THE RELATIONSHIP BETWEEN BODY MASS INDEX AND UNINTENDED PREGNANCY USING THE NATIONAL SURVEY OF FAMILY GROWTH, CYCLE 6 DATABASE

by

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CERTIFICATE OF APPROVAL

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List of abbreviations

ACASI – Audio Computer Assisted Self Interviewing

ANOVA – Analysis of Variance

CAPI – Computer Assisted Personal Interviewing

CI – Confidence Interval

BMI – Body Mass Index

BRFSS – Behavioral Risk Factor Surveillance System

MSA – Metropolitan Statistical Area

NSFG – National Survey of Family Growth

PCOS – Polycystic Ovarian Syndrome

PRAMS – Pregnancy Risk Assessment Monitoring System

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Abstract

Objective

It is estimated that 54.9 % of all Americans are overweight (BMI = 25-30 m/kg^2) or obese (BMI > 30 m/kg^2) [1]. Because obesity is an independent risk factor for a number of medical problems [1], this has resulted in serious health consequences for many individuals and for the health care system as a whole.

While rates of abortion in the United States appear to be declining [2], unintended pregnancy continues to be a major problem. Numerous factors contribute to a woman's risk of unintended pregnancy including socioeconomic and demographic variables as well as fertility contraception use, and sexual behavior. Recent studies suggest that BMI may also play a role in the risk of unintended pregnancy [3].

The primary objective of this study was to characterize the relationship between BMI and unintended pregnancy. We also explored the effect of BMI on sexual behavior, fertility and perceived fertility and contraceptive use.

Methods

This study employed the National Survey of Family Growth (NSFG), Cycle 6 database. This is a validated population-based representative database that includes information on a variety of reproductive health outcomes and behaviors. The NSFG, Cycle 6 is a weighted database. Thus, the 7,643 participants surveyed represented the 61.6 million women in the US of reproductive age in 2002. All analysis were performed using SPSS version 15.0 for Windows

(Chicago, Illinois) with the complex samples module to account for the complex sampling designed used by the NSFG.

Descriptive statistics including frequency measures were generated to compare demographic and socioeconomic variables between BMI groups. Health related outcomes, sexual behavior, contraceptive use, fertility and perceived fertility were compared between BMI groups using chi square tests for categorical variables and ANOVA for continuous factors.

The primary outcome in this analysis was unintended pregnancy in the last five years. Multiple logistic regression was employed and measures of association including odds ratios were calculated. The effect of confounding and effect modification was explored.

Results

We did not demonstrate a statistically significant association between BMI and the risk of unintended pregnancy in the last five years. This was true despite adjusting for a number of socioeconomic, demographic and health related factors. We found that women in the obese group were more likely to be using the most reliable forms of contraception and less likely to be using no contraception compared to the normal BMI and overweight group. Our analysis demonstrated no differences in perceived fertility between BMI groups although obese women were more likely than other BMI groups to have undergone sterilization. In terms of sexual behavior, there was a difference between BMI groups in terms of women who reported ever having had sex with a male with the overweight group being the most likely to report this history. However, there were no other differences in sexual behavior including the number of sexual partners, frequency of intercourse or age at first intercourse.

Conclusion

The results of our study, based on a large survey of reproductive aged women, failed to demonstrate that overweight and obese women have higher rates of unintended pregnancy. This is in contrast to the findings of prior case-controlled studies. While there are a number of possible reasons for this difference, this study differs from prior studies because of the study population provided by the NSFG database and our ability to incorporate multiple potential confounders into our analysis.

There is much work to be done in terms of elucidating factors that may contribute to unintended pregnancy and contraceptive efficacy in certain populations of women. It is only through a more thorough understanding of these factors that we will be able to properly address this important health care problem and improve the health of women.

Chapter 1 – Introduction

Body Mass Index or BMI is the measure of the weight of a person scaled according to height. It is calculated by dividing an individual's weight in kilograms by the square of their height in meters. BMI is used as a standard, objective way to estimate an individual's physical stature. Normal weight has come to be defined by a BMI of less than 25 m/kg^2 while obesity is defined by a BMI of greater than 30 m/kg^2. Those with a BMI between 25 m/kg^2 and 30 m/kg^2 are categorized as overweight [1].

Over the last four decades, the weight demographic in the United States has dramatically changed. It is now estimated that 54.9 % of all Americans are overweight or obese [1]. Because obesity is an independent risk factor for cardiovascular disease, type 2 diabetes, and osteoarthritis [1], this has resulted in serious health consequences for many individuals and for the health care system as a whole.

While rates of abortion in the United States appear to be declining [2], unintended pregnancy continues to be a major problem. Approximately half of all pregnancies are unplanned resulting in approximately 3 million unintended pregnancies in the United States every year [4]. Because of co-existing medical conditions, unplanned conception in the obese woman can represent a significant source of morbidity.

Providing optimum contraception in overweight and obese individuals is also challenging. Many forms of contraception are contraindicated in women with co-existing medical conditions such as cardiovascular disease. Recently, the efficacy of certain contraceptives, such as the contraceptive patch and the oral contraceptive pill, in obese women has been questioned [5]. Historically, contraceptive research has excluded obese and overweight women from clinical trials addressing efficacy. The studies that have been published suggest that among contraceptors, overweight and obese women are more likely to have an unintended pregnancy than women with normal BMIs [3].

The most notable study documenting this association was a case controlled study using the 1999 Pregnancy Risk Assessment Monitoring System (PRAMS) database [3]. The PRAMS database is a population-based survey of women who delivered live born infants. A total of 17 states participate in this system and 100-250 new mothers were recruited each month from eligible birth certificates. The PRAMS questionnaire asked women if they were using any contraception at the time of conception and whether the pregnancy was intended or unintended [6]. They found that among contraceptors, obese and overweight women were 1.73 times more likely than normal weight women to have an unintended pregnancy (95% CI 1.2-2.36). They did not find this association in noncontraceptors [3]. Because the PRAMS database did not collect information on the type of contraceptive used, they were not able to incorporate this into their analysis.

While contraceptive failure may be responsible for some of the unintended pregnancies in obese women, contraceptive non-use may also be a contributing factor. However, there are few studies examining the relationship between contraceptive use and BMI. Chuang et al published a study using cross sectional data from 11 states participating in the Family Planning Module of the Behavioral Risk Factor Surveillance System (BRFSS, 2000). They looked at contraceptive use among 7,943 sexually active women between the ages of 18 and 44 who were not trying to conceive. Using multiple logistic regression they found obesity was significantly associated with contraceptive nonuse (adjusted OR 1.34, 95% CI 1.16-1.55) [7].

An individual's perceived risk of pregnancy also factors into their choice of a contraceptive method. While it is known that overall, obese women have lower fertility than leaner women [7], it is not known whether this results in a false sense of protection against pregnancy despite non-contraceptive use. Obese and overweight women tend to experience menarche earlier than normal weight women potentially allowing for more reproductive years and unintended pregnancies at an earlier age. Also, since infertility in obese women is primarily related to polycystic ovarian syndrome, infertility risk in the non-PCOS obese woman is less clear.

Sexual behavior and the frequency of sexual intercourse also influences an individual's risk of pregnancy. Weight and the concept of body image are known to play a role in emotional health that in turn affects an individual's ability to experience intimacy and sexual satisfaction. Werlinger et al documented changes in sexual interest and frequency of sexual activity during times of weight loss in an obese population [8]. In this study, questionnaires were given to thirty two women who participated in a weight loss program. Subjects reported significant increases in frequency of sexual activity and improvement of body image with weight loss. Positive changes in sexual health have also been noted in obese individuals who undergo gastric bypass [8].

While it appears that there is an improvement of sexual function in formerly obese patients who experience weight loss, the relationship between BMI and sexual behavior has not been well studied. Adolfsson et al investigated the relationship between weight and sexual satisfaction. Using data from 2,810 men and women who participated in a survey done through the Swedish National Institutes of Public Health, they found no difference in sexual satisfaction between groups with differing BMIs and concluded that overweight and obese individuals compose a heterogeneous group with respect to sexual satisfaction [9]. Halpern et al used data from a 2-year longitudinal study of black and white adolescent girls and investigated the effect of body fat indices on dating and sexual activity. They found that adolescents with lower body fat indices were more likely to date and report coital activity among both white and black adolescent girls [10].

