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ORIGINAL ARTICLE

Urinary incontinence between 12 and 24 months postpartum: a cross-sectional study nested in a Brazilian cohort from two cities with different socioeconomic characteristics

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Abstract

Introduction and hypothesis We aimed to identify the prevalence of urinary incontinence (UI) during the postpartum period (12–24 months) in two cities with different socioeconomic indicators in Brazil (Ribeirão Preto, SP, and São Luís, MA) and to determine associated risk factors.

Methods A cross-sectional study nested in the Brazilian Ribeirão Preto and São Luís Birth Cohort Studies (BRISA) cohort was conducted in two Brazilian municipalities (Ribeirão Preto, and São Luís). A total of 13,214 women delivered in both cities (2010–2011). We interviewed 3,751 postpartum women in Ribeirão Preto and 3275 in São Luís (2011–2013). Univariate and multivariate analyses were performed to assess factors associated with postpartum UI for each municipality.

Results The prevalence of self-reported UI at 12–24 months postpartum was 16.3% (611 out of 3,751) in Ribeirão Preto and 11.4% (375 out of 3,275) in São Luís ($p < 0.001$). The univariate analysis performed at Ribeirão Preto showed that women who were obese, who had diabetes or gestational diabetes and who presented with excessive weight gain during gestation presented an association with postpartum UI. However, only weight gain during pregnancy remained strongly associated with UI on multivariate analysis ($p = 0.009$; OR 1.041 [1.010–1.073]). On the other hand, in São Luís, no risk factors were associated with postpartum UI at univariate and multivariate analysis.

Conclusions The prevalence of UI was higher in Ribeirão Preto (higher socioeconomic level) than in São Luís. Weight gain during pregnancy was statistically associated with UI in Ribeirão Preto. No independent variables remained associated in the final model with UI in São Luís.

Keywords Urinary incontinence · Postpartum · Cross-sectional study · Weight gain · Pregnancy

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Introduction

Urinary incontinence (UI) is defined as any involuntary loss of urine and can be related or unrelated to physical strain [1]. It is a common problem; its prevalence increases with age and can have a significant impact on women's quality of life [1]. Approximately 200 million people worldwide have been diagnosed with UI, and 178 million Euros are spent annually in the UK on treating patients with UI [2, 3].

According to the literature, the prevalence of UI may vary considerably during pregnancy and the postpartum period. A systematic review found that the prevalence of UI during pregnancy varied from 18.6 to 75% and concluded that uterine growth, foetal weight gain and pregnancy-associated hormonal changes are associated risk factors [4]. However, little is known about each factor's contribution to postpartum UI

[5]. Potential pathophysiological mechanisms are the change in position of important anatomical structures (e.g., ureterovesical junction), neurological diseases or the increase in intra-abdominal pressure [6, 7]. Moreover, mental health status may be impaired given that the presence of depressive symptoms and antidepressant use after 12 months postpartum were significantly higher in patients who presented with UI (23.8% vs 15.3%, $p = 0.012$) [6].

Usually, UI reaches its maximum peak incidence at the end of pregnancy, with remission occurring at 6 months postpartum. The mode of delivery (vaginal vs elective caesarean section) is directly associated with this rate; however, in a recent review, only one randomised controlled trial comparing vaginal delivery with elective caesarean section was found and the results were inconclusive [7]. When UI is added to faecal incontinence (double incontinence), the prevalence during pregnancy does not increase considerably; instrumental delivery, age over 35 years and episiotomy were associated risk factors for double incontinence [8].

One of the biggest limitations in studying UI during the postpartum period is assessing its long-term impact on patient health. Most of the existing large sample size studies analyse UI only up to 12 months postpartum [6]. Urinary incontinence has multiple factors that may influence its genesis. Socioeconomic differences may play a role, and these factors could be analysed in a developing country such as Brazil. For this reason, we aimed to assess the prevalence of UI postpartum and compare it with prenatal data obtained from a cohort study of two municipalities with differing socioeconomic features.

