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CLINICAL ARTICLE

Obstetrics

Risk and protective factors for pregnancy-related urinary incontinence until 1 year postpartum: A cohort study using patient-reported outcome measures in Italy

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Abstract

Objective: To investigate the epidemiology of pregnancy-related urinary incontinence (UI) and the related risk factors, focusing also on women's characteristics related to maternity pathway utilization.

Methods: In this prospective cohort study, we used patient-reported data obtained from the systematic survey on the maternity pathway that all pregnant women in Tuscany, Italy, can join. We selected 8410 women who completed—between March 2019 and November 2022—all five follow-up questionnaires from the first trimester until 12 months postpartum, each including a UI-specific patient-reported outcome measure. We performed panel regression models to explore the related risk factors.

Results: Prevalence of UI was 4.4% at the first trimester, 23.7% at the third trimester, and 15.6%, 12.6%, and 12.4% at 3, 6, and 12 months postpartum. UI occurrence and severity were higher in older, overweight/obese, and unemployed women. High-risk pregnancy and discomfort during pregnancy were risk factors. Receiving a cesarean section reduced the risk, while spontaneous tears, episiotomy, and high birth weight increased it. Women who experienced delays in pregnancy examinations because of long waiting times and women who had planned pregnancy had a higher risk, while performing during-pregnancy pelvic-floor-muscle training was protective.

Conclusion: Besides confirming the classic risk and protective factors for UI, we also found novel determinants related to the proper maternity pathway utilization.

KEYWORDS
ICIQ-SF, maternity pathway, patient-reported outcome, pelvic-floor-muscle training, postpartum, pregnancy, urinary incontinence

1 | INTRODUCTION

Pregnancy-related urinary incontinence (UI) is a well-defined clinical condition, but its reported prevalence can vary widely depending on geographic area and assessment methodology. It can affect 35%–67% of women during pregnancy and 15%–45% after delivery.[1] The most common type of pregnancy-related UI is stress UI, caused by increased abdominal pressure and hormonal changes during

pregnancy and the impact of childbirth on pelvic floor muscles.[2] The negative impact of pregnancy-related UI on women's health-related quality of life can be significant, including functional, psychological, physical, and social consequences. However, many women may not report their symptoms because of the resulting social stigma, and physicians may not inquire about them.[3]

Patient-reported outcome (PRO) measures have gained increasing relevance in clinical and research settings for the evaluation of pelvic floor diseases.[4] The International Consortium for Health Outcomes Measurement has established a standard set of PRO measures to explore women's health during pregnancy and childbirth.[5] PRO measures may help acquire a more patient-centered perspective, thereby aligning managerial goals with user needs, avoiding the "silo-vision" focused on the performance of a single hospital or department, and ultimately improving patient outcomes.[6]

Several previous articles exploring the epidemiology of pregnancy-related UI are available.[7,8] However, few studies have used a longitudinal approach to collect data from large populations with long-term follow up after delivery, especially in the Italian context. In a previous paper, we explored the main sociodemographic and delivery-related features associated with a higher risk of pregnancy-related UI using patient-reported data collected longitudinally up to 6 months postpartum.[9] However, our previous work did not consider variables related to utilization patterns of maternity care pathways, which are crucial risk factors for maternal-fetal comorbidities according to the literature.[10–12]

In this paper, we sought not only to enrich previous results by integrating data collected up to 12 months postpartum and enlarging the study cohort, but also to assess the effect of additional women's characteristics related to maternity care pathway utilization. We aimed to explore the main risk and protective factors for pregnancy-related UI symptomatology and occurrence, with a specific focus on the role of pelvic-floor-muscle training (PFMT) as a preventive intervention.[13]

2 | MATERIALS AND METHODS

2.1 | Study setting, design, and data source

Italy's National Health Service provides free health care for all citizens, according to a decentralized model in which each region is responsible for organizing health care and ensuring equity and quality of care.[14] Tuscany, a region in Central Italy with 3.7 million inhabitants, has a Regional Health Service (RHS) divided into three Local Health Authorities and 26 health districts. Tuscany has 40 hospitals, 95% of which are public, and 25 of them offer a birth center. Every year, about 22 000 women give birth in Tuscany.

The Tuscan RHS collaborated with our research laboratory to conduct a longitudinal systematic survey starting in March 2019 to collect user experiences, health outcomes, and satisfaction levels along the maternity pathway.[15] This survey has been integrated within the *hAPPyMamma* App, which contains the Digital Pregnancy Booklet of the Tuscan RHS. All pregnant women receiving the Pregnancy Booklet (paper or digital) are invited to participate in the online survey upon consent.

The systematic survey on the maternity pathway comprises eight questionnaires administered at different time points from the first trimester of pregnancy to 1 year after delivery. Although the data collected are pseudo-anonymized, they include information on sociodemographic and clinical characteristics, maternity pathway usage, experiences with health services, and satisfaction level. Besides, PRO measures are included at five different time points: first trimester (T0), third trimester (T1), 3 months postpartum (T2), 6 months postpartum (T3), and 12 months postpartum (T4).

