for obese and overweight individuals leads to improved health related quality of life.

Depression

Depression is a condition in which an individual suffers from feelings of sadness, loss, and/or anger that do not go away and interfere with daily activities (Zieve et al 2008). Depression appears in conjunction with obesity often in women (Stunkard et al 2003) but not men (Carpenter et al 2000; Heo et al 2006). Obese Latino women in particular are more susceptible to depressed mood, which is a gateway symptom for depression, than non-obese women (Heo et al 2006). Though there is a definite relationship between depression and obesity, it is unclear whether depression causes obesity, obesity causes depression, or if they co-occur (Stunkard et al 2003).

Major depression in adolescents predicts a higher BMI in adulthood. As obesity becomes more severe, depression is more common (Stunkard et al 2003). Richardson and colleagues (2003) found that depression in late adolescence lead to a two-fold increase in the occurrence of obesity for females. The trend was not observed for females or males who were depressed in early adolescence or males who were depressed in late adolescents (Richardson et al 2003). The research on the causal relationship between depression and obesity is not conclusive, but does demonstrate an association between the two factors.

Self Esteem

The self-esteem of obese and overweight individuals has been found to be associated with the view these individuals have about their weight. According to Klaczynski and colleagues (2004), lower self-esteem among obese individuals is associated with a combination of a negative view towards obesity and the belief that the obese individual caused their own obesity. Schwartz and Brownell (2004) also found an association between body dissatisfaction and self-esteem. Myers and Rosen (1999) found that stigmatization of an obese individual leads to lowered self esteem. Kolotkin and colleagues (2002) found that women experienced greater impairment of self-esteem related to excessive weight. Whether it is an individual's view of their weight, or pressures from society, obesity can have an effect on self-esteem.

Discrimination

In the US, the ideal of thinness leads to stigmatization of overweight and obese individuals. Women in particular are the target of discrimination due to weight (Fabricatore and Wadden 2004). Media images portray overweight and obese individuals in an extremely negative light, with these individuals rarely having leading roles and often being the target of teasing (Schwartz and Brownell 2004). Ridicule of these people is seen as socially acceptable (Fabricatore and Wadden 2004; Schwartz and Brownell 2004), and in fact, college student rate cocaine users and embezzlers as more acceptable marriage partners than obese individuals. The discrimination faced by overweight and obese individuals has been found to extend to discriminatory behaviors by employers, with thinner individuals with the same qualifications as an overweight or obese individual rated higher (Fabricatore and Wadden 2004). According to O'Dea (2005), obese adults are known to suffer from discrimination in the areas of employment, education, marriage, healthcare, and salary. Studies have shown that bias against overweight and obese individuals is held implicitly, or without the person holding the bias being aware of the bias. These implicit beliefs have been found to be at least as strong as implicit bias against race and gender (Schwartz and Brownell 2004). Therefore, there is a strong social bias against individuals of excessive weight, a bias that is largely accepted by society.

Financial Consequences

In addition to the health and psychosocial consequences of obesity there are also financial consequences that result from the increasing rates of obesity in the U.S. Expenditures due to obesity and overweight make up 5.3 percent of total health expenditures in the United States (Finkelstein et al 2003). Obesity had both direct and indirect costs. Indirect costs of obesity include morbidity and mortality consequences. Morbidity outcomes occur when work is lost due to health problems or disability and mortality outcomes refer to the work and wages lost when a person dies prematurely (Wolf 2002). Productivity, which is defined as days of work missed as a result of illness, has been found to be impacted by obesity (Wolf 2002). Annually, obesity results in 40 million lost days of productivity at work (Wellman and Friedberg 2002). Wellman and Friedberg (2002) estimate that the indirect costs of obesity totaled $56 billion dollars in 2000.

The direct costs of obesity, medical expenditures, increased from $52 billion in 1995 to $75 billion in 2003 (Riley). Type 2 diabetes, CHD, and hypertension are the conditions associated with obesity that incur the highest health costs (Wellman and Friedberg 2002). BMI has been found to be positively associated with health costs (Thompson et al 1999). Specifically, the care costs for women ages 45 to 54 rise from $23,000 to $28,700 to $35,300 at the BMIs of 27.5, 32.5 and 37.5 respectively. Thus, mild obesity increases costs by approximately 20 percent, moderate obesity increases costs by 50 percent, and severe obesity almost doubles medical costs of women (Thompson et al 1999). Morbidly obese (BMI of 40 or higher) individuals incur even greater costs than overweight and obese individuals (Arterburn et al 2005) Health Care Costs for the morbidly obese are 47 percent greater than for individuals who are obese, 65 percent greater than for overweight individuals, and 81 percent greater than costs for normal weight adults (Arterburn et al 2005).

The prevalence of overweight and obese patients with public or private/commercial insurance is 53.6 percent (Finkelstein et al 2003). Medicaid is more heavily populated with obese or overweight individuals compared with other forms of insurance. The increase in medical spending from 1993 to 2003 associated with obesity was 26.1 percent for out-of-pocket expenditures, 36.8 percent for Medicare and 39.1 percent for Medicaid (Finkelstein et al 2003). Thus, overweight and obesity have negative financial implications for the individual and costs the federal government, which funds Medicaid (Finkelstein et al 2004). Obesity is therefore an extremely heavy economic burden both directly and indirectly.

RISK FACTORS ASSOCIATED WITH OVERWEIGHT AND OBESITY

The health, psychosocial, and financial costs associated with obesity are of concern. This makes it important to understand if there are certain demographic factors associated with overweight so that prevention and intervention efforts can be tailored appropriately.

Age

The prevalence of obesity has been found to vary in relation to age. According to Wang and Beydoun (2007) the prevalence of overweight and obesity increase with age. Among men and women over 20 years approximately 66.3 percent are overweight or obese. The prevalence

grows to 70 percent for men and women over 60 years old (Wang and Beydoun 2007). Ogden and colleagues (2006) found that 28.5 percent of individuals 20-39, 36.8 percent of individuals 40-59 and 31.0 percent of individuals 60 and over were obese in 2003-2004. Thus, there was a large increase from the ages 20-39 and 40-59. The childbearing years for women are ages 25-45 (Williamson et al 1994), meaning that, for women, the increase in obesity prevalence during this period may be related to childbearing. In fact, a number of studies found that women of childbearing age are at increased risk for obesity (Hedley 2004; Rooney and Schauberger 2002), with women 4.7 times more likely to gain excessive weight if they bear children (Olson et al 2003). These years are a risky time for weight gain among women who become pregnant and are unable to lose pregnancy weight postpartum or continue to gain weight postpartum (Gunderson and Abrams 1999). Nevertheless, the trend of increasing prevalence of obesity with age is observed in men as well as women (Flegal et al 2002; Ogden et al 2006), and so the link between the childbearing years and obesity is not clear and other factors may be involved) Overall, there is a relationship between age and obesity but the research is limited and not conclusive.

