Age- and Type-Dependent Effects of Parity on Urinary Incontinence: The Norwegian EPINCONT Study

Guri Rortveit, MD, Yngvild S. Hannestad, MD, Anne Kjersti Daltveit, PhD, and Steinar Hunskaar, MD, PhD

OBJECTIVE: To investigate the association between parity and urinary incontinence, including subtypes and severity of incontinence, in an unselected sample, with special emphasis on age as a confounder or effect modifier.

METHODS: This was a cross-sectional study (response rate 80%) with 27,900 participating women. Data on parity and urinary leakage, type, frequency, amount, and impact of incontinence were recorded by means of a questionnaire. A validated severity index was used. Relative risks (RR) with nulliparous women as reference were used as an effect measure.

RESULTS: Incontinence was reported by 25% of participants. Prevalences among nulliparous women ranged from 8% to 32%, increasing with age. Parity was associated with incontinence, and the first delivery was the most significant. The association was strongest in the age group 20–34 years with RR 2.2 (95% confidence interval [CI] 1.8, 2.6) for primiparous women and 3.3 (2.4, 4.4) for grand multiparous women. A weaker association was found in the age group 35–64 years (RRs between 1.4 and 2.0), whereas no association was found among women over 65 years. For stress incontinence in the age group 20–34 years, the RR was 2.7 (2.0, 3.5) for primiparous women and 4.0 (2.5, 6.4) for grand multiparous women. There was an association with parity also for mixed incontinence, but not for urge incontinence. Severity was not clinically significantly associated with parity.

CONCLUSION: Parity is an important risk factor for female urinary incontinence in fertile and peri- and early postmenopausal ages. Only stress and mixed types of incontinence are associated with parity. All effects of parity seem to disappear in older age. (Obstet Gynecol 2001;98: 1004–10. © 2001 by the American College of Obstetricians and Gynecologists.)

From the Section for General Practice and the Section for Preventive Medicine, Department of Public Health and Primary Health Care, University of Bergen, Bergen, Norway.

The Nord-Trøndelag Health Study (the HUNT Study) is a collaboration between the HUNT Research Centre, Faculty of Medicine, Norwegian University of Science and Technology (NTNU), Verdal, the National Institute of Public Health, the National Health Screening Service of Norway, and the Nord-Trøndelag County Council. The EPINCONT Study was also supported by the Research Council of Norway. The authors have no commercial affiliations relevant to this study.

Urinary incontinence is highly prevalent among women,[1–3] and parous women seem to be at a higher risk for leakage than nulliparous women.[4,5] The mechanism for the association between childbearing and urinary leakage is, however, not understood. Furthermore, it has been difficult to decide whether there is a straightforward dose-response relationship with parity, as found in some studies,[5,6] or whether there is a certain threshold for degree of exposure that results in urinary incontinence.[7,8]

Few large epidemiologic studies have investigated parity as a risk factor for urinary incontinence. Where parity has been studied as part of general risk factor surveys, important confounders and effect modifiers, especially age, have seldom been taken into consideration. The aim of the present study was to explore the association between parity and urinary leakage in later life among a large, unselected sample of adult Norwegian women. We wanted to investigate whether any associations were age specific, and whether parity was related to type or severity of leakage.

MATERIALS AND METHODS

The study was part of the Norwegian EPINCONT study (EPidemiology of INCOntinence in the county of Nord-Trøndelag), which is presented in detail elsewhere.[1] The EPINCONT study is again part of the Nord-Trøndelag Health Survey 2 (HUNT 2), a large survey performed in one county in Norway during the years 1995–97. Everyone aged 20 years or more (n = 94,197) residing in the county were invited to participate. The complete HUNT 2 survey covered many topics, for example, mental health, cardiovascular diseases, asthma, and urinary incontinence. All women (n = 47,313) received a mailed invitation to visit a screening station. The source population of the EPINCONT study consisted of the 34,755 community-dwelling women who

0029-7844/01/$20.00
PII S0029-7844(01)01566-6

attended. In addition to completing a comprehensive questionnaire on many aspects of health, several clinical parameters were measured. Before leaving the screening station, the participants received a second questionnaire to be answered at home. Of these participants, 27,936 women (80%) responded and answered the incontinence part of the second questionnaire. The answers of 36 women were inapplicable in the analyses regarding parity. We were able to decide on the number of deliveries for the remainder, and thus the present study comprises 27,900 women.

