# Knowledge among Puerto Rican Women about Risk of Infertility Associated with Overweight and Obesity

Lorena González-Sepúlveda, MS*; Verushka Vera-Arroyo, MD†;
Maria Carro, MD†; Lizzie M. Ramos-Tollinchi, MPH*;
Josefina Romaguera, MD†; Sharee A. Umpierre, MD†

**Objective: Our study sought to evaluate how aware the women attending gynecology clinics at the University of Puerto Rico Medical Sciences Campus (UPR-MSC) were of the association between infertility and excess body weight (i.e., overweight and obesity).**

**Methods: Women 21 years old and older attending gynecology clinics at UPR-MSC were invited to participate in this study (n = 234). A self-administered survey was provided to all the women. Logistic regression models were performed to determine associations.**

**Results: About 56.8% of the women were found to be aware of the effects of obesity on fertility; their main source of medical information was their primary doctor. The odds (adjusted for age and annual income) of being aware of the association between obesity and infertility were about 2.41 (95% CI: 1.07–5.42) times higher in women with a BMI greater than or equal to 25 kg/m² than they were in those with a BMI of less than 25 kg/m². An interaction by age group (adjusted for BMI) was found for the association between annual income and knowledge of the obesity–infertility association ($OR_{\geq 40\ years\ old}$: 3.51, 95% CI: 1.41–8.72; $OR_{<40\ years\ old}$: 0.57, 95% CI: 0.15–2.13).**

**Conclusion: Our study revealed that there is a lack of knowledge regarding the effects of obesity on fertility and identifies characteristics associated with this knowledge. The contents of health-care-provider counseling and the barriers affecting communication between patients and health care providers could be assessed in further studies. [P R Health Sci J 2020;39:184-188]**

*Key words: BMI, Knowledge, Obesity, Infertility, Puerto Ricans*

Since 1960, the number of persons that are obese in the United States (US) has doubled (1). In 2009 and 2010, over 78 million US adults and about 12.5 million US children and adolescents were obese (2). Moreover, obesity affected over 650 million adults and 340 million children and adolescents, globally, in 2016 (3). The increasing trend of obesity among the population has made it become a major health issue, worldwide and in the US. In 2008, it was estimated that up to $147 billion in medical spending was attributable to the medical burden of obesity (4), and this kind of spending may increase by from $48 billion to $66 billion, per year (5), by 2030.

According to data from the Behavioral Risk Factor Surveillance System (BRFSS) (6), the prevalence of obese women in childbearing age (18–44 years) in the US grew from 24.9% to 27.6% from 2011 to 2017. Similarly, the prevalence of obesity in adults in Puerto Rico has been increasing over the years; from 2011 to 2017, the age-adjusted prevalence of obesity and that of overweight combined with obesity increased from 26.2% to 32.6% and from 65.0% to 67.4%, respectively (7). Furthermore, women may be even more likely to be obese than men are, as

shown in a previous study from Puerto Rico (43.7% vs. 37.6%; p<0.05) (8). These prevalences may raise concerns regarding the health of this particular population (women in Puerto Rico) because, as is well known, obesity has been associated not only with cardiometabolic diseases but also with the development of reproductive disorders, including infertility (9–10). Obese women (i.e., women with a body mass index [BMI] ≥ 30 kg/m²) have been shown to have infertility rates that are 3 times higher than are those of non-obese women (i.e., women with a BMI<30 kg/m²) (11). Moreover, it has been shown that the probability of pregnancy is reduced by 5% per unit of BMI exceeding 29 kg/m (12).

Two previous studies have assessed the awareness of the existing association between obesity and various reproductive health outcomes (including infertility). In the 2012 study of Cardozo et al. (13), 82.7% of the women attending infertility clinics at Northwestern Memorial Hospital at the time of the study were aware of the association between excess body weight and infertility. However, this proportion may not be representative of women that are not looking for infertility treatments, since women seeking such treatments may be more aware of the effects of obesity on fertility than their non-infertility-treatment-seeking counterparts are. The second, and newer (2013), study showed that 33.9% of the women in a predominantly African American urban region knew about the effects that obesity has on fertility (14).