Minority Status

Research suggests that rates of overweight and obesity vary depending on ethnicity and race. Hedley et al (2004) found that there was a large difference among ethnic and Caucasian populations of women. Of women who were 20 years or older, Caucasian women had an obesity prevalence of 30.7 percent while Mexican American women has a prevalence of 38.4 percent, and black women had the highest prevalence of 40.0 percent (Hedley et al 2004). Ogden and colleagues (2006) also found that adult Mexican American and black women had a much higher prevalence of obesity than Caucasian women. Extreme obesity was also found to be the most prevalent among black women, 13.5 percent, when compared with the Caucasian prevalence of 5.5 percent and the Mexican American prevalence of 5.7 percent (Hedley et al 2004). The prevalence among Caucasians and Mexican-Americans in this case is very similar. According to Flegal and colleagues (2002), non-Hispanic black women demonstrate the highest prevalence of obesity and overweight. Thus, ethnicity appears to be highly associated with the prevalence of obesity.

Low Socio-economic Status

Individuals with low Socioeconomic Status (SES) have also been cited as an at-risk population for obesity. The highest prevalence of obesity is found within groups with the highest poverty rates (Drewnowski 2004). Data from the National Health Interview Survey by the Center for Disease Control from 68,556 women showed that the women with the lowest income and education experienced the highest rate of obesity (Drewnowski 2004). Nationally, 43 percent of women in Women, Infants, and Children (WIC), a federal program that provides funding for food to pregnant and postpartum low-income women (FNS 2008) are overweight or obese; a 19 percent increase in the past 20 years (Riley 2006). In a study of 253 youth, it was determined that low-SES contributed significantly to weight gain over a 7 year period (Moore et al 2002). During this period the prevalence of overweight for low-SES youth increased from 37 percent to 67 percent (Moore et al 2002). It has been suggested that in developed countries low SES promotes obesity and obesity, in turn promotes low SES (Swinburn et al 2004). Sarlio-Lahteenkorva and colleagues (2004) found that educated obese women had incomes that were 30 percent lower than those of lean women of the same education level.

The prevalence of obesity among low-SES individuals could be associated with a number of different factors. It is likely partially a result of the availability and low-cost of high fat foods (Prentice 2001), such as fast food restaurants and packaged food at the grocery store. Healthy foods and organics are far more expensive, and so are potentially out of reach for low-income families. The close proximity of fast food restaurants (Block 2004) to low income neighborhoods and the lack of healthy food vendors (Kumanyika 2006) may also have an effect on the prevalence of obesity and overweight for this group. According to Reidpath and colleagues (2001), low SES individuals have 2.5 times more exposure to fast food establishments than the wealthiest population. The energy dense foods that are cheaper and so more available to low-income women lead to “passive overconsumption” because they are associated with low levels of satiation and satiety, unlike high- moisture food such as fruits and vegetables, which leave people feeling fuller (Drewnowski 2004). This, availability and pricing of food has a large effect on low-SES individuals.

For individuals with high SES, there are more opportunities for recreational physical activity that help to reduce the incidence of obesity (Swinburn et al 2004). Poorer neighborhoods

do not have as many opportunities for physical activity such as recreational facilities and also may harbor incivilities that discourage outdoor physical activity (Swinburn et al 2004). Kumanyika and colleagues (2007) note consumption of high calorie foods, low physical activity , limited or no availability of recreation facilities in the neighborhood, and marketing tactics that attract certain ethnicities as factors that are associated with increased obesity for low-SES individuals. There are barriers to physical activity associated with low income individuals including dangerous neighborhoods not suitable for outdoor activities and recreation areas that are dangerous or falling apart (Kumanyika 2006).

Summary of Factors Associated with Obesity and Overweight

In summary, obesity and overweight are associated with demographic factors. The demographics associated with a higher risk of obesity and overweight are important to understand in order to better focus efforts. In terms of age, middle-aged to older individuals are at the highest risk for being obese or overweight. The increase in weight for middle aged individuals may be related to childbearing for women, but since the same trend is seen in men other factors may contribute as well. However, there is a lack of research comparing men and women directly in terms of obesity and age, and so it is difficult to determine the relationship between the two groups.

African American women are more likely than women of other ethnicities to become overweight or obese. The prevalence of obesity among Mexican-American and Caucasian women was found to be very similar in one study, but greater prevalence among Mexican-Americans was found in other studies. Ethnicity is therefore associated with weight for African Americans but may vary with other ethnicities. Individuals in the lowest SES demonstrate the highest prevalence of obesity and overweight, and this prevalence has increased in recent years. Research has found that a number of factors influence weight in low SES communities. The consumption of certain foods with high fat content and a lack of healthy food among low SES individuals is an important contributing factor to weight. Limited resources, such as a lack of health food stores or sections within grocery stores, reduce the availability of health food. In addition, the larger number of fast food restaurants and the cheap cost of these foods in low-income comminutes compared with high income communities encourages the consumption of

these foods by low SES individuals. Therefore, middle-aged, African American, and low SES women should be considered when devising programs to reduce the incidence of overweight and obesity.

PREGNANCY AND WEIGHT GAIN

Weight gain related to pregnancies during childbearing years has been found to be associated with overweight or obesity later in life (Galtier-Dereure et al 2000; Gunderson 2000; Rooney and Schauberger 2002). Thus, in addition to certain demographic risk factors related to increased risk of overweight and obesity among women, such as being a minority and low-income, there are also certain time periods such as the child bearing years that can affect future weight problems.

Weight gain during pregnancy is expected and needed for the health of the infant. A problem occurs, however, when a woman gains excessively and/or is unable to lose gained weight after the infant has been delivered. Weight gain during pregnancy has been found to be associated with postpartum weight retention and obesity (Gunderson et al 2000; Kac et al 2004; Rooney and Schauberger 2002). Pre-pregnancy BMI is the best predictor of gestational weight gain (GWG), which is of concern as the incidence of obesity in pregnant women in America ranges from 18.5 percent to 38.3 percent (Galtier-Dereure et al 2000) and is rising (Siega-Riz et al 2004).

Pregnancy may lead to increased eating because the social changes associated with pregnancy, such as increased self-care, lower social demands, and added support, may contribute to a positive self-image and legitimize weight gain (Rocco 2005) (Clark and Ogden 1999). Pregnancy, therefore, may act as a "license for weight gain" by providing less societal pressure to be thin. In addition, pregnant women are interested in the health of their baby, and it was found that many believed that eating more was in the best interest of the baby (Clark and Ogden 1999). Overeating also tends to relieve nausea, and it was found that eating small meals often was not effective in inducing fullness (Clark and Ogden 1999).

