Prevalence and factors associated with the occurrence of urinary incontinence during pregnancy

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Abstract

Objectives: to determine the prevalence of urinary incontinence (UI) during pregnancy, to identify and quantify the factors associated with gestational UI.

Methods: a cross-sectional study carried out with women admitted for deliveries in all maternity wards in the city of Botucatu (São Paulo). Data were collected through a structured questionnaire, based on the literature, containing questions about the occurrence of UI, its types, risk factors and moments when urinary losses occurred. Associations between UI and the predictive variables were analyzed with logistic regression models.

Results: 950 women were interviewed, out of which 472 complained of urinary losses during pregnancy, resulting in a prevalence of 49.68% (CI95%= 46.51 - 52.86).The majority (61.8%) were classified as mixed UI. Among the covariates investigated, smoking (OR= 4.56), illicit drugs use (OR= 25.14), stimulant foods (OR= 1.84), constipation (OR=1.99), hypertensive disorders during gestation (OR= 3.23), gestational diabetes mellitus (OR= 2.89), parity (OR= 1.52) and previous caesarean sections (OR= 2.56) increased the chance of urinary losses during pregnancy.

Conclusions: there was a high prevalence of UI during pregnancy. This condition was strongly associated with lifestyle habits and gestational morbidities. Finally, it is worth highlighting the fact that delivery via caesarean section increased the chance of UI in subsequent pregnancies.

Key words *Pregnancy, Urinary incontinence, Epidemiology, Risk factors*

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Introduction

Urinary incontinence (UI) is defined as any involuntary loss of urine.[1] Through their symptoms, UI can be classified as: stress urinary incontinence (SUI),when it happens during an action requiring effort, exercise or during coughing or sneezing; urge urinary incontinence (UUI), when associated to a sudden need to urinate; and mixed urinary incontinence (MUI).[2]

The prevalence of UI during pregnancy can reach up to 75%, but the estimate varies depending on the period investigated, the study design and even the culture of a population. UI can last in the postpartum period, in which its prevalence ranges from 6% to over 30%.[3,4] It should be noted that the most common type of UI during gestation is SUI.[5]

The determination of UI is multifactorial and the most commonly highlighted associations occur with maternal age (when over 35 years old), skin color, multiparity, high pre-gestational body mass index, constipation, consumption of stimulating foods, alcohol and illicit drugs, comorbidities (such as *diabetes mellitus* and hypertension), as well as maternal pregnancy adaptations (such as hormonal changes and weight gain) and increased pressure on the pelvic floor (due to an increase in uterine volume).[4,6-8]

In addition to dysfunctionality, gestational UI produces major impairments to psychological and social well-being due to the high potential for embarrassment during this very special process in a woman's life.[1,3,6,9]

Given the lack of epidemiological evidence on preventive measures and follow-up of UI symptoms in pregnancy, the aim of the present study was to estimate its prevalence and the quantification of the main factors that predispose women to develop it during this period.

Methods

A cross-sectional study named the PULP Study (*Prevalence of Urinary Loss in Pregnancy*) was conducted in the municipality of Botucatu, State of São Paulo, from April 2012 to April 2014.

Assuming a probable universe of 3,000 deliveries during the two years of the study and a UI ratio of 50%, plus type I and II errors of, respectively, 5 and 10%, and a design effect of 2, the minimum sample size was estimated to be 935 patients.

Information was collected from women admitted to childbirth at the two hospitals with maternity wards operating in Botucatu (*Hospital Misericórdia Botucatuense and Hospital das Clínicas da Faculdade de Medicina*).

All pregnant women admitted to these maternity wards for delivery who consented to the protocol, regardless of gestational age, were interviewed during the period between hospitalization and discharge, when they were most comfortable to respond. The questions regarding the recently completed gestational period were conducted by two previously trained interviewers, aiming at quality control in the capture and recording of information.

Women under the age of 18 without parental or guardian permission, who had cognitive impairments that might affect understanding of the issues, and those who had a history of UI prior to pregnancy were excluded from the study.

The collection instrument was a structured survey which was read aloud and filled out by the interviewers, a method which takes into account that the majority of women in these services had low education levels. Sociodemographic factors, clinical-anthropometric information, obstetric history and clinical-surgical history were studied.