To our knowledge, no published studies have assessed (in a Hispanic population) the awareness of the effects of obesity on fertility. Hence, our study sought to evaluate both whether women attending gynecologic clinics at the University of Puerto Rico Medical Sciences Campus (UPR-MSC) were aware of the association between infertility and excess body weight (i.e., overweight and obesity) and the association between an individual's being aware and her sociodemographic characteristics.

## Materials and Methods

This study was reviewed and approved by the UPR-MSC Institutional Review Board (protocol number #A0180114). Patients from gynecology and gynecology–oncology clinics at UPR-MSC were invited to participate in this study. Eligibility criteria included being a female patient who was 21 years of age or older, was a resident of Puerto Rico, and did not present any cognitive (i.e., related to comprehension and/or judgment) or physical impairment. In a given potential participant, the presence of either physical or cognitive (or both) impairment was determined by the study coordinator, according to the information provided by the subject and/or the subject's family. The consent form was thoroughly explained to patients that met the inclusion criteria. A total of 234 women were interviewed after written consent was obtained.

A self-administered survey was provided to all the patients. The survey questions assessed the participants' knowledge of the effects of obesity on fertility (outcome). From a list of health issues that might or might not be related to obesity, the patients had to identify infertility as being a possible result of obesity. Those that correctly identified infertility as being related to obesity were considered as having knowledge of the existing association; meanwhile, those indicating that no such association existed or who left the question blank were classified as not having the knowledge. Additional information, such as sociodemographic characteristics (e.g., gender, age, civil status, education), possible sources of medical information (e.g., the internet, educational pamphlets, television), and lifestyles (e.g., diet and physical activity), was gathered by the survey.

The questions provided on the survey were obtained from the "Behavioral Risk Factor Surveillance System Questionnaire" (15) and previously validated questionnaires from other relevant studies (16–17). Information on the height and weight of each participant was obtained from her medical records so that we could calculate her BMI.

The study sample was characterized using percentages and central tendency measures (e.g., mean, median, standard deviation). A chi-squared test was performed to determine the associations between having knowledge about the increased risk of infertility in obese women and socio-demographic characteristics, BMI, physical activity, and history of cancer. Logistic regression models were performed to estimate the odds ratios (ORs) along with 95% confidence intervals (95% CIs); the adjusted models included age, BMI, and annual income as confounders. A likelihood-ratio test was performed to assess the interaction terms. Stata v.14 (College Station, Texas, USA) was used for all the statistical analyses.

## Results

Table 1 shows the participants' socio-demographics. About 56.8% of the participants demonstrated being aware of the effects of obesity on fertility. Obesity (i.e., a BMI $\geq$ 30 kg/m$^2$) was present in approximately 48.3% of the participants; among these women, around 61.1% knew about the association between infertility and increased body weight.

**Table 1**. Socio-demographic description of our study sample (n = 234).

| | n (%) |
|---|---|
| Age (in years) | |
| <40 | 69 (29.5) |
| ≥ 40 | 165 (70.5) |
| Education | |
| <High school | 45 (19.2) |
| ≥ High school | 189 (80.8) |
| Civil status | |
| Single | 82 (35.2) |
| Married/living with partner | 103 (44.2) |
| Divorced/separated | 29 (12.5) |
| Widower | 19 (8.2) |
| Employment status | |
| Employed | 52 (22.2) |
| Unemployed[a] | 146 (62.4) |
| Retired | 36 (15.4) |
| Income | |
| <$15,000 | 116 (70.3) |
| ≥ $15,000 | 49 (29.7) |

[a]Included students (n = 3) and housewives (n = 71).

