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# Overactive bladder: prevalence, risk factors and relation to stress incontinence in middle-aged women

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**Objective** To investigate the prevalence of and factors associated with overactive bladder in middle-aged women.

**Design** Cross sectional population-based study.

**Setting** Southern Sweden and the Women's Health in the Lund Area study (WHILA 1995–2000) where 6917 (64% of the invited) women, 50–59 years old in 1995, participated.

**Population** From the WHILA study, 1500 women reporting troublesome urinary incontinence (INCONT-1) and 1500 without incontinence (CONT-1) were selected by computerised randomisation and received the Bristol Female Lower Urinary Tract Symptoms (BFLUTS) questionnaire in January 2001.

**Methods** Overactive bladder was defined in two versions using the ICS definition of 2002 as either urgency alone (OAB-1) or urgency combined with frequency more than eight times per day and/or nocturia twice or more per night (OAB-2). Risk factors were analysed by multiple logistic regression analyses.

**Main outcome measures** Prevalence figures and odds ratios with corresponding 95% confidence intervals.

**Results** The prevalence of OAB-1 was 46.9% in the INCONT-1 and 16.7% in the CONT-1 group, and that of OAB-2 was 21.6% and 8.1%, respectively. Most urgency occurred in combination with stress incontinence (i.e. as mixed incontinence). The overlap between stress and urge symptoms increased with the frequency of stress incontinence episodes ( $P < 0.001$ ). Metabolic risk factors were body mass index (BMI)  $\geq 30$  for OAB-1, OAB-2 and stress incontinence, positive metabolic screening for OAB-1, family history of diabetes for OAB-2 and elevation of BMI  $\geq 25\%$  since the age of 25 for stress incontinence. Stress incontinence was associated with the current use of hormonal replacement therapy.

**Conclusions** Overactive bladder and stress incontinence are intimately associated with each other. Both OAB and stress incontinence are associated with abnormal metabolic factors, mainly increased BMI.

## INTRODUCTION

The concept of 'overactive bladder (OAB)' has recently been established.<sup>1,2</sup> OAB has been described as a 'syndrome of symptoms' defined by the International Continence Society as urgency, with or without urge incontinence, usually with frequency and nocturia.<sup>3,4</sup> The prevalence of OAB depends mainly on how it is defined.<sup>5,6</sup>

Traditionally, female urinary incontinence has been described and divided in relation to physical exertion

and/or the presence of the urge to void. Stress incontinence is usually regarded as a consequence of insufficiency in the pelvic floor and urethral striated sphincter. Urge incontinence and OAB are believed to originate in the bladder or neurological disorders.<sup>7–9</sup> This means that these two conditions are usually seen as separate dysfunctions. They do however have a lot in common. We know, for instance, that mixed incontinence is common, and also that treatment of the stress component by surgery as well as pelvic floor training most often has a beneficial effect on urge symptoms.<sup>10,11</sup> However, there is still no reliable method to predict neither a reduction/cure of the urge component of mixed incontinence by surgery nor when it could be worsened.<sup>12</sup> Our group has previously shown that incontinent middle-aged women, regardless of symptoms, have a more efficient bladder-emptying mechanism than symptom-free women expressed as higher urinary flow acceleration as well as maximum urinary flow without increase of the detrusor pressure. In addition, the incontinent women had a decreased ability to increase urethral pressure during squeeze compared with continent women of the same age.<sup>13,14</sup> An impaired pelvic floor muscle function measured by vaginal surface EMG has been demonstrated not

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3. Do you have to rush to the toilet to urinate?
- never ☐
- occasionally (less than one third of the time) ☐
- sometimes (between one and two thirds of the time) ☐
- most of the time (more than two thirds of the time) ☐
- all of the time ☐
- How much of a problem is this for you?
- not a problem ☐
- a bit of a problem ☐
- quite a problem ☐
- a serious problem ☐

**Fig. 1.** BFLUTS question concerning urgency.

only in women with stress incontinence but also in those with mixed and urge incontinence.<sup>15</sup> These findings imply a common aetiology for various types of female urinary incontinence, which should originate in the pelvic floor and urethral sphincter.

