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Prevalence and Risk Factors of Pregnancy-Specific Urinary Incontinence: Findings from the Diamater Cohort Study

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Summary

Pregnancy-specific urinary incontinence was prevalent in 62.1% of women, with pregestational BMI as a risk factor and physical activity as a protective factor.

Abstract

Introduction and Hypothesis: Pregnancy-specific urinary incontinence (PS-UI) is defined as any onset of new urinary leakage during pregnancy. The study aims to analyze the prevalence and risk factors of PS-UI. We hypothesized that demographic and clinical factors, including Gestational Diabetes, may contribute to the development of PS-UI. **Methods:** We recruited pregnant women from the Diamater cohort study. We evaluated the maternal characteristics, demographics, anthropometrics, hyperglycemic status, and the PS-UI occurrence. A logistic regression model was performed considering the clinical variables to determine the predictive factors for PS-UI occurrence. **Results:** PS-UI was prevalent in 62.1% of women, 58.85% began leaking urine between 24 and 28 gestational weeks, and 51% developed PS-UI at the end of pregnancy. The pregestational BMI is a risk factor for PS-UI, and physical activity is a protective factor that halves the risk of PS-UI developing. **Conclusions:** The weight management and encouragement to engage in physical activity

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during pregnancy should be emphasized in prenatal care to reduce the risk of PS-UI. Further studies are suggested to evaluate the impact of the association due to UI later in life.

Keywords: pregnancy-specific urinary incontinence; urinary incontinence; pregnancy; prevalence

Introduction

Urinary incontinence (UI) is a prevalent condition among women worldwide that can cause physical and emotional distress, have financial consequences, and place a burden on individuals and society (1, 2). Women with UI consume significantly more medical resources and incur higher costs than those without UI, but standardized prevention and treatment may positively impact costs and outcomes (3).

Pregnancy-specific urinary incontinence (PS-UI) is UI that first appears during pregnancy (4). Although PS-UI affects up to half of pregnant women and peaks in the third trimester (5-9), there are limited studies on its epidemiology. PS-UI is a strong predictor of UI postpartum and later in life, and identifying its risk factors will help healthcare providers and pregnant women make informed decisions (2, 10, 11).

PS-UI may be mild to moderate, but UI can negatively impact health-related quality of life (8, 12). However, few pregnant women seek professional assistance for urinary leakage (12, 13). Prenatal care is an entry point into the health system and provides an opportunity to engage women and provide information about disease severity (14). Few integrated care models link antenatal care and non-communicable disease prevention (14,15) despite their effectiveness in communicable disease prevention (16). Opportunistic screening for PS-UI risk factors may be feasible during critical points in the life course (14).

Our study aims to analyze the prevalence and risk factors of PS-UI during the pregnancy span, taking into account life-course approaches to women's health. We hypothesize that demographic and clinical factors, such as obesity, sedentarism, smoking, and gestational diabetes mellitus (GDM), may contribute to the development of PS-UI.

Method

Research Design and Subjects

The DIAMATER study is an ongoing prospective cohort study that examines the link between GDM and pelvic floor muscle dysfunction as moderators between GDM and UI throughout the lifespan (17). Following the Declaration of Helsinki, we conducted and approved the study by the Institutional Ethical Committee of the Botucatu Medical School of São Paulo State University (Protocol Number CAAE 82225617.0.0000.5411). Participants provided written informed consent, and their data were kept confidential. This report was consistent with the STROBE statement (21). This observational study screened 1450 pregnant women at the Perinatal Diabetes Research Center (PDRC) at the University Clinical Hospital of Botucatu Medical School (UNESP), Brazil, and followed them until delivery. All patients received prenatal care and gave birth at the same institution.

Eligible participants: adult (age 18-40) women in their first pregnancy and women in the second pregnancy, who had a prior planned C-section in their previous pregnancy, to avoid the previously parturition and vaginal birth impact in the pelvic floor function. All participants in the study began receiving prenatal care at the first trimester of gestation and underwent a hyperglycemia screening test at the first trimester and between 24-28 weeks of pregnancy, according to the actual recommendation screening and diagnosis (17-19).

