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ORIGINAL RESEARCH ARTICLE

Stress and urgency urinary incontinence one year after a first birth—prevalence and risk factors. A prospective cohort study

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Abstract

Introduction: Few prospective studies have examined the effect of pregnancy and childbirth on stress and urgency urinary incontinence separately. The aim of the present study was to assess the extent to which pregnancy, vaginal delivery, and vaginal delivery characteristics affect the risk of significant stress and urgency incontinence 1 year after delivery.

Material and methods: We conducted a prospective cohort study of 670 nulliparous women from early pregnancy to 1 year partum. The women were recruited at maternity health care service in Region Örebro County, Sweden, between October 1, 2014 and October 1, 2017 and completed questionnaires in early and late pregnancy and at 8 weeks and 1 year postpartum. Primary outcome measures were significant stress and urgency incontinence at 1 year postpartum in women who reported being continent before pregnancy. Generalized linear models were used.

Results: Stress and urgency incontinence commencing before pregnancy were reported by 4% and 3% of women, respectively, in the first questionnaire in early pregnancy, and these women were excluded from subsequent analysis. Stress and urgency incontinence were reported by 21% and 8%, respectively, at 1 year postpartum, in women not reporting incontinence before pregnancy. Stress incontinence during pregnancy increased the risk of stress incontinence postpartum (risk ratio [RR] 2.48, 95% CI 1.86–3.3). Urgency incontinence during pregnancy increased the risk of urgency incontinence postpartum (RR 4.07, 95% CI 2.1–7.89). Vaginal delivery increased the risk of stress incontinence postpartum (adjusted RR 2.63, 95% CI 1.39–5.01) but not of urgency incontinence. This effect of vaginal delivery on stress incontinence was similar irrespective of incontinence status during pregnancy. The population-attributable fraction of stress incontinence associated with vaginal delivery was 0.58 (95% CI 0.23–0.77).

Conclusions: This study shows essentially different risk factors for stress and urgency incontinence, supporting stress incontinence as being the subtype mostly associated with pregnancy and childbirth, and urgency incontinence as being more stable over

Abbreviations: BMI, body mass index; POPRACT, Pelvic Floor In Pregnancy And Childbirth Study; RR, risk ratio.

time. At a population level, vaginal delivery was the major risk factor for stress incontinence, followed by reporting stress incontinence during pregnancy.

KEYWORDS
cohort study, postpartum urinary incontinence, prospective, risk factors, stress urinary incontinence, urgency urinary incontinence

1 | INTRODUCTION

Urinary incontinence is a highly prevalent condition in women, substantially impairing quality of life.[1] The most common types of female urinary incontinence are stress incontinence and urgency incontinence, characterized by urinary leakage during physical strain or accompanied by a strong urge to void, respectively, or a mixture of these, known as mixed incontinence.[2] Stress and urgency incontinence have different treatment options and are presumed to have different underlying pathophysiology.[3]

Studies using retrospective data collection have shown that pregnancy and vaginal delivery increase the risk of postpartum stress incontinence,[4] but there is conflicting evidence whether the risk of postpartum urgency incontinence is likewise increased.[4,5] The ideal population in which to assess the risk of urinary incontinence associated with pregnancy and labor would be primigravid women who were assessed to be continent before pregnancy; however, this is difficult to achieve.[6] To obtain information on pre-pregnancy continence status not influenced by conditions during late pregnancy or postpartum, prospectively including women in early pregnancy is a feasible alternative.

Prospective cohort studies that have enrolled women during the first half of the pregnancy, excluding women with pre-pregnancy urinary incontinence, have found that unspecified urinary incontinence commonly starts during pregnancy and reaches its peak prevalence during the third trimester.[7–9] In our PubMed search we found only one prospective study of women without pre-existing urinary incontinence followed from early pregnancy, that assessed stress and urgency incontinence separately.[10] However, this study did no attempt to differentiate between mild or clinically significant urinary incontinence. Moreover, to our knowledge, no prospective study has calculated the extent to which stress incontinence and urgency incontinence are attributable to vaginal delivery compared with cesarean section.

In order to bridge these gaps of knowledge, we used data from a large cohort study that prospectively collected data from early pregnancy to 1 year postpartum on stress and urgency incontinence. The aim of the present study was to assess the extent to which pregnancy, vaginal delivery, and vaginal delivery characteristics affect the risk of significant stress and urgency incontinence 1 year after delivery.

