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# Anxiety and depression associated with incontinence in middle-aged women: a large Norwegian cross-sectional study

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## Abstract

**Introduction and hypothesis** Several studies have indicated depression and anxiety to be associated with urinary incontinence (UI), however, the strength of the associations varies widely. The objective of this study was to determine these associations in a large survey.

**Methods** In a cross-sectional population-based survey study, we analysed questionnaire data on UI, depression and anxiety from 5,321 women between 40 and 44 years. A multivariate logistic regression model was used to predict the odds of having high levels of anxiety and depression among women with UI of different types and severities.

**Results** Among women with UI, the adjusted OR for depression was 1.64 (95% CI, 1.32–2.04) and for anxiety 1.59 (95% CI, 1.36–1.86) compared with women without UI.

**Conclusion** UI was associated with both anxiety and depression in middle-aged women, with the strongest associations for mixed and urgency UI.

**Keywords** Urinary incontinence · Anxiety · Depression · Epidemiology

## Introduction

Urinary incontinence (UI), anxiety and depression are all common conditions among women. For UI, the prevalence in the general female population is about 25%, and during the lifetime approximately one half of all women will experience UI [1–3]. About one fifth will have one or more episodes of major depression and two studies show 12-month prevalences for anxiety disorders from 11% to 18% [4, 5].

Incontinence, anxiety and depression all have been shown to give decrements in social function and quality of life [6–9]. Compared with women with UI alone, women with both depression and UI have greater decrements in quality of life and functional status and also increased symptom burden of their UI [10]. Depression, anxiety and UI are all associated with social stigma, and the conditions are often not recognised by the physicians.

The prevalence of depression among women with UI varies in different studies; figures between 6% and 38% have been reported [11–14]. In terms of types of incontinence, 3–14% of women with stress incontinence report depression, compared with 21–42% of those with urgency or mixed incontinence [11, 13]. Because of the great differences in prevalence, further studies are necessary to give more knowledge about this association. There are less data on the relationship between anxiety and UI, and the few studies done are not conclusive [15, 16].

It has also been shown that women with UI had much higher risk of depression than women with other chronic conditions. Pharmacological research has demonstrated efficacy of serotonin-norepinephrine reuptake inhibitors for both major depression and stress UI, and this has contributed to the question if there are common biological underliers for both conditions.

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The main objective of the present study was to determine the association between depression and UI and anxiety and UI in middle-aged women in a large community-based cross-sectional study from Norway, The Hordaland Health Study (HUSK, 1997–1999).

## Materials and methods

The HUSK (1997–1999) was a collaboration between the National Health Screening Service, the University of Bergen, and local health services. HUSK was a large, population-based survey which covered many topics, for example mental health, cardiovascular diseases, cancer, muscle and skeletal diseases, occupational health, urinary incontinence and use of drugs. All persons born between 1953 and 1957, and who lived in the county of Hordaland were invited by mail to participate, altogether 29,400 individuals (14,349 women) were invited. A total of 8,584 men (57%) and 9,976 women (70%) met at a screening station (office or bus) for blood tests and some examinations, and received a questionnaire that they filled in at home and returned by mail; 8,843 women (89%) answered and returned the questionnaire, and 7,039 of the women received a questionnaire concerning depression, anxiety and UI. Five thousand three hundred twenty-one (76%) of these women answered, and our study was designed as a cross-sectional survey of the women in this subgroup; 24% did not answer the questionnaire.

### Urinary incontinence in HUSK

The section about UI in the HUSK questionnaire was similar to the questionnaire in the EPINCONT study [17] and started with an entry question about experiencing involuntary loss of urine or not. If the answer was yes, the woman was asked to answer more specific questions: How often do you leak (four levels), how much leakage each time (three levels), do you leak when coughing, sneezing, laughing, lifting heavy items (yes/no), is leakage accompanied by sudden and strong urgency to void (yes/no). It was also asked about duration of urinary leakage (three levels).

For analysis UI was defined as any leakage [18]. Those who, despite answering “no” or failing to answer the entry question, answered confirmatively regarding frequency, volume, and type of leakage, were also included. A Severity index developed by Sandvik et al. was used to categorize the severity of incontinence [19, 20]. The index was calculated by multiplying the reported frequency (four levels) by the amount of leakage (three levels). The resulting index value (1–12) was further categorized into slight (1–2), moderate (3–6), severe (8–9) and very severe

(12). 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-h “pad-weighing” test [20]. Accordingly, slight incontinence means a mean leakage of 6 g/24 h, moderate incontinence means a mean leakage of 23 g/24 h, severe incontinence means a mean leakage of 52 g/24 h and very severe incontinence means a mean leakage of 122 g/24 h. The Severity index is thus a semi-objective and quantitative perception of the leakage. In the analyses, the categories severe and very severe were combined, due to few women in each group.