Materials and methods

Study design, patient enrolment, and data collection

This is a cross-sectional study nested within the Brazilian Ribeirão Preto and São Luís Birth Cohort Studies (BRISA) cohort. Data for this study were collected between 2010 and 2011 in the Brazilian cities of São Luís (North-eastern region) and Ribeirão Preto (South-eastern region), Brazil. Details of this protocol have been previously published [9]. São Luís is situated on an island in one of the poorest regions in the country, whereas Ribeirão Preto is a municipality in one of the most developed regions of Brazil. The study was independently approved by the Institutional Review Boards of the University of São Paulo (process no. 11157/2008) and the Federal University of Maranhão (process no. 4771/2008-30).

Women with singleton pregnancies were recruited during prenatal visits by health care professionals. Once the study was explained to them and a decision was made to participate, informed consent was given, and a semi-structured questionnaire was administered. These women had their data collected during labour and delivery admissions and during postpartum visits. Data from new-borns were also obtained. After 12 months, the participants who were enrolled at the beginning of the cohort study were invited to be re-interviewed by mail or telephone. As not all would be returning in exactly 12 months, we included the follow-up period to be between 13 and 24 months. A different questionnaire was administered at this time, containing similar questions to the previous one in addition to new ones.

Outcomes

Sociodemographic and obstetric variables were assessed by an interviewer who administered a semi-structured questionnaire during an antenatal consultation; these comprised our independent variables. Urinary dysfunction was assessed only during the follow-up period. Women were asked the following open-ended questions: “After delivery of your last child, have you ever noticed any changes in your urinary habits, and if so, what was the change?” Followed by: “Did you lose urine with or without any strain after pregnancy?” Patients who responded affirmatively to the second question were considered to have UI. Objective confirmation of UI by means of clinical examination was not performed; hence, no other types of UI were investigated. Women who presented UI before pregnancy or who were uncertain whether UI had begun were excluded from this analysis. Other voiding dysfunctions were also excluded.

Statistical analysis

We compared the patients from Ribeirão Preto and São Luís to look for homogeneity between the groups (Supplementary Tables). To test the association between UI and categorical covariates, we used Pearson’s Chi-squared test. We used Student’s *t* test for continuous variables. We then used univariate analysis to examine risk factors for postpartum UI. All covariates that were statistically significant on univariate analysis ($p < 0.10$) were included in a multivariate analysis (multiple logistic regression) with crude and adjusted odds ratios and 95% confidence intervals for each variable. Cases with missing values were not treated with imputation methods. Data were tabulated in Microsoft Excel 2007, and statistical analysis was conducted at Intercooled Stata 13.0 (StataCorp, 2013; StataCorp, College Station, TX, USA).

Results

A total of 13,214 women were included in the BRISA cohort. Of these, 7,702 (59.6%) were enrolled in Ribeirão Preto, and 5,512 (40.4%) were enrolled in Sao Luís. Of these, 7,026 (53.2%) were reached at the 1- to 2-year follow-up period in both cities, 3,751 in Ribeirão

Preto and 3,275 in São Luís. The overall prevalence of UI was 14.1%; Ribeirão Preto displayed a higher rate (16.3%) than São Luís (11.4%); $p < 0.001$ (Fig. 1).

Table 1 displays the sociodemographic and clinical variables of the patients studied. In summary, Ribeirão Preto contained a higher percentage of white, overweight and older women, with a higher educational level and family income, a professional occupation, frequently overweight during their professional activities, and with a high use of tobacco and alcohol during pregnancy. Moreover, unplanned pregnancy was high in both cities, but highest in São Luís. Caesarean section rates were higher in Ribeirão Preto. As for comorbidities, prepregnancy diabetes and gestational diabetes were more prevalent in Ribeirão Preto. High rates of episiotomy could be found in both cities and the use of oxytocin was significantly higher in São Luís than in Ribeirão Preto.

We have also compared baseline variables from women who returned for consultation after 1–2 years with women who did not return for assessment. In São Luís, out of 11 independent variables that were searched, 5 (diabetes mellitus, gestational diabetes, planned gestation, pre- and post-gestational weight) did not show any differences and 6 (age, familiar income, weight gain during pregnancy, race, prolonged standing at work and frequently overweight) presented statistically significant differences (Supplementary Tables 1, 2). In Ribeirão Preto, most of the variables (race, prolonged standing at work, frequently overweight, planned gestation, diabetes, weight gain during pregnancy) did not present any difference (Supplementary Tables 3, 4).