Higher levels of GWG are associated with postpartum weight retention and potentially overweight and obesity (Clark and Ogden 1999) Women who gain more weight during pregnancy will also be more likely to retain it than women who gain a smaller amount of weight

(Clark and Ogden 1999) (Linne 2004). Weight retention also varies by pre-pregnancy BMI. Women who have a high BMI before pregnancy will be more likely to retain weight gained during pregnancy than women of normal BMI (Devine 2000). However, women who had normal weight before pregnancy are likely to return to their pre-pregnancy weight regardless of gain during pregnancy (Thorsdottir et al 2002). A study found that weight gain in the second trimester was most highly associated with weight retention than gain in the first or third trimesters (Abrams et al 2000). In another study of 419 women on Medicaid, only 15 percent of the Hispanic and low-income women involved reached their pre-pregnancy weight within 6 weeks after delivery. Specifically, it was found that 48.8 percent of women who gained below guidelines set by the Institute of Medicine (described in discussion), 14.3 percent of those who gained within guidelines, and 2.3 percent of those who gained above the IOM guidelines returned to their pre-pregnancy weight within 6 weeks postpartum (Walker et al 2004). Walker & Freeland-Graves (2004) found that Hispanics are more likely to retain weight gained during pregnancy then Caucasians. Thus, pre-pregnancy BMI, gestational weight gain (GWG), income, and ethnicity are associated with weight retention after pregnancy.

FACTORS ASSOCIATED WITH EXCESSIVE GWG

There are clearly a large number of risks associated with excessive weight gain during pregnancy. Therefore, it is important to understand the factors that potentially increase the risk of gaining excessively. By discovering the factors associated with excessive gain, interventions could be developed and steps taken to reduce the incidence of excessive GWG. Demographic (Wells et al 2006; Brawarsky et al 2005; Stotland et al 2005; Lararia et al 2007; Stotland et al 2005) (Scholl et al 1993; Stotland et al 2005) (Bergmann et al 1997) anthropometric (Linne 2004) (Bergmann 1997) (Haakstad 2007), behavioral (Pomerleau 2000), psychosocial (Walker et al2003), and biological (Siega-Riz et al 1997) (Brawarsky et al 2005) (Stotland et al 2005), have all been found to be associated with GWG.

Demographic Factors

Research has found associations between various demographic factor and excessive weight gain during pregnancy. Ethnicity (Brawarsky et al 2005; Stotland et al 2005; Wells et al

2006), Socioeconomic Status (Laraia et al 2007) (Schieve et al 1998), and age (Gunderson et al 2007; Siega-Riz 1997) have all been found to be associated with GWG.

Ethnicity

Ethnicity may also be associated with increased gestational weight gain. According to a study of 6,625 women by Wells and colleagues (2006), 32.9 percent of Latinos gained inadequately and 36.4 percent gained excessively. Thus, both inadequate and excessive weight gain are problematic for Latinos. In another study, of 1,100 women, 17.2 percent of Latinos gained inadequate weight during pregnancy while 50.6 percent gained excessively (Brawarsky et al 2005). In yet another study, this one of 9,788 women, it was found that 29 percent of Latinos gained inadequate weight and 51 percent gained above IOM guidelines (Stotland et al 2005). Thus, within the Hispanic population, excessive gain is a more common problem than inadequate.

When compared with Caucasians it has been found that Latinas (Schieve et al 1998) (Hickey et al 1995) and African Americans (Walker et al 2003) gain less weight than Caucasians and that Latinas are at a greater risk for inadequate gain (Wells et al 2006) (Stotland et al 2005). Walker and colleagues (2007) found that 47.3 percent of non-Hispanic white, 42.2 percent of non-Hispanic African Americans and 42.2 percent of Hispanic low income women gained excessive weight during pregnancy. However, it has also been found in a study of 305 Caucasian, Hispanic, and African American women that ethnicity is not associated with weight gain one way or another (Walker 2002). Gunderson and colleagues (2000) found that Caucasians, African Americans, and Hispanics were equally likely to gain excessive weight during pregnancy. Therefore, excessive weight gain is a problem within Caucasian, African American, and Hispanic groups but the research does not agree on which of these ethnicities, if any, is at a greater risk than the others for excessive gain.

Socio-economic Status

Socioeconomic Status, which is determined by education, occupation, income, and insurance status, is an additional factor that may have an effect on GWG. Dipietro (2003) found

in a study of 130 women that with increasing education level, high school to college to post-graduate, women were more likely to gain as recommended than those of lower education levels. Women with an education level of 12 years are more likely to gain either above or below guidelines compared with women who have over 12 years of education (Wells et al 2006).According to Brawarsky and colleagues (2005), of women with less than a high school education (n=177) 18.1% gained inadequately and 48.6% gained excessive weight. It was found that of individuals with a high school graduation (n=455) 15.6% gained inadequately and 56.0% gained excessively, and for women who graduated college (n=468) 11.8% gained inadequately and 52.8% gained excessively (Brawarsky 2005). Therefore, excessive gain is prevalent among all education levels.

A different study, of 622 women, found that in a lower income (Poverty Index Ratio below 185% of the federal poverty line) Caucasian population 22.6 percent gained inadequately and 47.5 percent gained excessively (Olson et al 2003). A third study, which analyzed the information from 120,531 pregnancy records, found that 43.7 percent of women in WIC gained excessively (Schieve et al 1998). In a study of Siouxland Women, Infants, and Children it was found that 42 percent of the women gained excessively while 16 percent gained less then recommended by the IOM guidelines (Walker 2007). It appears, therefore, that excessive weight gain is a very substantial risk for low SES women. There is a lack of research that compares high and low SES directly, and so further research in this area to examine any differences is highly warranted.

Age

The age a woman is at the time of the pregnancy may have an effect on the weight gained by that woman. According to Bergmann et al, women between 22 and 26 were more likely than other women to gain excessively (2007). Gunderson and colleagues (2000) found that women ages 24-30 were likely to gain more weight during pregnancy than women above 30. However, Gunderson and colleagues state (2000) that this difference may be related to the SES of the women involved which affects the timing of employment and career paths, which, in turn creates differences in the timing of pregnancy among women with different levels of socioeconomic status. Other studies found a relationship between lower age and excessive gain during

pregnancy (Stotland et al 2005) (Scholl et al 1993). Older women were found to gain more weight in the first trimester and less in the second and third (Abrams et al 1995). Siega-Riz and colleagues (1997) found that age and parity when viewed together served as a better predictor of weight gain than either factor alone. Other studies have found no relationship between age and GWG for women over 19 (Palmer et al 1985) (Walker et al 2002) (Strychar et al 2000), and for adolescents (Stevens-Simon et al 1993). The information regarding age and GWG are not consistent. There is evidence to suggest that GWG is increased for women in their twenties but the data is inconclusive, with some studies finding no relationship whatsoever. In particular, the relationship between age and SES and parity is not well understood and so further research into the relationship between age and GWG is warranted.

