Prevalence of Urinary Incontinence and Its Association with Body Mass Index among Women in Puerto Rico

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Abstract

Objective: Urinary incontinence (UI) affects the quality of life of millions of women world-wide. Prevalence estimates for UI range from 10% to 40%, but information on young and mid-life women, especially among Hispanics, is limited. This study estimated UI prevalence and its association with body mass index (BMI) in a population-based sample of 276 female residents of Bayamón, Puerto Rico (PR) aged 21–64 years.

Methods: A cluster sampling design was employed. Women were interviewed to gather data on socio-demographic, clinical, gynecologic, and UI characteristics. Descriptive statistics were used to characterize the study sample. Bivariate analyses of factors potentially associated with UI and BMI were conducted using generalized linear models (GLM). Multivariate GLM was used to determine the covariate adjusted association between BMI and UI.

Results: The prevalence of UI was 34.8% (95% confidence interval [CI]: 29.4–40.6%). Among women with UI, stress incontinence was most frequent (46.8%), followed by mixed (41.5%) and urge incontinence (11.7%). More than 45% of participants were either overweight ($25 \text{ kg/m}^2 \leq \text{BMI} \leq 29.9 \text{ kg/m}^2$) or obese ($\text{BMI} \geq 30 \text{ kg/m}^2$). The adjusted analysis revealed that women with a $\text{BMI} \geq 30 \text{ kg/m}^2$ had 1.96 ($p = 0.06$) times the probability of having UI compared to women with a $\text{BMI} < 25 \text{ kg/m}^2$.

Conclusions: UI is a public health problem among this population, and obesity marginally increases the possibility of having this condition. Public health efforts should focus on reducing obesity in PR, in order to have an impact on UI morbidity.

Introduction

ACCORDING to the International Continence Society, urinary incontinence (UI) is the complaint of any involuntary leakage of urine.¹ There are three types of UI: stress, urge, and mixed. Stress incontinence refers to the involuntary loss of urine while a person is performing physical activity such as exercise, laughing, sneezing, and coughing. Involuntary loss of urine associated with an urgent need to urinate is defined as urge incontinence, while mixed UI is a combination of both stress and urge incontinence.²

UI affects approximately 13 million North Americans, most of them women.³ It has been consistently demonstrated that UI is at least two times more common among women as compared to men.⁴ In the United States, UI prevalence increases from 28% among women aged 30–39 years, up to 55% among women aged 80–90 years.⁵ Given that UI has generally been considered a health condition of older ages,⁶ most

studies of UI focus on older women. However, almost one third of women aged 20–29 report UI.⁷

Multiethnic population studies suggest that the prevalence of UI varies among populations and across ethnic groups. The Study of Women's Health Across the Nation (SWAN) estimated the prevalence of UI in women aged 42–52 years living in seven cities in the United States.⁸ The prevalence was highest among non-Hispanic white women (66.0%) compared with Chinese (52.9%), African Americans (49.5%), and Hispanics (41.5%). Hunskaar and colleagues⁹ estimated that the prevalence of UI also varied among women living in four European countries. Spain had the lowest prevalence (23%) as compared with Germany (41%), United Kingdom (42%), and France (44%). Studies in Latin America are limited, but one study in Mexican women aged 20–80 years reported a prevalence of 46.5%.⁷ The wide range of prevalence estimates observed in these studies may be attributed to differences in the age distribution of the populations included for analysis

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and in the definitions of UI used, to the format of the questions used to define UI, to cultural acceptance of acknowledging the presence of the condition or to true differences in the burden of UI across populations.⁶

Factors associated with UI include increased age, pregnancy, vaginal delivery, multiple deliveries, hysterectomy, diabetes, post-menopausal status, and vaginal and urinary infections, although epidemiological studies are not always consistent.^{5,10,11,12} Body mass index (BMI) has also been associated with both prevalent^{5,7,8} and incident¹³ UI in epidemiological studies. Elevated BMI appears to increase the possibility of having and developing UI, while it reduces the odds of improvement and increases the odds of worsening of UI symptoms.¹⁴ Reductions in BMI have shown to be an effective intervention to reduce UI.^{15,16}