Key Message

A prospective cohort study found that stress incontinence was the predominant subtype of urinary incontinence 1 year postpartum. Vaginal delivery increased the risk of stress incontinence but not urgency incontinence, accounting for 58% of total prevalence at population level.

2 | MATERIAL AND METHODS

We conducted a prospective cohort study named the Pelvic Floor In Pregnancy And Childbirth (POPRACT) study in Region Örebro County, Sweden. All eligible nulliparous women registering for maternity health care in the region during early pregnancy between October 1 2014 and October 1 2017 were invited to participate by the midwife in charge. Exclusion criteria were first visit at maternity health care after 15^{+6} weeks of gestation, or insufficient knowledge of the Swedish language to complete the questionnaires used in the study. Participants were asked to answer the web-based questionnaires on four occasions: at entry into the study in the early pregnancy, at 36 weeks of gestation, at 8 weeks postpartum, and at 1 year postpartum. Participating women had their delivery at either of the two delivery wards in Region Örebro County, which are located at the Örebro University Hospital and Karlskoga Hospital. The midwife or obstetrician in charge completed a study protocol concerning delivery characteristics including perineal and vaginal tears.[11] In the present study, we focused on participants who responded to the questionnaire both in early pregnancy and at 1 year postpartum. Women reporting a subsequent pregnancy at 1 year postpartum were excluded.

The baseline questionnaire included items on socio-economic status, smoking, and whether urinary leakage occurred before pregnancy. The questionnaire at 1 year postpartum contained questions regarding height and weight. Body mass index (BMI) was calculated on these data, and was grouped as up to 25 kg/m^2, 25.1–30 kg/m^2, and more than 30 kg/m^2. All four questionnaires included a number of questions on pelvic floor dysfunction,[12,13] quality of life,[14,15] and sexual function.[15] The questions on urinary incontinence have been validated both in a general female population,[12] and at 12–18 months postpartum.[13] The first two questions concerned the presence (or absence) of any urinary leakage as well as the frequency of this leakage, henceforth referred to as unspecified incontinence. The answer options were "more seldom than once a month", "once a month or more", "once a week or more", and "every day and/or night". The following questions regard stress and urgency incontinence and their answer options are "yes, often", "sometimes", "infrequently" and "never".

Maternal age at delivery was categorized into up to 35 years and more than 35 years. Delivery mode was classified as vaginal delivery, including both spontaneous and instrumental deliveries, or cesarean section, including both acute and elective cesarean sections. Details regarding the information extracted from the obstetric record system and the study-specific delivery protocol are described in a previous publication on the study cohort.[11]

Primary outcome measures were stress and urgency incontinence reported at 1 year postpartum in women who were continent before pregnancy, presented as proportions, risk ratios, and population-attributable fractions. Stress incontinence was defined as reporting urinary leakage during physical strain "often" or "sometimes". Urgency incontinence was defined as reporting urinary leakage accompanied by a strong urgency to void "often" or "sometimes". Unspecified incontinence was defined as reporting any urinary leakage once a week or more. We also examined urinary incontinence during pregnancy, which was defined as reporting the respective type of incontinence according to the above-mentioned definitions in early pregnancy, late pregnancy, or both.

2.1 | Statistical analyses

Descriptive data are presented as numbers, proportions, and means and standard deviations (SD). Associations between potential risk factors and the various types of incontinence were evaluated using generalized linear models with binomial distribution and log-link function, estimating risk ratio. Adjusted risk ratios were obtained by including potential confounding variables of age and BMI in the model in addition to the risk factors of interest. Adjustment for age and BMI were not performed in the analyses using urinary incontinence during pregnancy as a risk factor for developing incontinence postpartum, because of a risk of overadjustment. Risk difference was estimated using identity link through extensions of generalized linear models to the binomial family. Population-attributable risk and population-attributable fraction were calculated based on risk ratios from generalized linear models. The population-attributable risk is the estimated risk of incontinence among women in this population that would not have occurred if the given exposure had not been present. The population-attributable fraction is the estimated proportion of incontinence incidence among women who delivered that would not have occurred if the given exposure had not been present. Data were analyzed using version 16 of STATA/SE (StataCorp LP).

2.2 | Ethical approval

Ethical approval was given by the Regional Ethical Review Board in Stockholm February 21, 2014 (registration number 2014/124–32). All participants provided written informed consent upon recruitment.