It is important to highlight that among the factors associated with UI, the study only collected those with real possibility of investigation and/or with technical conditions of measurement and that presented biological plausibility to support the association.

Women were classified as incontinent according to the ICS definition.[1] Their losses were classified as follows: stress urinary incontinence (SUI:involuntary loss of urine after exertion, sneezing or coughing), urge urinary incontinence (UUI: involuntary loss of urine accompanied or preceded by urgency) or mixed urinary incontinence (MUI) : involuntary loss of urine associated with urgency and exertion, sneezing or cough).[1,2]

The questions on the quantification of the frequency of SUI and UUI during gestation were standardized and validated according to Rohr *et al*.[10] They were, respectively: "Did you involuntarily wet yourself when practicing an exerting activity, when coughing, sneezing, laughing or lifting a heavy object?" and/or "Did you have a strong urge to urinate and had no time to get to the bathroom?". Bothquestions presented the same five possible alternative answers: never presented loss of urine; presented loss of urine only once during their lives; presented loss of urine more than once and less than weekly; presents loss of urine one or more times a week; and presents loss of urine daily.

The reference situations for the occurrence of

urinary incontinence were based on the literature[8,11]: if the urine was lost while coughing, sneezing, sleeping, during sexual intercourse, during a small effort, due to not being able to reach a bathroom, because of hearing water noises or being in contact with water, if it happened without the patient realizing it. In addition, the amount of urine loss was investigated and classified according to the pregnant woman's perception and classified into small, considerable or large amounts of loss.

The prevalence of UI and its respective confidence interval were estimated by the Wilson-score method.[12] Exploratory data analysis was presented as simple and cumulative frequency measurements (when relevant) for categorical variables and their comparisons by chi-square tests, as well as means and standard deviations for continuous variables and comparisons by Student's *t*-test. Both presented normal distribution. The analyzes were developed using the IBM / SPSS® Statistics v.25.0 and OpenEpi v.3.01 statistical packages.

First, univariate logistic regression models were adjusted to estimate factors associated with UI, with a dichotomous response variable to the occurrence of UI (continent = 0, incontinent = 1) and as predictor variables each of the variables collected in the interview which were considered biologically plausible. The continuous variables are: age (in years), pre-gestational weight (kg), weight at the end of pregnancy (kg), gestational weight gain (kg), pre-gestational body mass index (BMI), gestational BMI. The categorical variables are as follows: skin color/race (white, non-white), marital status (with and without partner), income (up to 1 minimum wage, 1-2 minimum wages, 2-3 minimum wages or 3 or more minimum wages), delivery methods (vaginal delivery, emergency cesarean delivery, elective cesarean section). Finally, the dichotomous categorical variables (yes/no) are: working outside the home, smoking, illicit drug use, alcohol use, consumption of stimulating foods, presence of constipation, regular exercise, previous and/or associated diseases, previous hypertension, gestational hypertensions (GH), type 1 *diabetes mellitus* (T1DM), type 2 *diabetes mellitus* (T2DM), previous gestational *diabetes mellitus* (GDM), GDM in this pregnancy, urinary tract infections, abortion and abdominal surgery.

Subsequently, the multiple logistic regression model was adjusted. In it, the dichotomous categorical response variable was the occurrence of UI (continent = 0, incontinent = 1) and the predictor variables were those that produced *odds ratio* (OR) estimates with p-values$\leq$0.25 in the univariate models. In the final model, two-tailed p-values$<$0.05 were considered significant.

The study was approved by the Research Ethics Committee of the Botucatu Medical School (protocol 3714-2010).

Results

During the investigation period, 1,032 women were admitted for delivery at both maternity wards. Of these, 82 (7.9%) were hospitalized or discharged on weekends (when researchers were not present) or refused to respond. Thus, 950 women were interviewed, with 472 complaining of urinary loss (incontinence), resulting in a prevalence of 49.68% (CI95% = 46.51-52.86). The prevalence estimate was not statistically different from the rate assumed when estimating the minimum sample size for the study (p= 0.186).