In Puerto Rico (PR), although a previous study showed that the most frequent health problem reported by the population (men and women) aged 65 years and older was UI (39.9%; 95% confidence interval [CI]: 34.7–43.4%), this finding has not been further examined in the Puerto Rican population and the impact of UI among younger populations has not been evaluated.¹⁷ This condition could be of particular relevance in PR as obesity is currently among the 10 most common health conditions affecting people ages 18–44 living in the island.¹⁸ Additionally, it has been documented that, as in the United States, obesity among women in P.R. has increased throughout the years, reaching a prevalence of 24.8% (95% CI: 23.0–26.6%) in 2006.¹⁹

Given the need for additional studies to document the burden of UI among younger populations and among Hispanics and the high prevalence of overweight and obesity in PR, the current study aimed to determine the prevalence of UI and its association with BMI in a population-based sample of women.

Methods

Study population, sampling design, and participant recruitment

A population-based cross-sectional study of non-institutionalized women aged 21–64 years residing in the urban zone of Bayamón, PR was conducted in 2006. A three-stage cluster sampling design was employed. First, a systematic selection of census block groups from the urban area of the municipality of Bayamón, PR, as defined by the Census 2000, was performed. The second stage consisted of a random selection of 36 blocks within selected census block groups. Finally, a segment of 10 consecutive households was randomly selected from each block, and one eligible woman in each household was invited to participate in the study.

After obtaining written informed consent, all women completed a structured face-to-face interview. The questionnaire was administered by a trained interviewer who collected information about demographic characteristics and clinical and gynecologic history. Questions on demographic characteristics were adapted from the Estudio Continuo de Salud,¹⁸ the questions on clinical and gynecologic history were retrieved from the SWAN,²⁰ and the IU history was an adaptation of the instrument developed by García and colleagues²¹ on their research on UI among Mexican women. Each of the four trained interviewers who participated in the data collection process used a weight scale (Tanita UM-028)

and a tape measure to obtain anthropometric measurements (height and weight) of study participants, using a standard protocol. Height and weight were measured on a flat surface and without shoes. The highest point of the head was used to determine each participant's height. The study protocol was approved by the Institutional Review Board (IRB) of the Medical Sciences Campus of the University of Puerto Rico.

Study variables

Demographic characteristics. Information collected on the participants' demographics included the following: age in years (21–35, 36–50, 51–64), birth place (PR, United States, or other), educational attainment (less than high school; high school; technical college or 2 years of university; bachelor or graduate studies), annual income (less than \$10,000; \$10,000–19,999; \$20,000–29,999; \$30,000–39,999), employment (yes/no), and marital status (single, living together/married, separated/widowed) at time of interview.

Clinical and gynecologic history. In order to be classified as incontinent, a woman had to report an episode of involuntary loss of urine (yes/no) within the 12 months prior to the interview. The Sandvik (1993) severity index was employed to characterize the severity of UI as mild (few drops of urine during the month), moderate (daily drops of urine), and severe (more amount of urine at least once a week).²² Weight and height measurements were used to calculate BMI, which was categorized in accordance with the categories established by the World Health Organization (WHO), as follows: BMI < 25 kg/m² (underweight/normal), 25 kg/m² ≤ BMI < 30 kg/m² (overweight), and BMI ≥ 30 kg/m² (obese).²³

Self-reported information on diabetes diagnosis (yes/no), consumption of medications (such as diuretics) that have frequent urination as a side effect (yes/no), and hormone use (both hormone therapy and oral contraceptives) in the 12 months prior to the interview (yes/no) was also obtained. In addition, women were asked about history of vaginal and urinary infections 12 months prior to the interview (yes/no), hysterectomy (yes/no), episiotomy (ever/never), number (0, 1, > 1) and type of deliveries (cesarean, vaginal, both), and pregnancy 12 months prior to the interview (yes/no).

Information on menstrual bleeding patterns was used to categorize women's menopausal status (pre-menopause, natural menopause, or surgical menopause). Specifically, premenopause was defined as the occurrence of any menses in the 12 months prior to interview. In accordance with the WHO definition, natural menopause was defined as twelve or more months of amenorrhea, not due to lactation, surgery, or other extreme cause.²⁴ Surgical menopause was defined as the cessation of menses as a result of hysterectomy or bilateral oophorectomy.