The use of these data for research purposes was authorized by the four ethics committees of Tuscany at the end of 2017 and was regulated by the Decree of the President of Tuscany Region number 6/R/2013, in line with the 2011 Italian guidelines on the use of personal data to perform customer satisfaction surveys in the healthcare sector. In this prospective cohort study, we employed these data to explore the risk and protective factors for the onset and severity of pregnancy-related UI. We used a specific PRO measure, the International Consultation on Incontinence Questionnaire—Short Form (ICIQ-SF).

2.2 | Participants

We included all women who answered all five questionnaires containing the ICIQ-SF scale from T0 to T4. The study period was from March 2019 to November 2022. Sociodemographic, pregnancy-related, delivery-related, and maternity pathway-related attributes of the participants were recorded through specific questions at different time points. Data were merged through record linkage using anonymous identifiers. We also assessed whether and when each woman performed PFMT, creating a four-level variable (Table 1).

2.3 | Outcome measure

We used the validated Italian version of the ICIQ-SF questionnaire to assess the presence of UI at each time point and compute the relative score reflecting symptom severity.[16] The ICIQ-SF is a three-item questionnaire that measures the frequency and volume of urine leakage and the overall UI impact. The score ranges from 0 to 21, with higher scores indicating greater symptom intensity. The ICIQ-SF has been incorporated into the core set for assessing pregnancy-related incontinence by the International Consortium for Health Outcomes Measurement.[17]

2.4 | Statistical analyses

We computed the ICIQ-SF score for each woman at all time points. To calculate UI prevalence, we created the dummy variable "Presence of UI", assuming value 1 when the ICIQ-SF score was non-zero.[18]

TABLE 1 Baseline characteristics of the study cohort according to the presence of UI at 12 months postpartum.

Characteristics	Total ($n=8410$)	No UI at T4 ($n=7368$)	UI at T4 ($n=1042$)	*P* value
Sociodemographic features				
Age class				<0.001
30–39 years	6094 (72.5%)	5336 (72.4%)	758 (72.7%)	
16–29 years	1372 (16.3%)	1234 (16.7%)	138 (13.2%)	
≥40 years	944 (11.2%)	798 (10.8%)	146 (14.0%)	
Maternal BMI				<0.001
Normal weight (18.5–25.0)	5804 (69%)	5142 (69.8%)	662 (63.5%)	
Underweight (<18.5)	593 (7.1%)	551 (7.5%)	42 (4.0%)	
Overweight (25.0–30.0)	1423 (16.9%)	1188 (16.1%)	235 (22.6%)	
Obese (>30.0)	590 (7%)	487 (6.6%)	103 (9.9%)	
Parity				0.003
Primigravida	5266 (62.6%)	4657 (63.2%)	609 (58.4%)	
Multiparous	3144 (37.4%)	2711 (36.8%)	433 (41.6%)	
Nationality				0.78
Italian	8005 (95.2%)	7015 (95.2%)	990 (95.0%)	
Non-Italian	405 (4.8%)	353 (4.8%)	52 (5.0%)	
Education				0.46
University	4718 (56.1%)	4115 (55.8%)	603 (57.9%)	
Middle school or less	555 (6.6%)	490 (6.7%)	65 (6.2%)	
High school	3137 (37.3%)	2763 (37.5%)	374 (35.9%)	
Income status				<0.001
Good	6211 (73.9%)	5496 (74.6%)	715 (68.6%)	
Average or poor	2199 (26.1%)	1872 (25.4%)	327 (31.4%)	
Work condition				0.75
Employed	7235 (86%)	6331 (85.9%)	904 (86.8%)	
Unemployed or student	601 (7.2%)	529 (7.2%)	72 (6.9%)	
Housewife	574 (6.8%)	508 (6.9%)	66 (6.3%)	
Civil status				0.87
Without partner	290 (3.4%)	255 (3.5%)	35 (3.4%)	
With partner	8120 (96.6%)	7113 (96.5%)	1007 (96.6%)	
Pregnancy features				
High-risk pregnancy				<0.001
No	6751 (80.3%)	5956 (80.8%)	795 (76.3%)	
Yes	1659 (19.7%)	1412 (19.2%)	247 (23.7%)	
Twin pregnancy				0.87
No	8284 (98.5%)	7257 (98.5%)	1027 (98.6%)	
Yes	126 (1,5%)	111 (1.5%)	15 (1.4%)	
UI during pregnancy				<0.001
No	6417 (76.3%)	5906 (80.2%)	511 (49.0%)	
Yes	1993 (23.7%)	1462 (19.8%)	531 (51.0%)	
Discomfort during pregnancy				<0.001
No	2299 (27.3%)	2104 (28.6%)	195 (18.7%)	
Yes	6111 (72.7%)	5264 (71.4%)	847 (81.3%)	
Smoking during pregnancy				0.10
No	7939 (94.4%)	6944 (94.2%)	995 (95.5%)	
Yes	471 (5.6%)	424 (5.8%)	47 (4.5%)	