Table 2 shows the associations between the participants' characteristics and the awareness of obesity's effects on fertility. Characteristics such as age, education, civil status, employment, physical activity, and history of cancer did not show any associations with being aware of obesity's effects on

**Table 2**. Association between awareness of obesity's effects on fertility and participants' characteristics (n = 234).

| Characteristic | Awareness of obesity's effects on fertility | | Unadjusted OR (95% CI) | Adjusted OR[a] (95% CI) |
| --- | --- | --- | --- | --- |
| | No (n = 101) n (%) | Yes (n = 133) n (%) | | |
| Age (in years) | | | | |
| <40 (Ref.) | 28 (40.6) | 41 (59.4) | 1.00 | 1.00 |
| ≥ 40 | 73 (44.2) | 92 (55.8) | 0.86 (0.49–1.52) | 0.70 (0.33–1.51) |
| Education | | | | |
| ≥ High school (ref.) | 77 (40.7) | 112 (59.3) | 1.00 | 1.00 |
| <High school | 24 (53.3) | 21 (46.7) | 0.60 (0.31–1.16) | 0.82 (0.35–1.92) |
| Civil Status | | | | |
| Single (ref.) | 33 (40.2) | 49 (59.8) | 1.00 | 1.00 |
| Married/living with partner | 47 (45.6) | 56 (54.4) | 0.80 (0.45–1.44) | 0.68 (0.31–1.48) |
| Divorced/separated | 9 (31.0) | 20 (69.0) | 1.50 (0.61–3.69) | 2.27 (0.76–6.83) |
| Widower | 11 (57.9) | 8 (42.1) | 0.49 (0.18–1.35) | 0.64 (0.19–2.20) |
| Employment Status | | | | |
| Employed (ref.) | 19 (36.5) | 33 (63.5) | 1.00 | 1.00 |
| Unemployed[b] | 63 (43.2) | 83 (56.9) | 0.76 (0.39–1.46) | 1.04 (0.41–2.66) |
| Retired | 19 (52.8) | 17 (47.2) | 0.52 (0.22–1.22) | 0.74 (0.24–2.26) |
| Annual Income | | | | |
| <$15,000 (ref.) | 55 (47.4) | 61 (52.6) | 1.00 | 1.00 |
| ≥ $15,000 | 15 (30.6) | 34 (69.4) | 2.04 (1.01–4.15)[c] | 2.03 (0.99–4.18)[d] |
| BMI (kg/m²) | | | | |
| <25.0 (ref.) | 30 (61.2) | 19 (38.8) | 1.00 | 1.00 |
| ≥ 25.0[e] | 71 (38.4) | 114 (61.6) | 2.54 (1.33–4.84)[c] | 2.41 (1.07–5.42)[c] |
| Physical Activity | | | | |
| No (ref.) | 58 (42.0) | 80 (58.0) | 1.00 | 1.00 |
| Yes | 43 (44.8) | 53 (55.2) | 0.89 (0.53–1.51) | 0.83 (0.42–1.61) |
| Hx of Cancer[f] | | | | |
| No (ref.) | 55 (40.7) | 80 (59.3) | 1.00 | 1.00 |
| Yes | 46 (46.5) | 53 (53.5) | 0.79 (0.47–1.34) | 0.81 (0.47–1.42) |

Definitions: Ref., reference; OR, odds ratios; BMI, body mass index; and Hx, history. [a]Logistic regression models were adjusted for age, BMI, and annual income, unless otherwise specified. [b]Included students (n = 3) and housewives (n = 71). [c]P-values less than 0.05. [d]A statistically significant interaction was found between age and annual income (LR chi2 = 6.08; p = 0.048). Among younger women (<40 years old), those with relatively higher annual incomes (≥ $15,000) had 0.5 (95% CI: 0.15–2.13) times the odds of being aware about the association between obesity and infertility, compared to those with annual incomes <$15,000. Among older women (≥ 40 years old), those with annual incomes ≥ $15,000 had 3.51 greater odds (95% CI: 1.41–8.72) of knowing about the association between obesity and infertility than did those with annual incomes <$15,000. [e]Obesity (30 kg/m²) was observed in 61.1% of these women. [f]Annual income was removed from the adjusted model.

and infertility compared to those with lower annual income. To the contrary, among women 40 years of age or older, those with annual incomes greater than or equal to $15,000 had 3.51 (95% CI: 1.41–8.72) times higher adjusted odds of being aware of the association between obesity and infertility than did women with lower annual incomes.