Anthropometric

Pre-pregnancy BMI

A woman's pre-pregnancy BMI has been found to be related to amount of weight gained during pregnancy and adherence to IOM guidelines. Approximately 60 percent of American women of child bearing age are overweight or obese (Sarwer et al 2006). According to Linne, high weight before pregnancy is associated with higher gain during pregnancy (2004). Other studies by Bergmann (1997) and Haakstad (2007) also found that higher pre-pregnancy BMI is associated with higher gain during pregnancy. A study by Siega-Riz et al (1994) found that 52 percent of overweight Hispanics and 75 percent of obese Hispanics gained excessive weight during pregnancy. Therefore, women who are overweight or obese before pregnancy are likely to gain more weight than women who are normal weight before pregnancy, and due to the prevalence of obesity itself this issue is of great concern. The research on pre-pregnancy BMI and GWG is conclusive, with BMI consistently found to be positively associated with GWG.

Behavioral

Smoking

Smoking status of a woman has been found to be related to the amount of weight she gains during pregnancy (Pomerleau 2000). When a woman quits smoking before or during pregnancy they are likely to gain much more weight than women who have never smoked (Pomerleau 2000). Women who had a high concern for their weight and quit smoking because they became pregnant gained far beyond the recommended maximum gain for women of their pre-pregnancy weight (Pomerleau 2000). Smoking during pregnancy, conversely, has been found to be associated with low pregnancy weight gain (Picone et al 1982; Strychar 2000). Therefore, previous smoking is associated with excessive weight gain during pregnancy. The majority of research regarding smoking and pregnancy deals with the effects smoking has on the infant and not GWG for the mother.

Psychosocial

Stress and Depression

The associations between stress and GWG and depression and GWG are unclear. High stress before pregnancy has also been found to be associated with inadequate gain (Walker et al 2002). According to Berenson and colleagues (1997) adolescents who experienced the stressors of domestic violence or unwanted pregnancy were more likely to gain inadequately. Other studies, however, have found stress to be associated with an increase in cortisol, which leads to increased calorie intake and potential weight gain (Epal et al 2000). Depression was found to be high for low SES women late in pregnancy regardless of ethnicity (Walker et al 2002). However, Walker (2002) concluded that psychosocial variables did not have a significant effect on GWG, as depression may be so prevalent in low SES groups that its effects can no longer be seen. Therefore, stress and depression may be related to GWG, but the association is unclear according to current research.

Biological

Parity

Whether or not a woman has previously given birth can affect how much weight she gains while pregnant. Nulliparity was found to be associated with excessive gain (Siega-Riz et al 1997; Brawarsky et al 2005) and also inadequate gain (Brawarsky et al 2005). Therefore, nulliparity is associated with gaining outside of IOM guidelines, whether excessively or inadequately. Stotland also found a relationship between excessive gain and nulliparity (2005), while Wells found a relationship between multiparity and inadequate weight gain (2006). Other studies have found no association between parity and GWG (Walker et al 2002) (Hickey et al 1995). Thus, data are not consistent concerning the association between parity and GWG.

SUMMARY

Obesity and overweight are growing problems in the U.S. (Flegal 2002), and these conditions have many health (Abbasi et al 002; ADA 2008; Bianchini et al 2002; Bray 2004; Calle et al 2003) (Carmichael 2003; Christensen 2004; DPP Research Group 2004; Gandelman 2008; Gelber 2003; Hall 2003; Hu et al 2002; Li 2006; Mann 2002; Mokdad 2003) (Nanchaha et al 2004; Nevitt 2002; Stein and Colditz 2004; Thompson et al 1999) (Weinrauch 2008) (Wilson et al 2002; Wolk 2003), psychosocial (Bornstein et al 2006; Bray 2004; Fabricatore and Wadden 2004; Fontaine and Barofsky 2001; Goodman et al 2003; Hassan 2003; Heo et al 2006; Klaczynski 2004; Myers and Rosen 1999; O'Dea 2005) (Richardson et al 2003; Schwartz and Brownell 2004; Stunkard et al 2003; Werrij et al 2005), and financial consequences (Thompson et al 1999) (Finkelstein et al 2003) (Arterburn et al 2005) (Riley 2003). A few groups, such as minorities (Flegal et al 2002; Ogden et al 2006; Sanchez-Johnsen et al 2003), individuals of a low SES status (Drewnowski 2004; Kumanyika 2006; Riley 2006; Swinburn et al 2004), women with a high prepregnancy BMI (Haakstad et al 2007), women who have previously smoked (Pomerleau et al 2000), and women with multiple children (Brawarsky et al 2005) have been found to be more likely to be overweight or obese than Caucasians or high SES, respectively. Pregnancy is a time during a woman's life in which she is at an increased risk for weight gain that could potentially contribute to overweight or obesity later in life (Galtier-Dereure et al 2000; Gunderson 2000; Rooney and Schauberger 2002). Pre-pregnancy BMI (Bergmann et al 1997; Haakstad et al 2007; Linne et al 2004), previous smoking (Clark and Ogden 1999; Pomerleau 2000), nulliparity (Siega-Riz et al 1997; Brawarsky et al 2005), ethnicity (Brawarsky et al 2005;

Stotland et al 2005; Walker 2002), low SES (Olson et al 2003; Schieve et al 1998; Walker et al 2007), and a pregnancy age between 20 and 29 (Gunderson et al 2000; Siega-Riz et al 1997) are all factors that have been cited by the literature as being associated with GWG. Factors that contribute to GWG have not been fully elucidated.

This study will focus on age and its association with gestational weight gain. Parity and SES will be controlled for, as these are factors that may have confounded previous research that evaluated the relationship between GWG and age. It is predicted that women between the ages of 20 and 29 will gain more weight than women below 20 or over 30 both when parity and SES are controlled for and when they are not.

MATERIALS AND METHODS

This retrospective study of gestational weight gain was conducted at Baystate Medical Center (BMC) in Springfield, MA. The data for the women in this study, who all delivered during a particular one year period, were abstracted from both medical and paper charts. The institutional Review Boards of the institutions participating in this study reviewed and approved the protocol.