Table 1 shows the anthropometric and sociodemographic information stratified between continent and incontinent women, groups that were statistically differentiated by skin color and income. Although both groups were mostly women who declared themselves white (above 70%), the proportion was higher in the incontinent group, whereas in relation to family income, most families are low income, and about 90% receive less than 2 minimum wages (MW). The concentration of families receiving up to 1 MW was higher in the group of continent women.

Regarding the classification of UI type, among incontinent pregnant women, the most frequent type was MUI (61.8%), followed by SUI (31.8%) and UUI (6.4%). Although the prevalence of UI in this population was quite high, at the time they were asked about perceived urinary loss, most women reported that the amount of urine they lost was "considerable" (48.1%) (Table 2). Table 2 also shows that the third trimester of pregnancy had the highest incidence of urinary loss (70%) and that over 43% of women had episodes several times a week. The most common situations for urinary loss among women classified as incontinent were also evaluated, and coughs (74%), sneezing (71%) and laughter (61%) were the situations in which most women reported the occurrence of UI. The finding that over 40% of them lost urine without realizing is noteworthy.

Table 3 presents the OR estimates and respective confidence intervals obtained in the univariate logistic regression model adjustments, and the following variables were independently statistically significant: age, skin color, tobacco, alcohol and illicit drug use, presence of constipation and gesta-

Table 1

Anthropometric and sociodemographic descriptive variables sorted in groups of women stratified by urinary loss (n=950).

	Continent (n=478)		Incontinent (n=472)		*p**
	$\bar{X}$ ± D		$\bar{X}$ ± SD		
Age (years)	25.14 ± 5.83		26.95 ± 5.81		0.433
Pre-gestational BMI (kg/m²)	26.33 ± 5.92		26.69 ± 6.41		0.565
Gestational BMI (kg/m²)	29.48 ± 6.11		29.77 ± 6.01		0.413
Pre-gestational weight (kg)	64.86 ± 13.14		65.84 ± 14.16		0.621
Final weight during pregnancy (kg)	76.34 ± 14.07		77.95 ± 15.56		0.488
Current gestation weight gain (kg)	11.69 ± 6.45		11.37 ± 6.24		0.149
	N	**%**	**N**	**%**	***p*****
Skin color					0.012
White	342	71.5	371	78.6	
Non-white	136	28.5	101	21.4	
Marital status					0.601
Has partner	402	84.1	391	82.8	
No partner	76	15.9	81	17.2	
Works outside the home					0.043
No	314	65.7	280	59.3	
Yes	164	34.3	192	40.7	
Family income (minimum wages)					<0.001
Up to 1	167	34.9	79	16.6	
1-2	259	54.2	350	74.2	
2-3	41	8.6	38	8.1	
3 or more	11	2.3	5	1.1	

*Student's t-test; ** Chi-square test; BMI= body mass index.

tional morbidities (GHD and GDM), as well as parity, birth routes and newborn (NB) weight in the current pregnancy.

When adjusting the multiple logistic regression model with the *insert stepwise technique*, usingvariables that presented values of $p \leq 0.25$ in the univariate models, it was observed that having non-white skin remained statistically significant in the adjustment as a factor that reduces the chance of UI by approximately 35%, while smoking, consumption of illicit drugs and stimulant foods, constipation, GHD and GDM, as well as parity and cesarean delivery increase the chance of UI in pregnancy.

Of particular note is the strength of association of some of these variables with the occurrence of UI. For instance, illicit drug use, increases the chance of UI by more than 25 times (OR = 25.1) and tobacco use, quadruples it (OR = 4.5). Gestational morbidities such as GHD and GDM, increase the chance of UI by 3.3 and 2.9 times, respectively. In addition, having performed at least one caesarean section more than doubles the chance of UI in subsequent pregnancy (OR = 2.56).

Discussion

Among this study's limitations are its cross-sectional design, limited as a tool for understanding the determinants related to the occurrence of UI, as well as the use of retrospective data, which usually brings flaws to the amount and quality of information, even though they have been thoroughly audited. However, using a large sample compared to other studies[13-15] helped to produce reliable results. This is the main positive aspect of the study.