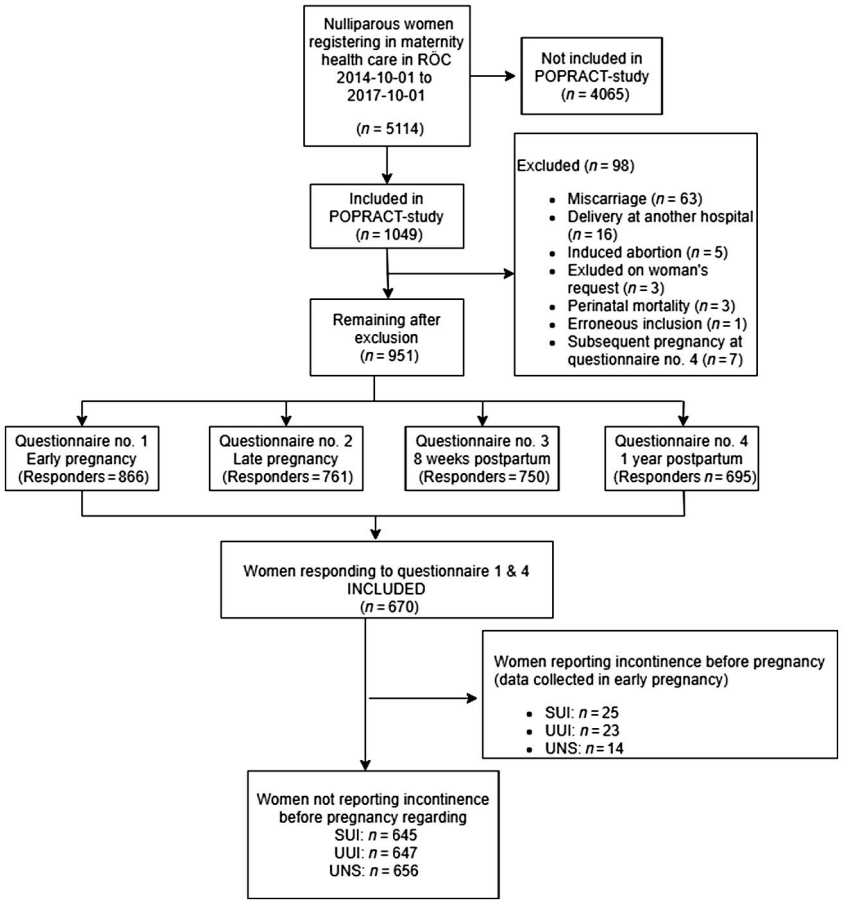

FIGURE 1 Flowchart illustrating the inclusion of the study sample. Responders are defined as women answering the first question about urinary leakage in each questionnaire. RÖC, Region Örebro County; POPRACT, Pelvic Floor In Pregnancy And Childbirth Study; SUI, stress urinary incontinence; UUI, urgency urinary incontinence; UNS, unspecified urinary incontinence

3 | RESULTS

Of the 1049 women included in the POPRACT study, 670 responded to the first question about urinary leakage both in early pregnancy and at 1 year postpartum, so qualifying to be included in the present study. A flowchart showing the inclusion is given in Figure 1. The actual numbers of women included in the analyses of risk factors is presented for each analysis separately, accounting for missing data in relevant variables.

Patient characteristics are shown in Table 1, presented as frequencies and percentages. The sample had a mean (SD, range) age of 28.9 (3.8, 20–41) years, BMI of 25.0 (5.0, 16.8–46.6) kg/m^2, gestational age at birth of 40 weeks (1^{+6} week, 28^{+1} weeks–42^{+3} weeks), fetal birthweight of 3503 (545, 1090–5140) g, and fetal head circumference of 34.8 (1.7, 27–40) cm. Means (SD) of gestational age at completing questionnaires 1 and 2 were 11^{+5} weeks (2^{+2} weeks) and 31 weeks (3^{+3} weeks), respectively. Means (SD) for time postpartum of completing questionnaires 3 and 4 was 11^{+1} weeks (2^{+5} weeks) and 1 year

TABLE 1 Women with and without stress incontinence, urgency incontinence, and unspecified incontinence (reported at follow up 1 year postpartum) by maternal characteristics and delivery mode. The total sample was *n* = 670. Presentation by incontinence status was restricted to women being continent to the specified type of incontinence before pregnancy