When we analysed all variables associated with UI in São Luís, none remained statistically associated, except for planned pregnancy ($p = 0.011$) and hours in labour ($p = 0.046$). In Ribeirão Preto, the presence of a paid occupation ($p = 0.006$), diabetes mellitus ($p = 0.004$) and gestational diabetes ($p = 0.001$), a higher BMI ($p = 0.010$) and a number of hours from labour to non-elective caesarean section ($p = 0.008$) were statistically associated with UI (Tables 2, 3). Furthermore, no neonatal variables were associated with UI in either of the cities.

Table 4 shows the univariate and multivariate analysis from both cities. In Ribeirão Preto, it was found that women with longer hours in labour before non-elective caesarean section ($p = 0.010$; OR = 1.011 [1.002–1.020]), who presented diabetes mellitus ($p = 0.006$; OR = 2.469 [1.297–4.701]) or gestational diabetes ($p = 0.001$; OR = 1.639 [1.209–2.221]) or obesity ($p = 0.014$; OR = 1.424 [1.075–1.886]) with higher weight gain during pregnancy ($p = 0.006$; OR = 1.022 [1.006–1.037]) were associated with postpartum UI. Of these risk factors, only weight gain during pregnancy ($p = 0.009$; OR 1.041 [1.010–1.073]) remained associated with UI after multivariate analysis. In São Luís, no risk factors were associated in the univariate and multivariate analysis; women who

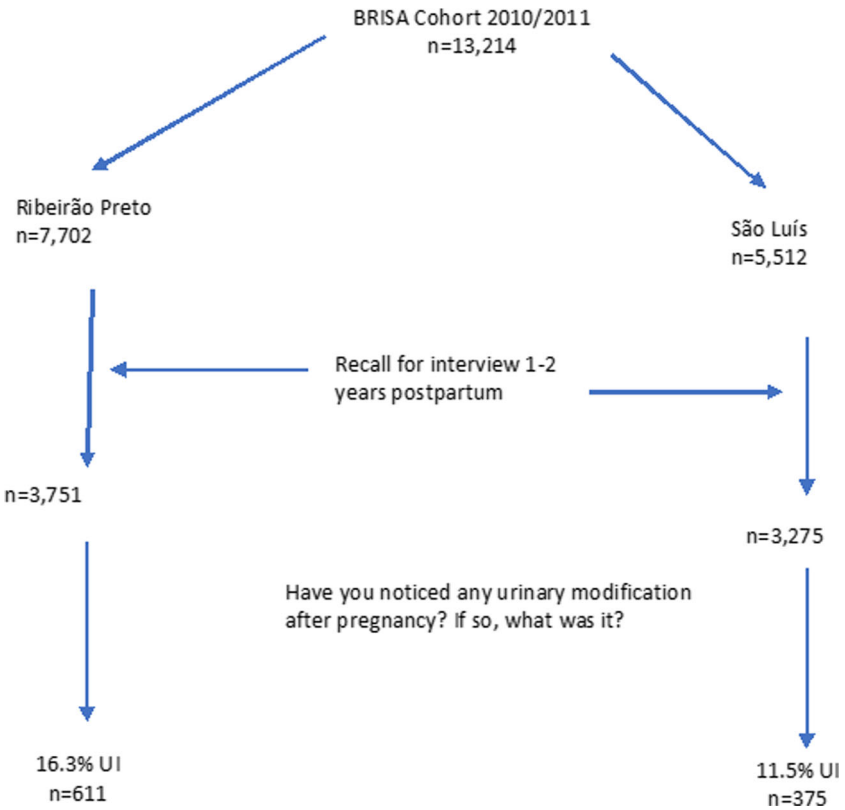

Fig. 1 Flowchart of patients interviewed 12–24 months postpartum

Table 1 Sociodemographic and clinical variables in women from Ribeirão Preto and São Luís