Sample Selection

The initial sample of 3,966 women who delivered at BMH between 7/1/05 and 6/30/06 was assessed using their electronic medical records and women with multi-fetal pregnancies, unknown ethnicity, primary language other than English or Spanish, and women who did not have height or weight dada at delivery were excluded. The remaining 1,016 women were then screened by paper medical chart review. This random sample was stratified by both ethnicity and site of prenatal care, which was to ensure that sufficient numbers of Hispanic and Caucasian women within each provider type were included. Women who received pre-natal care from clinics at BMC and women who received care from private practice obstetricians were included in this sample. The sample goal was 150 Hispanics and 150 Caucasians that received care from a clinic at BMC and 100 Hispanics and 100 Caucasians who received care at a private practice obstetrician.

Women were excluded during paper chart reviews if they were missing prepregnancy weight (N=226), dates of prenatal measurements (N=138), or insurance status (N=2). Women

were also excluded if they did not have a first trimester appointment (N=296), had a history of gastric bypass (N=2) or type 1 or 2 diabetes mellitus (N=31). Total, 441 women were excluded at this stage; 60% for one criterion and 40% for two of more criteria. The final sample, therefore, was 575 eligible deliveries including 134 Caucasians and 165 Hispanics receiving care at a BMC clinic and 140 Caucasians and 136 Hispanics receiving care from a private practice obstetrician.

Measures

Electronic and paper records were used to obtain the data for this study. The data from paper records was abstracted for women who remained eligible after the paper charts were screened. The abstraction form (Appendix I) was developed by the study team, pre-tested and modified before it was used to collect patient data. Three research assistants were trained in data abstraction and reviewed the charts of eligible women. The abstractions were recorded on scannable forms that were uploaded into a SAS database. Demographic and total weight gain during pregnancy information was obtained in this way.

Demographic Data

The women's date of birth, ethnicity, primary language, and marital status were obtained through the electronic medical records. The date of birth information was used to break women into the following age categories: 15-19, 20-24, 25-29, 30-34, and $\geq$ 35. Information concerning insurance type (public, private, no insurance, or unknown), parity, education level, and employment status at the beginning and end of pregnancy were obtained from the paper medical records.

Weight Gain during Pregnancy

Pregravid weight was self-reported by women either during their first pre-natal visit or at their first nutritionist visit and was obtained for this study from the paper medical chart. Height was obtained from the electronic medical chart and had been recorded at the time of delivery. BMI, which is weight in kilograms divided by height in meters squared, was calculated using the pregravid weight and height data.

RESULTS

Sample Characteristics

The characteristics of the sample population are described in table 1. In terms of pre-pregnancy BMI 11.6% of the sample had a BMI below 19.7, 46.02% had a BMI between 19.8 and 26 while 13.81% had a BMI between 26.1 and 29 and 28.32% had a BMI over 29.1. The sample was also characterized by insurance status with 35.38% of the sample having private insurance, 0.53% had no insurance, 63.92% had public insurance and insurance status was unknown for only 0.18% of the women. For 42.99% of the sample this pregnancy was their first, 28.96% had previously had one pregnancy, 16.38% had two previous pregnancies, and 11.48% had 3 or more. The population was broken up by age as follows; 22.09% of women in the study were between the ages of 15-19, 27.13% were between 20-24, 23.48% were 25-29, 17% were 30-34 and 9.91% were 35 or older.

Table 1: Sample Characteristics

Variable	*Category*	*All Subjects N*	*All Subjects %*
1. Age Category	Age 15-19	127	22.09
	Age 20-24	156	27.13
	Age 25-29	135	23.48
	Age 30-34	100	17.39
	Age >=35	57	9.91
2. Provider Category	Midwife clinic	112	19.48
	Private	276	48.00
	Resident clinic	187	32.52
7. Insurance type	Commercial/Private	202	35.38
	No Insurance	3	0.53
	Public	365	63.92
	Unclear/not known	1	0.18
8. Pre-pregnancy BMI	BMI 19.8 - 26.0	260	46.02
	BMI 26.1 - 29.0	78	13.81
	BMI <=19.7	67	11.86
	BMI >=29.1	160	28.32
9. Parity	0	236	42.99
	1	159	28.96
	2	91	16.58
	3 or more	63	11.48

Comparison of Age and GWG

The data were entered into the SAS statistics software and two sided confidence interval tests were run to observe the effects of age on GWG when parity and insurance status were not controlled for. Pre-pregnancy weight was controlled for in this table, as pre-pregnancy BMI is

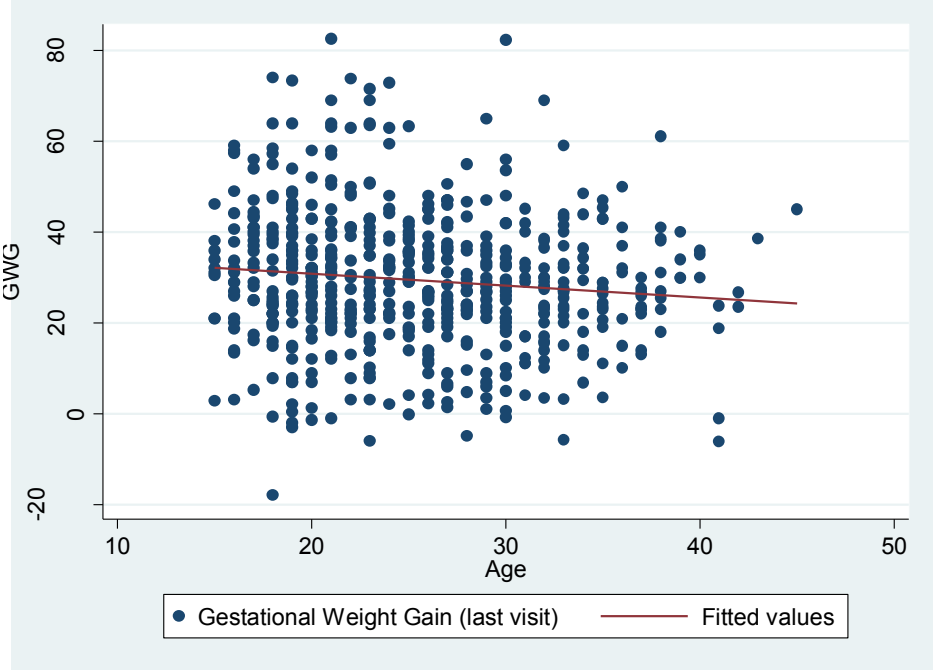
known to have an effect on GWG. It was found, with 95 percent confidence, that age had a significant effect on GWG. With every one year increase in age (from 15 to 35 +) the GWG a woman experienced decreased by 0.26 pounds. GWG was calculated using the woman's weight at her last visit and her pre-pregnancy weight. Therefore, as age increased the amount of weight a woman gained during pregnancy decreased.