Statistical analysis

Descriptive statistics were used to characterize the study sample. Overall and age group-specific prevalences of UI were estimated and their 95% CIs calculated. Considering the multi-stage cluster sampling design, the intra-class correlation coefficient was analyzed using a Generalized Linear Latent Mixed Model (GLLAMM). The intra-class correlation coefficient was almost zero ($\hat{\rho} = (1.08 \times 10^{-12})$); thus, the effect of living in the same block was excluded from the regression model.

Factors potentially associated with UI were selected based on the literature. Bivariate comparisons of these factors by UI were then assessed using a Generalized Linear Model (GLM).²⁵ Variables at least marginally associated ($p < 0.10$) with both UI and BMI in bivariate analysis were included in the multiple logistic regression model. Potential interactions between the predictor variables were tested using the deviance test.²⁵ All statistical analysis was performed using Stata, version 9 (Stata Corp., College Station, TX).

Results

A total of 276 of 356 eligible women completed the personal interview, for a response rate of 77.5%. Table 1 summarizes the sociodemographic characteristics of study participants. Participants' average age was 44.3 ± 12.6 years, 82.3% had been born in PR, and 33.7% had achieved undergraduate or graduate degrees. With regard to BMI, 24.6% of participants were overweight ($25 \text{ kg/m}^2 \leq \text{BMI} < 30 \text{ kg/m}^2$), while 22.0% were obese ($\text{BMI} \geq 30 \text{ kg/m}^2$).

The prevalence and types of urinary incontinence by age are shown in Table 2. Overall, 34.8% (95% CI: 29.4–40.7%) of the women reported that they had experienced involuntary

loss of urine in the preceding year. When stratified by age, the prevalence of UI varied from 24.4% in women aged 21–35, to 43.3% in women aged 36–50, to 34.7% in women aged 51–64 years. With respect to type, stress incontinence was most common (46.8%), followed by mixed (41.5%) and urge incontinence (11.7%). When stratified by age group, stress incontinence was most common among women aged 21–35 (61.1%) and those aged 51–64 (48.6%) years, while mixed incontinence was most common among those aged 36–50 years (51.2%).

Table 3 describes clinical characteristics of incontinence among those women who reported any UI. According to the 1993 Sandvick severity index, the largest proportion of women who experienced UI (43.8%) reported mild symptoms, while 30.2% experienced moderate and 26.0% more severe symptoms. The majority of incontinent women used pads (65.6%) to avoid wetting their garments with urine, while few reported a reduction in their daily activities (11.5%). Only 43.5% reported having consulted with their physician about their problem; among these, most had not been treated for their condition with either medication (76.2%) or surgery (90.5%).

Table 4 summarizes the crude associations between UI and the variables under study. A significant trend was observed

TABLE 1. DEMOGRAPHIC CHARACTERISTICS AND BODY MASS INDEX (BMI) OF A POPULATION-BASED SAMPLE OF WOMEN AGED 21–64 YEARS RESIDING IN BAYAMÓN, PUERTO RICO, 2006 ($N=276$), AND ITS COMPARISON WITH WOMEN FROM BAYAMÓN, PUERTO RICO, AGED 21–64 YEARS PARTICIPATING IN THE AMERICAN COMMUNITY SURVEY 2005–2007*

Characteristics	Study population		American Community Survey 2005–2007* %
	n	%	
Age group (years)			
21–35	78	28.3	32.6
36–50	97	35.1	36.0
51–64	101	36.6	31.4
Birth place			
Puerto Rico	227	82.2	89.5
United States	19	6.9	5.2
Other country	30	10.9	5.3
Education			
Less than high school	44	16.0	24.6
High school	63	22.8	21.8
Technical degree/2 years of university	76	27.5	28.2
Bachelor/graduate studies	93	33.7	25.4
Annual income [†]			
Less than \$10,000	70	28.9	4.7
\$10,000–19,999	59	24.4	40.1
\$20,000–29,999	53	21.9	27.3
\$30,000–39,999	60	24.8	—
Employment status			
Yes	160	57.9	50.8
No	116	42.1	49.2
Marital status			
Single	41	14.9	28.5
Living together/married	163	59.0	41.1
Separated/widowed	72	26.1	30.4
BMI			
BMI < 25 kg/m ²	148	53.6	—
25 kg/m ² ≤ BMI < 30 kg/m ²	68	24.6	—
BMI ≥ 30 kg/m ²	60	21.7	—

*Source: U.S. Census Bureau, 2005–2007 American Community Survey: women aged 21–64 years living in Bayamón, Puerto Rico.