Figure 1 shows the main sources of medical information for women in our study. About 79.9% and 54.3% of the participants indicated that they had obtained medical information through their primary doctors and the internet, respectively. Nevertheless, no association was observed between source(s) of medical information and being aware of the relationship between obesity and infertility; a slightly higher percentage (not significant) of women aware of the effects of obesity on fertility seemed to have obtained information from their primary doctors, as opposed to other sources.

## Discussion

The proportion of women that are aware of the relationship between obesity and infertility has been previously studied, both among those looking for infertility treatments due to difficulties getting pregnant and among African American women; however, the particular characteristics of these groups of women may not be shared by 1) women with
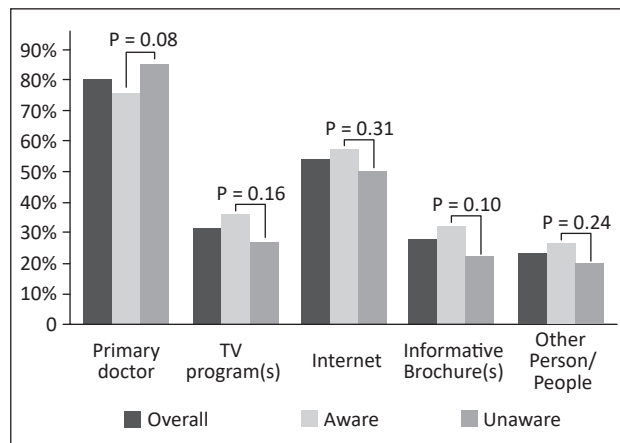
fertility (p>0.05). However, women with annual incomes lower than $15,000 and BMIs less than 25 kg/m² were less likely to know about the associations that exist between infertility and obesity than were those with annual incomes of $15,000 or more (52.6% and 69.4%, respectively; p = 0.046) and BMIs of 25 kg/m² or more (38.8% and 61.6%, respectively; p = 0.004). The odds of being aware of this association were about 2.41 (95% CI: 1.07–5.42) times higher among women with BMIs greater than or equal to 25 kg/m² than they were in those with BMIs less than 25 kg/m², after adjusting for age and annual income. An interaction by age group (adjusting for BMI) was found for the association between annual income and awareness of the relationship between obesity and infertility. Among women younger than 40 years of age, those with an annual income greater than or equal to $15,000 had 0.57 (95% CI: 0.15–2.13) times the adjusted odds of knowing the association of obesity



**Figure 1**. Participants' main sources of medical information and their association with the awareness of obesity's effects on fertility.

lower income or those who are not necessarily planning a pregnancy or 2) Hispanic women. Hence, our study focused on assessing the awareness regarding the association between obesity and infertility among women that may not have the same characteristics as the women in the previous studies. Determining the gaps in knowledge on the effects of obesity on fertility among gynecological patients at UPR-MSC in Puerto Rico may help develop guidelines for health professionals to achieve better delivery of medical information to our patients, as education is essential to patients if they are to manage their health conditions. As far as we are aware, this is the first study (in a Hispanic population) assessing the knowledge of the effects of obesity on fertility.

The results demonstrated that more than half of the women (56.8%) in our study were aware of the association between obesity and infertility. As expected, a lower percentage of the women in our study were aware of this relationship, compared to the women in the study of Cardozo et al. (13), possibly due to the women in our sample having less exposure to information regarding the possible causes and treatments for infertility. Nevertheless, our results show that the women in our study possessed greater awareness of the relationship between obesity and infertility than did African American women in the 2013 study by Cardozo and her team (14). This difference was expected, given that the participants in the referred-to study were recruited from a community fair; these participants may represent a different population from ours, which consisted of women attending gynecology and gynecology–oncology clinics.

In addition, in our study, in terms of the awareness of the effects of high body weight on fertility, there were differences between the women depending on their BMIs and their annual incomes; factors such as age, civil status, and physical activity, among others, didn't seem to be related to such awareness. Unlike what has been found in other studies (13–14), the women in our study with high body weights were more likely to know about the association between obesity and infertility than were those who were under- or normal weight. A likely explanation for this finding is that the obese women in our study may frequently be reminded by their health care providers of the risks their obesity may pose to their health, including their reproductive health.