The primary objective of this study was to characterize the relationship between BMI and unintended pregnancy. We also explored the effect of BMI on sexual behavior, fertility and perceived fertility and contraceptive use. Based on prior studies, we hypothesized that increasing BMI would correlate with increased rates of unintended pregnancy. We also hypothesized that increasing BMI would correlate with decreased sexual activity, decreased contraceptive use, decreased fertility and perceived fertility and choice of a less effective contraceptive method.

While there are a handful of studies that have examined the relationship between BMI and unintended pregnancy, these studies lacked the ability to control for behavioral and health related variables imperative to this relationship. This was the first study to examine the relationship between BMI and unintended pregnancy using the National Survey of Family Growth (NSFG), Cycle 6 database. This large database included behavioral and health related variables, previously unstudied in this context. Our ability to control for a large number of potential confounders differentiated our study from others and therefore represents a significant contribution to this area of research.

Chapter 2 – Materials and Methods

Study Population

The NSFG, Cycle 6 is a validated population-based representative database that includes information on a variety of reproductive health outcomes and behaviors [11]. The NSFG, Cycle 6 was conducted by the Institute of Social Research under contract with the National Center for Health Statistics. The function of the NSFG was to collect information on factors affecting pregnancy and reproductive health. Thus, information was collected on demographic and socioeconomic factors as well as a wide variety of reproductive health variables and outcomes including pregnancy, adoption, fertility, birth expectations, family planning services, marriage and cohabitation, and sexual experience. The NSFG has become the principal source of US national estimates of factors affecting reproductive health outcomes [11]. The NSFG survey has been repeated six times since its inception in 1973. Cycle 6 represents the most recently completed survey. The NSFG, Cycle 6 is a public database and files are available for public use at no charge.

Data for the NSFG, Cycle 6 was collected between January 2002 and March 2003 using in-person interviews with 7,643 women and 4928 men aged 15-44. All interviews were voluntary, confidential and lasted approximately 85 minutes. Interviews with female respondents were administered by trained female interviewers in the respondent's home. To protect the respondents' privacy, only one person was interviewed in each selected household.

While most of the questions were administered using computer assisted personal interviewing (CAPI) in which interviewers asked questions and entered responses with the assistance of a computer program, some of the more sensitive questions were asked using Audio

Computer Assisted Self-Interviewing (ACASI). The ACASI system allowed respondents to read and listen to questions and enter them into the computer system without the interviewer knowing the response. There was an overall 80% response rate for females in this survey.

Despite the use of instruments to improve the accuracy of data such as the ACASI system, it is well established that women under report the number of abortions they have had. Thus, it is not surprising that abortion data has been under reported in every cycle of the NSFG. This has been determined by comparing NSFG data with data provided by external abortion providers. When the number of abortions reported in the NSFG, Cycle 5 was compared to national rates of abortion, it was estimated that only 48% of abortions were reported in the interviewer recorded portion of the survey and 52% of abortions were reported in the ACASI portion of the survey. When the responses were combined, the number of abortions reported increased to 59% [12]. It is estimated that 43% of abortions were reported in Cycle 6 data [13].

The accuracy of abortion reporting also seems to vary across demographic groups. Women with a lower income are less likely to report a history of abortion compared to women with a higher income. Women older than 35 and women married at the time of abortion are also more likely to report abortion history accurately [12].

The NSFG, Cycle 6 employed a stratified, multistage, probability sample of households and eligible persons drawn from 120 areas across the country [13]. The target population for the survey was household women aged 15-44 who resided in all 50 states and the District of Columbia. The NSFG, Cycle 6 is a weighted database thus all respondents were assigned a weight based on demographic national averages provided by the US Census Bureau. The 7643 women in the NSFG, Cycle 6 represented the 61.6 million women aged 15-44 in the US household population in 2002.

The number of women that a respondent represented is called a sampling weight. Sampling weight was determined using four criteria. The first was the base sampling weight or the probability that an individual would be selected to participate in the survey. The second factor was the non-response adjustment that included eligibility, non-contact, and refusal adjustments. The third criteria used to determine sampling weight employed post-stratification and was based on age, sex, race, ethnicity and gender as provided by the US Census Bureau. The fourth factor was trimming which reduced the value of a few extremely large weights.

On average, each respondent represented 8,000 women. However, the sampling weight could vary considerably from individual to individual. All analysis of the NSFG, Cycle 6 database must be done using a sampling study design that takes into account weighting. Failure to do so will result in an underestimate of sampling variance. Variance is a measure of the variation of a statistic caused by sampling a proportion of the population rather than the whole population. If all females in the US ages 15 to 44 had been studied, the sampling variance would be zero. For the NSFG, Cycle 6 database, the variance is a function of sampling design and population parameter being estimated [13].

Definition of outcome

The outcome of interest in this analysis was unintended pregnancy. While the NSFG, Cycle 6 contained multiple variables that could have been used as a proxy for this outcome, we decided to use unintended pregnancy in the last five years as the primary outcome. We chose to do this because BMI can change over time and we had information about current BMI rather than BMI at the time pregnancy occurred. Thus, our outcome needed to represent a relatively current event since BMI represented a current respondent characteristic.

Respondents provided a detailed pregnancy history including whether each pregnancy was intended [i.e. whether the respondent wanted to have a baby at the time pregnancy occurred (yes/no)] and the outcome of each pregnancy. A pregnancy was classified as unintended if the respondent stated that the pregnancy was "too soon, mistimed" (i.e., the woman wanted to become pregnant at some point in the future, but not yet) or was "unwanted". A pregnancy was classified as wanted if the respondent stated that the pregnancy occurred at the "right time", was "late, overdue" or if they reported that they "didn't care" or "don't know for sure".

To confirm the relationship between unintended pregnancy and BMI, we repeated our analysis using several different outcomes including unintended pregnancy in the last 12 months, lifetime history of unintended pregnancy, abortion in the last 12 months, and lifetime history of abortion. Respondents provided data on abortion history in both the interviewer recorded and ACASI portion of the survey. However, as stated earlier, abortion is likely to be under reported in the NSFG, Cycle 6 making it more prudent to use unintended pregnancy as the primary outcome.

Definition of Determinants

Body Mass Index

Respondents were divided into three BMI categories, normal (BMI <25 m/kg^2), overweight (BMI 25-30 m/kg^2) and obese (BMI >30 m/kg^2). In this analysis, we were primarily interested in the relationship between BMI category and unintended pregnancy. However, other variables were incorporated into our analysis if they were found to be associated with unintended pregnancy and abortion in prior studies or were suspected to be associated based on the best available information. This included demographic and socioeconomic information as well as health related and behavioral factors.

Socioeconomic and Demographic Variables

Age was examined as a continuous variable and was also categorized into age brackets to examine differences between BMI groups. Current relationship status was incorporated into the analysis using a "cohabitation" variable. An individual was defined as cohabiting if they reported that they were either married or living with a partner of the opposite sex. They were defined as not cohabiting if they reported that they were widowed, divorced, separated or never married. We thought that it was important to group women in this manner because cohabitating women have been hypothesized to be particularly vulnerable to unintended pregnancy [14]. In terms of education level, individuals were examined using two variables, whether they had obtained a high school diploma or GED and whether they had obtained a college degree.

Respondents identified themselves as either Hispanic or Non-Hispanic. They identified the racial group which best described their background as White, American Indian or Alaska Native, Asian, Native Hawaiian or other Pacific Islander, and Black or African American. The race and ethnicity variables were combined and re-categorized into the following racial/ethnic groups: Non-Hispanic White, Hispanic, American Indian/Alaska Native, Asian/Native Hawaiian/Other Pacific Islander, and Black/African American. The decision was made to combine some groups such as Asian and Native Hawaiian/Other Pacific Islander because of the small number of respondents in some of the racial categories. This allowed all racial groups to be included in the analysis.