	Total sample (*n* = 670)	SUI status 1 year postpartum (*n* = 645)		UUI status 1 year postpartum (*n* = 647)		UNS UI status 1 year postpartum (*n* = 656)	
		No SUI	SUI	No UUI	UUI	No UNS UI	UNS UI
Age at delivery							
≤25 years	119	99 (85%)	18 (15%)	107 (91%)	11 (9%)	105 (89%)	13 (11%)
26–30 years	344	252 (76%)	77 (23%)	310 (94%)	21 (6%)	306 (91%)	32 (9%)
31–35 years	166	126 (79%)	34 (21%)	145 (91%)	14 (9%)	143 (89%)	17 (11%)
>35 years	41	30 (77%)	9 (23%)	36 (92%)	3 (8%)	32 (80%)	8 (20%)
Missing	0	0	0	0	0	0	0
Body mass index at 1 year postpartum							
≤25 kg/m^2	397	314 (82%)	67 (18%)	360 (94%)	25 (6%)	360 (92%)	31 (8%)
25.1–30 kg/m^2	166	122 (75%)	41 (25%)	145 (91%)	14 (9%)	143 (88%)	20 (12%)
>30 kg/m^2	96	65 (72%)	25 (28%)	87 (95%)	5 (5%)	74 (81%)	17 (19%)
Missing	11	6	5	6	5	9	2
Education							
9–<12 years	9	8 (89%)	1 (11%)	9 (100%)	0 (0%)	8 (89%)	1 (11%)
12 years	221	170 (80%)	43 (20%)	190 (89%)	24 (11%)	191 (87%)	29 (13%)
University	437	326 (78%)	94 (22%)	396 (94%)	25 (6%)	384 (91%)	40 (9%)
Missing	3	3	0	3	0	3	0
Smoking							
Yes	14	11 (79%)	3 (21%)	12 (86%)	2 (14%)	11 (79%)	3 (21%)
No	654	494 (79%)	135 (21%)	584 (93%)	47 (7%)	573 (90%)	10%)
Missing	2	2	0	2	0	2	0
Urinary incontinence during pregnancy[a]							
Yes	N/A	67 (58%)	49 (42%)	20 (71%)	8 (29%)	78 (76%)	25 (24%)
No	N/A	405 (83%)	83 (17%)	536 (93%)	39 (7%)	470 (92%)	42 (8%)
Missing	N/A	35	6	42	2	38	3
Delivery mode							
Spontaneous vaginal	465	338 (76%)	107 (24%)	407 (91%)	40 (9%)	402 (88%)	54 (12%)
Vacuum extraction	105	82 (79%)	22 (21%)	98 (96%)	4 (4%)	90 (89%)	11 (11%)
Elective cesarean section	64	56 (92%)	5 (8%)	58 (94%)	4 (7%)	58 (92%)	5 (8%)
Acute cesarean section	34	29 (88%)	4 (12%)	33 (97%)	1 (3%)	34 (100%)	0 (0%)
Missing	2						

Abbreviations: N/A, not applicable; SUI, stress urinary incontinence; UNS UI, unspecified urinary incontinence; UUI, urgency urinary incontinence.
[a]Refers to the corresponding type of urinary incontinence as described in the columns.

TABLE 2 Types and prevalence of urinary incontinence during pregnancy and at 8 weeks and 1 year postpartum. Women reporting the specific type of urinary incontinence before pregnancy were excluded, based on data collected in early pregnancy

	During pregnancy	8 weeks postpartum[d]	1 year postpartum
	n (%)	*n* (%)	*n* (%)
Stress urinary incontinence[a] (*n* = 645)			
Yes	116 (19%)	76 (12%)	138 (21%)
No	488 (78%)	538 (88%)	507 (79%)
Missing	41	31	0
Urgency urinary incontinence[b] (*n* = 647)			
Yes	28 (5%)	34 (6%)	49 (8%)
No	575 (95%)	582 (94%)	598 (92%)
Missing	44	31	0
Unspecified urinary incontinence[c] (*n* = 656)			
Yes	103 (17%)	93 (15%)	70 (11%)
No	512 (83%)	532 (85%)	586 (89%)
Missing	41	31	0

[a]Stress urinary incontinence was defined as reporting urinary leakage during physical stress "often" or "sometimes".

[b]Urgency urinary incontinence was defined as reporting urinary leakage accompanied by a strong urge to void "often" or "sometimes".

[c]Unspecified urinary incontinence was defined as reporting urinary leakage more than once a week.

[d]Prevalence of urinary incontinence at 8 weeks postpartum was not analyzed in the present article, but is included here for the sake of completeness.

2 weeks and 4 days (3 weeks), respectively. Detailed obstetric and fetal characteristics are presented in Supporting Information (Table S1).