[†]34 missing values.

Mean BMI: 25.87 ± 7.94 .

TABLE 2. PREVALENCE OF URINARY INCONTINENCE (UI) BY TYPE AND AGE GROUP AMONG A POPULATION-BASED SAMPLE OF WOMEN AGED 21–64 YEARS RESIDING IN BAYAMÓN, PUERTO RICO, 2006

Age group (years)	n	UI, n	Prevalence	95% CI	UI type [†]		
					Stress, n (%)	Urge, n (%)	Mixed, n (%)
21–35	78	19	24.4	14.8–33.9	12 (63.2)	2 (10.5)	5 (26.3)
36–50	97	42	43.3	33.4–53.2	17 (40.5)	4 (9.5)	21 (50.0)
51–64	101	35	34.7	29.9–39.4	17 (48.6)	5 (14.3)	13 (37.1)
Total	276	96	34.8	29.4–40.6	46 (47.9)	11 (11.5)	39 (40.6)

[†]Others types: 2 cases.

where the prevalence of UI increased from 27.9% in women with a BMI < 25 kg/m², to 35.3% in those overweight (25 kg/m² ≤ BMI < 30 kg/m²) to 51.7% among those obese (BMI ≥ 30 kg/m²; Pearson χ^2 test for trend = 10.82, $p = 0.004$). Although no significant difference in the prevalence of UI was observed between overweight women and those with BMI < 25 kg/m², obese woman were 2.76 times more likely to have UI compared with women with BMI < 25 kg/m². Other variables associated with UI in bivariate analysis included

TABLE 3. URINARY INCONTINENCE (UI) CHARACTERISTICS AND MANAGEMENT AMONG A POPULATION-BASED SAMPLE OF WOMEN AGED 21–64 YEARS RESIDING IN BAYAMÓN, PUERTO RICO, 2006 (N = 96)

Characteristics	Frequency, n	Percentage, %
Type of UI		
Stress	46	47.9
Urge	11	11.5
Mixed	39	40.6
Frequency of UI		
Less than one time per month	28	29.2
Sometimes in a month	34	35.4
Sometimes in a week	15	15.6
Every day	19	19.8
Urine lost		
Drops	40	41.7
More than drops	56	58.3
Severity index		
Light	42	43.8
Moderate	29	30.2
Severe	25	26.0
Use of Pads		
Yes	63	65.6
No	33	34.4
Reduction of activities		
Yes	11	11.5
No	85	88.5
Consulted about UI with physician		
Yes	42	43.8
No	54	56.3
Use of medicines*		
Yes	10	23.8
No	32	76.2
Surgery*		
Yes	4	9.5
No	38	90.5

*Only among those who consulted about UI with physician ($n = 42$).

increased age ($p < 0.05$), diagnosis of diabetes ($p < 0.001$), consumption of medications whose side effects included frequent urination ($p < 0.01$), vaginal infection ($p < 0.001$), and urine infection ($p < 0.001$). Hysterectomy ($p = 0.09$), episiotomy ($p = 0.06$), and multiple deliveries ($p = 0.07$) were marginally associated with UI ($p < 0.10$) in bivariate analysis. Annual income, pregnancy in the last 12 months ($p = 0.63$), type of delivery ($p = 0.22$), menopausal status ($p = 0.16$), and hormone use ($p = 0.15$) were not associated with UI.

In order to identify potential confounders of the association between UI and BMI, an additional bivariate analysis was performed in which we determined the association of BMI with any of the variables at least marginally associated to UI ($p < 0.10$). Of those variables, the following were also associated with BMI: diabetes ($p = 0.03$), vaginal infection ($p = 0.06$), number of deliveries ($p = 0.03$), age ($p = 0.03$), and medications whose side effects included frequent urination ($p = 0.002$). Thus, these variables were considered potential confounders of the association between UI and BMI and as a consequence were included in our multivariate analysis. Urinary tract infection ($p = 0.11$), hysterectomy ($p = 0.38$), and episiotomy ($p = 0.55$) were not associated with BMI, and thus were excluded from multivariate analysis (data not shown).

In the multiple logistic regression analysis, BMI ≥ 30 kg/m² remained marginally associated with UI (POR = 1.96; $p = 0.06$) after adjusting for potential confounders (age, diabetes, vaginal infection, number of deliveries and medications whose side effects included frequent urination; Table 5). No significant interactions among the predictor variables were identified ($p = 0.26$).