The NSFG, Cycle 6 categorized type of residence based on population using Metropolitan Statistical Areas (MSA). An MSA is defined by the U.S. Office of Management and Budget. An MSA is a county or a group of contiguous counties that contains a Census Bureau defined urbanized area of at least 50,000 with a metropolitan population of at least 100,000. An MSA contains a central city described as a large urbanized area and may contain other counties that are metropolitan in character. The NSFG, Cycle 6 divided areas of residence into three categories: 1) MSA central cities described as large, urban cities, 2) metropolitan areas described as metropolitan cities near a central city, and 3) other areas in which all other types of residence were categorized [13].

Socioeconomic status was incorporated into our analysis using two variables, total household income and the respondent's poverty threshold as defined by the US Department of Health and Human Services for the year 2002. Insurance status was also incorporated into this analysis. The NSFG, Cycle 6 database asked respondents to report whether they had private health insurance, state/public/government/military insurance, Medicaid or were uninsured.

Health Related Variables

In terms of health related variables, gravidity and parity were examined as categorical variables. General health status was also incorporated into the analysis. An individual was asked, "In general, how is your health? Would you say it is…?" Respondents could chose excellent, very good, good, fair or poor as a response.

Contraceptive Variables

We examined the respondent's current contraceptive method as well as the contraceptive method used with their last sexual intercourse with a male. Contraceptive method was divided into most reliable, reliable, least reliable and none using the strategy described in Table 1.

Table 1: Contraceptive Reliability Categories

Most Reliable	Reliable	Least Reliable
Male Surgical Sterilization	Contraceptive Patch	Rhythm or safe method
Female surgical Sterilization	Contraceptive Ring	Jelly or cream
IUD, coil or loop	Oral Contraceptive Pill	Withdrawal
Norplant		Male Condoms
Injectable Contraceptive		Female Condoms
Respondent was sterile		Cervical Cap
Partner was sterile		Sponge
		Foam, Suppository
		Natural family planning by temperature or mucus
		Emergency Contraceptives (The Morning After Pill)

Sexual Behavior Variables

Because it is unclear how body image and BMI affects sexual behavior, the relationship between BMI and sexual behavior was also included in this analysis. Potential differences in sexual orientation between BMI groups were examined using the question, "Do you think of yourself as heterosexual, homosexual, bisexual or something else?" Using variables from both the ACASI and interviewed portions of the survey, we also examined the frequency of male-female sexual intercourse using variables described in Table 2. Individuals who did not respond a particular question were excluded from the analysis.

Table 2: Sexual Behavior Variables

ACASI Variables (Self Recorded)	Interviewed Variables (Recorded by Interviewer)
Age at first intercourse	Age at first intercourse
Number of lifetime male partners	Number of lifetime male partners
Number of male partners in the last 12 months	Number of male partners in the last 12 months
	Current number of male partners
	Number of times respondent had male intercourse in the last 4 weeks
	History of sexual intercourse with a male

Fertility and Perceived Fertility Variables

Fertility and perceived fertility were examined using a number of variables. Differences in rates of sterilizing operations including bilateral tubal ligation, hysterectomy, bilateral oophorectomy and other sterilizing procedures were examined between BMI groups. Perceived fertility was examined using two questions. Respondents were asked whether it was possible for them to get pregnant using the following question, “Some women are not physically able to have children. As far as you know is it physically possible for you, yourself to have a baby?” Respondents were also asked whether it was difficult for them to get pregnant using the following question, “As far as you know, would you, yourself have any difficulty getting pregnant?”

Statistical Analysis

Respondents were excluded from the analysis if they had missing measurements for height or weight or if they reported being pregnant either in the self recorded ACASI portion of the survey or the interviewer recorded pregnancy and birth history portion of the survey. We chose to exclude pregnant women from this analysis because BMI can change dramatically during the course of a pregnancy and respondents who were pregnant would be less likely than non-pregnant respondents to report a BMI that would be representative of BMI at the time of conception.

Descriptive statistics were performed on the outcome variables and it was confirmed which outcome variable was the most appropriate to represent unintended pregnancy for this analysis. Descriptive statistics including frequency measures were performed to elucidate differences in demographic, socioeconomic, and health related variables between BMI groups. If a respondent did not reply to a particular question, they were excluded from that portion of the analysis. The significances of association was determined using Chi-Square tests for categorical variables and ANOVA for continuous factors.

Univariate analysis was performed for determinant variables found to be significantly associated with BMI category and the outcome variable representing unintended pregnancy. Univariate analysis was also performed for variables known to be related to unintended pregnancy such as income and race/ethnicity. Unadjusted odds ratios (ORs) and 95% confidence intervals (CIs) were obtained for each determinant variable and the outcome variable representing unintended pregnancy.

Multiple logistic regression was performed. BMI category and the determinant variables found to be significantly associated with the outcome variable to the 0.20 level were included in the initial model. Through backward selection, determinant variables were removed from the model at a significance level of 0.05. Adjusted OR and CIs were determined for all variables in the resultant model.

To assess confounding, we removed each variable from the model, one at a time. If the percent change in OR was more than 10% we considered the factor to be a confounder. We checked for effect modification by including the appropriate interaction terms in this analysis. We thought it appropriate to consider age, race/ethnicity, and income as effect modifiers for the relationship between BMI and unintended pregnancy.

All analysis were performed using SPSS version 15.0 for Windows (Chicago, Illinois) with the complex samples module to account for the complex sampling designed used by the NSFG, Cycle 6.

Sample Size

Our sample size was based on expected differences in the primary outcome, unintended pregnancy in the last five years between BMI groups. Based on the study by Brunner Huber et al, we expected that obese and overweight women would be 1.7 times as likely as normal weight women to have an unintended pregnancy [3]. It is estimated that 54.9 % of all Americans are overweight or obese [1], 49% of all pregnancies are unintended and 5% of women will have an unintended pregnancy in a given year [14]. Thus, we estimated that 30 % of women in the obese and overweight group would have an unintended pregnancy in a five-year period compared to 18% in the normal BMI group and that there would be a 12 % difference in unintended pregnancy rates between groups. To address this hypothesis, a total of 186 subjects in each arm of the study were needed to have 80 % power with a significance level of p=0.05. With a fixed non-weighted sample size of 7,643 and a weighted sample of 61.6 million, the NSFG, Cycle 6 provided an adequate sample to detect this difference.

Chapter 3 – Results

There were a total of 7643 women who participated in the NSFG, Cycle 6 survey. When weighting was taken into account, this translated into a weighted count of 61,057,678 female respondents. Of these respondents, 138 individuals did not report their weight and were excluded from the analysis. Additionally, 815 women identified themselves as being pregnant. These subjects were also excluded from the analysis leaving a total of 6690 survey participants. This resulted in a weighted population of 54,148,719 with 6,908,959 weighted participants excluded from the analysis.

The average BMI for the study population was 25.84 m/kg^2 (SD 0.09). There were 53.6 % of women who had a normal BMI, 25 % were classified as overweight and 21.4 % were classified as obese. The mean age at the time of interview for the study population was 30.12 years (SD 0.16). The mean ages of the BMI groups were 30.17 (SD 0.20) years, 29.80 (SD 0.37) years and 30.36 (SD 0.32) years for the normal, overweight and obese groups respectively. There were no statistically significant differences in mean age between BMI groups ($p = 0.419$).

The demographic and socioeconomic characteristics of the study population are presented in Table 3. There were no statistically significant differences between weight groups in terms of age, cohabitation status, race/ethnicity, education, income, poverty threshold, and insurance status. There was a statistically significant difference between BMI groups in terms of place of residence. Overall, 49.4% of individuals identified themselves as living in a large urban city.