Abnormal metabolic factors and disorders such as an elevated body mass index (BMI) and diabetes have been reported to be associated with urinary incontinence by many authors.<sup>16–21</sup> OAB in men with benign prostatic hyperplasia might be associated with the metabolic syndrome including diabetes mellitus, hyperinsulinaemia and hypertension.<sup>22,23</sup> Animal studies show that spontaneously hypertensive rats have subnormal bladder capacities and micturition volumes.<sup>24</sup> We have not found any reports in the literature specifically on risk factors for OAB in women. However, Hannestad *et al.*<sup>21</sup> showed in the EPINCONT study in Norway an association between BMI and urinary incontinence as a whole as well as the subtypes stress mixed and urge incontinence. We decided to investigate the prevalence of OAB as a part of the observational Women's Health in the Lund Area study,<sup>25</sup> the relations between OAB and stress incontinence and also the possible association between OAB and abnormal metabolic factors as well as other risk factors in middle-aged women.

## METHODS

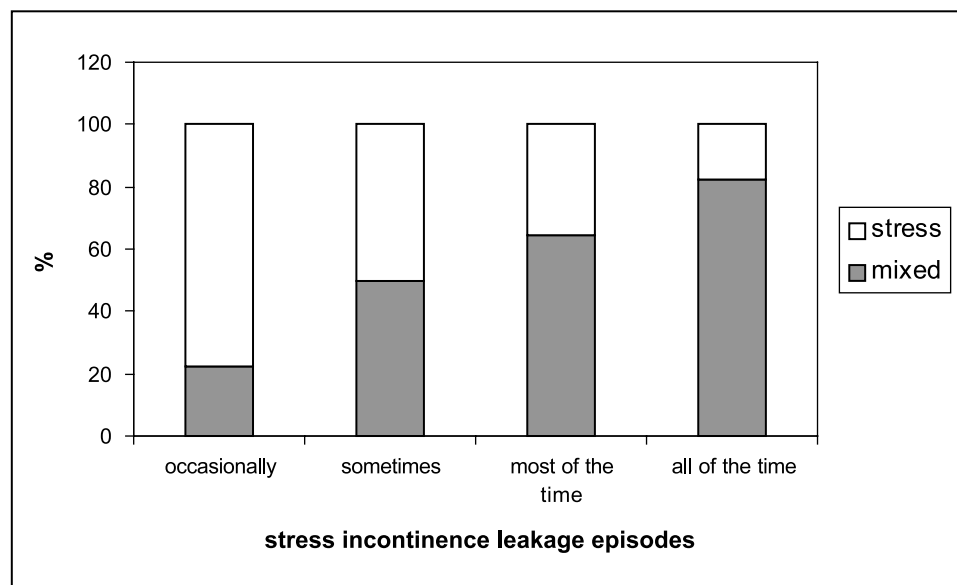
The women in this study were recruited from an observational study conducted through 1995–2000, Women's Health In the Lund Area (WHILA),<sup>25</sup> in which all women aged 50–59 ( $N = 10,766$ ; 96% being Caucasian) living in the Lund area of Southern Sweden by 1 December 1995, were invited to a screening procedure which took place from 2 December 1995 until 3 February 2000. The women were identified from a population register comprising all inhabitants. Sixty-four percent ( $n = 6917$ ) responded and attended the screening. The health screening program included physical and laboratory examinations and a questionnaire concerning physical activity, dietary habits, medical history, pharmacological treatment, family history of diabetes and hypertension, menopausal status, smoking and

alcohol habits, education, household and working status and quality of life. One of the questions was 'Do you have urinary leakage?' Thirty-two percent of the women reported having urinary leakage which caused a social or hygienic problem. In order to investigate the prevalence of other lower urinary tract symptoms as well, and not only incontinence, two groups were selected by computerised randomisation from the WHILA material; one group of women who admitted (INCONT-1) and one that denied urinary incontinence (CONT-1). Each of the two groups comprised 1500 women. Both groups received the Bristol Female Lower Urinary Tract Symptoms (BFLUTS)<sup>26</sup> questionnaire during the autumn of 2000. This questionnaire comprises 34 questions relating to incontinence and other lower urinary tract symptoms experienced during the last month as well as to sexual functions or quality of life (Fig. 1). We also added a question concerning hormonal replacement therapy during the preceding four months or longer. Two versions of OAB, both possible according to the ICS definition of 2002,<sup>3</sup> were constructed and investigated regarding prevalence. OAB-1: urgency 'sometimes' (i.e. the midpoint of the scale; Fig. 1), or more often according to BFLUTS (urgency of any degree was extremely common, 86% and 62% in the INCONT-1 and CONT-1 groups, respectively, and was therefore excluded as a possible definition of OAB); OAB-2: urgency sometimes or more often combined with one or both of urinary frequency more than eight times per day and nocturia twice or more per night. Both OAB and stress incontinence reported 'sometimes' or more often in BFLUTS were related to BMI  $\geq 30$ , BMI increase 25% or more since the age of 25, diabetes heredity, manifest diabetes mellitus, hypertension  $\geq 160$  systolic and/or 95 diastolic, triglycerides  $\geq 2.3$  mmol/L, waist-to-hip ratio  $\geq 0.90$ , positive screening (one or more of above mentioned parameters positive), smoking and alcohol habits and ongoing hormonal replacement therapy, all the former from the WHILA study, the last from the BFLUTS questionnaire. The WHILA and the BFLUTS studies were both approved by the local Ethics Committee at Lund University.