Variables	Ribeirão Preto Mean ± SD or *n* (%)	São Luís	Total	*p* value
Age (years)	27.07 (±6.20)	25.37 (±6.02)	26.28 (6.18)	<0.005
Unknown (*n*)	0	0	0	
Education level (years)				<0.005
< 4	838 (22.3)	743 (22.7)	1,581 (22.5)	
4–11	2,085 (55.6)	2,057 (62.8)	4,142 (59)	
12+	811 (21.6)	463 (14.1)	1,274 (18.1)	
Unknown	17 (0.5)	12 (0.4)	29 (0.4)	
Skin colour				<0.005
Non-white	1,552 (41.4)	2,697 (82.4)	4,249 (60.5)	
White	2,181 (58.1)	574 (17.5)	2,755 (39.2)	
Unknown	18 (0.5)	4 (0.1)	22 (0.3)	
Family income (Brazilian Reais)	2,324.47 (±1,983.14)	1.752.31 (±2.247.27)	2,061.69(±2,127.57)	<0.005
Unknown (*n*)	552	558	1,110	
BMI (kg/m^2)	29.60(±5.20)	27.76 (±4.28)	28.82 (±4.91)	<0.005
Occupation				<0.005
Non-paid	1,658 (44.2)	2,155 (65.8)	3,813 (54.3)	
Paid	2,092 (55.8)	1,120 (34.2)	3,212 (45.7)	
Unknown	1 (0.0)	0 (0.0)	1 (0.0)	
Prolonged standing at work				0.342
No	985 (26.3)	545 (16.6)	1,530 (21.8)	
Yes	1,105 (29.5)	570 (17.4)	1,675 (23.8)	
Unknown	1,661 (44.2)	2,160 (66.0)	3,821 (54.4)	
Carry weight with frequency				<0.005
No	1,634 (43.6)	945 (28.9)	2,579 (36.7)	
Yes	459 (12.2)	168 (5.1)	627 (8.9)	
Unknown	1,658 (44.2)	2,162 (66.0)	3,820 (54.4)	
Parity				0.067
1	1,891 (50.43)	1,573 (48.03)	3,464 (49.34)	
2	1,169 (31.16)	1,042 (31.82)	2,211 (31.39)	
3+	686 (18.28)	660 (20.15)	1,346 (19.17)	
Unknown	5 (0.13)	0 (0.0)	5 (0.0)	
Tobacco during pregnancy				<0.005
No	3,073 (81.0)	2,999 (91.6)	6,036 (85.9)	
Yes	714 (19.0)	275 (8.4)	989 (14.1)	
Unknown	0 (0.0)	1 (0.0)	1 (0.0)	
Alcohol during pregnancy				<0.005
No	2,888 (77.0)	3,025(92.4)	5,913 (84.2)	
Yes	863 (23.0)	250 (7.6)	1,213 (15.8)	
Unknown	0	0	0	
Weight gain during pregnancy (kg)	13.50 (±5.86)	12.85 (±5.67)	13.22 ± 5.78	<0.005
Unknown	319	596	915	
Planned pregnancy				<0.005
No	1,976 (52.7)	2,236 (68.3)	4,212 (60.0)	
Yes	1,764 (47.0)	1,035 (31.6)	2,799 (39.8)	
Unknown	11 (0.3)	4 (0.1)	15 (0.2)	
Diabetes mellitus				<0.005
No	3,701 (98.7)	3,258 (99.5)	6,959 (99.0)	
Yes	43 (1.1)	13 (0.4)	56 (0.8)	

Table 1 (continued)