Table 3: Demographic and Socioeconomic Characteristics of the Study Population

Characteristic	BMI Category			
	Total	Normal	Overweight	Obese
N	6690 (100%)	3600 (53.6%)	1643 (25.0%)	1447 (21.4%)
Weighted n	54,148,719	29,042,914	13,723,211	11,382,594
	N(weighted %)	n(weighted %)	n(weighted %)	n(weighted %)
Age at interview				
15-19 years	1020 (16.3)	539 (16.0)	268 (17.2)	213 (15.6)
20-24 years	1156 (15.4)	602 (15.1)	304 (16.5)	250 (14.4)
25-30 years	1100 (14.5)	595 (14.6)	269 (14.0)	236 (15.1)
30-45 years	3414 (53.8)	1864 (54.3)	802 (52.3)	748 (54.9)
Cohabitation Status				
Cohabitating	3297 (54.0)	1767 (46.0)	789 (45.8)	741 (45.9)
Not Cohabitating	3393 (46.0)	1833 (54.0)	854 (54.2)	706 (54.1)
Race/ethnicity				
Non-Hispanic White	3678 (66.4)	1986 (66.5)	924 (68.2)	768 (64.3)
Hispanic	1079 (11.8)	592 (12.0)	240 (10.6)	247 (12.5)
Black	1476 (15.4)	777 (15.1)	373 (15.0)	326 (16.4)
Asian, Native Hawaiian, Pacific Islander	245 (3.7)	138 (4.1)	52 (3.7)	55 (3.0)
American Indian, Alaska Native	214 (2.7)	107 (2.3)	54 (2.5)	51 (3.8)
High School Degree				
Graduate	5852 (87.6)	3143 (88.6)	1450 (90.0)	1259 (88.2)
Non-Graduate	838 (12.4)	457 (11.4)	193 (10.0)	188 (11.8)
College Degree				
Graduate	1859 (28.9)	1017 (30.1)	450 (27.8)	392 (26.8)
Non-Graduate	4831 (71.1)	2583 (69.6)	1193 (72.2)	1055 (73.2)
Income				
<10,000	749 (9.4)	418 (9.9)	162 (7.7)	169 (10.3)
10,000 to 50,000	3784 (53.9)	2009 (53.1)	959 (55.3)	816 (53.1)
50,000 to 75,000	1114 (18.9)	599 (19.3)	280 (18.7)	235 (17.6)
>75,000	1043 (17.8)	574 (17.7)	242 (18.3)	227 (19.0)
% of Poverty Level				
0-99%	1386 (18.8)	751 (19.5)	321 (16.8)	314 (19.4)
100-499%	4500 (69.5)	2403 (68.5)	1140 (71.8)	957 (69.1)
>500%	804 (11.7)	446 (12.0)	182 (11.4)	176 (11.5)
Insurance status				
Private health plan	4250 (68.1)	2282 (67.7)	1064 (70.2)	904 (66.4)
Public, government, state or military insurance	451 (6.4)	236 (6.1)	105 (5.8)	110 (7.7)
Medicaid	815 (9.5)	458 (10.2)	185 (8.2)	172 (9.2)
Uninsured	1174 (16.0)	624 (16.0)	289 (15.8)	261 (16.7)
Place of Residence*				
Large urban city	3220 (49.4)	1722 (49.6)	805 (51.9)	673 (46.2)
Metropolitan area	2483 (32.7)	1331 (32.3)	608 (32.7)	544 (34.3)
Other	1007 (17.9)	547 (18.1)	230 (15.4)	230 (19.5)

*Statistically significant difference between BMI groups p = 0.03

32.7% reported that they lived in a metropolitan area and 17.9% reported that they lived in another type of residence. Women in each of the BMI groups were most likely to live in a large urban city and although the differences in residence between BMI groups was statistically significant (p=0.034), they were small and varied between BMI groups by only 5-6%.

In terms of health related outcomes, there were statistically significant differences between BMI groups in terms of gravidity, parity and general health (Table 4). Nulligravid women represented the largest proportion of respondents from all BMI groups however there was a larger proportion of women of normal BMI who were nulligravid compared to the overweight and obese BMI groups. Women from all BMI groups were most likely to report primiparous status. However, normal weight women tended to report lower parity than the other two BMI groups. In terms of general health, as would be expected, a higher proportion of normal weight women (35.5%) reported excellent health compared to the overweight (25.5%) and obese (16.9%) BMI groups.

Overall, 28.7% of women were using the most reliable forms of contraception and 20% were using a reliable form of contraception. There were 15.6% of all respondents who were using the least reliable forms of contraception and 35.7% who were using no contraceptives. While the differences in contraceptive method choice between BMI groups were small, it was statistically significant (p= 0.037). Women in the obese weight group were more likely to use a reliable form of contraception and less likely to be non-contraceptors than normal weight and overweight women. There were 30% of women in the obese weight group who were using the most reliable forms of contraception compared to 29.1% in the normal weight group and 27.1% in the overweight group. There were 32.5% of women in the obese weight group who reported

Table 4: Characteristics of Health Related Variables by BMI Groups

Characteristic	BMI Category			
	Total	Normal	Overweight	Obese
N	6690 (100%)	3600 (53.6%)	1643 (25.0%)	1447 (21.4%)
Weighted n	54,148,719	29,042,914	13,723,211	11,382,594
	n (weighted %)	n (weighted %)	n (weighted %)	n (weighted %)
Gravidity*				
0	2813 (40.8)	1783 (49.0)	543 (29.9)	487 (33.3)
1	1318 (19.7)	652 (17.9)	342 (20.9)	324 (23.0)
2	1420 (21.8)	646 (18.5)	432 (27.3)	342 (23.8)
≥3	1139 (17.7)	519 (14.6)	326 (22.0)	294 (19.9)
Parity*				
0	2384 (34.5)	1551 (41.8)	439 (24.8)	394 (27.0)
1	1081 (15.9)	575 (15.7)	270 (16.2)	236 (16.2)
2	1190 (17.9)	579 (16.9)	331 (19.9)	280 (18.5)
≥3	2035 (31.7)	895 (25.6)	603 (39.1)	537 (38.3)
General Health*				
Excellent	1943 (28.8)	1278 (35.5)	434 (25.5)	231 (16.9)
Very Good	2641 (39.7)	1472 (40.2)	670 (42.0)	499 (35.2)
Good	1579 (24.0)	659 (18.8)	403 (24.9)	517 (35.5)
Fair/Poor	527 (7.5)	191 (5.5)	136 (7.6)	200 (12.4)

*****Statistically significant difference between BMI groups $p < 0.001$

using no contraceptive method compared to 36.0% in the normal weight group and 38.0% in the overweight group. There were no differences in contraceptive method with last male intercourse between BMI groups. The rates of contraceptive method choice are presented in Table 5.

We explored differences in history of sterilizing operations such as bilateral tubal ligation, bilateral oophorectomy and hysterectomy between BMI groups. There were no statistically significant differences between BMI groups in rates of bilateral tubal ligation or bilateral oophorectomy. There was, however, a statistically significant difference (p=0.007) between BMI groups in terms of a history of hysterectomy with 6.0% of women in the obese category reporting a history of a hysterectomy compared to 4.2% in the normal BMI group and 2.9% in the overweight group. These results are summarized in Table 5.

Table 5: Contraceptive Method by BMI Groups

Characteristic	BMI Category			
	Total	Normal	Overweight	Obese
N	6690 (100%)	3600 (53.6%)	1643 (25.0%)	1447 (21.4%)
Weighted n	54,148,719	29,042,914	13,723,211	11,382,594
	n (weighted %)	n (weighted %)	n (weighted %)	n (weighted %)
Current Contraceptive Method*				
Most Reliable	1838 (28.7)	989 (29.1)	444 (27.1)	405 (30.0)
Reliable	1339 (20.0)	715 (19.5)	300 (17.9)	324 (23.2)
Least Reliable	1065 (15.6)	581 (15.4)	267 (17.0)	217 (14.3)
None	2448 (35.7)	1315 (36.0)	632 (38.0)	501 (32.5)
Contraceptive Method with Last Male Intercourse				
Most Reliable	1618 (24.1)	890 (24.8)	375 (22.6)	353 (24.2)
Reliable	1210 (18.8)	656 (18.4)	235 (16.9)	319 (22.2)
Least Reliable	1334 (19.8)	708 (19.5)	359 (21.3)	267 (18.8)
None	2528 (37.3)	1346 (37.4)	674 (39.2)	508 (34.8)
History of Tubal Ligation				
Yes	1082 (16.9)	566 (16.6)	256 (15.5)	260 (19.5)
No	5608 (83.1)	3034 (83.4)	1387 (84.5)	1187 (80.5)
History of Bilateral Oophorectomy				
Yes	109 (1.8)	57 (1.5)	25 (1.3)	27 (2.9)
No	6581 (98.2)	3543 (98.5)	1618 (98.7)	1420 (97.1)
History of Hysterectomy**				
Yes	259 (4.3)	137 (4.2)	49 (2.9)	73 (6.0)
No	6431 (95.7)	3463 (95.8)	1594 (97.1)	1374 (94.0)
History of any other Sterilizing Operations				
Yes	76 (1.0)	37 (0.9)	22 (1.2)	17 (1.0)
No	6614 (99.0)	3563 (99.1)	1621 (98.8)	1430 (99.0)

*Statistically significant difference between BMI groups p = 0.031
**Statistically significant difference between BMI groups p = 0.007

To determine whether the difference in contraceptive method choice between BMI groups was due to differences in hysterectomy rates between groups, we excluded women with a history of a hysterectomy from the analysis (Table 6). This resulted in an unweighted population of 6431 and a weighted population of 51,825,505. There continued to be a statistically significant difference between BMI groups in terms of current contraceptive method ($p = 0.029$). However, when pairwise comparisons were made, there was no difference between BMI groups in terms of which group was most likely to be using the most reliable forms of contraception (overweight versus normal OR 0.903 [0.725, 1.125], obese versus normal 1.075 [0.861, 1.342]).