Stress, urgency, and unspecified incontinence commencing before pregnancy was reported by 25 (4%), 23 (3%), and 15 (2%) women, respectively, in the first questionnaire in early pregnancy. Women reporting the presence of stress incontinence before pregnancy were excluded from analysis for stress incontinence. Similar exclusions were made in analyses of urgency and unspecified incontinence.

3.1 | Prevalence and progression of urinary incontinence during pregnancy and postpartum

The prevalences of stress, urgency, and unspecified incontinence, respectively, during pregnancy, at 8 weeks postpartum, and at 1 year postpartum, in women not reporting incontinence before pregnancy, are presented in Table 2. Stress incontinence, urgency incontinence, and unspecified incontinence commencing during pregnancy were reported by 19%, 5%, and 17% of women, respectively. At 1 year postpartum, stress incontinence, urgency incontinence, and unspecified incontinence were reported by 21%, 8%, and 9% of women, respectively.

The prevalence of urinary incontinence during pregnancy and 1 year postpartum by incontinence status during pregnancy and by vaginal delivery vs cesarean section, is presented in Figure 2. The highest prevalence of both stress and urgency incontinence was found in women who had the corresponding type of incontinence during pregnancy and underwent a vaginal delivery.

3.2 | Onset of urinary incontinence during pregnancy as a risk factor of incontinence 1 year postpartum

Onsets of stress, urgency and unspecified incontinence during pregnancy were associated with increased risk of the corresponding incontinence reported at 1 year postpartum (see Table 3, panel A). Stress incontinence during pregnancy compared with not reporting stress incontinence was associated with a 23% increased risk of stress incontinence postpartum, whereas having urgency incontinence during pregnancy increased postpartum urgency incontinence by 13%.

3.3 | Contribution of vaginal delivery to urinary incontinence 1 year postpartum

The analysis of delivery mode as a risk factor for urinary incontinence 1 year postpartum is presented in Table 3, panel B. Vaginal delivery increased the risk of stress incontinence, but not for urgency incontinence, and this remained the case after adjustment for age and BMI. Vaginal delivery also statistically significantly increased the risk of unspecified incontinence regardless of status during pregnancy, after adjusting for age and BMI. When stratifying by incontinence status during pregnancy, vaginal delivery was a statistically significant risk factor for stress incontinence 1 year postpartum both in women who were continent during pregnancy and in those who were not. Vaginal delivery compared with cesarean section contributed to 56%–63% of stress incontinence at 1 year postpartum.

Characteristics of vaginal delivery were analyzed as potential risk factors for urinary incontinence, but none of them showed statistically significant association (see Supporting Information Table S2).

4 | DISCUSSION

In this large prospective cohort of primiparous women, stress incontinence was the predominant subtype of de novo incontinence at 1 year postpartum. Stress incontinence during pregnancy increased the risk of stress incontinence postpartum. Urgency incontinence during pregnancy increased the risk of urgency incontinence postpartum. Vaginal delivery increased the risk of postpartum stress incontinence, but not of postpartum urgency incontinence. Vaginal delivery conferred the major population-attributable fraction of

stress incontinence in this cohort, followed by having stress incontinence during pregnancy.

The prospective data collection starting in early pregnancy enabled us to exclude women reporting the presence of incontinence before pregnancy from the analysis of risk factors. Even though the risk of recall bias cannot be ruled out, we consider this risk to be low given the short duration of the pregnancy when responding to the questionnaire. This a strength of our study because primigravid women with no history of urinary incontinence before pregnancy are considered the most suitable population for the assessment of incontinence risk associated with pregnancy and delivery.[6]

We analyzed stress and urgency incontinence separately, as these subtypes are two conditions with different pathophysiology and clinical treatment.[3] As described elsewhere, only one prospective study of women without history of pre-pregnancy urinary incontinence has investigated subtypes of incontinence separately, although this study used only an affirmative answer to define stress and urgency incontinences.[10] To our knowledge, the present study is the first prospective study to focus on women without a history of pre-pregnancy urinary incontinence and to investigate urgency and stress incontinence using cut-offs based on frequency. We defined stress and urgency incontinence as reporting leakage "often" or "sometimes", because reporting symptoms less frequently might include incontinence that is perceived as less significant by the women. We recognize that there might be women being bothered even by infrequently occurring incontinence, and using questions on the impact of incontinence might help to identify these women. However, bother of incontinence is influenced by many factors including psychosocial factors, so in our study to explore biological risk factors we chose to use a definition based on frequency.