The opening question in the incontinence section was whether or not the woman had involuntary loss of urine. If the answer was affirmative, the subject was asked more specific questions concerning frequency of leakage (four answer levels), amount of leakage each time (three levels), circumstance of leakage (coughing, sneezing, laughing, lifting heavy items) (yes/no), and whether leakage was accompanied by a sudden and strong urge to void (yes/no). We also asked about the extent to which she considered her leakage a problem (five levels).

In both questionnaires, the women were asked how many children they had given birth to. In the first questionnaire, they were also asked about age at first and last delivery, whereas the second included questions about the number of pregnancies and the year of birth of every child up to number seven. Thus, it was possible to check internal validity for the number of childbirths thoroughly.

Data for none, one, two, and three deliveries are presented, whereas data for four and more are aggregated into one category. Women with parity of four or more are denoted as grand multiparous. Nulliparous women are regarded as the reference group.

Urinary incontinence was defined as any leakage. The incontinent group was defined by including everyone who answered "yes" to the opening question ($n = 6375$). Those who answered "no" or failed to answer the opening question but who answered affirmatively regarding both frequency, volume, and type of leakage ($n = 489$) were also included. In total, the incontinent group consisted of 6864 women.

A severity index developed by Sandvik et al was used to characterize the degree of incontinence.[9] The index is calculated by multiplying the reported frequency (four levels) by the amount of leakage (dichotomized to two levels). The resulting index value [1–8] is further categorized into slight [1–2], moderate [3–4], and severe [6–8]. Typically, slight incontinence denotes leakage of drops a few times a month, moderate incontinence daily leakage of drops, and severe incontinence larger amounts at least once a week. The severity index has been validated against a 48-hour "pad weighing" test,[10] and it has also been validated in another study.[11]

Severity was dichotomized to two levels, mild incontinence on one hand and moderate and severe incontinence on the other. The impact of incontinence (to what extent the leakage was a problem) was dichotomized to minor problem (no problem/a small nuisance) and troublesome (some bother/much bothered/a major problem).

If the woman answered "yes" to the question about loss of urine when coughing etc, and "no" or no answer on the question about urge to go to the toilet, stress incontinence was defined. Urge incontinence was defined the other way around. If both questions were answered affirmatively, mixed incontinence was defined. Those who gave no answer or "no" to both questions were grouped as "other." We also defined a "stress component present" group consisting of all women with stress incontinence and mixed incontinence as opposed to the "pure stress" group with only stress incontinence.

In most analyses, 10-year age groups were used, except the youngest age group was defined as 20–34 years and the oldest as 75 years and over. When appropriate, three wider age groups were used (20–34, 35–64, and 65 and over).

Proportions were used to describe the prevalence of urinary leakage, type, degree of severity, and problem related to the leakage. Relative risks (RR) were used to describe effects of parity. Effect modification between parity and age was tested by multiple logistic regression, where age and parity each were divided into three levels.

Effects are denoted as strong when RRs are 1.8 and more, and weak when RRs are 1.2–1.7. RRs are given with 95% confidence intervals (CI). P values less than .05 were considered significant. The Statistical Package for Social Sciences (SPSS 9.0, Chicago, IL) was used for statistical analyses.

Ethical approval was obtained from both the Regional and the National Ethics Review boards. All subjects gave explicit written consent to the use of the data. Approval was obtained from the Norwegian Data Inspectorate.