Discussion

This is the first population-based study to assess the prevalence of UI in a population of women in PR aged 21–64 years and its association with BMI. Overall, one-third of these women reported having symptoms of UI. This prevalence is similar to that reported by previous studies among Hispanic women. The prevalence of UI in women of mixed Hispanic ethnicities aged 42–52 years who participated in the SWAN cross-sectional study was 41.5%.⁸ Velázquez et al.⁷ found a prevalence of UI of 46.5% in Mexican women aged 20–80 years, while Hunskaar et al.⁹ reported a prevalence of 23% in Spain in women older than 18 years. The age difference of the study populations accounts for some of the differences observed across these studies. In addition, even though our definition of UI was the same as that used by SWAN in their cross-sectional analysis,⁸ differences between this definition

TABLE 4. CRUDE ASSOCIATIONS BETWEEN SOCIODEMOGRAPHIC, CLINICAL AND GYNECOLOGIC CHARACTERISTICS AND URINARY INCONTINENCE (UI) PREVALENCE AMONG A POPULATION-BASED SAMPLE OF WOMEN AGED 21–64 YEARS RESIDING IN BAYAMÓN, PUERTO RICO, 2006 (*N* = 276)

Characteristic	UI, n (%)		<i>P</i> OP _{crude}	95% CI	<i>p</i> value [†]
	Yes	No			
Socio-demographic					
Age group, years					
21–35*	19 (24.4)	59 (75.6)	1.00	–	–
36–50	42 (43.3)	55 (56.7)	2.37	1.2–4.56	0.01
51–64	35 (34.6)	66 (65.4)	1.65	0.77–2.12	0.14
Annual income					
< \$25,000*	51 (33.3)	102 (66.7)	0.87	0.53–1.39	0.57
≥ \$25,000	43 (37.1)	78 (63.4)	1.00	–	–
Clinical and gynecologic					
BMI*					
BMI < 25 kg/m ² ‡	41 (27.9)	107 (72.3)	1.00	–	–
25 kg/m ² ≥ BMI < 30 kg/m ²	24 (35.3)	44 (64.7)	1.42	0.77–2.63	0.26
BMI ≥ 30 kg/m ²	31 (51.7)	29 (48.3)	2.76	1.50–5.19	0.01
Diabetes diagnoses					
Yes	21 (50.0)	21 (50.0)	2.10	1.08–4.09	0.03
No*	75 (32.2)	158 (67.8)	1.00	–	–
Medicines with frequent urination as a secondary effect					
Yes	32 (60.4)	21 (39.6)	3.85	2.06–7.17	0.01
No*	63 (28.4)	159 (71.6)	1.00	–	–
Urine infection					
Yes	52 (50.0)	52 (50.0)	2.91	1.74–4.86	0.01
No*	44 (25.6)	128 (74.4)	1.00	–	–
Vaginal infection					
Yes	36 (51.4)	34 (48.6)	2.57	1.47–4.49	0.01
No*	60 (29.1)	146 (70.9)	1.00	–	–
Pregnant in the last 12 months (<i>n</i> = 234)					
Yes	6 (42.9)	8 (57.1)	1.31	0.44–3.92	0.63
No*	80 (36.4)	140 (63.6)	1.00	–	–
Number of deliveries (<i>n</i> = 276)					
0*	11 (24.4)	34 (75.6)	1.00	–	–
1	11 (25.6)	32 (74.4)	1.06	0.40–2.79	0.90
> 1	74 (39.4)	114 (60.6)	2	0.96–4.21	0.07
Type of delivery (<i>n</i> = 231)					
Natural	52 (39.7)	79 (60.3)	1.48	0.79–2.79	0.22
Cesarean*	20 (30.8)	45 (69.2)	1.00	–	–
Mixed	13 (37.1)	22 (62.9)	1.33	0.56–3.16	0.52
Episiotomy (<i>n</i> = 228)					
Ever	54 (42.2)	74 (57.8)	1.70	0.98–2.96	0.06
Never*	30 (30.0)	70 (70.0)	1.00	–	–
Hysterectomy (<i>n</i> = 276)					
Yes	25 (44.6)	31 (55.4)	1.69	0.93–3.07	0.09
No*	71 (35.3)	149 (67.7)	1.00	–	–
Menopausal status (<i>n</i> = 266)					
Pre-menopause*	55 (33.9)	107 (66.1)	1.00	–	–
Natural menopause	18 (31.6)	39 (68.4)	1.85	0.34–10.4	0.46
Surgical menopause	21 (44.7)	26 (55.3)	3.23	0.62–16.9	0.16
Hormone use 12 months prior to the interview (<i>n</i> = 276)					
Yes	16 (45.7)	19 (54.3)	1.69	0.82–3.48	0.15
No*	80 (33.2)	161 (66.8)	1.00	–	–

*Reference group.

