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ORIGINAL ARTICLE

The prevalence and risk factors of overactive bladder symptoms and its relation to pelvic organ prolapse symptoms in a general female population

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Abstract
Introduction and hypothesis To study the prevalence and risk factors of overactive bladder (OAB) symptoms and its relationship with symptoms of pelvic organ prolapse (POP).
Methods This is a cross-sectional study including women aged between 45 and 85 years, registered in eight general practices. All women were asked to self complete the validated Dutch translated questionnaires. All symptoms were dichotomized as present or absent based on responses to each symptom and degree of bother.
Results Forty-seven percent of the women filled out the questionnaire. Prevalence of urgency was 34% and the prevalence of any OAB symptoms 49%. Prevalence of OAB symptoms increased with advancing age. Symptoms of POP were an independent risk factor for symptomatic OAB. Other risk factors were continence and prolapse surgery in the past, age above 75, overweight, postmenopausal status and smoking.
Conclusions The prevalence of any OAB symptoms was 49%. POP symptoms were an independent risk factor for symptomatic OAB.

Keywords Overactive bladder · Urgency · Urge incontinence · Frequency · Pelvic organ prolapse · Prevalence

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Introduction

Pelvic organ prolapse (POP) and overactive bladder (OAB) symptoms are important problems for women. POP is a prevalent problem which has been reported to affect 50% of parous women [1]. Eleven percent of the women will have undergone an operation for prolapse or urinary incontinence by the age of 80 [2].

OAB is known to be a highly prevalent disorder that increases with age in both sexes and that has a profound impact on quality of life [3]. According to the International Continence Society (ICS) OAB is defined as urgency with or without urge incontinence, usually with frequency and nocturia [4]. This term can only be used if there is no proven infection or 'obvious pathology'. It is a matter of debate whether POP should be considered as 'obvious pathology'.

Symptoms of OAB are often seen in patients with POP [5]. Community based studies showed that the prevalence of OAB symptoms is higher in patients with POP than without POP [5]. The same tendency is found in hospital based studies [5]. Nevertheless, the literature about the prevalence of the combination of POP and OAB is scarce.

To study the relation between POP and OAB, we used data from a cross-sectional study which was performed in a small Dutch city about the prevalence of pelvic floor symptoms in the general population [6].

The objective of this study is to investigate risk factors for OAB and specifically to explore the relationship between OAB and prolapse. This is important for clinical practice because the two diagnoses are often co-occurring which has possible consequences for diagnosis and treatment.

Methods

The study was cross-sectional in a small town, Brielle, in the Netherlands. Brielle was chosen because it has a homogenic population, where all women are registered in one of the nine general practices. All women aged 45 to 85 years registered on the patients lists of eight out of nine general practices were invited to enrol in the study, which is 95% of the women in this age group. The women were sent information about the study and informed that they could enrol by filling out an informed consent form. All women who consented were asked to complete a self-report questionnaire. Non-responders received a reminder 8 weeks later that contained the same questionnaire. To check for selection bias, permanent non-responders were invited to complete a short questionnaire that comprised five questions about age, parity, presence of stress urinary incontinence (yes/no), faecal incontinence (yes/no) and feeling of vaginal bulging (yes/no). To encourage a high response to the questionnaire, we used envelopes with the name and logo of the Erasmus University, coloured paper and stamped addressed return envelopes.

Three options were possible: women refused to participate in the study, women filled out only the questionnaire and women filled out the questionnaire and underwent vaginal examination. For the purpose of this study, data on vaginal examination are not used. The relation between symptoms and signs of vagina prolapse has been extensively described in an earlier study [6]. A flowchart of the study design is presented in Fig. 1. In this study, all women who answered the questionnaires are included.

The self-reported questionnaire used for this study are a composite of internationally well-known questionnaires that have been validated for the Dutch language. It contains, amongst others, disease-specific questions from the validated Dutch translation of the Urinary Distress Inventory(UDI) [7] next to other questionnaires and items which were not used for the present study [6].