RESULTS

Table 1 shows the prevalence and number of incontinent women, according to age groups and parity. Urinary incontinence was associated with both age and parity. Notably, prevalence among nulliparous women was high, ranging from 8% to 32% according to age. For age groups over 65 years, parity had no influence on prevalence. In age groups affected by parity, the first delivery had a higher impact than each of the next. The prevalences increased by between 6% (in age group 35–44

Table 1. Number of Incontinent Women (*n*) and Prevalence (%) According to Age and Number of Deliveries

Number of deliveries	All ages (y)		20–34	35–44	45–54	55–64	65–74	>75
	All	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)
0	4103	569 (14)	191 (8)	59 (15)	55 (18)	40 (16)	99 (28)	125 (32)
1	3224	717 (22)	231 (17)	125 (21)	136 (29)	73 (30)	82 (25)	70 (28)
2	8961	2202 (25)	340 (19)	550 (22)	645 (29)	229 (24)	234 (27)	204 (35)
3	6972	1916 (28)	148 (19)	416 (25)	562 (30)	341 (28)	263 (30)	186 (35)
4	2898	908 (31)	35 (28)	105 (25)	206 (34)	230 (31)	200 (32)	132 (35)
5	1065	340 (32)	2 (14)	17 (24)	60 (40)	93 (30)	95 (28)	73 (41)
6	441	133 (30)	0 (0)	5 (33)	14 (33)	28 (22)	42 (29)	44 (42)
7	138	46 (33)	0 (0)	0 (0)	7 (41)	10 (36)	14 (29)	15 (37)
≥8	98	33 (34)	0 (0)	1 (100)	0 (0)	4 (25)	8 (31)	20 (40)
Total	27,900	6864 (25)	947 (15)	1278 (23)	1685 (29)	1048 (27)	1037 (29)	869 (35)

years) and 14% (in age group 55–64 years) with the first delivery. As shown in Figure 1, the relative effect of parity was strongest in the age group 20–34, where the prevalence was more than doubled from 8% for nulliparous to 17% for primiparous women. An equally large absolute effect was found in the age group 35–64, where the first delivery accounted for an increase in prevalence from 16% to 26%. Differences according to parity in the age group over 65 years were not statistically significant.

Table 2 shows RRs for incontinence according to age groups and parity. The RRs were highest in the youngest age group (20–34 years) with an RR of 2.2 for primiparous women, declining thereafter, before it again became stronger in peri- and early postmenopausal age groups, where RRs for primiparous women of 1.7 and 1.9 were found. The first delivery was the most influential, but a slight dose-response relationship for each subsequent child was also found. For women older than 65 years, the effect of parity disappeared.

To exclude temporary postpartum incontinence, we also performed the analyses excluding women who had delivered within the last year, but this did not alter the results.

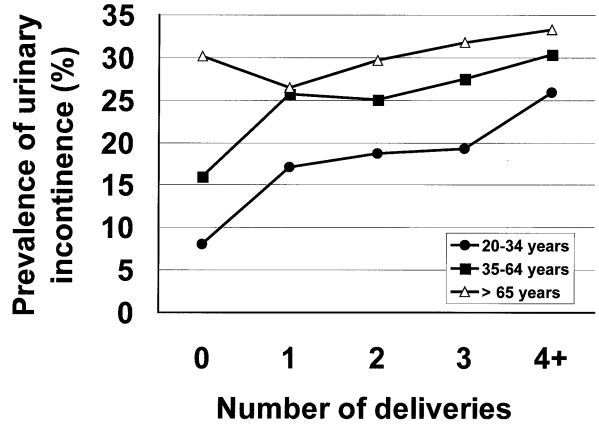

Figure 1. Prevalence of urinary incontinence by age groups and parity.

Rortveit. Parity and Incontinence. Obstet Gynecol 2001.

Table 3 shows that the effect of parity was strongest among the youngest women and absent among the eldest women. The effect modification by age was statistically significant on all levels, except for age group 20–34 versus age group 35–64 among primiparous women.

When all ages were analyzed together, stress and (for parity of three or more) mixed incontinence were found to be strongly and significantly associated with parity. The effects on stress incontinence were strong among women aged 20–44 years (RRs 2.7 and 1.9 for primiparous women), weak among women aged 45–64 years, and absent among women aged 65 years or more (Table 2). The effects on mixed incontinence were strong both for women aged 20–34 (RR 1.9 for primiparous women) and for those aged 45–64 (RRs 2.0 and 2.8 for primiparous women). No consistent association between urge type and parity could be found (Table 2).