Variables	Ribeirão Preto Mean ± SD or *n* (%)	São Luís	Total	*p* value
Unknown	8 (0.2)	4 (0.1)	12 (0.2)	
Gestational diabetes				<0.005
No	3,487 (93.0)	3,197 (97.6)	6,684 (95.1)	
Yes	256 (6.8)	75 (2.3)	331 (4.7)	
Unknown	8 (0.2)	3 (0.1)	11 (0.2)	
Mode of delivery				<0.005
Vaginal	1,500 (40.0)	1,675 (51.2)	3,175 (45.2)	
Caesarean	2,159 (57.6)	1,600 (48.8)	3,759 (53.5)	
Forceps/vacuum	92 (2.4)	0 (0.0)	92 (1.3)	
Unknown	0	0	0	
Hours in labour	7.04 (±9.04)	6.84 (±11.90)	6.93 (±10.60)	<0.005
Unknown	2,261	1,696	3,957	
Hours in labour before non-elective caesarean section	5.39 (±10.88)	8.70 (±17.05)	6.76 (±13.87)	<0.005
Unknown	1,632	1,782	3,414	
Birthweight (g)	3,154.81 (±528.50)	3,197.80 (±537.85)	3,174.83 (±533.27)	<0.005
Unknown	226	22	248	
Head circumference (cm)	34.35(±1.82)	33.93 (±1.75)	34.15 (±1.80)	<0.005
Unknown	225	22	247	
Episiotomy				0.267
No	543 (14.5)	646 (18.9)	1,189 (16.9)	
Yes	971 (25.9)	1,065 (31.1)	2,036 (29.0)	
Labour analgesia				<0.005
No	674 (18.0)	1,650 (50.4)	2,324 (33.1)	
Yes	3,071 (81.9)	1,620 (49.5)	4,691 (66.8)	
Unknown	6 (0.1)	5 (0.1)	11 (0.1)	
Intrapartum oxytocin				0.145
No	2,501 (66.7)	2,158 (65.9)	4,659 (66.3)	
Yes	1,208 (32.2)	1,116 (34.1)	2,324 (33.1)	
Unknown	42 (1.1)	1 (0.0)	43 (0.6)	

reported planned pregnancies were associated with protective factors for UI at univariate analysis, but this association did not persist after adjusting for confounding factors.

Discussion

This study has found that the UI prevalence was different in two cities with socioeconomic disparities. A more developed city (Ribeirão Preto) presented a higher UI rate in the postpartum period and maybe the influence of socioeconomic disparities between the cities did not have a deep impact on this prevalence. Interestingly, Ribeirão Preto presented higher rates of smoking and alcohol use than São Luís; we would expect the opposite if we consider the socioeconomic differences between the cities. Data from a secondary analysis of a recent North American study found that socioeconomic measures were not significantly related to seeking treatment for UI [10]. Our results are similar to those of other studies in Brazil, such as a survey of 220 women interviewed 2 years after delivery; they found a prevalence of UI after vaginal delivery of 17% and after elective caesarean section of 18.9%, with the presence of UI during pregnancy as a risk factor for persistence during postpartum [11]. It also resembles the results published by The International Consultation on Incontinence; their estimates of UI during postpartum vary between 15 and 30% [12]. To our knowledge, this is the cross-sectional study with the largest cohort postpartum follow-up studying UI in Latin America.

It is expected that UI prevalence during the postpartum period is high until 6 months after delivery. A systematic review found that the UI prevalence after 3 months postpartum was 33% [13]. Interestingly, a longitudinal follow-up of patients until 24 months postpartum found that half of the UI cases improved within this period [14]. However, the study with the longest follow-up period for UI found that the

Table 2 Sociodemographic and clinical (binomial) variables and the presence of postpartum urinary incontinence (UI) in Ribeirão Preto and São Luís