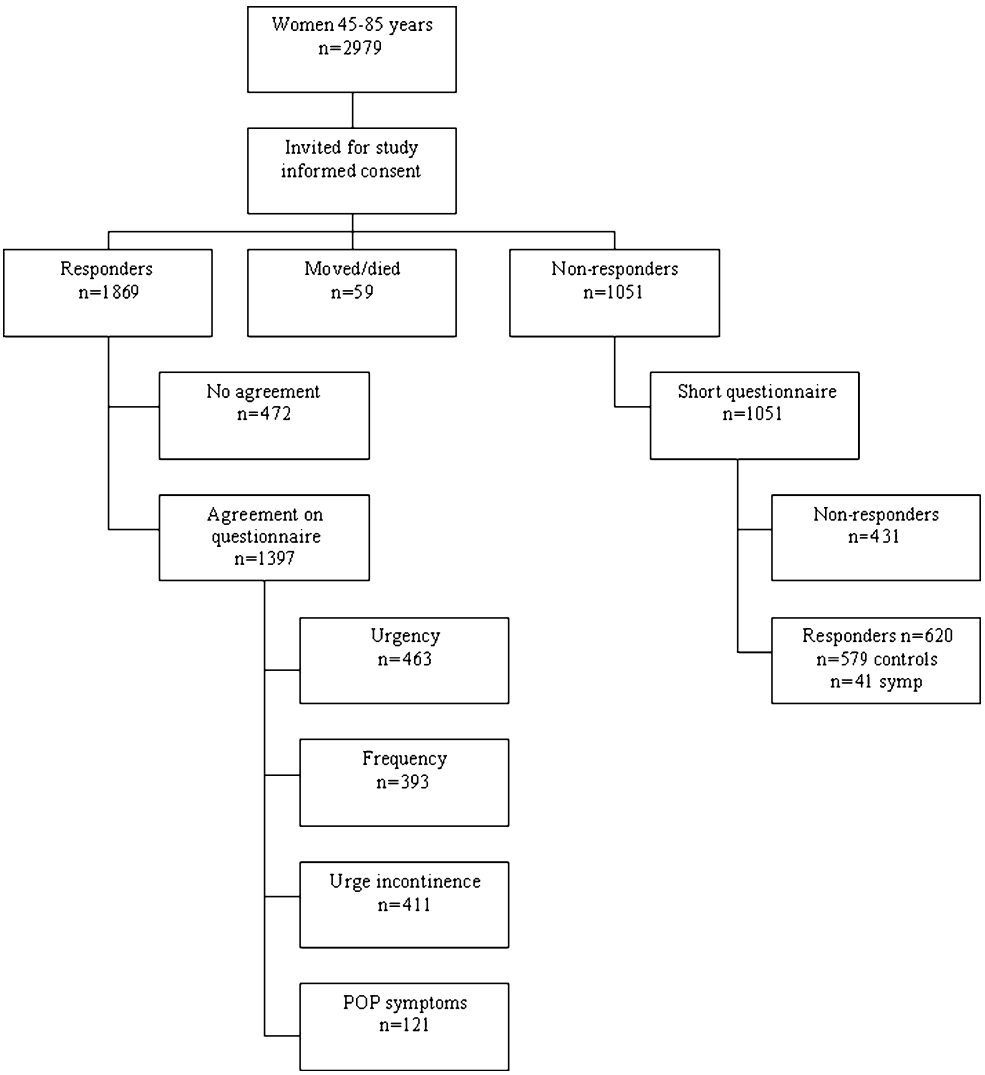

Fig. 1 Flowchart of the study

Women rated the amount of bother of various symptom on a 5-point Likert scale, from 0 (no complaints at all) to 4 (very serious complaints). In addition, questions about ethnicity, parity, POP symptoms during pregnancy, family history, menopausal status, hormone replacement therapy (HRT), previous pelvic floor surgery, educational level, smoking and heavy physical work were also included.

The Medical Ethics Research Committee (METC) of the Erasmus MC in Rotterdam, the Netherlands, approved this study.

Measurements

All symptoms were dichotomized as present or absent based on responses to each symptom and degree of bother with these symptoms. Women who denied the presence of a specific symptom as well as women who answered confirmative on a specific question but answered not to be bothered by it were considered as negative (absent) while women who indicated that they were little to severe bothered were considered as positive (present). The item of POP symptoms is merged from women who reported either seeing and/or feeling vaginal bulging. For the item any OAB symptoms, women who had urgency and/or frequency and/or urge incontinence symptoms were included (see Fig. 2).