Table 6 : Contraceptive Method by BMI Groups, Excluding Women With a History of a Hysterectomy

Characteristic	BMI Category			
	Total	Normal	Overweight	Obese
N	6431 (100%)	3463 (53.7%)	1594 (25.7%)	1374 (20.6%)
Weighted n	51825505	27808873	13322571	10694061
	n (weighted %)	n (weighted %)	n (weighted%)	n (weighted %)
Current Contraceptive Method*				
Most Reliable	1598 (25.9)	864 (26.4)	397 (25.0)	337 (25.9)
Reliable	1339 (20.7)	715 (20.3)	300 (18.4)	324 (24.7)
Least Reliable	1062 (16.2)	578 (16.0)	267 (17.5)	217 (15.2)
None	2432 (37.1)	1306 (53.7)	630 (39.1)	496 (34.1)

*****Statistically significant difference between BMI groups p = 0.029

To determine whether the higher rates of use of the most reliable contraceptive methods in the obese group was due to a history of a sterilizing operation, we excluded women with a history of a sterilizing operation from the analysis. These results are presented in Table 7. This analysis resulted in an unweighted population of 5480 and a weighted population of 43,906,571. Although there continued to be a statistically significant difference in contraceptive method choice between BMI groups (p = 0.004), the direction of the association changed for the most reliable contraceptive method category. There were 10.8% of women in the obese category who were using the most reliable contraceptive method compared to 14.3% in the normal weight category and 12.8% in the overweight category. When pairwise comparisons were made, there were again, no differences between weight groups in terms of which BMI group was most likely to be using the most reliable forms of contraception (overweight vs normal OR 0.853 [0.649,1.121], obese vs. normal 0.796 [0.591, 1.074]).

Table 7 : Contraceptive Method by BMI Groups, Excluding Women with a History of Surgically Sterilizing Operation

Characteristic	BMI Category			
	Total	Normal	Overweight	Obese
N	5480 (100%)	2971 (53.9%)	1361 (26.0%)	1148 (20.1%)
Weighted n	43,906,571	23669140	11,406,932	8,830,499
	n (weighted %)	n (weighted %)	n (weighted%)	N (weighted %)
Current Contraceptive Method*				
Most Reliable	680 (13.2)	390 (14.3)	172 (12.8)	118 (10.8)
Reliable	1338(24.4)	714 (23.8)	300 (12.5)	324 (30.0)
Least Reliable	1058 (19.1)	574 (18.7)	267 (20.5)	217 (18.5)
None	2404 (43.2)	1293 (43.2)	622 (45.2)	489 (40.8)

*****Statistically significant difference between BMI groups p = 0.004

Table 8: Sexual Behavior for Different BMI Groups

	Self Recorded (ACASI) Mean (SD)	Interviewer Recorded Mean (SD)
Age at first intercourse *(weighted n, unweighted n) p value*	*(53336456, 6606) 0.569*	*(53840400, 6740) 0.855*
Normal	17.55 (0.12)	18.13 (0.22)
Overweight	17.43 (0.21)	18.29 (0.29)
Obese	17.41 (0.45)	17.89 (0.31)
Number of lifetime male partners *(weighted n, unweighted n) p value*	*(48288752, 5928) 0.372*	*(45700201, 5708) 0.087*
Normal	6.21 (0.20)	5.57 (0.15)
Overweight	6.53 (0.30)	5.50 (0.22)
Obese	7.06 (0.33)	6.02 (0.34)
Number of male partners in the last 12 months (weighted n, unweighted n) *p value*	*(48872574, 6009) 0.256*	*(47145201, 5875) 0.496*
Normal	1.85 (0.13)	1.13 (0.02)
Overweight	1.86 (0.27)	1.18 (0.07)
Obese	1.61 (0.16)	1.09 (0.02)

There were no statistically significant differences between BMI groups for age at first intercourse, the number of lifetime male partners and the number of male partners in the last 12 months. This was true for both self recorded ACASI and interviewer recorded data. These results are displayed in Table 8. There were however, differences in reported values between the

Table 9: Sexual Behavior by BMI Group

Characteristic	BMI Group			
	Total	Normal	Overweight	Obese
N	6690 (100%)	3600 (53.6%)	1643 (25.0%)	1447 (21.4%)
Weighted n	54,148,719	29,042,914	13,723,211	11,382,594
	n (weighted %)	n (weighted %)	N (weighted %)	n (weighted %)
History of Sexual Intercourse* with a Male				
Yes	5973 (89.5)	3134 (87.4)	1507 (92.5)	1332 (91.5)
No	717 (10.5)	466 (12.6)	136 (7.5)	115 (8.5)
Sexual Orientation				
Heterosexual	6075 (90.5)	3287 (91.0)	1488 (89.9)	1300 (90.3)
Homosexual, Bisexual, Other	615 (9.5)	313 (9.0)	155 (10.1)	147 (9.7)
Frequency of Sexual Activity				
0 times in the last month	2307 (32.8)	1209 (32.6)	601 (34.1)	497 (32.2)
1-5 times in the last month	2170 (32.2)	1210 (33.5)	484 (28.0)	476 (34.2)
6-10 times in the last month	1191 (18.6)	648 (18.4)	304 (19.6)	239 (17.6)
>10 times in the last month	1022 (16.3)	533 (15.5)	254 (18.3)	235 (16.1)
Number of Current Partners				
None	2443 (33.7)	1286 (33.7)	621 (34.4)	536 (33.1)
1 partner	4132 (64.8)	2252 (64.6)	994 (64.4)	886 (65.5)
> 1 partner	115 (1.5)	62 (1.7)	28 (1.2)	25 (1.4)

***** Statistically significant difference between BMI groups $p < 0.001$

self recorded ACASI and interviewer recorded portions of the survey with individuals reporting a younger age at first intercourse and a greater number of partners in the self recorded ACASI portion of the survey.

In terms of sexual orientation, 90.5% of all respondents reported that they were heterosexual and 9.5% reported that they were homosexual, bisexual or both. There were no statistically significant differences between BMI groups in terms of sexual orientation. There were also no statistically significant differences between BMI groups in terms of frequency of sexual activity, and number of current partners. There was a statistically significant difference ($p<0.001$) between BMI groups in the number of individuals who reported ever having sexual intercourse with a male. The overweight group was more likely than the obese group and the normal weight group to have had sexual intercourse before while the normal weight group was the least likely to have reported a history of sexual intercourse with a male. The results are summarized in Table 9.

There was a statistically significant difference between BMI groups in the number of respondents who reported that they were surgically sterile at the time of the interview with a higher percentage of obese individuals reporting that they were surgically sterile (p=0.025). There was no difference between BMI groups in terms of whether an individual thought it was possible to get pregnant or whether it was difficult to get pregnant. These results are summarized in Table 10.