Similarly, among women 40 years of age and older, those with annual incomes greater than or equal to $15,000 had higher odds of being aware of the association; meanwhile, an inverse relationship was observed among women younger than 40 years of age. This finding may be explained by fertility timing preferences. Women who desire to have children may temporarily alter their fertility preferences in response to changes in economic circumstances (18). According to Testa (19), economic theories on the fertility behavior of women consider the effect of women's careers on their childbearing. Hence, younger women with higher incomes, probably not yet fulfilling career goals or else focused on life goals other than childbearing, may have lower fertility intentions compared to older women with higher incomes who may feel accomplished in their careers, a situation that may lead to decreased levels of knowledge regarding reproductive-related topics in younger women with higher incomes.

The participants' main source of medical information was their primary doctor, followed by the internet. Although we would expect greater awareness among women receiving medical information from their primary doctors or from internet searches, our finding suggests that these women are in need of more and better information regarding the association between obesity and infertility. In fact, none of the information sources assessed in our study showed differences in levels of participants' awareness, which may raise a red flag on the type and quality of information women are searching for and/or receiving to clarify their doubts regarding their reproductive health.

Limitations inherent to the study design may be found in our study. First, the group of women surveyed may not represent all Hispanic women but only those looking for gynecological care services at UPR-MSC gynecology or gynecology–oncology clinics. Second, the proportion of women knowing about the association between obesity and infertility may have been overestimated due to the close-ended survey questions; it is possible that some participants randomly selected answers that suggest their having knowledge that they did not necessarily have. Hence, a non-differential misclassification of outcome may have occurred, making the odds ratios closer to the null values; this suggests that stronger associations between our study variables could be found. Finally, the results may have been influenced by other factors not evaluated in our study.

Despite its limitations, our study reveals that there is a lack of knowledge in our study population regarding the effects of obesity on fertility and identifies characteristics associated with this knowledge. Evaluations of the content of health-care-provider counseling and of barriers affecting communication between patients and health care providers are recommended in order to improve patients' knowledge of health topics. Further studies should assess 1) the reasons for obese women being more aware of the association between obesity and infertility than under- and normal weight women are and 2) the interaction terms between income and age when determining awareness of reproductive-related topics.

## Resumen

Objetivo: Nuestro estudio evaluó el conocimiento de las mujeres que acudían a las clínicas ginecológicas de la Universidad de Puerto Rico Recinto de Ciencias Médicas (UPR-RCM) sobre la asociación entre infertilidad y exceso de peso corporal (es decir, sobrepeso y obesidad). Métodos: Mujeres (≥ 21 años de edad) que acudían a las clínicas de ginecología de la UPR-RCM fueron invitadas a participar en este estudio (n = 234). Se proporcionó una encuesta auto-administrada a todas las mujeres. Se realizaron modelos de regresión logística para determinar asociaciones. Resultados:

Alrededor del 56.8% de las mujeres mostraron estar al tanto de los efectos de la obesidad en la fertilidad; la principal fuente de información médica fue el médico primario. Las probabilidades (ajustadas por edad e ingreso anual) de conocer la asociación entre obesidad e infertilidad fueron aproximadamente 2.41 (IC 95%: 1.07-5.42) veces más altas entre mujeres con índice de masa corporal (IMC) ≥ 25 kg/m2 que en aquellas con IMC <25 kg/m2. Se encontró una interacción por grupo de edad (ajustado por IMC) para la asociación entre el ingreso anual y el conocimiento de la asociación obesidad-infertilidad $OR_{\geq 40\ años}$: 3.51, 95% IC: 1.41-8.72; $OR_{<40\ años}$: 0.57, 95% IC: 0.15-2.13). Conclusión: Nuestro estudio demuestra la falta de conocimiento sobre el efecto de la obesidad en la fertilidad e identifica las características asociadas a este conocimiento. El contenido del asesoramiento de los proveedores de la salud y las barreras que afectan la comunicación entre los pacientes y los proveedores de servicios de salud puede evaluarse en estudios futuros.

## Acknowledgments

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