(Continues)

TABLE 1 (Continued)

Characteristics	Total ($n=8410$)	No UI at T4 ($n=7368$)	UI at T4 ($n=1042$)	*P* value
Folate intake				0.36
Yes	8084 (96.1%)	7077 (96.1%)	1007 (96.6%)	
No	326 (3.9%)	291 (3.9%)	35 (3.4%)	
Pertussis vaccination				0.67
No	3484 (41.4%)	3046 (41.3%)	438 (42.0%)	
Yes	4926 (58.6%)	4322 (58.7%)	604 (58.0%)	
Influenza vaccination				0.13
No	6742 (80.2%)	5925 (80.4%)	817 (78.4%)	
Yes	1668 (19.8%)	1443 (19.6%)	225 (21.6%)	
Delivery features				
Mode of delivery				<0.001
Spontaneous	5662 (68.3%)	4862 (66.9%)	800 (78.5%)	
Cesarean section	2052 (24.8%)	1920 (26.4%)	132 (13.0%)	
Operative	574 (6.9%)	487 (6.7%)	87 (8.5%)	
Tears				<0.001
No	3019 (36.9%)	2653 (37.0%)	366 (36.6%)	
Spontaneous	2362 (28.9%)	1977 (27.6%)	385 (38.5%)	
Episiotomy	742 (9.1%)	626 (8.7%)	116 (11.6%)	
Cesarean section (N/A)	2052 (25.1%)	1920 (26.8%)	132 (13.2%)	
Birth weight				<0.001
≤75th centile (3.5 kg)	5929 (72.2%)	5245 (72.9%)	684 (67.5%)	
>75th centile (3.5 kg)	2279 (27.8%)	1950 (27.1%)	329 (32.5%)	
Pathway attributes				
Access to health services				0.17
Easy	6915 (82.2%)	6074 (82.4%)	841 (80.7%)	
Average or difficult	1495 (17.8%)	1294 (17.6%)	201 (19.3%)	
Delays in examinations due to waiting				0.001
Never	5924 (70.4%)	5234 (71.0%)	690 (66.2%)	
Sometimes or often	2486 (29.6%)	2134 (29.0%)	352 (33.8%)	
Perceived involvement in choices				0.16
Low or average	5235 (62.2%)	4566 (62.0%)	669 (64.2%)	
High	3175 (37.8%)	2802 (38.0%)	373 (35.8%)	
Planned pregnancy				0.43
Yes	4910 (58.4%)	4290 (58.2%)	620 (59.5%)	
No	3500 (41.6%)	3078 (41.8%)	422 (40.5%)	
Examination booking				0.17
Booked by health workers	7642 (90.9%)	6707 (91.0%)	935 (89.7%)	
On their own	768 (9.1%)	661 (9.0%)	107 (10.3%)	
Pelvic-floor-muscle training				<0.001
Just after pregnancy	948 (11.3%)	800 (10.9%)	148 (14.2%)	
Just during pregnancy	1860 (22.1%)	1649 (22.4%)	211 (20.2%)	
During + after pregnancy	1197 (14.2%)	1022 (13.9%)	175 (16.8%)	
Never	4405 (52.4%)	3897 (52.9%)	508 (48.8%)	

Note: Data are presented as number (percentage). All these variables were used as covariates in multivariable panel models. Our data set had no missing data except for mode of delivery ($n=122$), tears ($n=235$), and birth weight ($n=202$) because these variables were obtained from the delivery questionnaire, which did not include the ICIQ-SF items.

Abbreviations: BMI, body mass index (calculated as weight in kilograms divided by the square of height in meters); ICIQ-SF, International Consultation on Incontinence Questionnaire—Short Form; T4, 12 months postpartum; UI, urinary incontinence.

Furthermore, we recoded the responses to define the type of UI (stress, urgent, mixed, undefined) using a specific question from the ICIQ-SF scale that asked women when and how they happened to leak urine. We then categorized all the women's baseline characteristics and compared them between women who did and did not report UI at T4, as well as between PFMT groups.

We ran panel regression models to explore the risk and protective factors associated with UI occurrence and greater symptom severity. We used linear regressions for ICIQ-SF scores and logistic regressions for UI onset. The models were adjusted for respondent characteristics (Table 1) and health district fixed effects using the variable "health district of residence" to account for geographic differences. We estimated the R^2 (linear regression) and Pseudo R^2 (logistic regression) coefficients to assess the models' goodness of fit. We performed a sub-analysis stratifying by UI type to explore the preventive and/or rehabilitative role of PFMT. We investigated how the performance of PFMT influenced UI symptom intensity over time according to UI type, using the same models described above.