Table 10: Fertility and Perceived Fertility by BMI Group

Characteristic	BMI Group			
	Total	Normal	Overweight	Obese
N	6690 (100%)	3600 (53.6%)	1643 (25.0%)	1447 (21.4%)
Weighted n	54,148,719	29,042,914	13,723,211	11,382,594
	n (weighted %)	n (weighted %)	n (weighted %)	N (weighted %)
Surgically Sterile at the time of the interview*				
Yes	1210 (18.9)	629 (18.5)	282 (16.9)	299 (22.4)
No	5480 (81.1)	2971 (81.5)	1361 (83.1)	1148 (77.6)
Possible to get pregnant				
Yes	6527 (97.9)	3507 (97.7)	1606 (98.1)	1414 (98.0)
No	163 (2.1)	93 (2.3)	37 (1.9)	33 (2.0)
Difficult to get pregnant				
Yes	521 (7.5)	287 (7.7)	133 (8.2)	101 (6.4)
No	6169 (92.5)	3313 (92.3)	1510 (91.8)	1346 (93.6)

*****Statistically significant difference between BMI groups = 0.025

The primary outcome in this analysis was unintended pregnancy in the last five years. In this analysis, 14.2 % of all women reported a history of unintended pregnancy in the last five years. Only, 10.4 % of all respondents reported one unintended pregnancy in the last five years, 3.0 % reported two and 0.8 % reported three or more unintended pregnancies. Normal weight women had the highest percentage of unintended pregnancies with 14.6 % of normal weight women reporting an unintended pregnancy in the last five years. Overweight women had the second highest rate of unintended pregnancy at 14.0 % and obese women had the lowest rate of unintended pregnancy at 13.4 %. These differences were not statistically significant (p=0.621).

Table 11: The Relationship between BMI, Unintended Pregnancy and Abortion

Characteristic	BMI Category				
	Total	Normal	Overweight	Obese	p value
	n(weighted%)	n(weighted%)	n(weighted%)	n(weighted%)	
Unintended Pregnancy in the Last Five years					0.621
Yes	1105 (14.2)	606 (14.6)	274 (14.0)	225 (13.4)	
No	5585 (85.8)	2994 (85.4)	1369 (86.0)	1222 (86.6)	
Number of Unintended Pregnancies in the Last Five Years					0.542
0	5585 (85.8)	2994 (85.4)	1369 (86.0)	1222 (86.6)	
1	810 (10.4)	441 (10.5)	206 (10.5)	163 (9.8)	
2	214 (3.0)	115 (3.1)	52 (2.9)	47 (2.7)	
≥3	81 (0.8)	50 (1.0)	16 (0.6)	15 (0.9)	
Unintended Pregnancy in the Last Year					0.235
Yes	269 (3.4)	135 (3.2)	72 (4.2)	52 (2.8)	
No	6421 (96.6)	3465 (96.8)	1571 (95.8)	1395 (97.2)	
Abortion in the Last Year					0.840
Yes	80 (1.0)	49 (1.0)	18 (1.1)	13 (0.3)	
No	6610 (99.0)	3551 (99.1)	1625 (98.9)	1434 (99.7)	
Lifetime History of Abortion					0.764
Yes	1085 (15.1)	614 (14.9)	294 (16.1)	222 (14.1)	
No	5605 (84.9)	2986 (85.1)	1394 (83.9)	1225 (85.1)	
Lifetime History of Unintended Pregnancy					0.693
Yes	2955 (42.9)	1611 (43.2)	714 (41.9)	630 (42.9)	
No	3735 (57.1)	1989 (56.8)	929 (58.1)	817 (57.1)	

There were 42.9% of all respondents who reported an unintended pregnancy during their lifetime and 3.4% who reported an unintended pregnancy in the last 12 months. There were 15.1% of all respondents who reported having an abortion in their lifetime and 1.0 % of all respondents who reported that they had had an abortion in the last year. Table 11 reports the proportion of individuals who experienced an unintended pregnancy or abortion by BMI category. There were no statistically significant differences in any of these outcomes between BMI groups.

In terms of the number of abortions an individual reported, there were no statistically significant differences between BMI groups. This was true for both the self-recorded ACASI portion of the survey and the interviewer recorded portion of the survey. Women from all BMI groups had a similar number of pregnancies in the last five years and a similar number of unwanted pregnancies in the last five years. This data is reported in Table 12.

Table 12: Mean Number of Abortions, Pregnancies and Unwanted Pregnancies by BMI Group

Characteristic	BMI Category			
	Normal mean (SD)	Overweight mean (SD)	Obese Mean (SD)	P value
Self Recorded (ACASI)Number of Abortions in Lifetime	0.82 (0.12)	1.07 (0.38)	0.67 (0.19)	0.603
Interviewer Recorded Number of Abortions in Lifetime	0.34 (0.02)	0.37 (0.06)	0.34 (0.04)	0.869
Reported Number of Unwanted Pregnancies in the Last Five years	0.20 (0.01)	0.18 (0.02)	0.18 (0.02)	0.589
Reported Number of Pregnancies in the Last Five years	0.44 (0.02)	0.43 (0.03)	0.44 (0.03)	0.956

Based on differences on socioeconomic, demographic and health related variables between BMI groups, we chose to examine the relationship between 14 different variables and our primary outcome, unintended pregnancy in the last five years. These 14 variables included BMI group, age at interview, cohabitation status, race/ethnicity, high school education, college education, income, insurance status, gravidity, parity, general health, current contraceptive. method and history of intercourse with a male. The unadjusted odds ratios and CIs are presented in Table 13.

Table 13: Number, Weighted Percents, Unadjusted Odds Ratios (OR) and 95% Confidence Intervals (CI) of the Association Between Selected Characteristics and Unintended Pregnancy in the Last Five Years (reference = yes, positive history of unintended pregnancy in the last five years)

Characteristic	Cases n (weighted %)	Controls n (weighted %)	OR	[95% CI]	p-value
BMI Category					0.621
Normal	606 (14.6)	2994 (85.4)	Reference	Reference	
Overweight	274 (14)	1369 (86.0)	0.953	[0.778, 1.168]	
Obese	225 (13.4)	1222 (86.6)	0.902	[0.729, 1.116]	
Age at interview					<0.001
15-19 years	112 (10.7)	908 (89.3)	1.158	[0.878, 1.527]	
20-24 years	343 (24.3)	813 (75.7)	3.106	[2.527, 3.819]	
25-30 years	293 (25.5)	807 (74.5)	3.302	[2.636, 4.138]	
30-45 years	357 (9.4)	3057 (90.6)	Reference	Reference	
Cohabitation Status					0.015
Cohabitating	583 (15.4)	2679 (84.6)	1.226	[1.040, 1.446]	
Not Cohabitating	522 (12.9)	2906 (87.1)	Reference	Reference	
Race/ethnicity					<0.001
Non-Hispanic White	469 (11.3)	3209 (88.7)	Reference	Reference	
Hispanic	222 (19.4)	857 (80.6)	2.534	[1.706, 3.763]	
Black	320 (21.0)	1156 (79.0)	1.319	[0.855, 2.034]	
Asian, Native Hawaiian, Pacific Islander	37 (14.2)	208 (85.8)	1.904	[1.537, 2.359]	
American Indian, Alaska Native	57 (24.8)	155 (75.2)	2.090	[1.717, 2.544]	
High School Degree					<0.001
Graduate	890 (13.0)	4962 (87.0)	Reference	Reference	
Non-Graduate	215 (24.4)	623 (75.6)	2.170	[1.735, 2.715]	
College Degree					<0.001
Graduate	213 (10.0)	1646 (90.0)	Reference	Reference	
Non-Graduate	892 (16.0)	3939 (84.0)	1.717	[1.412, 2.087]	