A stress component was defined if the woman answered “yes” on the question about loss of urine when coughing, laughing, sneezing or making an effort. An urgency component was defined if she answered “yes” on the question about urgency to void. Mixed incontinence was defined if she answered “yes” on both these questions. Those who answered “no” on both the urgency UI question and the stress UI question or did not answer these questions in spite of answering yes on the question about loss of urine, were grouped as other/unclassified.

### Anxiety and depression in HUSK

Anxiety and depression was in HUSK measured by the Hospital Anxiety and Depression Scale (HADS) [21, 22]. This is a self-administered questionnaire consisting of 14 items, seven for anxiety (HADS-A) and seven for depression (HADS-D). Each item has four possible answers and is scored on a Likert scale from 0 to 3. The item scores are added, giving subscales from 0 (minimum symptom level) to 21 (maximum symptom level). HADS-A contains questions related to restlessness and worry and one question reflecting panic attacks. The HADS-D focuses mainly on the reduced pleasure response aspect of depression, but also psychomotor retardation and impaired mood. Clinically significant anxiety is usually defined as a HADS-A score of 8 or more. Depression is usually defined as a HADS-D score of 8 or more. This cut-off defined the high level of anxiety and depression groups in our study. We also did analyses with a cut-off of 11 as a measure of very high level of anxiety and depression. Missing substitution was performed for individuals who had responded to five or six of the seven HADS-D questions. This was done by multiplying the obtained score by 7/5 if five of the seven questions were answered and by 7/6 if six questions were answered. If only between one and five questions were answered, the person was excluded and coded as missing. Data on anxiety and depression and the validity of HADS in the HUSK population have previously been published [21, 23, 24].



## Adjustment variables

In a multivariate logistic regression model, we adjusted for age, education, nocturia, parity, body mass index and smoking.

## Statistics

Descriptive statistics were used to characterize the overall study population. We estimated prevalence rates for anxiety, depression and UI with different types and severities in the whole study group. Prevalence rates of anxiety and depression were calculated among the incontinent and the continent women, and in the subgroups of incontinent women according to type and severity of incontinence. Logistic regression analysis was used to adjust for possible confounding factors. All statistical analyses were performed using the programme SPSS 15.0.

Approvals for HUSK were obtained from Regional ethics review board and from the Norwegian Data Inspectorate.

## Results

Seven thousand thirty-nine women received the questionnaire about UI, depression and anxiety. Five thousand three hundred twenty-one (76%) answered, and this defined our study population for further analyses. Missing or unclassified values was less than 8% in this domain.

Table 1 shows the socio-demographic characteristics of the study group. Mean age was 42 years, the large majority was married and with rather high educational level. Almost 85% stated their health status as being good or very good, less than 10% were obese, and about a third were daily smokers.

### Urinary incontinence, anxiety and depression in the study group

Table 2 shows frequency, amount of leakage, type, severity and duration of UI; 26.2% of the women had UI. More than two thirds of the incontinent women had leakages less than once a week. More than half were experiencing symptoms of stress incontinence alone. Almost 60% had slight UI according to the Sandvik severity index, and most of the women reported a duration of the problem of less than 5 years.

Almost one of five had high levels of anxiety defined by a HADS-A score of 8 or more, and about 6% had very high levels of anxiety defined by a HADS-A score of 11 or more; 8.5% had high levels of depression defined by a HADS-D score of 8 or more, and about 2% had very high levels of depression defined by a HADS-D score of 11 or more. About 6% had both HADS-A and HADS-D score of

**Table 1** Socio-demographic characteristics of the study population: the Hordaland Health Study ( $N=5,321$ )

Variable	Number	Percent
Age at inclusion (years)		
40	1,058	19.9
41	1,062	20.0
42	1,068	20.1
43	1,148	21.6
44	985	18.5
Marital status		
Not married	521	9.8
Married	4,022	75.6
Widow or widower	50	0.9
Separated or divorced	728	13.7
Education		
Elementary school	1,036	19.5
Secondary school	2,386	44.8
University	1,850	34.8
Missing	49	0.9
Annual family income (NOK 1000)		
0–199	800	15.0
200–399	1,886	35.4
>400	2,306	43.3
Missing	329	6.1
Parity		
0	440	8.3
1	555	10.4
2	2,091	39.3
3	1,601	30.1
4+	542	10.2
Missing	92	1.7
Body mass index (kg/m <sup>2</sup> )		
Underweight (<18.5)	66	1.2
Normal (18.5–24.9)	3,206	60.3
Overweight (25–29.9)	1,532	28.8
Obesity (>30)	504	9.5
Missing	13	0.2
Self-rated health		
Bad	51	1.0
Not very good	727	13.7
Good	3,284	61.7
Very good	1,213	22.8
Missing	46	0.9
Daily smoking		
Yes	1,808	34.0
No	3,429	64.4
Missing	84	1.6

8 or more. Missing or unclassified data were less than 1% for anxiety and depression, about 8% for type of UI, and 3–6% for the rest of the variables shown in Table 2.