We used aggregated administrative health data provided by the Tuscan Health Authority to our laboratory under a collaborative agreement to verify the representativeness of our sample compared with the general population (Table S1). We identified the general population of pregnant women in Tuscany between 2019 and 2021 ($n=65\,939$) using the Birth Assistance Certificate, an administrative database comprising all women giving birth annually in Tuscany. We stratified both the study cohort and the general population in 36 strata (Table S2), using age (three-level variable), nationality (two-level variable), parity (two-level variable), and education (three-level variable). After computing—in both data sets—the number of observations for each stratum in all health districts, we divided the value in the real population by the value in our sample. This proportion represents the "weight" variable used to weight our regression models on the general population and obtain a more generalizable result (Table S3).

Statistical analyses were performed with Stata software version 17.0 (Stata Corp, LLC, College Station, TX, USA). Statistical significance was set at a *P* value below 0.05.

2.5 | Ethical approval

Before launching the systematic survey on the maternity pathway, we submitted to the evaluation of the four ethics committees of Tuscany and obtained their *nihil obstat* between November and December 2017. Therefore, as explained in previously published papers using the same data source,[9,18] informed consent and ethics approval were not required to conduct the present study, in line with the 2011 Italian guidelines on processing personal data to perform customer satisfaction surveys in the healthcare sector. The use of PRO measures has also been regulated within this legal framework with the Decree of the President of Tuscany Region number 6/R/2013, so PRO measures have been equated with other types of surveys, such as patient-reported experience questionnaires, for which informed consent is not required. Patients were also accurately informed, using a specific informative document, that they were free to participate or not in the survey and could drop out at any time.

3 | RESULTS

We obtained 8410 respondents who completed all five follow-up questionnaires up to T4. As shown in Table 2, the overall UI prevalence was 4.4% ($n=370$) at T0, 23.7% ($n=1993$) at T1, 15.6% ($n=1315$) at T2, 12.6% ($n=1059$) at T3, and 12.4% ($n=1042$) at T4. The weighted prevalence was 5.4% at T0, 24.1% at T1, 14.7% at T2, 13.2% at T3, and 12.4% at T4. Finally, the mean ± standard deviation ICIQ-SF scores were 7.6 ± 2.7 at T0, 8.2 ± 3.1 at T1, 8.5 ± 3.4 at T2, 8.5 ± 3.3 at T3, and 8.7 ± 3.4 at T4.

Table 1 and Table S4 show the baseline characteristics of women. Most women were between 30 and 39 years old, of normal weight, and Italian. These characteristics differed from those of the general population (Table S1). More than half were primigravidae and had a university degree, unlike the general population (Table S1). A good income status was reported by 74% of women. Most women were employed and lived with a partner. The sociodemographic features differed between women who did not experience UI and women who did 1 year postpartum, with a higher proportion of older, overweight/obese, multiparous, and poorer women in the second group. The other characteristics of women are shown in Table 1 but are not discussed here for synthetic purposes.

Prevalence of UI was very similar at T0 and T1 in all women, regardless of PFMT (Figure 1). At T2, T3, and T4, UI prevalence was lower in women who had performed PFMT during pregnancy or who had never performed PFMT. Women who performed PFMT during pregnancy and experienced UI had constant symptom intensity throughout the follow up, whereas those who never performed PFMT had increasing symptom severity after delivery, especially at 6 and 12 months postpartum. Women who performed PFMT only after delivery had low symptom severity at early pregnancy, which then worsened at later time points reaching the highest average values postpartum. Finally, women who performed PFMT both during pregnancy and postpartum reported the most intense symptomatology at the beginning of pregnancy and immediately after childbirth.

The main risk and protective factors that emerged from the weighted models are shown in Figure 2 and Tables S5 and S6. The risk of UI occurrence, but not of more severe symptomatology, was higher in women over 40 years. Overweight and obesity were risk factors for both UI occurrence and more severe symptoms, whereas being underweight was protective. UI occurrence was lower in housewives than in employees. Women reporting a high-risk pregnancy (i.e. a pregnancy with complications) and distress during pregnancy (i.e. changes in couple life, relationship difficulties with the family, difficulties in managing the other

TABLE 2 Urinary incontinence (UI) prevalence and ICIQ-SF scores at the different time points with a specific focus on UI type.[a]