The prevalence of UI during pregnancy found in the present study was of 49.68%, a rate consistent with the literature.[3,7,16] However, it is important to highlight that the study sample, besides its magnitude, which already draws attention when compared to the literature,[8,17,18] was sequentially composed of all pregnant women admitted in the period and,

Table 2

Characteristics of urinary loss among women who had signs and symptoms (n = 472).

	n	%	% acum
Urinary incontinence type			
Urge	30	6.4	6.4
Stress	150	31.8	38.2
Mixed	292	61.8	100.0
Gestational trimester of onset of incontinence			
1st trimester	60	12.7	12.7
2nd trimester	82	17.4	30.1
3rd trimester	330	69.9	100.0
Loss amount			
Small	175	37.1	37.1
Considerable	227	48.1	85.2
Large	70	14.8	100.0
Loss frequency			
Daily	76	16.1	16.1
Once a Week	191	40.5	56.6
Several times a week	205	43.4	100.0
Loss situation *			
Laughter	288	61.0	-
Coughing	350	74.2	-
Sneezing	336	71.2	-
Carrying weights	75	15.9	-
Jumping	7	1.5	-
Small efforts	60	12.7	-
Intercourse	81	17.2	-
Sleeping	137	29.0	-
While feeling like urinating	248	52.5	-
Going to the bathroom	178	37.7	-
Upon hearing sound of water	19	4.0	-
Hand contact with water	17	3.6	-
Foot contact with water	1	0.2	-
Without noticing	194	41.1	-

* Each incontinent woman may report multiple loss situations.

except for the few criteria of non-inclusion and occasional losses due to weekends, it is very close to the population base of the municipality's parturient patients. Thus, there is no evidence that this finding cannot be extrapolated to other municipalities of similar size that are regional references for obstetric services.

Another important finding that corroborates the literature is that UI negatively affects and impacts on the quality of life of pregnant women.[6,13,18] The most reported type of UI was mixed (61.8%), that is, those that occur due to both effort and urgency, and 40% of these women lost urine without realizing it, leaving them susceptible to uncomfortable and unpredictable situations. In terms of quantities, almost half (48.1%) of incontinent pregnant women consider that they lost a considerable amount of urine, an evident source of anxiety and possible social isolation in order to avoid embarrassment.

The results of this investigation showed that skin color is strongly associated with incontinence, in the sense that having non-white skin reduces the chances of having UI during pregnancy, which is corroborated by the literature.[19] Some authors[6,19] explain this finding through genetic and anatomic-functional aspects, which place women with non-white skin, especially black women, with stronger pelvic floor muscles, as well as regarding the anatomical position of the organs, which seem to favor continence.

Another result that caught our attention was

Table 3

OR estimates and confidence intervals obtained in the adjustment of univariate logistic regression between various covariates and occurrence of urinary incontinence.

	OR	CI95%	*p*
Age (years)	1.055	1.031 - 1.079	<0.001
Pre-pregnancy BMI (kg/m²)	1.011	0.989 - 1.031	0.364
Gestational BMI (kg/m²)	1.008	0.987 - 1.029	0.463
Pre-gestational weight (kg)	1.005	0.996 - 1.015	0.268
Final weight during pregnancy (kg)	1.007	0.999 - 1.016	0.095
Weight gain in current pregnancy (kg)	0.992	0.972 - 1.012	0.432
Skin color (non-white ref.)	0,685	0.509 - 0.921	0.012
Physical activity	0.907	0.638 - 1.289	0.586
Smoking	3.389	2.551 - 4.504	<0.001
Alcohol consumption	491	0.295 - 0.817	0.006
Use of illicit drugs	4.861	1.382 - 16.953	0.014
Stimulant food consumption	1.633	0.094 - 2.738	0.063
Intestinal constipation	1.688	1.271 - 2.242	<0.001
Previous SAH	0.218	0.133 - 1.359	0.284
GHD	2.689	1.803 - 4.009	<0.001
DM1	0.000	0.00	1.000
Previous DM2	1.695	0.403 - 7.134	0.472
GDM	2.592	1.514 - 4.441	0.001
UTI	1176	0.906 - 1.527	0.223
Previous abdominal surgery	0.000	0.00	1.000
Abortions	1.145	0.814 - 1.611	0.437
Parity	1.417	1.251 - 1.607	<0.001
Delivery method (vaginal ref.)	1.507	1.125 - 2.018	0.006
NB weight (current pregnancy)	1.252	1.093 - 1.434	0.001