Table 2: Regression of GWG vs. Age

Outcome variable: wghtchglastlbs (Gestational Weight Gain (last visit)), n=575

Covariate	Coef.	Std. Err.	P>|t|	95% Conf. Interval
Age				
per unit	-0.265	0.098	0.007	(-0.457 to -0.072)
Constant	36.171	2.568	<0.001	(31.127 to 41.216)

Figure 1: Regression Analysis of GWG (lbs) vs. Age(years)



Comparison of GWG and Parity

In this analysis GWG and parity were compared with pre-pregnancy BMI controlled for as a predictor of GWG. Parity was found to be significantly associated with GWG. Women who had never previously given birth were found to gain the most weight compared with women who had 1, 2, 3 or more previous pregnancies. Women who were pregnant for the second time (parity=1) gained an average of 4.87 pounds less than women with parity=0, while women with parity=2 gained 4.57 pounds less than women with no previous pregnancies. Women who had a three or more previous pregnancies gained 7.03 pounds less than women with no previous pregnancies.

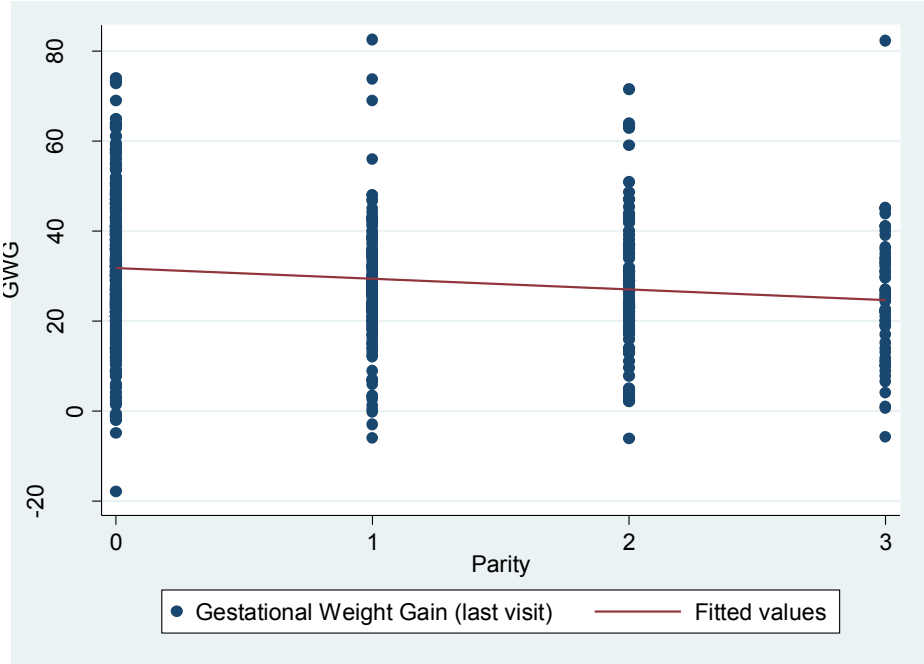
Table 3: Regression of GWG vs. Parity

Outcome variable: wghtchglastlbs (Gestational Weight Gain (last visit)), n=549

Covariate	Coef.	Std. Err.	P>|t|	95% Conf. Interval
Paritytype				
0*	0			
1	-4.867	1.525	0.001	(-7.862 to -1.871)
2	-4.566	1.834	0.013	(-8.168 to -0.964)
3 or more	-7.034	2.108	0.001	(-11.174 to -2.894)
Constant	32.448	0.967	<0.001	(30.548 to 34.349)

* Baseline category

Figure 2: Regression Analysis of GWG (lbs) vs. Parity



Comparison of Insurance Type and GWG

Pre-pregnancy weight was again controlled for in the analysis of GWG and insurance status. In this case, it was found that women with private/commercial insurance gain less weight than women with public insurance. However, these findings were not significant.

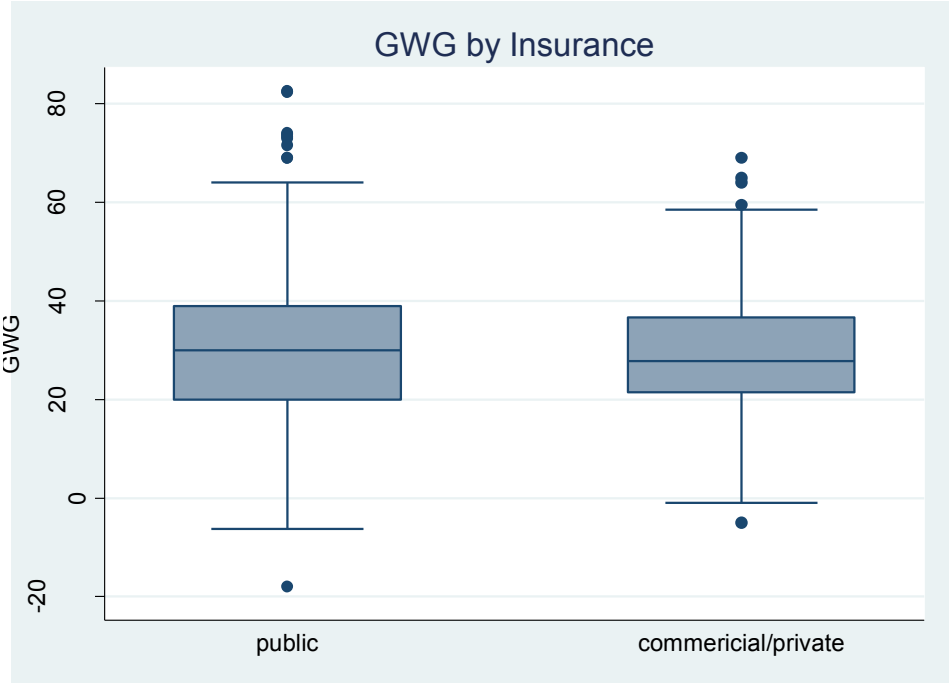
Table 4: Regression of GWG vs Insurance Type

Outcome variable: wghtchglastlbs (Gestational Weight Gain (last visit)), n=570

Covariate	Coef.	Std. Err.	P>|t|	95% Conf. Interval
Insurance type				
public*	0			
commercial/private	-1.497	1.327	0.260	(-4.104 to 1.109)
Constant	30.018	0.790	<0.001	(28.467 to 31.570)

* Baseline category

Figure 3: GWG (lbs) Compared with Insurance Type



Comparison of GWG and Age, Parity, and Insurance Type

The effect of age on GWG was analyzed, without the influence of parity and insurance status, by controlling for these factors. It was found that older women gain less weight than younger women, but these findings were not statistically significant. Therefore, the age at which a woman is pregnant does not affect the amount of weight she gains when the influence of parity and insurance status are removed.