	T0	T1	T2	T3	T4
Full study cohort ($n=8410$)					
Number	370	1993	1315	1059	1042
Prevalence	4.4%	23.7%	15.6%	12.6%	12.4%
Weighted prevalence	5.4%	24.1%	14.7%	13.2%	12.4%
ICIQ-SF score	7.6±2.7	8.2±3.1	8.5±3.4	8.5±3.3	8.7±3.4
Stress UI					
% of total prevalence	50.3%	60.6%	43.3%	48.8%	58.2%
ICIQ-SF score	7.6±2.8	7.9±3.1	8.0±3.1	8.0±3.1	8.4±3.4
Urgency UI					
% of total prevalence	11.9%	4.7%	11.6%	12.0%	8.9%
ICIQ-SF score	7.1±2.5	7.6±2.9	7.5±2.8	7.5±2.7	7.8±2.8
Undefined UI					
% of total prevalence	24.6%	13.4%	20.5%	14.7%	10.4%
ICIQ-SF score	7.2±2.2	8.4±2.9	8.6±3.4	8.9±3.4	8.5±3.1
Mixed UI					
% of total prevalence	13.2%	21.3%	24.6%	24.5%	22.5%
ICIQ-SF score	8.8±2.9	9.2±3.2	9.8±3.7	9.7±3.6	9.9±3.6

Abbreviations: ICIQ-SF, International Consultation on Incontinence Questionnaire—Short Form; T0, T1, T2, T3, and T4, time points in first trimester and third trimester, and 3, 6, and 12 months postpartum, respectively; UI, urinary incontinence.

[a]Data are presented as number, percentage or mean ± standard deviation.

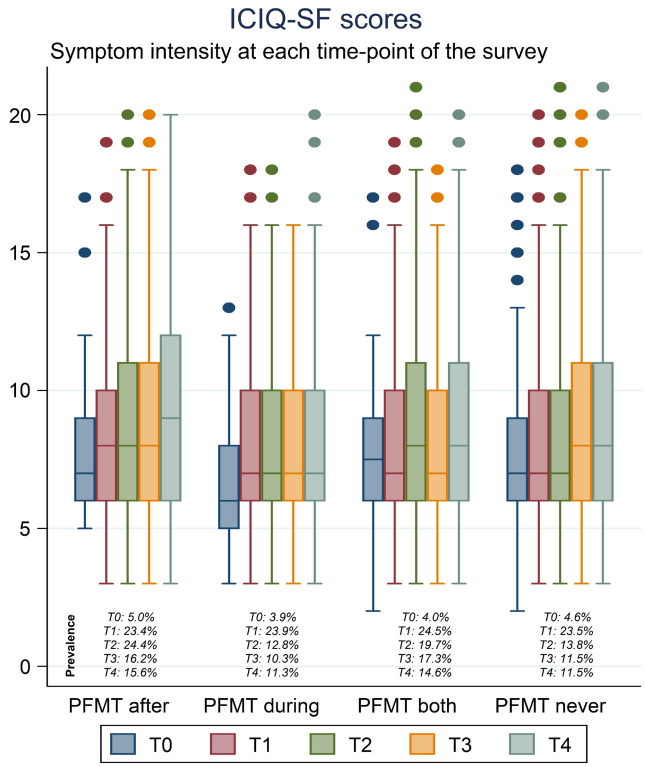

FIGURE 1 Boxplots of International Consultation on Incontinence Questionnaire—Short Form (ICIQ-SF) scores and prevalence of urinary incontinence according to the performance of pelvic-floor-muscle training (PFMT) at the different time points during the maternity pathway (T0: first trimester of pregnancy; T1: third trimester of pregnancy; T2: 3 months postpartum; T3: 6 months postpartum; T4: 12 months postpartum).

children, difficulties in reconciling family and work, reduced time for herself, reduced social life, physical fatigue, financial constraints, physical change, fears related to the child, sense of isolation and loneliness, mood swings) were at higher risk. Cesarean delivery was found to be protective, while undergoing spontaneous tears or episiotomy were found to be risk factors. A birth weight over 3.5 kg increased the risk of only more severe symptoms. Women experiencing delays in pregnancy examinations due to waiting and women who had planned pregnancy had a higher risk.

The risk and protective factors emerged from non-weighted models were comparable (Figure S2). The risk was given by age over 30 years. Non-high income increased the risk, while job condition lost significance. Moreover, experiencing difficult access to health services and not having pregnancy examinations directly booked by healthcare workers were risk factors.

Both weighted and non-weighted models (Figure 2 and Figure S2, respectively) showed that the risk of UI symptom severity and occurrence was higher in women who performed PFMT only postpartum or both during and after pregnancy than in women who performed it only during pregnancy. Furthermore, compared with women who performed during-pregnancy PFMT, women who never carried out PFMT were also at higher risk of more intense symptomatology but not of developing UI ($P>0.05$). This evidence was confirmed by weighted and non-weighted models stratified for UI type (Figure 3; Figure S3; Table S7), which revealed that performing during-pregnancy PFMT rather than also or only after delivery reduced the risk of more intense symptoms in women with stress and mixed UI.