Variables		Ribeirão Preto			São Luís		*p* value *
		Without UI *n* (%)	With UI *n* (%)	*p* value*	Without UI *n* (%)	With UI *n* (%)	
Paid occupation	No	1,330 (81.60)	300 (18.40)	0.006	1,909 (88.58)	246 (11.42)	0.930
	Yes	1,757 (84.96)	311 (15.04)		991 (88.48)	129 (11.42)	
Prolonged standing at work	No	837 (85.76)	139 (14.24)	0.302	483 (88.62)	62 (11.38)	0.773
	Yes	917 (84.13)	173 (15.87)		502 (88.07)	68 (11.93)	
Carry weight with frequency	No	1,384 (85.64)	232 (14.36)	0.064	840 (88.89)	105 (11.11)	0.106
	Yes	372 (82.12)	81 (17.88)		142 (84.52)	26 (15.48)	
Tobacco use during pregnancy	No	2,515 (83.83)	485 (16.17)	0.233	2,665 (88.86)	334 (11.14)	0.089
	Yes	573 (81.97)	126 (18.03)		235 (85.45)	40 (14.55)	
Alcohol use during pregnancy	No	2,388 (83.61)	468 (16.39)	0.752	2,500 (88.97)	310 (11.03)	0.076
	Yes	700 (83.04)	143 (16.96)		400 (86.02)	65 (13.98)	
Planned pregnancy	No	1,608 (82.97)	330 (17.03)	0.402	1,958 (87.57)	278 (12.43)	0.011
	Yes	1,470 (84.00)	280 (16.00)		938 (90.63)	97 (9.37)	
Diabetes mellitus	No	3,054 (83.64)	597 (16.35)	0.004	2,887 (88.61)	371 (11.39)	0.186
	Yes	29 (67.44)	14 (32.56)		10 (76.92)	3 (23.08)	
Gestational diabetes	No	2,890 (83.99)	551 (16.01)	0.001	2,833 (88.61)	364(11.39)	0.378
	Yes	192 (76.19)	60 (23.81)		64 (85.33)	11 (14.67)	
Episiotomy	No	473 (82.45)	93 (17.55)	0.543	566 (87.62)	80 (12.38)	0.733
	Yes	800 (83.68)	156 (16.32)		939 (88.17)	126 (11.83)	
Labour analgesia	No	550(83.58)	108(16.42)	0.920	1,453 (88.06)	197 (11.94)	0.363
	Yes	2,532(83.43)	503(16.57)		1,443 (89.07)	177 (10.93)	
Intrapartum oxytocin	No	1,793(84.70)	324 (15.30)	0.177	1,906 (88.32)	252 (11.68)	0.576
	Yes	838 (82.81)	174 (17.19)		993 (88.98)	123 (11.02)	
Mode of delivery	Vaginal	1,231 (83.57)	242 (16.43)	0.969	1,470 (87.76)	205 (12,240	0.163
	Caesarean	1,782 (83.47)	353 (16.53)		1,430 (89.38)	170 (10.62)	

*Chi-squared test

prevalence of UI remained almost the same (37.9%), with 76.4% persistence of urinary complaints in women reported 3 months postpartum [15].

It was shown that the weight gain during pregnancy was the only risk factor associated with UI in Ribeirão Preto after multivariate analysis. This is similar to some studies, such as that by Hernandez et al., which found that after a 6-month postpartum period women who acquired UI were more frequently associated with higher weight gain [16]. An epidemiological study has found that weight loss postpartum may be important for avoiding incontinence and regaining continence [17]. Usually, the foetus is responsible for most of the maternal weight gain, followed by blood, extracellular fluid and adipose tissue [18]. However, it was recently shown that in obese/overweight women, maternal fat, but not lean mass, is increased after an excessive gestational weight gain [19].

The impact of weight has been studied in the literature on UI. For non-pregnant women, the Program to Reduce Incontinence by Diet and Exercise (PRIDE) study sponsored by the NIDDK has published several studies showing that the comprehensive behavioural weight-loss programme resulted in a greater reduction in the frequency of self-reported UI episodes, with a tendency to maintain this result if weight is controlled for 12 months [20]. The EPINCONT study showed that there is a correlation between weight gain and UI in an adult population [21]. Weight gain may be indirectly related to abdominal adiposity, such as BMI. However, women were not statistically related to postpartum UI in this cohort of women after multivariate analysis. Two other variables that did not remain statistically associated with UI in the final model were diabetes mellitus and gestational diabetes. Chuang et al. showed that gestational diabetes increases the presence of UI in a 2-year cohort of 6,653 women and Kim et al. also showed that stress UI is common among women with a history of gestational diabetes [22, 23]. It is possible that a higher rate of gestational diabetes in Ribeirão Preto than in São Luís could be explained by an underdiagnosis of this disease in São Luís.

Greater parity was also associated in the univariate analysis, which is compatible with previous studies, such as the EPINCONT initiative and McArthur's study. However, it did not remain in the multivariate analysis, similar to tobacco use. It is already known that smoking increases urgency and frequency by three times in women [24]. Furthermore, it is also known that pregnant women who smoke do not tend to quit smoking (53.8%) [25].