Table 13: Continued

Characteristic	Cases n (weighted %)	Controls n (weighted %)	OR	[95% CI]	p-value
Income					<0.001
< 10,000	181 (21.4)	568 (78.6)	2.346	[1.684, 3.270]	
10,000-50,000	696 (16.1)	3088 (83.9)	1.644	[1.248, 2.166]	
50,000-75,000	118 (9.1)	996 (90.9)	0.857	[0.610, 1.205]	
>75,000	110 (10.4)	933 (89.6)	Reference	Reference	
Insurance status					<0.001
Private health plan	503 (10.3)	3747 (89.7)	Reference	Reference	
Public, government, state or military insurance	87 (16.7)	364 (83.3)	1.753	[1.281, 2.397]	
Medicaid	275 (33.5)	540 (66.5)	4.416	[3.533, 5.521]	
Uninsured	240 (18.7)	934 (81.3)	2.012	[1.623, 2.495]	
Place of Residence					0.005
Large urban city	505 (13.7)	2695 (86.3)	1.216	[0.930, 1.588]	
Other metro area	468 (16.4)	2015 (83.6)	1.505	[1.147, 1.976]	
Non metro area	132 (11.6)	875 (88.4)	Reference	Reference	
Number of prior pregnancies					0.525
0	475 (15.1)	2338 (84.9)	1.179	[0.914, 1.522]	
1	210 (13.9)	1108 (86.1)	1.073	[0.797, 1.446]	
2	241 (13.7)	1179 (86.3)	1.055	[0.797, 1.396]	
≥3	179 (13.1)	960 (86.9)	Reference	Reference	
Number of births					0.679
0	404 (14.9)	1980 (85.1)	1.117	[0.908, 1.374]	
1	175 (14.6)	906 (85.4)	1.091	[0.844, 1.409]	
2	193 (13.6)	997 (86.4)	1.003	[0.783, 1.284]	
≥3	333 (13.6)	1702 (86.4)	Reference	Reference	
General Health					0.947
Excellent	327 (14.4)	1616 (85.6)	Reference	Reference	
Very Good	450 (14.4)	2191 (85.6)	0.999	[0.822, 1.213]	
Good	242 (13.7)	1337 (86.3)	0.943	[0.749, 1.186]	
Fair/Poor	86 (14.7)	441 (85.3)	1.024	[0.731, 1.436]	
Current Contraceptive Method					<0.001
Most Reliable	348 (16.5)	1490 (83.5)	Reference	Reference	
Reliable	233 (14.8)	1106 (85.2)	0.878	[0.698, 1.105]	
Least Reliable	245 (20.0)	820 (80.0)	1.271	[1.002, 1.612]	
None	279 (9.6)	2169 (90.4)	0.539	[0.432, 0.673]	
History of Sexual Intercourse with a Male					0.504
Yes	985 (14.3)	4988 (85.7)	1.089	[0.848, 1.398]	
No	120 (13.3)	597 (86.7)	Reference	Reference	

BMI category and other predictor variables that were significant to the 0.20 level in univariate analysis were included in the initial model. This included age, cohabitation status, race/ethnicity, high school education, college education, income, insurance, residence and current contraceptive method. After backward selection was employed, our final model included BMI, age, cohabitation status, race/ethnicity, and current contraceptive method. The adjusted OR and CIs are presented in Table 14. The overweight and obese groups had a slightly lower risk of unintended pregnancy in the last five years compared to the normal weight group. However, these results were not statistically significant (p = 0.261) with all CIs crossing 1.0.

Table 14: Adjusted Odds Ratios (OR) and 95% Confidence Intervals (CI) of the Association Between Selected Characteristics and Unintended Pregnancy in the Last Five years (reference = yes, positive history of unintended pregnancy in the last five years)

Characteristic	Adjusted OR	[95% CI]	p-value
BMI Category			0.461
Normal	Reference	Reference	
Overweight	0.951	[0.771, 1.172]	
Obese	0.870	[0.697, 1.085]	
Age at interview			<0.001
15-19 years	2.089	[1.472, 2.996]	
20-24 years	4.201	[3.299, 5.349]	
25-30 years	3.653	[2.870, 4.650]	
30-45 years	Reference	Reference	
Cohabitation Status			0.001
Cohabitating	1.439	[1.521, 1.796]	
Not Cohabitating	Reference	Reference	
Race/ethnicity			<0.001
Non-Hispanic White	Reference	Reference	
Hispanic	1.737	[1.394, 2.165]	
Black	2.195	[1.780, 2.706]	
Asian, Native Hawaiian, Pacific Islander	1.228	[0.760, 1.984]	
American Indian, Alaska Native	2.539	[1.687, 3.823]	
Current Contraceptive Method			<0.001
Most Reliable	Reference	Reference	
Reliable	0.603	[0.463, 0.785]	
Least Reliable	0.919	[0.711, 1.188]	
None	0.418	[0.321, 0.545]	

Although the relationship between BMI and unintended pregnancy was not statistically significant, we assessed for confounding. Removal of each variable, one at a time, did not result in a 10% change in OR for BMI. Indeed, the OR for BMI did not change very much between our initial model presented in Table 13 and the final model presented in Table 14. Interaction terms for BMI and age, BMI and contraceptive method, BMI and race/ethnicity, and BMI and income were included in the analysis and none of these terms were statistically significant.

Although the interaction term for BMI and age was not significant, we repeated the analysis with the study population divided into different age categories. We did this specifically to explore the directionality of the relationship between BMI and unintended pregnancy in the last five years for our youngest and oldest age groups. These results are presented in Table 15. Pairwise comparisons were also performed. These results are presented in Table 16. It is notable that the directionality of the association between BMI and unintended pregnancy changed for the youngest age category with the risk of unintended pregnancy in the last five years being higher in the obese and overweight group compared to the normal weight group. However, this association was not statistically significant.

Table 15: History of Unintended Pregnancy in the Last Five Years by BMI Category and Age Group

Positive History of Unintended Pregnancy in the Last Five years	BMI Category			
	Normal Weighted %	Overweight Weighted %	Obese Weighted %	p value
Age 15-19 years	9.7	13.3	10.0	0.425
Age 20-24 years	26.2	22.7	21.7	0.354
Age 25-30 years	26.1	24.7	24.8	0.929
Age 30-45 years	9.8	8.7	9.1	0.724

Table 16: Odds Ratios for Unintended Pregnancy in the Last Five Years by Age Category (Reference = yes, positive history of unintended pregnancy in the last five years)

Age Category	BMI Groups	Odds Ratio	[95% CI]
Age 15-19 years	Overweight vs. normal	1.438	[0.822, 2.515]
	Obese vs. normal	1.036	[0.564, 1.902]
Age 20-24 years	Overweight vs. normal	0.829	[0.580, 1.186]
	Obese vs. normal	0.780	[0.536, 1.137]
Age 25-30 years	Overweight vs. normal	0.932	[0.614, 1.415]
	Obese vs. normal	0.935	[0.591, 1.480]
Age 30-45 years	Overweight vs. normal	0.871	[0.605, 1.255]
	Obese vs. normal	0.913	[0.637, 1.310]

The analysis was also repeated using the number of unintended pregnancies in the last five years, unintended pregnancy in the last year, abortion in the last year, lifetime history of unintended pregnancy and lifetime history of abortion as the outcome and we were unable to demonstrate a difference in risk for any of these outcomes between BMI groups. Analysis was also individually repeated after non-contraceptors were excluded, women with a history of a sterilizing operation were excluded, pregnant women were included, the normal BMI group was divided into normal weight (BMI 18-25 kg/m^2) and underweight (BMI <18 kg/m^2) and the obese and overweight weight groups were combined and we were unable to demonstrate a difference in unintended pregnancy between BMI groups. The analysis was also repeated with BMI included as a continuous variable and we were unable to demonstrate a difference in unintended pregnancy between BMI groups.

Chapter 4 – Discussion

In this study, we did not demonstrate an association between BMI and risk of unintended pregnancy in the last five years. This was true despite adjusting for a number of socioeconomic, demographic and health related factors. Indeed, we were not able to demonstrate an association between BMI and any of the unintended pregnancy or abortion related variables.

We found that women in the obese group was more likely to be using the most reliable forms of contraception compared to the normal BMI and overweight group and were less likely to be using no contraception than these groups. Also in contrast to our hypothesis, we observed no differences in perceived fertility between BMI groups although obese women were more likely than other BMI groups to have had a sterilizing operation in the past. In terms of sexual behavior, there was a difference between BMI groups in terms of women who reported ever having had sex with a male with the overweight group being the most likely to report this history. However, there were no other differences in sexual behavior including the number of sexual partners, frequency of intercourse or age at first intercourse. Thus, if we had demonstrated a difference in unintended pregnancy between BMI groups, it would have been unlikely that these factors would have accounted for the difference.