Data are presented as number of women (percentage), mean (standard deviation) or median (range) as appropriate. Chi-square test was used to compare the difference between the women with- versus without POP symptoms.

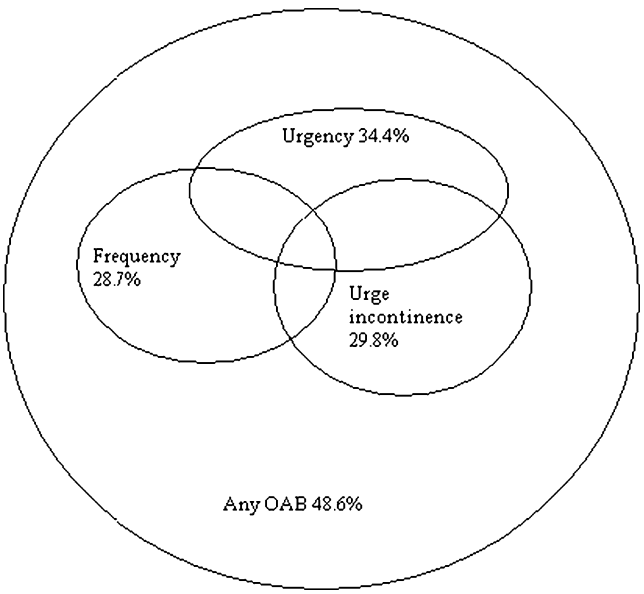

Fig. 2 Any OAB symptoms in relation to urgency, frequency and urge incontinence

Logistic regression was used for the univariate and multivariate analysis. For logistic regression, the backward elimination procedure was used. Variables with a $P<0.3$ in univariate analysis were included in the multivariate analysis. We presented the odds ratio (OR) and 95% CI for each of the OAB symptoms. The level of significance was set at an alpha value of 0.05. All data were entered and analysed in a SPSS 15.0 database for Windows (SPSS, Inc., Chicago, IL).

Results

Of the 2,979 women who were eligible for this study, 1,397 (47%) filled out the questionnaire. In the non-responder group, 59% filled out and returned the short questionnaire (620/1,051), giving a total response rate of 62.7% (Fig. 1). Scores in the short questionnaire group were not significantly different from those in the total study group. Details of the response rate are presented in a previous report [6].

Table 1 shows the characteristics of the women included in this study. Table 2 shows the prevalence of OAB symptoms per age category. In Table 3, the prevalence of POP symptoms in women with and without OAB symptoms is presented.

In Table 4, the various possible risk factors including the presence of POP symptoms for the presence of OAB symptoms are presented in a univariate logistic regression model.

The OR shows the chance of the presence of OAB symptoms. An OR >1 indicates that the factor is positively correlated with the outcome variable; an OR <1 means that the factor indicates a negative correlation.

Table 5 shows the multivariate analysis of the OAB symptoms where all factors of the univariate analysis with a $P<0.3$ are taken into account.

Discussion

In this cross-sectional study, we looked at the prevalence of OAB symptoms and specifically the relationship between OAB symptoms and POP symptoms. We found a prevalence of urgency, frequency and urge urinary incontinence of 34%, 29% and 30%, respectively. The prevalence for any OAB symptoms was 49%. This is comparable with other studies, where a prevalence of 16.8–49% was found in women [3, 8]. POP symptoms were present in 11.4%, which is comparable with other studies where a prevalence of 4–30% was found [9–11].

Risk factors

This study found POP symptoms to be an independent risk factor for OAB symptoms. The sparse cross-sectional

Table 1 Patients' characteristics and details of previous pelvic operations

Number of women	1397
Age (years)[a]	
45–55	647 (46.9%)
56–65	435 (31.5%)
66–75	233 (16.9%)
76–85	66 (4.8%)
Parity	
0	120 (8.6%)
1	215 (15.4%)
2	675 (48.3%)
≥3	387 (27.7%)
Body mass index (kg/m2)[b]	
<20	53 (3.9%)
20–25	599 (43.9%)
25–30	519 (38.0%)
≥30	193 (14.1%)
Race[c]	
Caucasian	1,351 (98.5%)
Non-Caucasian	20 (1.5%)
Smoking	
Former smoking[d]	326 (23.6%)
Current smoking[d]	280 (20.3%)
Postmenopausal status	1,009 (72.2%)
Hormone suppletion[e]	88 (6.4%)
Previous gynaecological surgery	
Prolapse surgery[h]	103 (7.4%)
Hysterectomy[i]	234 (16.9%)
Incontinence surgery[j]	47 (3.4%)