**Table 2** Prevalence of high levels and very high levels of anxiety and depression, defined as HADS cut-off of 8 and 11, respectively, and distribution of frequency, amount of leakage, type, severity index and duration of UI among the 1,398 women with UI: the Hordaland Health Study (N=5,321)

	Number	Percent
Anxiety and depression score		
HADS-A, ≥8	1,048	19.9
HADS-A, ≥11	343	6.4
HADS-D, ≥8	448	8.4
HADS-D, ≥11	130	2.4
HADS-A and HADS-D, ≥8	329	6.2
UI variable		
Any urinary incontinence	1,398	26.2
Frequency of UI (n=1,338)		
Less than once a month	456	34.1
Once or more per month	492	36.8
Once or more per week	91	21.7
Every day and/or night	99	7.4
Amount (n=1,348)		
Drops or little	869	64.5
Small amounts	454	33.7
More	25	1.9
Type of UI (n=1,287)		
Stress	744	53.2
Urgency	129	9.2
Mixed	414	29.6
Severity of UI (n=1,325)		
Slight (1–2)	772	58.3
Moderate (3–6)	482	36.3
Severe/very severe (8–9–12)	71	5.4
Duration of UI (n=1,308)		
0–5 years	888	67.9
5–10 years	282	21.6
>10 years	138	10.6

Anxiety and depression among women with UI

Table 3 shows prevalences of high levels of anxiety and depression among women with and without UI. Unadjusted analyses showed that about one of four had high levels of anxiety in the incontinent group. This was significantly higher than in the continent group ( $p < 0.001$ ). Almost 12% had high levels of depression in the UI group. This was also significantly higher than in the continent group ( $p < 0.001$ ). We also found significant associations between UI and other HADS-categories, for example in combined high levels of anxiety and depression and when we used a HADS cut-off of 11 instead of 8 (data not shown). Missing values were only 2.6% in these analyses.

**Table 3** Percentage of anxiety and depression among women with and without UI, and by continence type and severity: the Hordaland Health Study (N=5,321)

	Anxiety		p value*	Depression		p value*
	n	%		n	%	
Continenence status						
Continent	667	17.6		274	7.2	
Incontinent	359	25.8		164	11.8	
Continenence type						
Stress	170	22.9	0.003	67	9.0	<0.001
Mixed	132	32.0		70	16.9	
Urgency	36	28.1		15	11.7	
Continenence severity						
Slight	184	23.9	0.111	70	9.1	0.009
Moderate	131	27.3		69	14.3	
Severe	24	33.8		11	15.5	

\*p values by Chi-square test

Prevalences of high levels of anxiety and depression by different type and severity of UI

In table 3, we also compared the different types and severities of UI regarding prevalence of high levels of anxiety and depression. Among the different types of UI, the highest rates of anxiety were seen in mixed UI (32.0%) and urgency UI (28.1%). The highest prevalences of depression were also seen in mixed UI (16.9%) and urgency UI (11.7%). For grade of severity, there were highest prevalences of both anxiety and depression among women with severe UI. The results were not statistically significant for anxiety, although the absolute differences were larger. Missing values were approximately 8% in the analyses on type and 6% in the analyses on severity.

Logistic regression

Table 4 shows adjusted and unadjusted odds ratios for incontinence associated with high levels of anxiety and depression. After adjustment for age, education, nocturia, parity, body mass index and smoking, urinary incontinence was still significantly associated with anxiety and depression, with the highest odds ratios for mixed and severe UI. Due to missing values on one or more variables, missing cases in the analyses were approximately 8%.