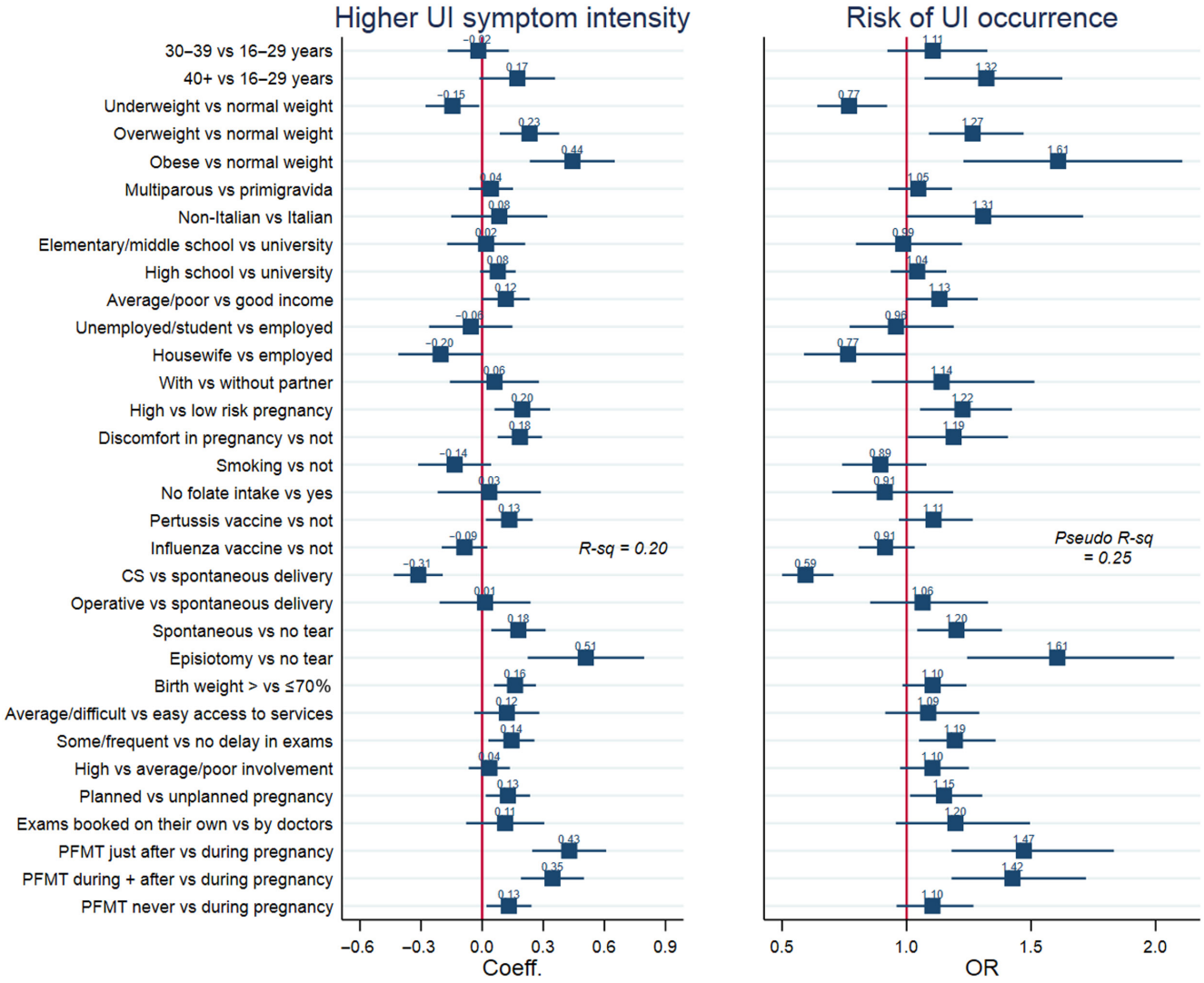

FIGURE 2 Weighted models for urinary incontinence (UI) symptom severity and occurrence. Health district fixed effects were included but are not shown here. UI prevalence and severity was assessed at five time points from the beginning of pregnancy until 1 year postpartum. The value as represented on the square indicates the odds ratio (OR) or Coefficient (Coeff.); the blue segment represents the 95% confidence interval; and the red line represents the baseline above or below which the variable is significant. CS, cesarean section; PFMT, pelvic-floor-muscle training.

4 | DISCUSSION

The present study analyzed patient-reported data from a large cohort of respondents who completed five follow-up questionnaires from the beginning of pregnancy to 1 year postpartum. UI prevalence increased to 24% at the end of pregnancy and decreased to 13% at 6 months postpartum, with a further slight reduction at 12 months postpartum (12%). The lack of reduction in prevalence 1 year after delivery was accompanied by a very mild increase in symptom intensity.