Table 5: Multivariate Regression of GWG vs. Age, Parity and Insurance Type

Outcome variable: wghtchglastlbs (Gestational Weight Gain (last visit)), n=544

Covariate	Coef.	Std. Err.	P>|t|	95% Conf. Interval
Age				
per unit	-0.114	0.128	0.374	(-0.367 to 0.138)
Paritytype				
0*	0			
1	-4.470	1.578	0.005	(-7.569 to -1.371)
2	-3.840	2.000	0.055	(-7.768 to 0.088)
3 or more	-6.630	2.327	0.005	(-11.201 to -2.059)
Insurance type				
public*	0			
commercial/private	-0.757	1.612	0.639	(-3.923 to 2.408)
Constant	35.398	2.847	<0.001	(29.805 to 40.991)

* Baseline category

DISCUSSION

According to the results, women who have never previously given birth gain more than women who have had previous pregnancies. Insurance status did not have a significant influence on GWG. The information obtained from the charts, however, was not sufficient to use education or income as an estimate of SES, as this data was lacking on many of the charts, and so insurance data was the only factor used to define SES in this study. It is important to note that insurance status is a very raw measure of SES and so may not have represented the full effect of low SES on weight gain during pregnancy. Also, the pre-pregnancy weight data was self reported by women at their first prenatal appointment or nutritional appointment and could, therefore, have been under or overestimated.

Age led to increased GWG for older women when pre-pregnancy weight was controlled for, but was not found to be significantly associated with GWG when parity and insurance status were controlled for. However, pre-pregnancy BMI was controlled for in the bivatiate analysis, but was not controlled for in the multivariate analysis that compared the effects of age when parity and SES were controlled for. Since pre-pregnancy BMI is known to have an effect on GWG, the fact that it was not controlled for in the multivariate analysis could have had a substantial effect on the results. The analysis is currently being redone to include pre-pregnancy BMI.

This study looked into the weight gain that occurred during pregnancy as a result of age and controlled for the interaction of parity and SES with age. Currently, the IOM has specific guidelines that suggest how much a woman should gain based on her weight before pregnancy. This study did not look at the particular gain recommendations suggested by the IOM, which recommend a gain of 28-40 pounds for women with a BMI <19.8kg/m^2, 25 - 35 pounds for a BMI 19.8 - 26.0 gain, 15 -25 pounds for women with BMI 26.1 - 29.0 gain, and at least 15 pounds for women with a BMI over 29 kg/m^2 (No upper limit is set for obese women) (Stotland et al 2004). Nevertheless, this study demonstrates which populations, such as those with lower parity, may be at an increased risk for gaining weight.

When a woman does gain outside the guidelines, either inadequately or excessively, twice as many poor pregnancy outcomes occur (Abrams et al 2000). One of the most reported consequences of excessive gain for the mother is retention of the weight gained during pregnancy (Abrams et al 2000) (Galtier-Dereure et al 2000). The likelihood of macrosomia, large for gestational age babies, is increased for women who gain excessively (Linne 2004) (Abrams et al 2000) (Galtier-Dereure et al 2000) (Steinfield et al 2000). Infants of women who gain excessive weight during pregnancy have also been found to have low APGAR (Appearance, Pulse, Grimace, Activity, Respiration, scored on a 1-10 scale) scores (Galtier-Dereure et al 2000). The rate of perinatal mortality is increased for women who gain excessively during pregnancy. In terms of the delivery, Cesarean delivery becomes more likely as GWG increases (Abrams et al 2000) (Steinfield et al 2000). Therefore, there are many consequences associated with excessive GWG.

The IOM guidelines were developed by the Institute of Medicine in 1990. Some believe that the IOM guidelines encourage weight *gain* so much that they lead women to over gain (Abrams et al 2000). Currently, efforts are underway to update the 18 year old guidelines based on observed GWG trends (IOM 2008). The negative effects associated with gain outside the guidelines makes it incredibly important that the factors associated with GWG are understood and accounted for as these new guidelines are developed.

The results of this study suggest that parity has a significant influence on GWG but insurance status and age do not. However, future studies should look into the effects of the combination of age and parity to see if particular age groups are at an increased risk for excessive gain when it is their first pregnancy. Also, the age a woman is at the onset of her pregnancy may increase the effects of SES on GWG. Therefore, though the direct effects of age on GWG were found not to be significant, age may potentially lead to increased risk when combined with other factors and future studies should investigate this. The data collected in this study could be used to determine if younger women of low parity are at increased risk for excessive GWG when compared with older women of the same parity by analyzing those two factors together. The interaction between insurance status and age is of less interest as both factors were found to not be significantly associated with GWG, but low age combined with a particular insurance status could potentially lead to significant results. Therefore, further analysis of this data in addition to future studies on age, parity, SES and the combined effect on GWG are warranted.

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APPENDIX I: ABSTRACTION FORM

Data Abstraction Form

(This page to be completed for all records reviewed for eligibility)

☐☐☐☐☐☐☐

Account # ☐☐☐☐☐☐☐☐☐☐

Date of abstraction: ☐☐ / ☐☐ / ☐☐ (Month / Day / Year) Reviewer's initials: ☐☐

Has ACOG form: Ⓨ Yes Ⓝ No

Complete all items (1 thru 5) for all charts

Eligibility check:

1. Has pre-pregnancy weight data — Ⓨ Yes Ⓝ No *
2. Has dates of pre-natal weights — Ⓨ Yes Ⓝ No *
3. Has a first trimester appointment — Ⓨ Yes Ⓝ No *
4. History of gastric bypass — Ⓝ No Ⓨ Yes *
5. Has insurance status — Ⓨ Yes Ⓝ No *
6. Diagnosis of type I or type II diabetes mellitus — Ⓝ No Ⓨ Yes *

If a circle is filled above that has an * next to it, then STOP here and fill the following circle as ineligible. ⓘ Ineligible

Information is organized by the sources in which it may be found.