Data are presented as number of women (percentage)

[a] Data on 16 women are missing

[b] Data on 33 women are missing

[c] Data on 26 women are missing

[d] Data on 15 women are missing

[e] Data on 30 women are missing

[f] Data on 25 women are missing

[g] Data on 18 women are missing

[h] Data on 13 women are missing

[i] Data on 14 women are missing

[j] Data on 15 women are missing

studies who mentioned a relationship between POP symptoms and OAB, showed a higher prevalence of OAB symptoms with POP symptoms than without POP symptoms (!) [5] but were not controlled for other risk factors. The same relationship between POP and OAB is found in hospital based studies, the prevalence of OAB symptoms is greater in patients with POP than without POP [5]. However, by the nature of these epidemiological studies a

Table 2 Prevalence of overactive bladder symptoms and any OAB symptoms per age group[a]

	Frequency[b]	Urgency[c]	Urge incontinence[d]	Any of the OAB symptoms
45–55	162 (25.3%)	193 (30.9%)	178 (27.7%)	298 (46.1%)
56–65	121 (28.4%)	141 (33.7%)	116 (26.9%)	200 (46.2%)
66–75	80 (35.9%)	92 (40.5%)	79 (35.0%)	126 (54.5%)
76–85	24 (37.5%)	33 (54.1%)	32 (48.5%)	42 (63.6%)
Overall	393 (28.7%)	463 (34.4%)	411 (29.8%)	677 (48.6%)

Data are presented as number of women (percentage)

[a] Data on age category on 16 women are missing

[b] Data on frequency on 28 women are missing

[c] Data on urgency on 52 women are missing

[d] Data on urge incontinence on 16 women are missing

causal relationship cannot be established. There are many possible theories regarding the pathophysiology of OAB in relation to POP and it is likely that bladder obstruction plays an important role [5]. Nevertheless, several other mechanisms might be considered. The pathophysiological relationship between OAB and POP needs to be studied further. Important clinical implication of the relationship between POP and OAB is that treatment of POP could give an improvement in OAB symptoms. This is consistent with the finding in a recent review [5].

Another important risk factor for OAB symptoms was surgery for urinary incontinence in the past. Many studies have shown a relationship between continence surgery and OAB symptoms where the prevalence of de novo OAB varied between 15% and 29% on the short term (1–3 months postoperatively) [12, 13] and 0–30% on the long term [12–14]. As in other studies, we found

Table 3 Prevalence of prolapse symptoms[e] in women with symptoms of OAB

	Prolapse symptoms	No prolapse symptoms	P[a]
Frequency[b]	66 (41.8%)	320 (26.9%)	0.000
Urgency[c]	77 (49.7%)	379 (32.4%)	0.000
Urge incontinence[d]	64 (40.3%)	340 (28.3%)	0.003
Any of the OAB symptoms[e]	84 (69.4%)	588 (46.6%)	0.000

Data are presented as number of women (percentage)

[a] P value using chi-square test to compare the difference between women with versus without prolapse symptoms.

[b] Data on 28 women are missing

[c] Data on 52 women are missing

[d] Data on 16 women are missing

[e] Data on four women are missing

[f] Data on prolapse symptoms on 24 women are missing

Table 4 Factors of the univariate logistic regression analysis on the various OAB symptoms