Women with pregestational UI, known type 1 or type 2 diabetes, preterm delivery (<37 weeks of gestation), multiple pregnancies, known fetal anomaly, connective tissue diseases, and any clinical condition that may have jeopardized their health status were excluded from the study.

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Data Collection

Participants were recruited until 24 weeks of gestation and invited to join the study if they met the inclusion criteria. We recruited 992 participants between 2017 and 2022. After giving their written consent, they were asked to answer a questionnaire with personal details; clinical and obstetric, historical, and anthropometric measures were taken. Participants were evaluated at two time points (TP): 24–28 weeks of gestation (1st TP) and 36–38 weeks of gestation (2nd TP).

PS-UI was defined as any onset of new urinary leakage during pregnancy (4). The participants were asked to answer "yes" or "no" as to whether they had experienced PS-UI. Participants who gave positive responses were identified as having UI, following the definition set by the International Continence Society (20). Early PS-UI was considered to be incontinence that started before 28 weeks of gestation, and Late PS-UI was that which started at the end of the third trimester, after 36 weeks of gestation.

In this cohort, the diagnostic guidelines proposed by the American Diabetes Association were used to identify patients with GDM (19) using the 75-g oral glucose tolerance test (75 g-OGTT).

Statistical Analysis

The prevalence of PS-UI was calculated by obtaining the frequencies of UI in the 1st TP, 2nd TP (without intersections), and 1st TP plus 2nd TP. With these three groups, associations with the demographic variables were made using the chi-square test.

A logistic regression model was performed considering the occurrence of UI in these three scenarios, including demographic variables as explanatory variables, to determine the participants' risk or protective factors for UI. We used a significant 5% or the corresponding p-value in all tests and SAS for Windows, version 9.4.

Results

The study involved 992 pregnant women from the Diamater cohort (Figure 1). Thus, 616 had PS-UI, and 376 did not (non-PS-UI). Table 1 shows the demographic characteristics by PS-UI status.

Table 1. Characteristics of the study population.

Variable		non PS-UI	PS-UI	p - value
Partnership status	Married	311 (83.4%)	515 (83.6%)	0.926
	Not married	62 (16.6%)	101 (16.4%)	
Education level	basic level	27 (7.2%)	42 (6.9%)	
	high school	229 (61.1%)	427 (69.7%)	0.014
	college/university	119 (31.7%)	144 (23.5%)	
Ethnicity	Caucasian	299 (81%)	495 (80.5%)	0.835
	Non-caucasian	70 (19%)	120 (19.5%)	
Pregestational BMI (kg/m2)		26.9 ± 6.25	28.48 ± 7.28	0.002
BMI - 1st TP (kg/m2)		29.4 ± 6.04	30.8 ± 6.85	0.004
BMI - 2nd TP (kg/m2)		31.6 ± 6.20	33.75 ± 6.51	0.002
Gestational weight gain - 1st TP (kg)		6.39 ± 5.04	6.08 ± 6.19	0.477
Gestational weight gain - 2nd TP (kg)		11.76 ± 7.34	11.36 ± 7.63	0.613
Fasting blood glucose (mg/dL)		79.48 ± 12.71	80.11 ± 14.44	0.583
OGTT - fasting (mg/dL)		74.82 ± 12.66	76.11 ± 11.06	0.161
OGTT- 1 h (mg/dL)		116.7 ± 31.27	119.17 ± 32.7	0.321
OGTT - 2 h (mg/dL)		105.08 ± 28.1	107.01± 8.88	0.378

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Chronic coughing	0	9 (1.8%)	0.025
Constipation	91 (31.5%)	152 (28.9%)	0.439
Fecal incontinence	3 (1.1%)	6 (1.2%)	0.887
Previous arterial hypertension	24 (8.3%)	53 (10.2%)	0.376
Alcohol consumption	1 (0.4%)	9 (1.8%)	0.091
Smoking in pregnancy	12 (4.3%)	26 (5%)	0.615
Physical activity	66 (23.1%)	76 (14.7%)	0.003
Gestational diabetes mellitus	81 (22%)	154 (25.2%)	0.242
Pregnancy-induced hypertension	2 (3%)	8 (4.4%)	0.611
Urinary tract infection	7 (10.8%)	22 (12.4%)	0.735

PS-UI, Pregnancy-Specific Urinary Incontinence; BMI, body mass index; OGTT, oral glucose tolerance test; TP, time point (1st: 24-28 weeks of gestation; 2nd: 36-38 weeks of gestation); Data are expressed as mean ± standard deviations or absolute frequency (n) and percentage (%). The differences between the groups were compared using the Chi-square test. Significance $p < 0.05$. Percentages are based on the number of patients responding to each question.