†Wald test to bivariate model.

‡Pearson χ^2 test for trend = 10.82; *p* = 0.004.

and that used in other studies may also account for some of the observed differences in the prevalence of UI.

When stratified by age, approximately one-quarter of women aged 21–35 years and one-third of women aged 51–64 years reported UI, with the highest prevalence (43.4%) re-

ported by women aged 36–50 years. This is not consistent with previous studies, which have generally found that the prevalence of UI increases with age,^{5,6,12} although somewhat consistent with epidemiological studies that have found a higher prevalence in women aged 45–55 years, an age range

TABLE 5. GENERALIZED LINEAR MODELS OF THE CRUDE AND COVARIATE ADJUSTED ASSOCIATION BETWEEN BODY MASS INDEX (BMI) AND URINARY INCONTINENCE (UI), AMONG A POPULATION-BASED SAMPLE OF WOMEN AGED 21–64 YEARS RESIDING IN BAYAMÓN, PUERTO RICO, 2006 (N = 274)

Characteristic	POR _{crude}	95% IC	p value [†]	POR _{adjusted} [‡]	95% IC	p value [‡]
BMI						
BMI < 25*	1.00	—	—	1.00	—	—
25 ≤ BMI < 30	1.42	0.77–2.63	0.26	1.27	0.65–2.49	0.48
BMI ≥ 30	2.76	1.50–5.19	0.01	1.96	0.97–3.96	0.06

*Reference group.

[†]Wald test to bivariate model.

[‡]After adjusting for diabetes, medicines with frequent urination as a secondary effect, vaginal infection, age, and numbers of deliveries.

[‡]Wald test to multivariate model after adjusting for diabetes, medicines with frequent urination as a secondary effect, vaginal infection, age, and numbers of deliveries.

that coincides with the menopausal transition.²⁶ Alternatively, our results may be explained by a greater social acceptability, with increased willingness to acknowledge the disease, among women aged 36–50 years as compared to those aged 51–64 years. Our finding may also in part reflect the impact of hysterectomy on UI prevalence in this population as our results showed a marginally significant association between hysterectomy and UI (OR = 1.69, $p = 0.09$). Given the high prevalence of hysterectomy in the Puerto Rican population (13.1% of women 35–49 years and 32.5% of women older than 50 years) (Ramos et al., unpublished data, 2002), future epidemiological studies should also assess the impact of this surgical procedure on UI among middle-aged women in PR.

As has been seen in previous studies, the present study revealed that stress-incontinence was more common than mixed or urge incontinence, respectively. SWAN also found that stress incontinence was the most frequent type of UI in midlife women in their study, regardless of the racial/ethnic group.¹³ The latter is also consistent with the results of other studies that have shown similar patterns of disease occurrence.^{4,6,12} Our study results are also consistent with previous studies that have observed that the prevalence of UI type varies by age, with higher prevalence of UI caused by stress in young women.^{6,11,12,13} However, the prevalence of UI by type and age group in our study should be interpreted with caution, given that the small number of cases in each category might affect the precision of our prevalence estimates.

Among incontinent women, we found that the majority of women surveyed used pads to avoid wetting their garments with urine and more than 40% had discussed their problem with their physician. However, few were being or had been treated for their condition. These results are consistent with results of studies performed in other populations that have found that only a small proportion of women discuss the problem with their doctor⁴ and even fewer have received a diagnosis or treatment for their UI symptoms.^{26,27,28}

With respect to BMI, one quarter (24.6%) of the interviewed women were overweight and one fifth (22.0%) were obese at the time of the survey. In the 2006 Behavioral Risk Factor Surveillance System (BRFSS) survey for women 18 years and older in PR, nearly 33.9% were classified as overweight while one quarter (24.8%) were classified as obese.¹⁹ Even though this suggests a lower prevalence of overweight/obesity in our study population than in PR, this difference may be partially explained by the fact that our study measured women's BMI, while the BRFSS relies on self-reported information. Although no differences were observed in multivariate analysis be-

tween overweight women and normal/underweight women with respect to the presence of UI, obese women were twice as likely to report symptoms of incontinence compared with normal/underweight women after adjusting for age, diabetes, use of medicines with frequent urination as a secondary effect, vaginal infection, and number of deliveries ($p = 0.06$).