The effects of parity on the "stress component present" group (stress and mixed incontinence together) were strong with overall RRs ranging from 1.7 for primiparous to 2.5 for grand multiparous women (all statistically significant). Stratified by age, strong effects were restricted to the age groups 20–34 and 55–64, all statistically significant. Weak and statistically significant effects were found in the age group 35–54 (data not shown). As for incontinence overall, no change of effect on type could be found when women who had delivered within the last year were excluded.

Analyses on severity (severe/moderate versus mild incontinence, missing data not included) did not show clinically significant effects of parity. We found RR 1.2 (CI 1.1, 1.3) for grand multiparous women, but other results were nonsignificant. When stratified by age, there was a weak effect of parity on severity in the age group

Table 2. Relative Risks for Incontinence and Stress, Urge, and Mixed Types of Incontinence by Number of Deliveries According to Age*

	Number of deliveries	All ages (y)		20–34		35–44		45–54		55–64		65–74		>75	
		%	RR (CI)	%	RR (CI)	%	RR (CI)	%	RR (CI)	%	RR (CI)	%	RR (CI)	%	RR (CI)
Incontinence	0	14	1	8	1	15	1	18	1	16	1	28	1	32	1
	1		1.6 (1.5, 1.8)		2.2 (1.8, 2.6)		1.4 (1.1, 1.9)		1.7 (1.3, 2.2)		1.9 (1.4, 2.7)		0.9 (0.7, 1.2)		0.9 (0.7, 1.1)
	2		1.8 (1.6, 1.9)		2.4 (2.0, 2.8)		1.5 (1.2, 1.9)		1.6 (1.3, 2.1)		1.6 (1.2, 2.1)		0.9 (0.8, 1.2)		1.1 (0.9, 1.3)
	3		2.0 (1.8, 2.2)		2.4 (2.0, 3.0)		1.6 (1.3, 2.1)		1.7 (1.3, 2.2)		1.8 (1.3, 2.4)		1.1 (0.9, 1.3)		1.1 (0.9, 1.3)
	≥4		2.3 (2.1, 2.5)		3.3 (2.4, 4.4)		1.6 (1.2, 2.2)		2.0 (1.5, 2.6)		1.9 (1.4, 2.6)		1.1 (0.9, 1.3)		1.2 (1.0, 1.4)
Stress	0	6	1	3	1	6	1	11	1	9	1	11	1	11	1
	1		1.9 (1.6, 2.2)		2.7 (2.0, 3.5)		1.9 (1.2, 2.9)		1.5 (1.0, 2.2)		1.9 (1.2, 3.1)		0.8 (0.5, 1.3)		0.8 (0.5, 1.4)
	2		2.3 (2.0, 2.6)		3.4 (2.7, 4.4)		2.2 (1.5, 3.2)		1.7 (1.2, 2.3)		1.2 (0.8, 1.9)		0.8 (0.6, 1.2)		1.1 (0.8, 1.6)
	3		2.4 (2.1, 2.7)		3.6 (2.7, 4.8)		2.4 (1.6, 3.6)		1.5 (1.1, 2.1)		1.5 (1.0, 2.2)		0.8 (0.6, 1.2)		1.1 (0.8, 1.6)
	≥4		2.3 (2.0, 2.7)		4.0 (2.5, 6.4)		2.1 (1.4, 3.2)		2.0 (1.4, 2.8)		1.3 (0.9, 2.0)		1.1 (0.8, 1.5)		1.0 (0.7, 1.5)
Urge	0	2	1	1	1	2	1	2	1	2	1	4	1	8	1
	1		1.2 (0.9, 1.6)		1.7 (1.1, 2.8)		1.3 (0.5, 3.5)		1.5 (0.6, 3.8)		0.7 (0.2, 2.5)		0.8 (0.4, 1.7)		1.1 (0.6, 1.8)
	2		1.0 (0.8, 1.3)		1.0 (0.6, 1.7)		1.1 (0.5, 2.5)		1.1 (0.5, 2.5)		1.1 (0.4, 2.6)		1.3 (0.7, 2.2)		0.8 (0.5, 1.2)
	3		1.1 (0.9, 1.5)		1.2 (0.6, 2.3)		1.1 (0.5, 2.6)		1.1 (0.5, 2.5)		1.2 (0.5, 2.8)		1.1 (0.6, 2.0)		0.8 (0.5, 1.3)
	≥4		1.5 (1.2, 1.9)		1.0 (0.2, 4.1)		1.8 (0.7, 4.6)		0.8 (0.3, 2.2)		1.2 (0.5, 2.7)		1.0 (0.5, 1.7)		0.9 (0.6, 1.5)
Mixed	0	5	1	3	1	6	1	5	1	3	1	12	1	12	1
	1		1.5 (1.2, 1.8)		1.9 (1.4, 2.7)		1.0 (0.6, 1.7)		2.0 (1.1, 3.5)		2.8 (1.3, 6.2)		1.0 (0.7, 1.5)		0.8 (0.5, 1.3)
	2		1.7 (1.4, 1.9)		2.3 (1.7, 3.1)		1.0 (0.6, 1.5)		1.5 (0.9, 2.6)		3.1 (1.5, 6.3)		1.0 (0.7, 1.4)		1.2 (0.9, 1.7)
	3		2.1 (1.8, 2.5)		1.7 (1.1, 2.6)		1.1 (0.7, 1.7)		2.3 (1.4, 3.8)		3.4 (1.7, 6.8)		1.3 (0.9, 1.8)		1.3 (0.9, 1.8)
	≥4		2.8 (2.4, 3.3)		4.0 (2.3, 7.0)		1.2 (0.8, 2.0)		2.4 (1.4, 4.1)		4.6 (2.3, 9.2)		1.2 (0.9, 1.6)		1.5 (1.1, 2.0)