The questionnaire we used was chosen because it has been validated on women postpartum,[13] which is the case for only a limited number of questionnaires exploring urinary incontinence.[16] In the present questionnaire, the answer options regarding frequency are different for stress and urgency incontinence (often/sometimes/infrequently/never) and for unspecified incontinence (daily/≥weekly/≥monthly,<monthly), respectively, explaining our different cut-offs for stress and urgency incontinence and for unspecified incontinence. The various cut-offs used probably explain the higher prevalence of stress incontinence compared with unspecified incontinence in this study. Urinary leakage weekly or more often has been suggested as a criterion for significant incontinence in epidemiological research,[17] and the use of a questionnaire that allows the definition of incontinence as such would have helped us to provide estimates that have higher comparability with existing studies. No formal core outcome set is available for urinary incontinence[18] and there is an urgent need

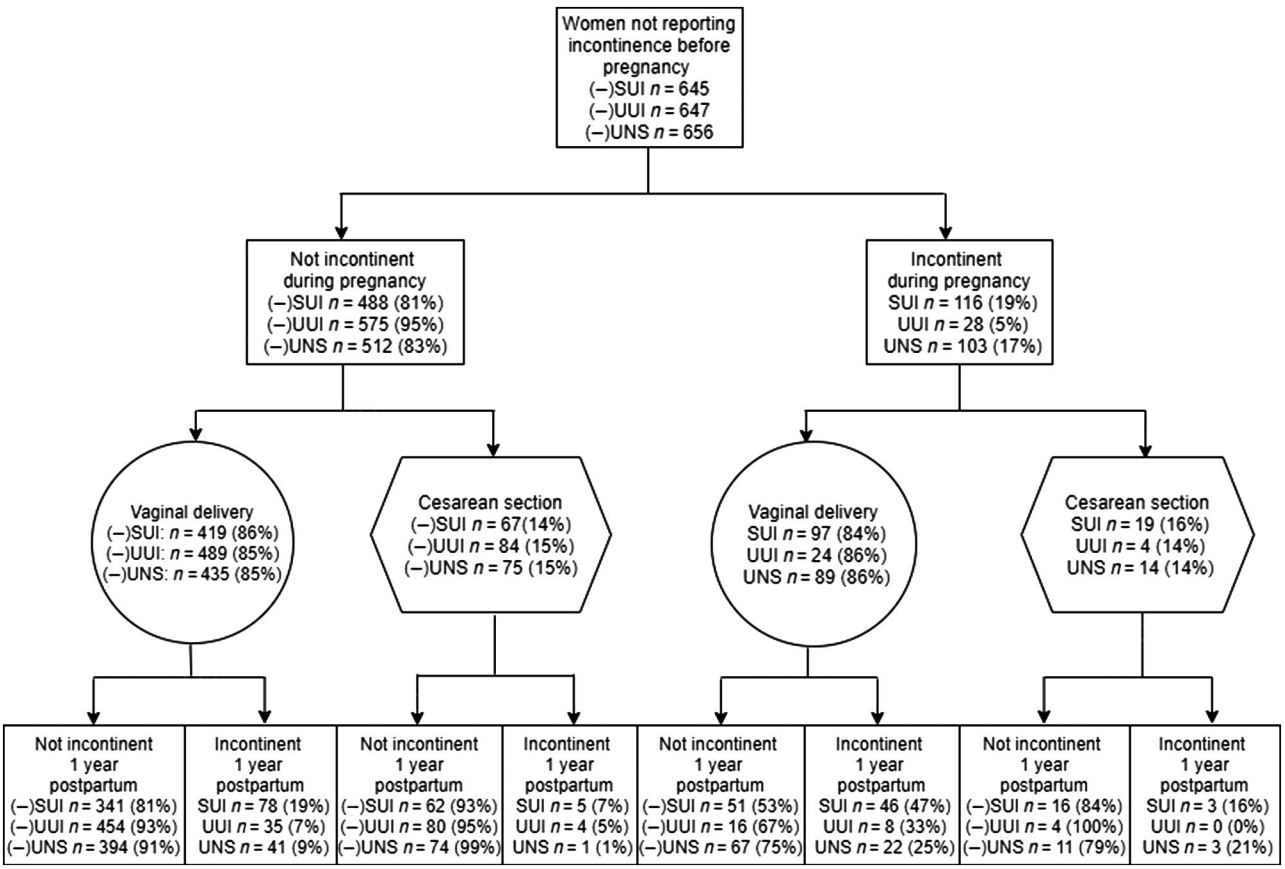

FIGURE 2 Prevalence of urinary incontinence during pregnancy and 1 year postpartum by incontinence status during pregnancy and vaginal delivery vs cesarean section. (–) indicates no urinary incontinence. SUI, stress urinary incontinence; UUI, urgency urinary incontinence; UNS, unspecified urinary incontinence