Although marginally significant, our results are consistent with previous studies that have found associations between BMI and both prevalent^{5,7,8} and incident UI.^{13,29} A cross-sectional study of women aged 30–90 years, conducted in Washington State, observed that women with a BMI ≥ 30 kg/m² were almost twice as likely to have UI (OR_{adjusted} = 1.77; 95% CI: 1.34–2.33) compared to women with a BMI < 30.⁵ A cross-sectional study of women aged 30–59 years in living in Denmark¹¹ also found that women aged 30–59 years with a BMI of 30–39.9 kg/m² were more likely to have UI (OR = 2.23; $p < 0.05$) when compared to women with a BMI of 13.7–20 kg/m². In a cross-sectional study of 800 women aged 20–80 years living in Mexico, women with UI had higher BMI than those who were continent (24.6 ± 4 vs. 27 ± 5.5 kg/m², $p < 0.0001$). Likewise, Mexican women with UI in this study were more likely to be overweight or to have type I, II and III obesity.⁷ In the Nurses' Health Study II, a prospective study of 30,982 women aged 37–54 years, the odds of incident UI was 2.11 (CI 95%: 1.84–2.42) in women with BMI greater than 35 kg/m² compared with women whose BMI was 21–22.9 kg/m².²⁹ The association between BMI and UI observed in our study is of special relevance given the high prevalence of overweight (24.6%) and obesity (22.0%) among women in PR.¹⁹

The biological plausibility for the association between BMI and UI has been explained by the fact that individuals who are overweight have undue pressure placed on the bladder and surrounding muscles.^{30,31} Being overweight, especially with central adiposity, increases intra-abdominal pressure and, thus, pressure on the bladder and pelvic organ support structures.¹³ As this abdominal pressure upon the bladder increases, the severity of UI is also higher. Loss of weight is reported to reduce the severity of UI and in some instances cure it.³²

Few epidemiologic studies of gynecologic conditions have been conducted in PR. The high response rate achieved in this study (77.5%) with no financial compensation given to women for their participation suggests the cultural acceptability of surveys of gynecologic health among women on the island. The main limitation of our study is the potential for information bias, an issue that is present in every study that

relies on self-reported information. Nonetheless, information on BMI was accurately measured in our study by trained interviewers. To assess the potential for selection bias, women recruited in the study were compared with those who refused to participate with regard to demographic characteristics. There were no statistically significant differences between the study participants and the women who refused to participate in regard to average age, level of education, marital status, and family income (data not shown), highlighting the generalization of our results to the source population. We also compared the study participants with the population of women aged 21–64 living in the municipality of Bayamón, PR according to the 2005–2007 American Community Survey (Table 1).³³ Results showed that women from Bayamón, PR have lower educational attainment, higher single marital status and that a smaller proportion was in the 51–64-year age group compared to our study population.

Conclusion

In conclusion, this is the first epidemiologic study of urinary incontinence in young adult and mid-life urban women conducted in PR. Our results show that UI is a public health problem and that obesity marginally increases the probability of women having this condition. In order to determine the overall prevalence of UI in PR and its relation to BMI, it is essential to perform an analytic epidemiologic study with a larger sample size, representative of the island. As suggested by Parazzini,¹⁰ future studies should focus particularly on the potential differences in the epidemiological characteristics of different types of UI in order to gain insight into the pathogenic mechanisms of these conditions. Also, this study found that only a small proportion of women discuss UI with their doctor, and fewer have received treatment for their UI symptoms. This demonstrates the importance of educating women regarding UI, the factors associated with it, and the appropriateness of discussing UI symptoms with one's healthcare provider. Public health efforts should focus on educating women about the impact of obesity on UI and on reducing obesity in this population, in order to have an impact on UI morbidity.

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Disclosure Statement

The authors have no conflicts of interest to report.

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