There are several potential limitations that are related to the type of information that was collected in the NSFG, Cycle 6. Because of the cross-sectional design of this study, we cannot conclude that any associations found between variables are due to causal relationships. Also, Exposure misclassification is possible since both weight and height information was self-reported by study participants rather than objectively measured. Although a number of studies have documented that self-reported weight and height is an accurate representation of a woman's true weight [15-17], the validity of this information is a limitation of this study. We believe that this type of exposure misclassification would be nondifferential because normal weight, overweight, and obese women tend to underestimate their weight. Although underweight women may overestimate their weight, doing so would place them in the normal weight category and we did not differentiate between underweight and normal weight women for our analysis. All BMI groups tend to slightly over report their height [15-17]. This type of nondifferential exposure misclassification would bias our results towards the null hypothesis.

Misclassification of pregnancy intendedness could also affect the results of this study. Women whose pregnancy resulted in a live birth would be more likely to indicate that the pregnancy was wanted or intended whether they were planning to get pregnant at the time of conception or not. This type of misclassification would be expected to affect all three BMI groups equally and would be nondifferential. This type of error probably would have underestimated the true outcome-exposure association if one existed.

As discussed earlier, it is also well established that women under report the number of abortions they have had. Even with the implementation of the ACASI portion of the NSFG, Cycle 6, this is undoubtedly true for this database. Although our primary outcome was not abortion, abortion was explored as one of our outcomes and it is likely that under reporting of abortion affected this portion of our analysis. Furthermore, we cannot assume that all pregnancies that end in abortion were unintended. Previously published reports from the NSFG, Cycle 6 database report that 8% of pregnancies ending in abortion were actually intended [14]. We expect that outcome misclassification would be non-differential in this instance as well because the demographic and socioeconomic characteristics that affect reporting such as marital status and age did not vary significantly across BMI groups. Nonetheless, analysis based on abortion as an outcome is likely to be unreliable.

Although characterizing a pregnancy as intended or unintended is practical for statistical analysis, there are limits to this type of categorization. Intendedness is perhaps more accurately viewed as a continuous variable as pregnancy intentions are often characterized by ambivalence and different levels of intention [14]. While an individual may not intend to get pregnant, they may feel happiness upon discovering that they are pregnant. Furthermore, an individual's perception of intendedness may change over the course of a pregnancy.

With any type of survey, information bias is a potential problem. Interviewers or respondents may misunderstand the questions and there is always a bias due to a respondent's desire to give a socially desirable answer. However, the NSFG, Cycle 6 took extensive measures to standardize questionnaires and questionnaire protocols. Moreover, the questions in this survey have been validated through over five prior cycles of the NSFG database as well as rigorous pre-testing. Thus we believe that information bias, while possible is minimal.

The variables that affect weight and unintended pregnancy are complex. While we tried to incorporate all variables that could affect these measures into our analysis, it is possible that unmeasured confounding introduced by unidentified factors could have affected the results of this study.

Recall bias is another potential limitation of using the NSFG, Cycle 6 database. The results of this survey relied on an individual's ability to recall past events such as their age at first intercourse. For many women in the survey, particularly those in the older age groups, these events may have occurred many years prior.

Our results are different than those published in prior studies, most notably, the results published by Brunner-Huber et al using the PRAMS database. While there are a number of possible reasons for this difference, the main hypothesized reason is the difference in study population. This study included non-pregnant women of reproductive age. These women may or may not have experienced a pregnancy in their lifetime and may or may not have chosen to continue an unintended pregnancy. The study using the PRAMS database included women who had delivered infants and collected information on the birth intentions of that particular pregnancy 2-6 months following delivery. This group is likely to have over reported that their pregnancy was intended. Thus, the group of gravid women who chose to continue their pregnancies that were surveyed in the PRAMS database would be different from the group of women surveyed the NSFG, Cycle 6.

Indeed, the possibility of selection bias was introduced by the authors of the study using the PRAMS database. They hypothesized that lighter women who have an unintended pregnancy may be more likely to have an induced abortion because they may be able to detect pregnancy at an earlier stage. Lighter women are less likely to have irregular cycles due to PCOS and may more easily recognize small changes in weight than obese and overweight women. If a pregnancy is recognized later, it may be more difficult for a woman to terminate this pregnancy. This is especially true in states where there is limited access to second trimester abortion providers. Brunner Huber et al. supported the possibility of selection bias by analyzing data from the 1995 NSFG, Cycle 5 database. They found that the mean BMI of women with an unintended pregnancy who chose to continue the pregnancy was slightly higher than the BMI of women who chose to have an induced abortion (23.1 m/kg^2 versus 24.6 m/kg^2). This difference was statistically significant (p=0.012) [3].

In our analysis, we were also able to control for potential confounders that could not be controlled for in prior analysis including sexual behavior and contraceptive method choice. While the PRAMS database used in Brunner Huber's study identified whether women were using any contraceptives at the time of conception, information was not available regarding the type or reliability of that particular contraceptive method [3]. In the NSFG, Cycle 6 database, we were able extract data on the particular contraceptive method currently being used and compare risk of unintended pregnancy across BMI groups while adjusting for the reliability of that method.

In contrast to Brunner Huber's study, the general direction of our results suggest that overweight and obese BMI groups have a lower risk of unintended pregnancy than women in the normal weight group. Obese and overweight women in our study were also more likely to use more reliable forms of contraception. While incorporating contraceptive method choice into our multiple logistic regression model should have adjusted for contraceptive method choice, our lack of statistical significance may suggest that although obese and overweight women use more reliable forms of contraception, they have comparable rates of unintended pregnancy, suggesting a higher failure rate.

It should be noted that we had information on the contraceptive method being used at the time of the survey rather than the contraceptive method used at the time of conception. There is a temporal nature to these two variables. An individual who experienced a recent unintended pregnancy and may be more likely to access the health care system and start a reliable contraceptive method than those who had not experienced an unintended pregnancy. This would explain why women using reliable, least reliable, and no contraceptive method had a lower risk of unintended pregnancy in the last five years compared to women who were using the most reliable forms of contraception in our study. However, further analysis needs to be done to elucidate this relationship.

While our analysis does not allow us to draw conclusions on contraceptive efficacy in obese or overweight women, obese women were more likely to use most reliable forms of contraception than normal and overweight women. These results are in contrast to the study published by Chuang et al using the BRFSS database [7]. The population used in the study by Chuang et al was limited to sexually active women of reproductive age who were trying to prevent pregnancy while the NSFG, Cycle 6 survey included all women no matter what their pregnancy intentions were. This may have resulted in a highly motivated group of contraceptors in Chuang's study who were more likely overall to use a contraceptive method. Numerous factors may have preferentially prevented the obese and overweight group of women from many contraceptive methods. Co-morbidity and medical illness may have decreased the use of estrogen containing products such as the oral contraceptive pill, transdermal patch and the contraceptive ring. Concerns about weight gain with Depo Provera may also have decreased its use in women with higher BMIs. Use of intrauterine devices in all women was not as common as it is currently. Thus, despite being motivated to prevent pregnancy, overweight and obese women in Chuang's study may have had fewer contraceptive method choices making normal weight women who were also motivated to prevent pregnancy more likely to use a contraceptive method. In the NSFG database, mixed motivation to prevent pregnancy may have made this difference less pronounced.

Chapter 5 – Conclusion

As the obesity epidemic continues to spread in our country, it is important to know how BMI affects the risk of unintended pregnancy as well as contraceptive use, sexual behavior and perceived fertility. The results of our study, based on a large representative survey of reproductive aged women, failed to demonstrate that overweight and obese women have higher rates of unintended pregnancy, which has been described in prior studies. Our findings are substantial and robust because the large sample size and high quality of the NSFG permitted the incorporation of several potential confounders into our model which were not possible to include in prior analysis.

As stated earlier, research in contraceptive efficacy and unintended pregnancy in obese and overweight women has been limited by several factors including the exclusion of these women from most trials involving contraceptive efficacy. There is still much work to be done in this area and this type of data analysis cannot substitute for prospective clinical trials which would specifically address which methods heavier women should use to most effectively prevent unintended pregnancy. However, this report represents a contribution to our understanding of which factors affect unintended pregnancy rates in this country. It is only through a thorough understanding of these factors that we will be able to properly address this important health care problem and improve the health of women.

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