Discussion

This study shows that UI is associated with high levels of depression and anxiety in women 40–44 years old. For both

**Table 4** Unadjusted and adjusted odds ratios for anxiety and depression for women with any incontinence, different types of incontinence and different severity of incontinence versus continence: the Hordaland Health Study ( $N=5,321$ )

	Anxiety		Depression	
	Unadjusted	Adjusted <sup>a</sup>	Unadjusted	Adjusted <sup>a</sup>
Continence	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)
Any incontinence	1.67 (1.43–1.94)	1.59 (1.36–1.86)	1.85 (1.50–2.28)	1.64 (1.32–2.04)
Severity of UI				
Slight	1.51 (1.25–1.83)	1.52 (1.25–1.85)	1.39 (1.05–1.85)	1.38 (1.04–1.83)
Moderate	1.77 (1.42–2.21)	1.63 (1.30–2.05)	2.30 (1.72–3.07)	1.93 (1.43–2.60)
Severe	2.50 (1.50–4.16)	2.30 (1.36–3.88)	2.67 (1.38–5.17)	2.14 (1.08–4.22)
Type of UI				
Stress	1.39 (1.15–1.69)	1.39 (1.14–1.69)	1.33 (1.00–1.77)	1.27 (0.95–1.69)
Urgency	1.84 (1.24–2.75)	1.70 (1.14–2.56)	1.81 (1.04–3.16)	1.65 (0.94–2.90)
Mixed	2.25 (1.79–2.82)	2.05 (1.62–2.59)	2.74 (2.05–3.67)	2.24 (1.65–3.03)

Brackets indicate 95% CI. Due to missing values on one or more variables, missing cases in the analyses varied between 424 and 430.  $N=4,891$  in the analyses for anxiety and  $N=4,897$  in the analyses for depression

<sup>a</sup> Adjusted for age, education, nocturia, parity, body mass index and smoking

depression and anxiety, the association was strongest for mixed and urgency incontinence and the association was stronger with increasing severity of the UI. The associations persisted also after adjusting for established risk factors for UI, like obesity, smoking and parity.

Strengths of the study include a population-based design with a large sample size and a good response rate. In addition, we had few missing individuals in the multivariate analyses. As the HADS and UI questions were part of a larger survey, we have no reason to think that incontinent women and women with depression or anxiety are under-represented in HUSK because of embarrassment and reluctance to report their problems, or over-represented because of eagerness to tell.

Another strength of the study is that we used validated scales for analyses of UI, anxiety and depression. An important reason for differing prevalence estimates of anxiety and depression among incontinent women in earlier studies is that study populations are selected on different criteria and different survey procedure and, most important, the use of different definitions of urinary incontinence. In this study we use a symptom-based questionnaire based on the definition of The International Continence Society [18]. The prevalence of UI in our population corresponded well with the results in other large population-based studies that used the same definition [5, 17, 25]. For severity, we used the Sandvik severity index, which has demonstrated good validity against 24-h pad-weighing tests [19, 20]. We investigated the association for both type and severity, which is not done in most of the comparing studies. The large number of incontinent women resulted in sufficient statistical power to show differences between different types and severities of UI.

The self-rated HADS is widely used in population-based surveys. In a literature review investigating the validity of HADS, the authors concluded that a cut-off score of 8+ for both HADS-A and HADS-D gives an optimal balance between sensitivity and specificity for HADS as a screening instrument [22]. The sensitivity and specificity of HADS-A and HADS-D with a cut-off on 8+ were found to be approximately 0.8. The literature review concluded that among three studies of primary care populations, HADS had an excellent ability to detect DSM-III defined psychiatric morbidity.

There are also some limitations in this study, such as the age range of our study population. In one study, women aged 18–44 years with UI had the highest prevalence of depression, almost three times that of women of 45 or older [12]. Even if the response rate was high in the study, 24% did not answer the questionnaire. This gives a possibility of bias, and therefore represents a limitation of the study. Another problem could also be that women with severe depression may be less likely to participate in a mailed survey. Furthermore, the use of HADS may underestimate the prevalence of depression among women, suggested in a study investigating the validity of HADS [21]. Even if the HADS has been found to perform well in assessing symptom load in anxiety and depressive disorders, it is not a diagnostic instrument [21]. In our study, we have therefore identified persons with high anxiety and depression symptom load, not patients with an anxiety and depression disorder.

We found a crude prevalence of high levels of depression symptom among incontinent women of 11.8%. The prevalence of depression among women with UI varies

in different studies, and figures between 6% and 38% have been reported [11–15, 26]. One large survey found a high prevalence of UI of 42%, and among the incontinent women a prevalence of major depression of 6.1% compared with 2.2% among the non-incontinent women [11]. In another large population-based survey, the prevalence of UI was as low as 3.2%, but the patients in that study had to have consulted a doctor for the incontinence problem [12]. The prevalence of high levels of depression among the women with UI in that study was 15.5% compared with 9.2% in the non-incontinent women. A third population-based cross-sectional study reported a prevalence of UI of 16%, and an OR of 1.82 (95% CI, 1.26–2.63) for incontinent women to have depression compared with a continent group [26]. Both the different definitions of UI and different cut-offs for depression contribute to the variations in results between the studies.