Statistical analyses were made using the  $\chi^2$  test, the  $\chi^2$  test for trend and multiple logistic regression using computer

**Table 1.** Prevalence of mixed incontinence (i.e. OAB-1 and OAB-2 in combination with stress incontinence) and pure urge incontinence 'sometimes' or more often in the women reporting incontinence (INCONT-1) and continence (CONT-1) in the WHILA study. The vast majority of women with urgency also have stress incontinence.

	INCONT-1 (%), $n = 1336$	CONT-1 (%), $n = 1346$	$P$
Mixed incontinence (OAB-1 + stress)	40.5	9.4	0.0003
Mixed incontinence (OAB-2 + stress)	18.4	5.0	<0.0001
Urge incontinence	2.2	0.8	0.004



**Fig. 2.** Women reporting more pronounced stress incontinence expressed as a higher frequency of leakage episodes in the BFLUTS also had a higher prevalence of urgency (i.e. mixed incontinence);  $P < 0.001$ ,  $\chi^2$  test for trend.

software SPSS 10.0 system (SPSS, Chicago, Illinois, USA). Odds Ratio (OR) with a confidence interval (CI) of 95% was used to express risk estimation.

## RESULTS

A total of 2682 (89%) women responded and were included. Missing answers in the questions analysed in this study accounted for 1.2–2.0% of the total. Premenopausal women accounted for 2.25% ( $n = 27$ ) and 1.45% ( $n = 18$ ) of the INCONT-1 and CONT-1 groups, respectively (ns). In the INCONT-1 group, 711 (59.3%) of the women had used some kind of hormonal replacement therapy continuously during the last four months, in the CONT-1 group 657 (52.9%),  $P < 0.01$ .

In contrast to the WHILA study, urinary leakage was reported regardless of perceived bother in the BFLUTS;

thus, both stress and urge incontinence were reported to a certain degree by women in the CONT-1 group. The multiple logistic regression analyses were made based on symptoms reported in the BFLUTS questionnaire.

The prevalence of OAB-1 was 46.9% in the INCONT-1 group and 16.7% in the CONT-1 group ( $P = 0.0003$ ), of OAB-2 21.6% in the INCONT-1 group and 8.1% in the CONT-1 group ( $P < 0.0001$ ). The prevalence of overactive bladder in combination with stress incontinence is presented in Table 1. In the women who reported stress incontinence in the BFLUTS, the prevalence of coexisting OAB (i.e. mixed incontinence) increased significantly with increasing frequency of stress incontinence episodes (Fig. 2).

OAB was independently associated with abnormal metabolic factors but not with lifestyle factors such as smoking or alcohol consumption (Table 2). Because mixed incontinence was much more common than urge incontinence, stress incontinence was entered into the logistic regression analysis to avoid confounding; it turned out to be the factor with the strongest association to OAB-1 (OR 4.5,

**Table 2.** Risk factors for the two versions of overactive bladder analysed by multiple logistic regression analysis. Stress incontinence is defined as stress incontinence sometimes or more often according to the BFLUTS questionnaire.