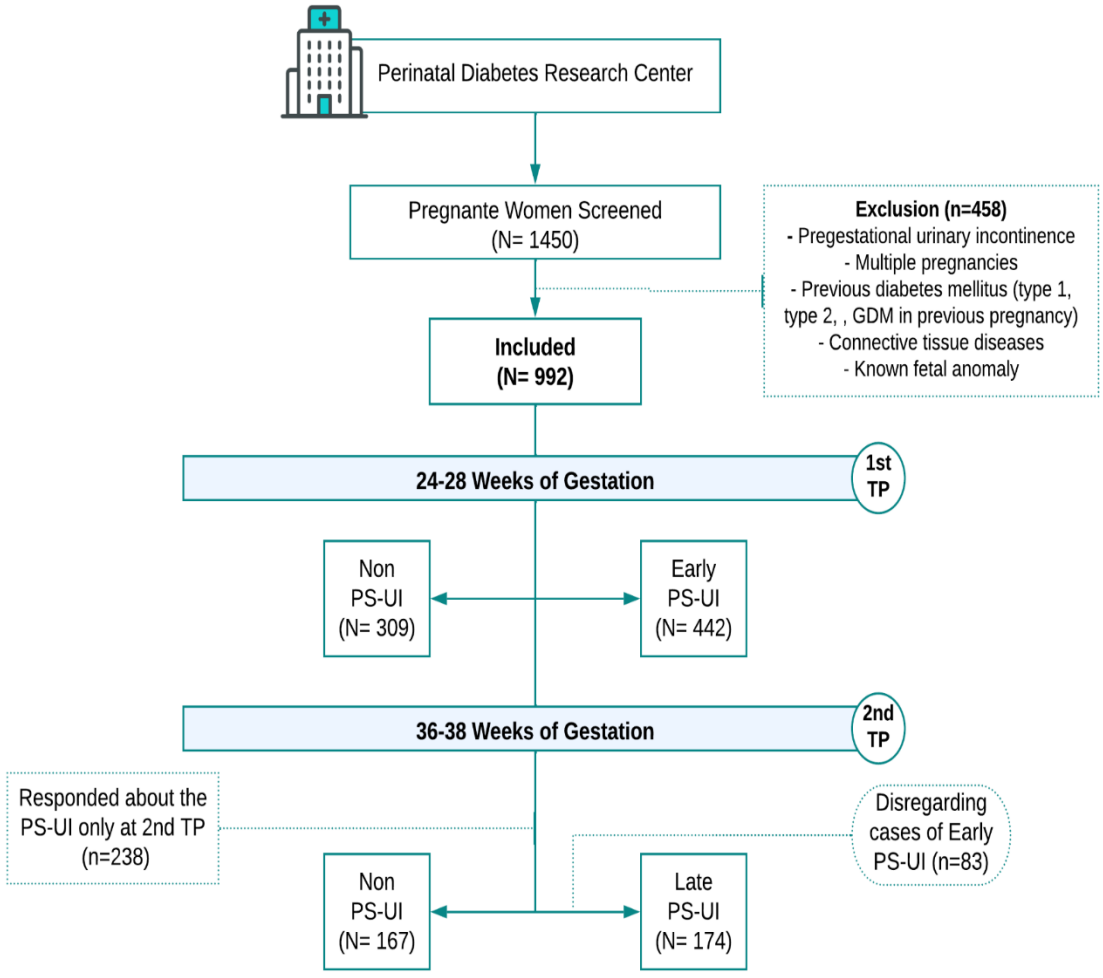

Figure 1. The Diamater cohort fluxogram.

Compared to those without PS-UI, women with PS-UI had a higher pregestational BMI (p=0.002) and BMI at the 1st TP (p=0.004) and 2nd TP (p=0.002). Moreover, women with PS-UI engaged in less physical activity during pregnancy (p=0.003) and presented with more chronic coughing (p=0.025).