RR = relative risk; CI = confidence interval (95%).

* Prevalence (%) of incontinent women in reference groups is given separately. Prevalences for each type category do not add to the total because figures for the category "other types" are not given.

Table 3. Effect Modification of Age on the Effect of Parity

		Age group (y)		
		20–34 OR (CI)	35–64 OR (CI)	>65 OR (CI)
Parity	0	1	1	1
	1	2.4 (1.9, 2.9)*	1.8 (1.5, 2.2)*	0.8 (0.7, 1.1)
	≥2	2.8 (2.3, 3.3)	2.0 (1.6, 2.3)	1.1 (0.9, 1.3)

OR = odds ratio; CI = confidence interval (95%).

* Interaction between parity and age was statistically nonsignificant for age group 20–34 vs age group 35–64 among primiparous women (P = .07). For all other levels, P values for interaction are <.01.

55–64 (one delivery: RR 1.4 [CI 0.9, 2.4], two deliveries: RR 1.7 [CI 1.1, 2.7], three deliveries: RR 1.8 [CI 1.1, 2.8], and four and more deliveries: RR 1.7 [CI 1.1, 2.7]); otherwise, there was no significant effect. The same analyses on stress incontinence only gave results of the same magnitude.

Similar analyses were performed for the relationship between parity and impact of incontinence (troublesome versus minor problem). There was a weak, but statistically significant effect on impact for grand multiparous women with RR 1.3 (CI 1.2, 1.5), otherwise no statistically significant effects were found. No significant effects were found when stratifying by age. When the stress incontinence group was analyzed separately with regard to impact, statistically significant effects were found only for grand multiparous women with RR 1.5 (CI 1.1, 1.9). Stratifying by age gave mainly nonsignificant results, but there was a trend in the age group 45–54 years with RRs ranging from 1.8 to 3.3, statistically significant only for grand multiparous women.

Excluding women who had delivered within 1 year before the survey did not change the results for severity or impact of incontinence.