		Frequency OR (95% CI)	Urgency OR (95% CI)	Urge incontinence OR (95% CI)	Any OAB OR (95% CI)
Age (years)[a]	45–55	Ref	Ref	Ref	Ref
	56–65	1.2 (0.9, 1.5)	1.1 (0.9, 1.5)	1.0 (0.7,1.3)	1.0 (0.8, 1.3)
	66–75	**1.7 (1.2, 2.3)**	**1.5 (1.1, 2.1)**	**1.4 (1.0, 1.9)**	**1.4 (1.0, 1.9)**
	76–85	**1.8 (1.0, 3.0)**	**2.6 (1.5, 4.5)**	**2.5 (1.5, 4.1)**	**2.0 (1.2, 3.5)**
Parity	≤2	Ref	Ref	Ref	Ref
	>2	1.3 (1.0, 1.7)	1.0 (0.8, 1.3)	1.0 (0.8, 1.3)	1.2 (0.9, 1.5)
Body mass index (kg/m2)[b]	<20	0.7 (0.3,1.5)	**0.4 (0.2, 1.0)**	0.7 (0.4, 1.5)	0.6 (0.3, 1.0)
	20–25	Ref	Ref	Ref	Ref
	25–30	**1.6 (1.3, 2.1)**	**1.3 (1.0, 1.7)**	**1.5 (1.1, 1.9)**	**1.4 (1.1, 1.7)**
	≥30	**2.0 (1.4, 2.8)**	**2.2 (1.6, 3.1)**	**2.2 (1.6, 3.1)**	**2.3 (1.7, 3.2)**
Smoking					
Former smoking[c]	Yes	**1.3 (1.0, 1.8)**	1.2 (0.9, 1.6)	1.0 (0.8, 1.4)	1.1 (0.8, 1.4)
	No	Ref	Ref	Ref	Ref
Current smoking[c]	Yes	1.0 (0.8,1.4)	1.3 (1.0, 1.7)	1.3 (1.0, 1.7)	1.2 (1.0, 1.6)
	No	Ref	Ref	Ref	Ref
Postmenopausal status	Yes	**1.5 (1.2, 2.0)**	**1.6 (1.2, 2.0)**	**1.4 (1.1, 1.8)**	**1.3 (1.0, 1.7)**
	No	Ref	Ref	Ref	Ref
Hormonal suppletion therapy[e]	Yes	1.2 (0.7, 1.9)	1.2 (0.7, 1.8)	0.7 (0.4, 1.2)	0.9 (0.6, 1.4)
	No	Ref	Ref	Ref	Ref
Previous gynaecological surgery					
Prolapse surgery[d]	Yes	**2.5 (1.7, 3.8)**	**2.6 (1.7, 3.9)**	**1.9 (1.3, 2.9)**	**2.9 (1.9, 4.6)**
	No	Ref	Ref	Ref	Ref
Hysterectomy[h]	Yes	**1.5 (1.1, 2.1)**	1.3 (0.9, 1.7)	1.3 (1.0, 1.8)	1.3 (1.0, 1.7)
	No	Ref	Ref	Ref	Ref
Incontinence surgery[c]	Yes	**3.5 (1.9, 6.5)**	**3.4 (1.9, 6.3)**	**4.3 (2.3, 8.0)**	**6.5 (2.9, 14.5)**
	No	Ref	Ref	Ref	Ref
Prolapse symptoms[i]	Yes	**2.0 (1.4, 2.7)**	**2.1 (1.5, 2.9)**	**1.7(1.2, 2.4)**	**2.6 (1.7, 3.9)**
	No	Ref	Ref	Ref	Ref

All values with $P<0.05$ are illustrated in **bold**

Ref: reference

[a] Data on 16 women are missing

[b] Data on 33 women are missing

[c] Data on 15 women are missing

[d] Data on 13 women are missing

[e] Data on 30 women are missing

[f] Data on 25 women are missing

[g] Data on 18 women are missing

[h] Data on 14 women are missing

[i] Data on 24 women are missing

the prevalence of OAB symptoms increased with advancing age [3, 8].

Overweight (body mass index [BMI] greater then 30) was another independent risk factor for OAB symptoms. This is consistent with other studies, who found the same relationship [15–19]. The study of Cheung found a similar OR for overweight [15], where the study of Lawrence found a higher OR (2.73) [18]. On the other hand, Choo et al. [16] found that BMI was only a predictor for OAB dry (urgency with or without frequency or nocturia), but not for OAB wet (urgency with urge incontinence, with or without frequency or nocturia).