In one community-based study, the statistically significant association with depressive symptoms was lost after multivariate adjustment [14]. Only nocturia remained significantly associated with depression throughout all analyses. In our study, we also found that nocturia was significantly associated to both depression and anxiety, but the association between incontinence and depression and anxiety was still significant after adjusting for nocturia.

There are less data on the relationship between anxiety and UI than between depression and UI. One study showed a significant association between anxiety and urgency incontinence, but bias here could be that anxiety was also associated with a number of other urinary symptoms [15]. One cross-sectional study found an association between anxiety and urinary incontinence (OR, 1.5; 95% CI, 1.1–1.9) [27]. Another cross-sectional study showed a high prevalence of anxiety among patients with UI but also among patients with other types of lower urinary tract symptoms [28].

Our study also investigated the association for type and severity, which is not done by most of the comparing studies. We found that for both depression and anxiety, the association was strongest for urgency (28.1% anxiety and 11.7% depression,  $p=0.003$  for anxiety and  $<0.001$  for depression) and mixed incontinence (32.0% anxiety and 16.9% depression,  $p=0.003$  for anxiety and  $<0.001$  for depression). One other study, which used the same way of classifying type and severity as we did, but only investigated for severe depression, also found the strongest association with urgency (6.6% severe depression) compared with stress UI (4.7% severe depression) with  $p<0.001$  [11]. In one study, the prevalence of anxiety was similar for women with either urgency or stress UI but higher for those with mixed incontinence. The prevalence of depression in the same study was lowest for women with stress UI and highest for those with mixed [15].

In terms of incontinence severity, our study showed that the association with depression was strongest for severe UI (9.1% with slight UI, 15.5% with severe UI,  $p<0.01$ ). The prevalence of high levels of anxiety among women with UI in our study was also increasing by increasing severity, but this association was not significant (23.9 with slight UI, 33.8% with severe UI,  $p=0.11$ ). The results for high levels of depression and UI correspond with two other comparable studies. In one of these studies, they used Sandvik Severity Index, the same classifying method as we used [11]. They found an increasing prevalence of depression with increasing severity of UI (2.1% with mild UI, 8.3% with severe UI,  $p<0.001$ ). In the other study, they not only used frequency of UI as a measure for severity, but they also found the same tendency [26]. We have no other comparable studies investigating the relationship between anxiety and severity of UI. Our study, which showed a significant association between anxiety and UI, is the first study on a large sample size which investigate the association for both type and severity of UI, as far as we know.

As a cross-sectional study, our study cannot answer the question of whether being incontinent causes women to be depressed or anxious or whether depression and anxiety causes incontinence. Several common biological and neurological underliers are possible; serotonergic pathways are linked to both the regulation of voiding function and depression. Serotonin, which level is low in clinically depressed persons, inhibits the micturition reflex pathway and facilitates the closure of the urethral sphincter [29]. It is also known that depression and anxiety activates the sympathetic nerve system where noradrenalin is the main product released by the sympathetic nerves. Higher levels of noradrenalin can cause physiological changes in the bladder and contribute to UI [29]. If the direction of causality is going from UI to depression, it would have to do with the burden of having a chronic illness. In addition, incontinent women may have smaller social networks and fewer outside activities, which in turn may contribute to depression [26]. Two longitudinal cohort studies show opposite results regarding causality between depression and UI [15, 30]. One of these studies also investigated the relationship between anxiety and UI, and found that anxiety was both a risk factor and a consequence of UI [15]. In two other studies persons with UI were more likely to meet criteria for anxiety but only if they reported functional impairment secondary to their UI [31, 32].

For clinical practice, it is important to be aware of the extensive co-occurrence of urinary incontinence and depression and anxiety. These are all common conditions in primary care, all with adverse effects on function and with quality-of-life decrements. As we know that the symptom burden of UI is greater with a co-morbid illness, the practitioners' knowledge about this association is of great importance for the patients



[11, 32]. It is also important because less than a third of the patients with an incontinence problem consult their doctor about their UI symptoms [33]. In some previous articles, a screening for depression among women with UI has been suggested. In our opinion, more knowledge about causality and details about the co-morbid group is necessary before we can recommend such conclusions for clinical settings and practical life.

## Conclusions

This study contributes to and expands the cross-sectional-based evidence that UI and depression and UI and anxiety often co-occur in middle-aged women. The association was strongest for mixed and urgency UI and severe incontinence. Prospective observational studies are necessary to investigate potential causality of the association.

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**Conflicts of interest** None.

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