These prevalence values are consistent with previous studies, although slightly lower.[19,20] This could be related to the incomplete representativeness of our cohort, which included a lower percentage of multiparous, overweight, and obese women, whereas a higher proportion of women had vaginal delivery than in the general population of pregnant women (Table S1). Despite weighting prevalence by age, education, parity, and nationality, we did not take into account other known risk factors for pregnancy-related UI (such as maternal weight and mode of delivery) because, otherwise, we would have obtained too many strata, with the risk of having few or no observations in some strata.[21] Moreover, data on maternal weight from administrative databases were incomplete, and the distribution of the mode of delivery was similar between the study cohort and the general population. Also, the underestimation of UI prevalence may be due to the use of self-reported data.[7]

The present study confirmed well-known and widely described risk factors for pregnancy-related UI, such as advanced age, overweight/obesity, high birth weight, spontaneous tears, episiotomy, and vaginal delivery.[22–24] We also found that employment was a risk factor.[25] Finally, we suggested the role of during-pregnancy PFMT as a preventive intervention to reduce UI risk, as previously shown.[9,26,27]

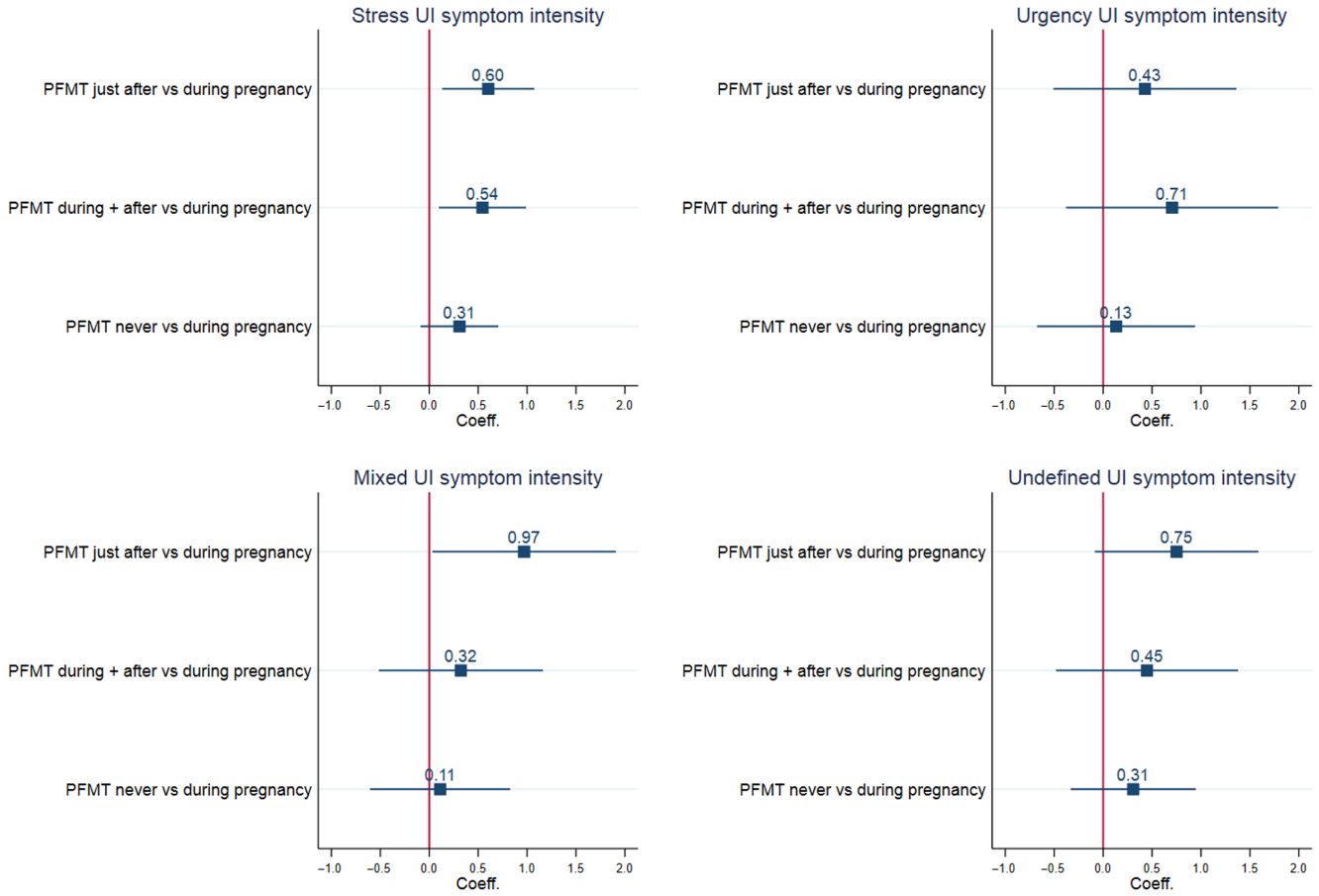

FIGURE 3 Weighted models for urinary incontinence (UI) symptom severity by stratifying for UI type with a specific focus on the role of pelvic-floor-muscle training (PFMT).