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PS-UI prevalence among the studied population was 62.1%, with 58.85% occurring between 24 and 28 weeks of gestation, as shown in Table 2. Excluding the 83 cases of early PS-UI (Figure 1), the prevalence of late PS-UI among pregnant women was 51%.

Table 2. Prevalence of Pregnancy-Specific Urinary Incontinence.

Weeks of gestation			
		n	%
24-28 weeks			
1st TP	(1) non PS-UI	309	41.15
	(2) Early PS-UI	442	58.85
36-38 weeks			
2nd TP	(1) non PS-UI	167	49.0
	(2) Late PS-UI	174	51.0
1st and 2nd TP			
	(1) non-PS-UI	376	37.9
	(2) PS-UI	616	62.1

PS-UI, Pregnancy-Specific Urinary Incontinence; TP, time point (1st: 24-28 weeks of gestation; 2nd: 36-38 weeks of gestation); Data are expressed as absolute frequency (n) and percentage (%).

PS-UI, Pregnancy-Specific Urinary Incontinence; BMI, body mass index; OGTT, oral glucose tolerance test; TP, time point (first: 24-28 weeks of gestation; second: 36-38 weeks of gestation); Data are expressed as means ± standard deviations or absolute frequency (n) and percentage (%). The differences between the groups were compared using the Chi-square test. Significance $p < 0.05$. Percentages are based on the number of patients responding to each question.

Both early and late incontinence were associated with higher pregestational BMI and BMI from the time point it was assessed, as shown in Table 3. Women with early PS-UI engaged in less physical activity during pregnancy (p=0.004), while those with late PS-UI reported more chronic coughing (p=0.012) and alcohol consumption during pregnancy (p=0.047).

Table 3. Association between Pregnancy-Specific Urinary Incontinence (PS-UI) and characteristics according to the time points.

Variable		**1st TP**			**2nd TP**		
		non PS-UI (n=309)	**Early PS-UI (n=442)**	**p-value**	**non PS-UI (n=167)**	**Late PS-UI (n=174)**	**p-value**
Partnership status	Married	261 (84.5%)	367 (83%)	0.601	136 (82.4%)	148 (85.1%)	0.511
	Not-married	48 (15.5%)	75 (17%)		29 (17.6%)	26 (14.9%)	
Education level	basic level	22 (7.1%)	27 (6.1%)		11 (6.6%)	15 (8.7%)	
	high school	191 (61.8%)	319 (72.5%)	0.007	93 (55.7%)	108 (62.4%)	0.210
	college/university	96 (31.1%)	94 (21.4%)		63 (5.2%)	50 (28.9%)	
Ethnicity	Caucasian	253 (82.4%)	365 (82.6%)	0.952	124 (76.1%)	130 (75.1%)	0.843
	Non-caucasian	54 (17.6%)	77 (17.4%)		39 (23.9%)	43 (24.9%)	
Pregestational BMI (kg/m2)		27.04 ± 6.28	28.5 ± 7.33	0.003	27.31 ± 6.42	29.47 ± 6.69	0.003
BMI - 1st TP (kg/m2)		29.49 ± 6.1	30.83 ± 6.87	0.005	29.58 ± 6.8	30.24 ± 6.64	0.637
BMI - 2nd TP (kg/m2)		31.23 ± 6.76	33.49 ± 6.33	0.213	31.67 ± 6.2	33.92 ± 6.64	0.002
Gestational weight gain - 1st TP (kg)		6.31 ± 5.01	6.09 ± 6.26	0.614	6.18 ± 7.73	5.85 ± 4.97	0.833
Gestational weight gain - 2nd TP (kg)		10.81 ± 5.55	10.62 ± 8.76	0.863	11.6 ± 8.18	11.81 ± 6.83	0.802
Fasting blood glucose (mg/dL)		79.86 ± 12.4	79.42 ± 12.23	0.691	81.63 ± 13.26	82.12 ± 19.37	0.826