BMI= body mass index; SAH = systemic arterial hypertension; GHD = gestational hypertensive disorder; DM1 = *diabetes mellitus* type 1; DM2 = *diabetes mellitus* type 2; GDM = Gestational *diabetes mellitus*; UTI = Urinary Tract Infection ; NB = newborn.

tobacco use, in which pregnant women who smoked had a 4.5 times greater chance of presenting UI during pregnancy than those who did not smoke. One of the possible ways to explain the finding is through one of the consequences of smoking - chronic coughing - which increases the overload on the pelvic floor muscles, already stressed by the pregnancy, thus favoring urinary losses.[5,20]

Other risk factors, such as GDM and other gestational comorbidities, were strongly associated with the occurrence of UI in our sample, results that are corroborated by the literature.[5,16,21] The association between GDM and UI is due to the repercussions that this comorbidity causes, such as obesity and the consequent increase in infants' BMI and macrosomia, which generate increased abdominal and pelvic floor muscle pressure, resulting in decreased urinary continence.[5] The association of UI with illicit drugs, however, is not evidenced in the literature. A plausible explanation would derive from the findings that pregnant women who use illicit drugs also consume alcoholic beverages[22] that stimulate detrusor activity. Another possible explanation is that pregnant women who use illicit drugs tend to have low adherence to prenatal care, not receiving proper counseling and follow-up care, increasing the likelihood of obstetric diseases, and UI may be one of them.[22]

In addition, having performed at least one caesarean section more than doubles the chance of UI in subsequent pregnancies (OR = 2.56). This association could be explained by possible traumas that may compromise the components responsible for the physiology of urination and consequent urinary continence caused by this surgical procedure. Examples include pudendal nerve compression and injuries to the pelvic floor muscles,[23] although these traumas may occur in some procedures related to vaginal delivery, such as episiotomies.

Some authors consider that vaginal delivery is a risk factor for the development of UI in future pregnancies.[2,4,6] However, another study emphasized that

this association was not fully elucidated.[23] Still, in an attempt to clarify and seek answers about the birth routes as a risk factor for UI in subsequent pregnancies, a study of ultrasound findings of pelvic floor musculature in vaginal and caesarean sections (elective and non-elective) was performed and found no statistically significant differences between delivery routes and UI symptomatology, nor with anatomical changes of the pelvic floor.[17]

In addition to the mode of delivery, parity was associated with UI, in that the increase in the number of births increases the chance of gestational urinary incontinence by more than 40% (OR = 1.41). This can be explained by the fact that the gestational period exposes the woman's body to the action of hormones such as relaxin, which acts on ligament laxity and may lead to the occurrence of UI. Thus, it is understood that with increasing parity, the hormonal dose response results in increased susceptibility to UI in subsequent pregnancies.[13,23]

Despite the recent decrease, Brazil is still considered one of the countries with the highest occurrence of surgical deliveries,[24] with around 56% of deliveries done by c-section,[25] much higher than numbers recommended by WHO (10-15% of all deliveries).[26] Surgical deliveries are based primarily on medical beliefs passed on to pregnant women as the safest way to prevent potential harm to a woman's body,[27] which is often associated with vaginal deliveries.

The findings of this study indicate that there is a high prevalence of UI in the gestational period, and it is worth mentioning that mixed UI had the highest reported percentage among UI types (61.8%). In addition, this condition is strongly associated with factors such as lifestyle and morbidities manifested during pregnancy. Our findings support the claim that cesarean delivery increases the chance of developing UI in subsequent pregnancies.

Authors' contribution

Santini ACM participated in the elaboration of protocol / project, data collection and management and writing/editing of the manuscript. Santos ES e Vianna LS performed data collection and management and writing/editing of the manuscript. Bernanrdes JM worked in the data analysis and writing/editing of the manuscript. Dias A participated in the elaboration of development of protocol/project, data analysis and writing/editing of the manuscript. All authors approved the final version of the article.

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