The present study also assessed some maternity pathway-related attributes that have been considered in a few previous studies.[10–12] High-risk pregnancy, discomfort during pregnancy, delaying pregnancy examinations due to waiting, difficulty in accessing health services, and not having pregnancy examinations booked by health workers were risk factors. These factors could reflect a broader deficit in the system's ability to provide adequate care to pregnant women, particularly those experiencing discomfort during pregnancy or those with high-risk pregnancies. Identifying these factors underscores the need for targeted interventions to improve the quality and accessibility of maternity care services.

The strength of the present study is the use of a large amount of data collected longitudinally at different time points, from the beginning of pregnancy to 12 months postpartum. Our cohort consisted of a large sample of respondents who completed all follow-up questionnaires. Also, we used a well-validated PRO measure to assess UI. Furthermore, we used weighted models to account for differences between the study cohort and the general population, and although we did not consider some variables (maternal weight and mode of delivery), we still obtained reliable and robust results.

However, the present study presents some limitations. First, due to the intrinsic nature of patient-reported data, respondents may make mistakes in reporting information and have some difficulties in interpreting the questions and filling them out correctly. However, such data are gaining increasing importance and have been widely employed in the literature. They represent real-world data useful for health managers and policy-makers in outlining user needs, enabling healthcare services to align supply to demand. Nonetheless, despite the advantages associated with the use of PRO measures, the observational nature of the study does not allow for drawing strong conclusions about causality.

Second, the study cohort may not be fully representative of the general population, as we have previously discussed. For instance, we enrolled older women with a higher education level. To overcome this limit, we weighted our statistical models on the general population, considering age class, nationality, parity, and education.

Third, the present study was conducted in one Region, so the findings are not generalizable to the national level. However, we collected data from all over the Region, and as the Italian National Health Service is a decentralized system, our results remain relevant because they provide managers and policy-makers with a useful tool to implement initiatives and strategies within the regional territory.

Finally, our results may be susceptible to confounding factors. For instance, we lacked objective clinical information to compare with patient-reported data, such as the PFMT regimen and intensity

or the prevalence of urinary tract infections. Also, we might not have considered other sociodemographic or clinical variables that were not asked about in our survey. Nevertheless, to our knowledge, this was the first study to explore the epidemiology of pregnancy-related UI using such a large number of covariates and focusing on both individual and managerial attributes.

The present study used data collected from the entire population of pregnant women in Tuscany, gathered systematically and longitudinally from the beginning of pregnancy until 1 year postpartum. We achieved a high response rate to the first questionnaire, with about 55 000 women responding to the T0 questionnaire from March 2019 to November 2022, although the response rate declined over time, with only 8410 women completing all follow-up questionnaires in the same period. To put this into perspective, about 66 000 women gave birth in Tuscany between 2019 and 2021.

Our results have important clinical implications. First, we found that at 12 months postpartum, not only did the prevalence of UI not decrease, remaining around 12%, but also the intensity of symptoms increased slightly. Second, our results suggest the importance of PFMT in reducing UI risk, particularly for women with stress-related or mixed UI. It then becomes essential to implement and promote strategies that allow for reducing UI risk and long-term comorbidities—such as PFMT. These strategies, to be cost-effective, cannot target the whole population but only specific risk groups.[27,28] The present study assessed the main sociodemographic and clinical risk factors for pregnancy-related UI. Moreover, it was the first study to propose that factors related to clinical status during pregnancy and the fruition of the maternity pathway might also affect the risk.

Our findings underscore the need for policies and managerial initiatives that improve access to healthcare services for pregnant women, reduce waiting times for examinations, and encourage healthcare providers to book pregnancy examinations directly on behalf of women. Addressing these factors could help ensure that pregnant women receive timely and appropriate care throughout their maternity pathway. Policy-makers and health managers should also consider measures to increase awareness of UI and its potential long-term consequences, as well as measures to support the provision of effective interventions to reduce the risk.

In conclusion, the present study not only reported on classical risk factors and the beneficial role of during-pregnancy PFMT as a preventive strategy to be promoted in specific risk groups but also highlighted several risk factors related to the women's experiences and clinical conditions during pregnancy and to the fruition of the maternity pathway, on which policy-makers and health managers could act to improve the women's perceived quality of life and avoid long-term comorbidities.

AUTHOR CONTRIBUTIONS

Amerigo Ferrari: Conceptualization; data curation; formal analysis; investigation; methodology; data analysis; writing—original draft; writing—review and editing. **Paolo Mannella:** Writing—original draft; data analysis. **Alessia Caputo:** Writing—review and editing; interpretation of data. **Tommaso Simoncini:** Conceptualization; validation; writing—review and editing. **Manila Bonciani:** Conceptualization; project administration; supervision; validation; writing—review and editing.

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CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest.

DATA AVAILABILITY STATEMENT

Research data are not shared.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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