	Odds ratio	Confidence interval	P
<b>OAB-1</b>			
Stress incontinence	4.5	3.7–5.6	<0.001
BMI $\geq 30$	1.5	1.1–2.1	0.013
Positive screening	1.3	1.04–1.7	0.022
<b>OAB-2</b>			
Stress incontinence	3.0	2.3–3.9	<0.001
BMI $\geq 30$	1.6	1.2–2.3	0.004
Family history of diabetes	1.5	1.04–2.3	0.029

**Table 3.** Risk factors associated with stress incontinence 'sometimes' or more often analysed by multiple logistic regression analysis. BMI  $\geq 30$  and the elevation of BMI by 25% or more since the age of 25 are both independent risk factors. In this material, low to moderate alcohol consumption seems to lower the risk of stress incontinence.

	Odds ratio	Confidence interval	P
Elevated BMI	1.69	1.38–2.06	<0.001
BMI $\geq 30$	1.55	1.17–2.05	0.002
Use of hormone replacement therapy	1.47	1.22–1.78	<0.001
Low alcohol consumption	0.72	0.57–0.89	0.03
Moderate alcohol consumption	0.64	0.46–0.88	0.006

95% CI 3.7–5.6,  $P < 0.001$ ) and OAB-2 (OR 3.0 95% CI 2.3–3.9,  $P < 0.001$ ), respectively. Stress incontinence was associated with abnormal metabolic factors and current hormonal replacement therapy. Mild to moderate alcohol consumption was negatively associated with stress incontinence (Table 3).

## DISCUSSION

Stress incontinence was strongly associated with symptoms of OAB. The vast majority of women with OAB in this study, in the INCONT-1 group 40% of 46% with OAB-1, also reported stress incontinence symptoms (i.e. mixed incontinence). Traditionally, this association has been explained by a behavioural adaptation in the stress incontinent woman, emptying her bladder more frequently to reduce the leakage, thus inducing frequency and later on urgency. Conceivably, our findings could be in favour of a close association between the origin itself of stress and urge symptoms. This is also supported by our previous studies that show more efficient emptying of the bladder without detrusor pressure increase as well as an impaired ability to raise urethral pressure in incontinent women regardless of stress or urge/mixed symptomatology compared with continent women of the same age and parity.<sup>13,14</sup> Together with the lack of consistency between urge symptoms and urodynamically demonstrated detrusor overactivity,<sup>27,28</sup> this leads us to assume that urgency in the majority of cases originates from a deteriorated neuromuscular ability to close the proximal urethra. Similar findings were reported by Bump *et al.*<sup>29</sup> in a study concerning medical treatment of mixed incontinence, where the major determinant of concurrent urge symptoms in women with stress incontinence was the severity of the stress incontinence. Scotti *et al.*<sup>30</sup> suggested that the outcome of surgery in patients with mixed incontinence was better in those in whom the stress component preceded the urge in the history. When the urge component preceded the stress, the outcome was poor. The wider definition OAB-1 (i.e. urgency sometimes or more often) showed the strongest association with coexisting stress incontinence. The reason why urgency is so closely correlated to stress incontinence could be that it is related to physical activity (i.e. the triggering mechanism is the same as in stress incontinence). This is consistent with our findings showing an increasing prevalence of coexisting OAB in stress incontinent women with an increasing frequency of stress leakage episodes.

The results of this part of the WHILA population-based study show an association between metabolic factors (mainly elevated BMI) and the presence of an OAB. These findings coincide with those of a recently published study by the Leicestershire MRC Incontinence Study Group where OAB as well as stress incontinence were associated with obesity.<sup>31</sup> This study found, in contrast to ours, an association between smoking and OAB, and also that OAB as well

as stress incontinence were related to diet. A similar association between the components of the metabolic syndrome and an OAB has previously been found in men with benign prostatic hyperplasia.<sup>22</sup>

The current definition of OAB is vague but helps to improve communication with the patient. The BFLUTS questionnaire tends to give high prevalence figures for most lower urinary tract symptoms,<sup>32</sup> possibly because it also catches infrequent symptoms.

In the original WHILA study, the incontinent group reported a higher hormonal replacement therapy use. In the BFLUTS study, current use of hormonal replacement therapy was associated with an elevated risk of stress incontinence but not with OAB.

## CONCLUSIONS

Symptoms of an OAB are common in middle-aged women, the exact prevalence depending on how widely the ICS definition is interpreted. OAB was associated with factors of the metabolic syndrome, firstly BMI  $\geq 30$ , but also to a high degree with concurrent stress incontinence. The data in this study support the previously suggested model of a common origin for stress and urge symptoms.<sup>33</sup>

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