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OGTT - fasting (mg/dL)	74.58 ± 12.83	75.77 ± 10.58	0.206	78.46 ± 11.73	77.84 ± 13.2	0.755
OGTT- 1 h (mg/dL)	115.65 ± 29.98	118.24 ± 32.9	0.311	126.02 ± 35.13	123.81 ± 31.5	0.755
OGTT - 2 h (mg/dL)	105.08 ± 26.77	106.19 ± 28.86	0.615	112.05 ± 33.39	111.15 ± 28.87	0.862
Chronic coughing	0	1 (0.3%)	0.426	0	8 (6.7%)	0.012
Constipation	79 (31.6%)	113 (28.7%)	0.430	27 (27.8%)	39 (29.5%)	0.778
Fecal incontinence	1 (0.4%)	3 (0.8%)	0.568	2 (2.2%)	3 (2.5%)	0.879
Previous arterial hypertension	17 (6.8%)	29 (7.3%)	0.795	12 (12.4%)	24 (19.4%)	0.163
Alcohol	1 (0.4%)	4 (1%)	0.391	0	5 (4.2%)	0.047
Smoking	8 (3.2%)	19 (4.8%)	0.328	6 (6.6%)	7 (5.9%)	0.832
Physical activity	53 (21.4%)	51 (12.8%)	0.004	22 (22.9%)	25 (20.7%)	0.689
Gestational diabetes mellitus	70 (23.0%)	103 (23.5%)	0.877	116 (70.7%)	121 (70.3%)	0.939
Pregnancy-induced hypertension	0	3 (4.2%)	0.185	3 (3.8%)	5 (4.6%)	0.778
Urinary infection	1 (2.6%)	7 (9.5%)	0.184	9 (11.3%)	15 (14.4%)	0.526

PS-UI, Pregnancy-Specific Urinary Incontinence; BMI, body mass index; OGTT, oral glucose tolerance test; TP, time point (1st: 24-28 weeks of gestation; 2nd: 36-38 weeks of gestation); Data are expressed as means ± standard deviations or absolute frequency (n) and percentage (%). The differences between the groups were compared using the Chi-square test. Significance $p < 0.05$. P-values represent the results from the relevant statistical tests. Percentages are based on the number of patients responding to each question.

As demonstrated in Table 4, the logistic regression model identified pregestational BMI as a risk factor for PS-UI (OR=1.04, IC95%: 1.01; 1.07). Physical activity was identified as a protective factor, halving the risk of developing PS-UI (OR=0.5, IC95%: 0.32; 0.80). The analysis of the 1st TP also revealed that pregestational BMI was a risk factor and physical activity was a protective factor for Early PS-UI. There was no correlation between the variables and the incidence of Late PS-UI.

Table 4. Model of logistic regression model of Pregnancy-Specific Urinary Incontinence (PS-UI).

Variable		**Early PS-UI (n=442)**			**Late PS-UI (n=442)**			**PS-UI (1st plus 2nd TP)**		
		OR*	**95% CI****	**p - value**	**OR***	**95% CI****	**p - value**	**OR***	**95% CI****	**p - value**
Education level	basic level									
	high school	1.28	0.62 ; 2.63	0.172	0.62	0.04 9.28	0.491	1.21	0.58 ; 2.51	0.304
	college/university	0.89	0.40 ; 1;96	0.359	1.20	0.08 ; 19.02	0.629	0.91	0.41 ; 2.04	0.493
Ethnicity	Caucasian	1.22	0.76 ; 1.96	0.416	2.65	0.46 ; 15.15	0.274	1.28	0.88 ; 0.78	0.519
	Non-caucasian									
Age (years)		0.99	0.96 ; 1.02	0.375	1.01	0.92 ; 1.12	0.805	0.99	0.96 ; 1.03	0.706
Pregestational BMI		1.03	1.01 ; 1.06	0.014	1.02	0.93 ; 1.11	0.716	1.04	1.01 ; 1.07	0.006
Constipation		1.21	0.84 ; 0.83	0.312	1.02	0.26 ; 4.03	0.974	0.78	0.54 ; 1.13	0.193
Fecal incontinence		3.02	0.29 ; 31.82	0.358				2.81	0.26 ; 29.92	0.392
Previous arterial hypertension		0.83	0.41 ; 1.70	0.616	1.4	0.16 ; 12.32	0.761	0.84	0.41 ; 1.76	0.652