DISCUSSION

This study demonstrates a strong and significant association between parity and urinary incontinence with RRs ranging from 1.6 for primiparous women to 2.3 for grand multiparous women. The findings support deliveries as an important risk factor for incontinence. However, the prevalence of incontinence among nulliparous women also was rather high, indicating that other risk factors have substantial influence. The effects of parity were clearly related to age and type of incontinence. Women in reproductive (20–34 years old) and peri- and early postmenopausal (45–64) ages were found to show the strongest association between incontinence and childbearing. Stress and mixed incontinence, but not urge incontinence, was associated with parity.

A strength of the EPINCONT survey is that it is large and population based, and the overall response rate is very satisfactory. These factors should ensure a low degree of selection bias, and narrow CIs strengthen the precision of the results. Still, the youngest and the eldest did not participate to the same degree as the middle-aged.[1] The young nonparticipants may represent a healthy part of the population, and it could also be that they have fewer children than the participating group (therefore being more mobile and out of the district for a period). If this is the case, our results would underestimate the effect of parity in the youngest age groups. However, a study of nonparticipants in the HUNT 1 survey (The Nord-Trøndelag Health Study conducted in 1984–86) suggested that the youngest nonparticipants did not have lower rates of morbidity than participants.[12] Even though we do not yet have a corresponding study from the HUNT 2 survey, this indicates that this kind of selection bias may not be a problem for validity in this age group. The study of nonresponders from 1984–86 indicated that a group of the eldest nonparticipants had significantly poorer health than the participants.[12] Although this may influence prevalence estimates, there is no reason to believe that it may affect the relative effect estimate of parity because parity hardly influences selection bias in this group.

Parity is a parameter associated with little recall bias in this kind of study.[13] Still, a weakness of this study is that the women's reproductive history is not explored in detail. Our data on incontinence are, however, of good quality, and the high number of participants permitted analyses on subgroups according to age, parity, type, severity, and impact of incontinence. The incontinence part of the questionnaire has been used in previous studies,[14] and the severity index has been validated.[10,11]

Chiarelli et al reported results similar to ours, with the largest effects of parity in the youngest age group.[4] In that study, adjusted odds ratios (OR) were 2.8 for primiparous women in the age group 18–23 years and 1.6 in the age group 45–50. No effect could be found among the eldest (70–75 years). Estimates of the parity effect on incontinence vary in other studies. Jolleys found an increase in prevalence of incontinence related to parity,

rising from 17% incontinent women in the nulliparous group, to 42% in the primiparous group, and 56% among women with four children, not adjusted for age.[15] This is a somewhat stronger effect than found for all ages together in the present study. In a study of outpatient clinic subjects, Faùndes et al found a prevalence ratio of 5.4 for one and two children and 4.5 for three or more, which is substantially higher than our estimates.[8] In accordance with this, Persson et al, in a population-based study, found ORs ranging from 3.6 for primiparous to 7.1 for grand multiparous women.[16] In a study of women of 30–59 years of age, Foldspang et al reported effects of parity somewhat weaker than found in the present study, with prevalence rising from 12% for nulliparous to 17% for primiparous women and further to 22% for women with four children.[17] Methodologic differences (eg, age of study group and setting) can explain some of this variation. Definition of urinary incontinence differs between studies, and ours is rather broad.

The importance of age when studying effects of parity has often been underestimated. Although only a few studies have taken into consideration that age might be an important confounder, the results in the present study suggest that age even is an effect modifier; the effect of parity differs significantly between different age groups. Parity seems to exert its effects mainly in the child-producing period, and to some extent in peri- and early postmenopausal ages. In older ages, when both prevalence and severity of incontinence increase,[1] the effects of parity seem to disappear. This is consistent with findings by others.[4,18] Thom et al, in a study of women aged 60 years and over, reported adjusted ORs ranging from 0.94 for primiparous to 1.58 for grand multiparous women, all statistically insignificant, but with significant test for trend.[19] Teasdale et al reported that elderly women with high parity (four and more) had a higher prevalence of incontinence than other women.[20]