MR = medical record
MDAF = multidisciplinary admission form, within MR
ACOG = within MR
FS = facesheet, within MR
CIS - mother
CIS - fetus
E+C; CC = clinic chart
H+P = history and physical

Insurance (source- FS)

Insurance Type	○ Public ○ Commercial/Private ○ No insurance ○ Unclear/not known

(Public health insurance coverage: Mass Health, Medicaid, HealthNet, Network Health, and Healthy Start)

Employment Status (source- FS)

Employment at onset of pregnancy	○ Employed ○ Disabled ○ None ○ Unemployed (specify:_____)
Employment at end of pregnancy	○ Employed ○ Disabled ○ None ○ Unemployed (specify:_____)

Education (source- ACOG)

Education (check highest level achieved)	○ Unclear/not known ○ Never attended school ○ Write in the highest elementary, middle, or highschool grade ☐☐ ○ High school (completed, including GED ○ Vocational or Technical or Associate's degree ○ University/college ○ Post-graduate (graduate)

Complete the box below for ALL ELIGIBLE records: (source- ACOG, NUTRITION, MDAF)

Height ☐ feet ☐☐.☐ inches

Pre-pregnancy ☐☐☐.☐ lbs

Source of Data:
- ○ AGOG
- ○ Nutrition Consult
- ○ MDAF

Past pregnancies (source- ACOG) G ☐ P ☐☐☐☐

Year	GA Weeks	Delivery Type and Comments	Birth Weight lbs	oz
1. ☐☐☐☐	☐☐		☐☐	☐
2. ☐☐☐☐	☐☐		☐☐	☐
3. ☐☐☐☐	☐☐		☐☐	☐
4. ☐☐☐☐	☐☐		☐☐	☐
5. ☐☐☐☐	☐☐		☐☐	☐
6. ☐☐☐☐	☐☐		☐☐	☐

Lifestyle Habits (source- ACOG + MDAF)	No	Yes, this pregnancy	Yes, past	Yes, unknown timing
Tobacco use	○	○	○	○
Alcohol use	○	○	○	○
Alcohol: high-risk or abuse (13 grams of alcohol =1 drink). High-risk drinking for non-pregnant women > 9 drinks/wk	○	○	○	○
Illicit/recreational drugs	○	○	○	○

If *previous* smoking: Quit smoking at any time during pregnancy? Ⓝ No Ⓨ Yes Ⓤ Unclear timing of quitting

Weights at pre-natal visits: (source- ACOG)

	Date Month / Day / Year	Weeks gestation Weeks Days	Weight lbs
1	__ __ / __ __ / __ __	__ __ __	__ __ __ . __
2	__ __ / __ __ / __ __	__ __ __	__ __ __ . __
3	__ __ / __ __ / __ __	__ __ __	__ __ __ . __
4	__ __ / __ __ / __ __	__ __ __	__ __ __ . __
5	__ __ / __ __ / __ __	__ __ __	__ __ __ . __
6	__ __ / __ __ / __ __	__ __ __	__ __ __ . __
7	__ __ / __ __ / __ __	__ __ __	__ __ __ . __
8	__ __ / __ __ / __ __	__ __ __	__ __ __ . __
9	__ __ / __ __ / __ __	__ __ __	__ __ __ . __
10	__ __ / __ __ / __ __	__ __ __	__ __ __ . __
11	__ __ / __ __ / __ __	__ __ __	__ __ __ . __
12	__ __ / __ __ / __ __	__ __ __	__ __ __ . __
13	__ __ / __ __ / __ __	__ __ __	__ __ __ . __
14	__ __ / __ __ / __ __	__ __ __	__ __ __ . __
15	__ __ / __ __ / __ __	__ __ __	__ __ __ . __
16	__ __ / __ __ / __ __	__ __ __	__ __ __ . __

Medications at first visit or in the months preceding pregnancy (source- ACOG-Problem Lists)

Medication type	No	Yes
Oral diabetes	○	○
Insulin	○	○
Antihypertensive	○	○
Lipid-lowering	○	○
Thyroid	○	○
Asthma	○	○
SSRIs	○	○
Other anti-depressants	○	○
Other psychiatric	○	○
Other prescribed meds	○	○

Psychiatric History (source- ACOG + MDAF + E+C)	No	Yes, this pregnancy	Yes, past	Yes, unknown timing
Depression	○	○	○	○
Anxiety	○	○	○	○
Post-traumatic stress disorder	○	○	○	○
Domestic violence	○	○	○	○
Anorexia	○	○	○	○
Bulimia	○	○	○	○
Other eating disorder (state: _____)	○	○	○	○
Psychotic disorder (state: _____)	○	○	○	○
Other psychiatric problem (state: _____)	○	○	○	○

24-28-week labs (source- ACOG +CIS-mother)

	GA	Date	Result	Result not found
Diabetes screen #1	☐☐	☐☐/☐☐/☐☐	☐☐☐	○
			Results	
GTT-3 Hour	☐☐	☐☐/☐☐/☐☐	☐☐☐ ☐☐☐	
			Result not found	○

Labor and Delivery Data (source-MDAF, H+P, CIS- fetus)

Due Date	☐☐/☐☐/☐☐
Delivery date	☐☐/☐☐/☐☐
Baby APGAR Scores	☐☐☐
Baby gender	Ⓕ Female Ⓜ Male
Baby weight	☐☐☐☐ grams
Baby length	☐☐.☐☐ inches
Labor related complications for Baby	○ Hypoglycemia ○ Abruption ○ Meconium Fluid ○ Non-reassuring fetal tracing
Baby's MR #	☐☐☐☐☐☐☐
Baby's head circumference	☐☐

Nutrition Consult Dates (source-MR)

	Date Month / Day / Year
1	/ /
2	/ /
3	/ /
4	/ /
5	/ /

Outpatient Health Care Services during Pregnancy (source-CIS/IDX)

	Date Month / Day / Year	Type of Service	Reason for visit
1	/ /		
2	/ /		
3	/ /		
4	/ /		
5	/ /		
6	/ /		
7	/ /		

ER visits and hospitalizations during this pregnancy (source-unknown)

	Date of Admission	Date of Discharge	Discharge Diagnosis
1	/ /	/ /	
2	/ /	/ /	
3	/ /	/ /	

Specific Tests (source-unknown)

	Date (Month / Day / Year)	Type of Test	Where
1	__ __ / __ __ / __ __	ⓝ NST ⓑ BPP	
2	__ __ / __ __ / __ __	ⓝ NST ⓑ BPP	
3	__ __ / __ __ / __ __	ⓝ NST ⓑ BPP	
4	__ __ / __ __ / __ __	ⓝ NST ⓑ BPP	
5	__ __ / __ __ / __ __	ⓝ NST ⓑ BPP	
6	__ __ / __ __ / __ __	ⓝ NST ⓑ BPP	

NST - Non-stree Test; BPP - Biophysical Profile)

Postpartum Weight Data
(source-CC + CIS - mother for later dates)

Attended visit between 3 and 8 weeks postpartum	○ No ○ Yes
Date of Postpartum visit	__ __ / __ __ / __ __
Weight at Postpartum visit	__ __ __ . __ lbs
Lactation status	○ Breastfeeding only ○ Bottle-feeding ○ Combined breast/bottle