Table 3 Sociodemographic and clinical (continuous) variables and the presence of postpartum urinary incontinence (UI) in Ribeirão Preto and São Luís

Variables	Ribeirão Preto				São Luís		
	UI	*n*	Mean (standard deviation)	*p* value*	*n*	Mean (standard deviation)	*p* value*
Age (years)	No	3,088	27.06 (±6.19)	0.491	2,900	25.41 (±6.06)	0.386
	Yes	611	27.24 (±6.23)		375	25.12 (±5.76)	
Family income (R$)	No	2,637	2,359.77 (±2,008.72)	0.073	2,408	1,780 (±2,308.87)	0.064
	Yes	523	2,189.10 (±1,883.65)		309	1,529 (±1,678.40)	
Weight gain during pregnancy (kg)	No	2,837	13.37 (±5.76)	0.005	2,354	12.85 (±5.94)	0.843
	Yes	553	14.12 (±6.26)		301	12.92 (±6.26)	
BMI (kg/m^2)	No	2,603	29.48 (±5.15)	0.010	2,084	27.71 (±4.27)	0.126
	Yes	520	30.12 (±5.30)		273	28.14 (±4.35)	
Hours in labour	No	1,226	6.89(±8.52)	0.143	1,387	7.07 (±12.33)	0.046
	Yes	240	7.83 (±9.08)		192	5.24 (±7.96)	
Hours in labour before non-elective caesarean section	No	1,753	5.12 (±10.26)	0.008	1,333	8.62 (±16.95)	0.601
	Yes	345	6.83 (±13.72)		160	9.37 (±18.01)	
Parity	No	3,084	1.77 (±1.08)	0.079	2,900	1.84 (±1.11)	0.382
	Yes	610	1.84 (±1.10)		375	1.96 (±1.23)	
Birthweight (g)	No	3,088	3,154.10 (±527.96)	0.697	2,893	3,197.78 (±536.991)	0.993
	Yes	611	3,166.17 (±526.49)		375	3,197.02 (±545.82)	
Head circumference (cm)	No	2,898	34.36 (±1.83)	0.753	2,878	33.94 (±1.77)	0.765
	Yes	578	34.33 (±1.83)		375	33.91 (±1.62)	

*Student's *t* test

Our study did not find any differences associating the mode of delivery and the presence of UI in the two cities. Tahtinen et al. recently published a systematic review with meta-analysis regarding mode of delivery and found that vaginal delivery increased two-fold the risk of SUI compared with caesarean section (elective or not) after 1 year postpartum and caused an absolute increase of 8%; a subgroup analysis showed that if the comparison had been made with elective caesareans, the risk would increase three-fold [26]. Another variable that was not associated with UI and commonly investigated was the episiotomy. Some studies consider episiotomy to be a risk factor [27], but a recent study by Bo et al. found no influence of episiotomy on the prevalence of UI [28] and at our institution, we did not find episiotomy to be a risk factor for perineal trauma [29].

The strengths of this study are the number of women who have been followed up for a period over 12 months; the possibility of assessing differences between two cities with socioeconomic disparities that could influence UI prevalence; and the high percentage of women who returned to follow-up (69.4%). The number of patients followed in our study is comparable with one of the largest postpartum cohort studies in the literature [15], with a higher compliance at follow-up, and its sample size was sufficient to calculate all descriptive and subgroup analyses. Moreover, the variable that was associated with UI in Ribeirão Preto (weight gain during pregnancy) did not show a statistical difference when analysing baseline data between the group of women who returned after 12–24 months and the group of women who did not come back; this analysis reinforces that we did not have a major selection bias in the group analysed after 12–24 months. As for weaknesses, it is important to mention that we did not assess the UI prevalence during pregnancy in this cohort of women, as a standardised UI questionnaire was not used to interview these women and we did not also discriminate for subtypes of UI; some independent variables (frequently overweight, episiotomy, prolonged standing position during pregnancy) presented with missing data. Moreover, other independent variables related to perineal trauma that could be included in the study to address UI are lacking, such as duration of the second stage of labour, birthing position during the second stage and foetal presentation. As a cross-sectional study, this design cannot attribute causality to any of the independent variables.

Most studies report a large number of risk factors with considerable disagreement among some of them in regard to their influence on urinary incontinence. The great number of variables to be simultaneously observed and the role they play during pregnancy makes it difficult for the researcher to individualise them and to understand their exact function in the pathophysiology of UI during pregnancy and postpartum.