TABLE 3 Unadjusted and adjusted risk ratios, risk differences, and population-attributable risks and fractions for the associations between urinary incontinence during pregnancy and urinary incontinence 1 year postpartum (Panel A), and vaginal delivery and urinary incontinence 1 year postpartum (Panel B), respectively

Risk factor	Outcome measure	Unadjusted RR (95% CI)	Adjusted RR (95% CI)	Risk difference (95% CI)[a]	Population-attributable risk (95% CI)[a]	Population-attributable fraction (95% CI)[a]
PANEL A						
Urinary incontinence during pregnancy (reference category: no urinary incontinence during pregnancy)						
SUI	SUI ($n = 609$)	2.48 (1.86–3.3)*	Not estimated	0.25 (0.16–0.35)*	0.05 (0.03–0.07)*	0.23 (0.14–0.31)*
UUI	UUI ($n = 604$)	4.07 (2.1–7.89)*	Not estimated	0.21 (0.04–0.37)*	0.01 (0–0.02)*	0.13 (0.02–0.22)*
UNS UI	UNS UI ($n = 630$)	2.93 (1.87–4.59)*	Not estimated	0.16 (0.07–0.24)*	0.03 (0.01–0.04)*	0.25 (0.11–0.36)*
PANEL B						
Vaginal delivery (reference category: cesarean section)						
Including all women regardless of urinary incontinence status during pregnancy						
Vaginal delivery	SUI ($n = 632$)	2.41 (1.27–4.57)*	2.63 (1.39–5.01)*	0.13 (0.06–0.2)*	0.12 (0.07–0.18)*	0.58 (0.23–0.77)*
	UUI ($n = 634$)	1.39 (0.56–3.44)	1.39 (0.55–3.48)	0.02 (0.02–0.86)	0.02 (−0.03–0.06)	0.25 (−0.7–0.67)
	UNS UI ($n = 643$)	2.24 (0.92–5.42)	2.75 (1.13–6.64)*	0.08 (0.06–0.11)*	0.06 (0.02–0.1)*	0.59 (0.07–0.82)*
Among those who did not report urinary incontinence during pregnancy						
Vaginal delivery	SUI ($n = 486$)	2.49 (1.05–5.93)*	Not estimated	0.11 (0.04–0.18)*	0.1 (0.03–0.16)*	0.56 (0.01–0.81)*
	UUI ($n = 573$)	1.5 (0.55–4.12)	Not estimated	0.02 (−0.03–0.07)	0.02 (−0.02–0.06)	0.3 (−0.73–0.72)
	UNS UI ($n = 510$)	7.07 (0.99–50.6)	Not estimated	0.08 (0.04–0.12)*	0.07 (0.04–0.1)*	0.84 (−0.11–0.98)
Among those who reported urinary incontinence during pregnancy						
Vaginal delivery	SUI ($n = 116$)	3 (1.04–8.66)*	Not estimated	0.32 (0.12–0.51)*	0.27 (0.1–0.44)*	0.63 (−0.01–0.86)
	UUI ($n = 28$)	Not estimated[b]	Not estimated[b]	0.33 (0.14–0.52)	Not estimated[b]	Not estimated[b]
	UNS UI ($n = 103$)	1.15 (0.4–3.35)	Not estimated	0.03 (−0.17–0.23)	0.03 (−0.17–0.23)	0.12 (−1.26–0.65)

Panel A: No adjustments were made because of the possibility of overadjustment. Panel B: Vaginal delivery was both analyzed regardless of urinary incontinence status during pregnancy and stratified on incontinence status during pregnancy. Body mass index and age were included as potential confounders in analysis including all women regardless of urinary incontinence status during pregnancy, and were mutually adjusted for. Because of limited samples size, an adjusted analysis was not possible to perform in the analyses stratified on urinary incontinence status during pregnancy.

Abbreviations: RR, risk ratio; SUI, stress urinary incontinence; UNS UI, unspecified urinary incontinence; UUI, urgency urinary incontinence.

[a]PANEL B: Adjusted analyses were performed of vaginal delivery as a risk factor in the unstratified analysis. Body mass index and age were included as potential confounders.

[b]There were no women who had urgency urinary incontinence during pregnancy, a cesarean section, and reported urgency urinary incontinence 1 year postpartum.