Another factor for achieving urgency was smoking. Other studies are not conclusive about the role of smoking in OAB [17, 20, 21]. The study of Bradley et al. [20] found no relation between current smoking and urinary symp-

Table 5 Risk factors on OAB symptoms after multivariate regression analysis

		Frequency OR (95% CI)	Urgency OR (95% CI)	Urge incontinence OR (95% CI)	Any OAB OR (95% CI)
Age (years)[a]	45–55		Ref	Ref	Ref
	56–65		1.0 (0.8, 1.4)	0.9 (0.6, 1.1)	0.9 (0.7, 1.2)
	66–75		1.4 (1.0, 2.0)	1.3 (0.9, 1.8)	1.3 (1.0, 1.8)
	76–85		2.7 (1.5, 4.9)	2.2 (1.3, 3.8)	2.1 (1.2, 3.7)
Body mass index (kg/m^2)[b]	<20	0.7 (0.3, 1.6)	0.4 (0.2, 0.9)	0.7 (0.3, 1.5)	0.5 (0.3, 1.0)
	20–25	Ref	Ref	Ref	Ref
	25–30	1.5 (1.1, 2.0)	1.2 (0.9, 1.6)	1.3 (1.0, 1.8)	1.3 (1.0, 1.6)
	≥30	1.7 (1.2, 2.4)	2.2 (1.5, 3.1)	2.0 (1.4, 2.9)	2.2((1.5, 3.1)
Smoking					
Smoking in the past[c]	Yes		1.4 (1.1, 1.9)		
	No		Ref		
Current smoking[c]	Yes		1.7 (1.2, 2.3)		1.4 (1.0, 1.8)
	No		Ref		Ref
Postmenopausal status	Yes	1.3 (1.0, 1.8)			
	No	Ref			
Previous gynaecological surgery					
Prolapse surgery[d]	Yes		2.3 (1.4, 3.6)		
	No		Ref		
Incontinence surgery[e]	Yes	2.9 (1.5, 5.5)		4.3 (2.3, 8.2)	6.7 (2.8, 16.3)
	No	Ref		Ref	Ref
Prolapse symptoms[f]	Yes	2.4 (1.6, 3.5)	2.2 (1.4, 3.3)	1.8 (1.2, 2.6)	2.3 (1.5, 3.5)
	No	Ref	Ref	Ref	Ref
Variance explained by the model[g]		5.8%	8.8%	6.6%	9.1%

OR odds rario, *Ref* reference

[a] Data on 16 women are missing

[b] Data on 33 women are missing

[c] Data on 15 women are missing

[d] Data on 13 women are missing

[e] Data on 18 women are missing

[f] Data on 24 women are missing

[g] Nagelkerke R^2

toms, while a large cross-sectional study showed that current and former smoking was associated with urgency [21]. One study found that current smokers were 1.44 time more likely to develop OAB, and the increased risk for former smokers was nearly significant [17]. The induction of OAB in smoking could be related to an anti-oestrogenic hormonal effect on the bladder and uretra [22] and a nicotine induced phasic contraction of the detrusor muscle [23].

Postmenopausal status was a risk factor for the symptom frequency in our study. This is consistent with another study which found postmenopausal status to be a predictor for OAB symptoms [24]. This can be explained because oestrogen has an important role in the urogenital tract through oestrogen receptors in urethra, bladder and pelvic floor [25], where deficiency causes atrophic changes [26], which is associated with OAB symptoms. Reversal of the atrophy by oestrogen treatment can have a positive influence on OAB symptoms [27].

Surprisingly, we found previous prolapse surgery to be a predictor for the symptom urgency, this in contrast to practically all studies that showed an improvement of OAB symptoms after prolapse surgery [5]. A possible explanation for this finding is that women after prolapse surgery achieved de novo urgency, as was found in 5% of the patients in one study [28].

Strengths and weaknesses

The strong point about this study is that it is a large cross-sectional study in a homogenic female population, which made multivariate analysis possible; as a result, however,

genetic and racial factors could not be included, which is also an inherent weakness of the design.

Another weakness of this study is that not all factors of influence on OAB are included, such as food and beverages (coffee and alcoholic consumption) and the use of OAB therapies (bladder training and pharmacotherapy).

Conclusion

In this study, we found a prevalence of urgency of 34%, as the core symptom of the OAB spectrum, and of any OAB symptoms of 49%. POP symptoms are an independent risk factor for OAB symptoms. Other risk factors are continence surgery in the past, age above 75, overweight and smoking.

Conflicts of interest None.

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