Except for the analyses that exclude women who have delivered in the year before the survey, the analyses in this study are performed on the number of deliveries without taking into account time aspects concerning the onset of symptoms or the time since first and last deliveries. Therefore, we cannot show how closely urinary incontinence is related in time to each woman's obstetric history, even though we found that parity exerted its strongest effects during average ages of childbearing. Foldspang et al, however, did analyses on this time parameter and found increased risks of urinary incontinence with increasing age at the time of the last child birth for women aged 30–44 years.[17] Kuh et al found that women over 30 years old at their first delivery were at higher risk of developing incontinence.[21]

There is some disagreement about whether there is a dose-response relationship between number of deliveries and incontinence. Such an association is found by some authors,[5,15] whereas others have found a certain threshold, mostly at one delivery,[8,21] but also other levels have been reported.[22] Thomas et al found one threshold at one delivery and a second at four deliveries.[7] Our study supports the view that the first delivery is the most significant, but each subsequent delivery adds to the risk of incontinence.

Stress incontinence was the type of incontinence found to be most closely related to parity, consistent with other studies.[17,21] However, we also found a strong effect on mixed incontinence. The categorization into different types of incontinence can be associated with some validity problems in this kind of study because some of those classified as mixed incontinent after answering a questionnaire would probably be classified as having stress incontinence if clinically examined.[23] We therefore analyzed the stress component group (stress and mixed incontinence). The two most striking patterns were confirmed: that the strongest effect of parity is exerted during the active child-producing period between 20 and 34 years and in early postmenopausal ages, and that the first delivery is the most important.

In a previous report from the EPINCONT study, we documented that stress incontinence is correlated with a higher proportion of mild and moderate incontinence compared with the other types.[1] In the present study, we found no evidence that parity was related to severity, even when analyzing the stress part alone. This contradicts results presented by Kuh et al, who found a dose-response effect of parity on severity.[21]

Several theories of mechanisms for the effect of parity have been proposed.[24] On the basis of this survey with no data on specific delivery parameters (such as cesarean, use of forceps, etc), we are not able to explore the mechanisms behind the effect of parity. Our results still allow us to suggest that there might be a two-step process with the first being a short-term effect directly related to pregnancy or delivery, and then a more intermediate-term effect triggered by changes around menopause. Degenerative changes may thereafter exert a more significant influence. Also, reparative processes may make differences resulting from damage through pregnancy or childbirth less influential with time.

This study confirms that parity is significantly associated with urinary incontinence among women under 65 years of age. Primarily, stress and, to some extent, mixed types of incontinence are affected by parity, whereas urge type is not. Severity does not seem to be influenced. Also, nulliparous women have a high risk of developing incontinence. Further research should be aimed at investigating the relative contributions of the pregnancy, the

mode of delivery, and other factors connected to the delivery or the child.