*$p < 0.05$.

for a core outcome set to be defined in order to make prevalence data comparable between studies.[18] We chose 1 year postpartum as the time-point for our outcome measures, because by this time the pelvic floor is not thought to recover from delivery any further, but still few women are expected to be pregnant again.

We estimated measures of effect at the population level, which to our knowledge only one prospective study on postpartum urinary incontinence has presented previously. However, their results refer to unspecified incontinence.[9] Showing the different impact of risk factors on different types of urinary incontinence within a community is useful to guide where preventive strategies should be targeted.

Women in our cohort showed higher educational level and lower likelihood of smoking compared with the overall Swedish pregnant population.[19] High educational level is a proxy of high socio-economic status, and the latter was a protective factor of urinary incontinence in the majority of studies.[3] Hence, the higher prevalence of high educational level of our population might have biased the prevalence of incontinence to be lower compared with the pregnant population in Sweden. On the other hand, some women dropped out during follow up (27%). If these women tended to be continent to a greater extent than those who remained for follow up, the prevalence of incontinence in our study may have been slightly over-rated. Furthermore, if such dropout was associated with our risk factors, the associations may have been under- or overestimated.

We found stress incontinence to be more prevalent compared with urgency incontinence, both during pregnancy and at 1 year postpartum. The prevalences of stress and urgency incontinence during pregnancy and at 1 year postpartum are similar to those in the prospective study by Chan et al cited earlier.[10] However, the definition of incontinence in that study was an affirmative answer to

the corresponding incontinence question, irrespective of how often leakage occurred, and so the prevalences of clinically significant stress and urgency incontinence are probably lower than ours.[3]

Vaginal delivery was associated with increased risk of stress incontinence at 1 year postpartum compared with cesarean section, whereas no significant association with urgency incontinence was found. Stress incontinence during pregnancy increased the risk of stress incontinence at 1 year postpartum. Urgency incontinence during pregnancy was a risk factor of urgency incontinence at 1 year postpartum. Compared with our results, Chan et al found similar associations between stress and urgency incontinence during pregnancy and the corresponding subtype of incontinence at 1 year postpartum, as well as between vaginal delivery and stress incontinence at 1 year postpartum.[10] At population level, we found that vaginal delivery accounted for more than half of all stress incontinence compared with if all women delivering vaginally had instead delivered by cesarean section. Solans-Domènech et al found a corresponding population-attributable fraction of vaginal delivery, though this was regarding unspecified type of incontinence at 7 weeks postpartum.[9]

Different pathophysiological mechanisms might explain the higher prevalence of stress incontinence compared with urgency incontinence during pregnancy, and also the increased risk of stress but not of urgency incontinence after vaginal delivery. Urethral hypermobility caused by mechanical injury during pregnancy and/or vaginal delivery is the main pathophysiological mechanism proposed for stress incontinence, whereas increased afferent nerve input from the bladder and detrusor overactivity underlying urgency incontinence has not been linked to pregnancy and vaginal delivery to the same extent.[3]

In the search for preventive measures against stress incontinence, cesarean section may appear a tempting solution. However, cesarean section may cause other maternal and neonatal morbidity that exceeds that of vaginal delivery, so arguing against the preventive use of cesarean section for this matter. Identifying those risk factors of vaginal delivery that may be modified in obstetric care appears a more attractive approach to prevent stress incontinence. In the present study we found no associations between single characteristics of the vaginal delivery and the outcome measures studied, which is in accordance with other prospective studies that reported associations only with combinations of risk factors.[20,21] This we interpret as meaning that there might be aspects of vaginal delivery that cause urinary incontinence other than those previously studied. Our study and previous studies have examined risk factors similar to those of obstetric anal sphincter injury; future research should aim to explore novel risk factors related to vaginal delivery.

5 | CONCLUSION

This prospective study of primiparous women showed essentially different risk factors for stress and urgency incontinence, supporting stress incontinence as being the subtype mostly associated with pregnancy and childbirth, and urgency incontinence as being more stable over time. At a population level, vaginal delivery was the major risk factor for stress incontinence, followed by reporting stress incontinence during pregnancy. Future research should focus on exploring novel risk factors related to vaginal delivery that could be targeted in new preventive strategies against stress incontinence.

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CONFLICT OF INTEREST

None.

AUTHOR CONTRIBUTIONS

MHJ: Project development, data collection, data analysis, manuscript writing. KF: Project development, data analysis, manuscript editing. GT: Data analysis, manuscript editing. AH: Support for data analysis, manuscript editing. KN: Project development, data analysis, manuscript editing.

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

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