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Smoking	2.08	0.78 ; 5.53	0.141				1.85	0.69 ; 4.91	0.220
Physical activity	0.51	0.32 ; 0.80	0.003	0.72	0.13 ; 3.88	0.700	0.5	0.32 ; 0.79	0.003
Gestational diabetes mellitus	1.10	1.01 ; 1.06	0.649	0.94	0.25 ; 3.58	0.928	1.16	0.75 ; 1.81	0.500

PS-UI, Pregnancy-Specific Urinary Incontinence; BMI, body mass index; TP, time point (1st: 24-28 weeks of gestation; 2nd: 36-38 weeks of gestation); *Odds Ratio ; **95% Confidence Interval for Odds Ratio; Significance $p < 0.05$. P-values represent the results from the relevant statistical tests.

Discussion

PS-UI was prevalent in 62.1% of pregnant women, 58.85% began leaking urine between 24 and 28 gestational weeks, and 51% developed PS-UI at the end of pregnancy. The pregestational BMI is a risk factor for PS-UI, and physical activity is a protective factor that halves the risk of PS-UI developing.

A systematic review showed that primiparous women had a higher risk of postpartum UI following vaginal delivery compared to C-section, regardless of their continence status before childbirth. Nonetheless, the protective effect of C-section was significantly higher in nulliparous women without UI before delivery. Compared to our results, we detected a higher prevalence of PS-UI even in a sample with a previous C-section (21).

A literature review of lower urinary tract symptoms in women, with a particular emphasis on incontinence and overactive bladder, revealed that age, smoking, pregnancy, asthma, obesity, dementia, vaginal delivery, constipation, diuretic use, and certain medications were identified as risk factors for UI (22).

The pathophysiology underlying antenatal and postpartum UI remains poorly understood (23). The reduced protective effect of C-section against antenatal UI in nulliparous women with UI may be attributed to the characteristics of the women's tissues (24). It is possible to assume that preexisting UI or pregnancy-induced UI may not be associated with perineal trauma but rather with weakened supportive tissues. Thus, it could clarify why a C-section may not prevent UI in such cases (21).

A recent study that evaluated pelvic floor outcomes at different stages of pregnancy, which included stress incontinence, anal incontinence, prolapse, and sexual dysfunction, found that at least one pelvic floor disorder symptom was experienced by 60.8% of the study cohort during pregnancy and that particular symptoms were exacerbated in the third trimester of pregnancy. The prevalence of PS-UI was lower than that presented in this study, with the participants ' overall rates equally distributed in the first, second, and third trimesters of pregnancy ($p = 0.168$). In the third trimester of pregnancy, symptoms related to urinary distress were reported to be more intense than those in the first and second trimesters of pregnancy (25).

Obesity is a well-established risk factor for UI, regardless of sex, age, and other factors (22). Hence, obesity may lead to UI in several ways. Firstly, excess weight puts additional pressure on the pelvis, bladder, and pelvic floor muscles, weakening these muscles and impairing the ability to control urination. Additionally, obesity may also increase systemic inflammation and intra-abdominal pressure, which can lead to bladder dysfunction and UI (26).

That weight loss may help improve UI in people with obesity. A study conducted by Subak et al. (2005) found that a structured weight loss program led to a significant reduction in UI episodes in overweight and obese women (27). Similarly, a meta-analysis reported that weight loss interventions were effective in reducing UI in women with obesity (28).

The exclusion of women with pregestational UI or vaginal deliveries in prior pregnancies may limit generalizability.

Conclusion

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Most women had urinary incontinence at some point during their pregnancy. The onset of PS-UI was proportional among those who leaked urine between 24 and 28 gestational weeks and those who leaked at the end of pregnancy. The pregestational BMI is a risk factor for PS-UI, and physical activity is a protective factor that halves the risk of PS-UI developing. The findings suggest that weight management and encouragement to engage in physical activity during pregnancy should be incorporated into prenatal care to reduce the risk of PS-UI and, consequently, UI later in life.

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Conflicts of Interest: None

List of Abbreviations:

UI: urinary incontinence
PS-UI: pregnancy-specific urinary incontinence
GDM: gestational diabetes mellitus
OGTT: oral glucose tolerance test
BMI: body mass index

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