A higher prevalence of UI was found in a city with higher socioeconomic indices. It is important to address the control of weight gain during gestation by understanding the characteristics of each population. Pregnant women should know how much weight they can gain during gestation; a study from a developed country showed that only a third of women

Table 4 Univariate and multivariate analyses of variables associated with postpartum urinary incontinence from Ribeirão Preto and São Luís

Variables	Ribeirão Preto				São Luís			
	Crude OR (95%CI)	*p* value	Adjusted OR* (95%CI)	*p* value	Crude OR (95%CI)	*p* value	Adjusted OR* (95%CI)	*p* value
Age	1.004 (0.991–1.019)	0.491			0.992 (0.974–1.010)	0.386		
Education level (< 4 × 12 years)	0.849 (0.654–1.104)	0.222			0.879 (0.599–1.292)	0.514		
Education level (<4 × 4–11 years)	0.908 (0.733–1.055)	0.379			1.115 (0.854–1.455)	0.422		
Skin colour (non-white versus white)	0.885 (0.743–1.055)	0.174			1.067 (0.808–1.410)	0.645		
Paid occupation	0.785 (0.659–0.934)	0.006	0.111 (0.006–1.836)	0.125	1.010 (0.805–1.266)	0.930		
Prolonged standing at work	1.136 (0.891–1.447)	0.301			1.055 (0.731–1.521)	0.773		
Carry weight with frequency	1.298 (0.984–1.714)	0.065	1.298 (0.872–1.932)	0.198	1.464 (0.920–2.331)	0.107	1.089 (0.496–2.392)	0.830
Alcohol use during pregnancy	1.085 (0.869–1.354)	0.467			1.342 (0.995–1.811)	0.054	0.556 (0.228–1.356)	0.197
Tobacco use during pregnancy	1.140 (0.919–1.415)	0.234			1.358 (0.953–1.935)	0.090	1.268 (0.442–3.638)	0.659
Parity	1.057 (0.979–1.140)	0.155			1.091 (0.998–1.192)	0.053	0.880 (0.682–1.135)	0.327
Hours in labour	1.009 (0.996–1.023)	0.147			0.978 (0.957–1.000)	0.054	0.950 (0.894–1.010)	0.104
Hours in labour before non-elective caesarean section	1.011 (1.002–1.020)	0.010	1.001 (0.986–1.016)	0.864	1.002 (0.993–1.011)	0.601		
Planned pregnancy	0.928 (0.779–1.105)	0.402			0.728 (0.570–0.929)	0.011	0.620 (0.322–1.193)	0.153
Diabetes mellitus	2.469 (1.297–4.701)	0.006	2.608 (0.660–10.297)	0.171	2.334 (0.639–8.520)	0.199		
Gestational diabetes	1.639 (1.209–2.221)	0.001	1.171 (0.623–2.201)	0.622	1.337 (0.699–2.559)	0.380		
Vaginal delivery × caesarean section	1.007 (0.842–1.205)	0.933			1.173 (0.945–1.455)	0.147		
Forceps/vacuum × caesarean section	1.085 (0.621–1.894)	0.774			–	–		
Episiotomy	0.916 (0.691–1.215)	0.543			0.949 (0.704–1.280)	0.733		
Labour analgesia	1.012 (0.805–1.269)	0.920			0.904 (0.729–1.122)	0.363		
Intrapartum oxytocin	1.149 (0.929–1.406)	0.177			0.936 (0.745–1.177)	0.576		
Weight gain during gestation	1.022 (1.006–1.037)	0.006	1.041 (1.010–1.073)	0.009	1.002 (0.981–1.023)	0.843		
Body mass index >30 kg/m^2	1.424 (1.075–1.886)	0.014	0.861 (0.516–1.436)	0.568	1.307 (0.939–1.818)	0.314		
Birthweight 4,000 g or more	0.945 (0.605–1.475)	0.805			1.272 (0.828–1.954)	0.271		
Head circumference 38 cm or more	1.328 (0.746–2.362)	0.334			1.542 (0.586–4.052)	0.380		

OR odds ratio, *CI* confidence interval

*Logistic regression using all variables with *p* level below 0.10 during univariate analysis

identified their adequate weight gain recommendation [30]. Future studies must be performed using quality-of-life questionnaires during all trimesters of gestation and the postpartum period with the aim of a better understanding of the risk factors associated with UI.

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Compliance with ethical standards

Conflicts of interest None.

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