REFERENCES

1. Hannestad YS, Rortveit G, Sandvik H, Hunskaar S. A community-based epidemiological survey of female urinary incontinence: The Norwegian EPINCONT study. J Clin Epidemiol 2000;53:1150–7.
2. Hunskaar S, Arnold EP, Burgio K, Diokno AC, Herzog AR, Mallett VT. Epidemiology and natural history of urinary incontinence. Int Urogynecol J Pelvic Floor Dysfunct 2000;11:301–19.
3. Thom DH, Brown JS. Reproductive and hormonal risk factors for urinary incontinence in later life: A review of the clinical and epidemiologic literature. J Am Geriatr Soc 1998;46:1411–7.
4. Chiarelli P, Brown W, McElduff P. Leaking urine: Prevalence and associated factors in Australian women. Neurourol Urodyn 1999;18:567–77.
5. Samuelsson E, Victor A, Svardsudd K. Determinants of urinary incontinence in a population of young and middle-aged women. Acta Obstet Gynecol Scand 2000;79: 208–15.
6. Milsom I, Ekelund P, Molander U, Arvidsson L, Areskoug B. The influence of age, parity, oral contraception, hysterectomy and menopause on the prevalence of urinary incontinence in women. J Urol 1993;149:1459–62.
7. Thomas TM, Plymat KR, Blannin J, Meade TW. Prevalence of urinary incontinence. BMJ 1980;281:1243–5.
8. Faùndes A, Guarisi T, Pinto-Neto AM. The risk of urinary incontinence of parous women who delivered only by cesarean section. Int J Gynaecol Obstet 2001;72:41–6.
9. Sandvik H, Hunskaar S, Seim A, Hermstad R, Vanvik A, Bratt H. Validation of a severity index in female urinary incontinence and its implementation in an epidemiological survey. J Epidemiol Community Health 1993;47:497–9.
10. Sandvik H, Seim A, Vanvik A, Hunskaar S. A severity index for epidemiological surveys of female urinary incontinence: Comparison with 48-hour pad-weighing tests. Neurourol Urodyn 2000;19:137–45.
11. Hanley J, Capewell A, Hagen S. Validity study of the severity index, a simple measure of urinary incontinence in women. BMJ 2001;322:1096–7.
12. Holmen J, Midthjell K, Forsen L, Skjerve K, Gorseth M, Oseland A. A health survey in Nord-Trøndelag 1984–86. Participation and comparison of attendants and non-attendants. Tidsskr Nor Laegeforen 1990;110:1973–7.
13. Olson JE, Shu XO, Ross JA, Pendergrass T, Robison LL. Medical record validation of maternally reported birth characteristics and pregnancy-related events: A report from the Children's Cancer Group. Am J Epidemiol 1997; 145:58–67.
14. Seim A, Sandvik H, Hermstad R, Hunskaar S. Female urinary incontinence–consultation behaviour and patient experiences: An epidemiological survey in a Norwegian community. Fam Pract 1995;12:18–21.
15. Jolleys JV. Reported prevalence of urinary incontinence in women in a general practice. BMJ 1988;296:1300–2.
16. Persson J, Wolner-Hanssen P, Rydhstroem H. Obstetric risk factors for stress urinary incontinence: A population-based study. Obstet Gynecol 2000;96:440–5.
17. Foldspang A, Mommsen S, Lam GW, Elving L. Parity as a correlate of adult female urinary incontinence prevalence. J Epidemiol Community Health 1992;46:595–600.
18. Hansen FR, Thiessen KA, Krakauer R. Urinary symptoms in elderly women in nursing homes. Frequency and social consequences of urinary incontinence in elderly women living in nursing homes. Ugeskr Laeger 1990;152: 3242–4.
19. Thom DH, van den Eeden SK, Brown JS. Evaluation of parturition and other reproductive variables as risk factors for urinary incontinence in later life. Obstet Gynecol 1997; 90:983–9.
20. Teasdale TA, Taffet GE, Luchi RJ, Adam E. Urinary incontinence in a community-residing elderly population. J Am Geriatr Soc 1988;36:600–6.
21. Kuh D, Cardozo L, Hardy R. Urinary incontinence in middle-aged women: Childhood enuresis and other lifetime risk factors in a British prospective cohort. J Epidemiol Community Health 1999;53:453–8.
22. Ryhammer AM, Bek KM, Laurberg S. Multiple vaginal deliveries increase the risk of permanent incontinence of flatus and urine in normal premenopausal women. Dis Colon Rectum 1995;38:1206–9.
23. Sandvik H, Hunskaar S, Vanvik A, Bratt H, Seim A, Hermstad R. Diagnostic classification of female urinary incontinence: An epidemiological survey corrected for validity. J Clin Epidemiol 1995;48:339–43.
24. Handa VL, Harris TA, Ostergard DR. Protecting the pelvic floor: Obstetric management to prevent incontinence and pelvic organ prolapse. Obstet Gynecol 1996;88: 470–8.

Address reprint requests to: Guri Rortveit, MD, Section for General Practice, University of Bergen, Ulriksdal 8c, N-5009 Bergen, Norway; E-mail: guri.rortveit@isf.uib.no.

Received April 2, 2001. Received in revised form July 2, 2001. Accepted July 12, 2001.