

Potential benefits of diagnosis and treatment on health outcomes among elderly people with symptoms of overactive bladder

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Disclosures

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SUMMARY

Objectives: This study examined potential benefits of diagnosing and treating elderly adults with overactive bladder (OAB) symptoms. **Methods:** Data were analysed from the OAB Re-Contact Study ($N = 2750$), a cross-sectional, self-reported Internet survey. Elderly respondents (65+ years old) with OAB were identified according to current medication use to control OAB symptoms or by scores > 14 (men) or > 16 (women) on the OAB Awareness Tool. Treated were those currently using prescription medication and never treated were those who never used prescription medication for OAB. Outcome measures included health-related quality of life, activity impairment, OAB-related severity and symptoms, and health-care resource use (e.g. hospitalisations). Generalised linear models predicted health outcomes as a function of diagnosis or treatment, adjusting for covariates. **Results:** Diagnosed vs. not diagnosed elderly respondents had higher mental component summary (MCS) scores and SF-6D health utilities, and less activity impairment. Treated vs. never treated elderly respondents had higher MCS and SF-6D health utilities, less activity impairment, fewer OAB symptoms, lower OAB Awareness Tool scores, and lower odds of having bladder problems or incontinence. There were no significant differences in healthcare resource use. Further analysis by age group (middle-aged vs. elderly respondents) revealed significantly greater diagnosis- and treatment-related benefits on MCS (2.93 and 4.49 points more, respectively) and activity impairment (1.24 and 1.37 times as much, respectively) among elderly respondents. **Conclusions:** Diagnosis and treatment were each associated with a lower health burden for elderly adults with OAB symptoms. These findings highlighted the importance of diagnosis and treatment in alleviating OAB symptoms and their impact on health outcomes.

What's known

Overactive bladder (OAB) poses a considerable humanistic burden on patients by negatively affecting their health-related quality of life (HRQoL). Additionally, OAB involves a high economic burden. While behavioural and pharmacological treatments for OAB can improve patients' symptoms and HRQoL, elderly adults tend to be under-diagnosed or under-treated for this condition.

What's new

Elderly people with OAB symptoms who were diagnosed with or treated for OAB self-reported better mental summary scores and SF-6D health utilities, as well as less activity impairment, than those not diagnosed or never treated. The benefits of diagnosis and treatment were greater for elderly people than for their middle-aged counterparts with OAB symptoms. These findings underscore the importance of diagnosis and treatment on health outcomes among elderly people with OAB symptoms.

Introduction

Overactive bladder (OAB) is clinically defined by the experience of certain abnormal urinary symptoms in the absence of a diagnosed urinary tract infection or other pathology. Specifically, OAB is characterised by the increased urgency to urinate, a greater frequency of urination, the disruption of sleep to urinate (i.e. nocturia), and incontinence (1). Overall, 27.2% of men and 43.1% of women aged 40 or older experienced OAB symptoms at least sometimes during the prior month, with 15.8% of men and 32.6% of women experiencing OAB often (2). Prevalence of OAB has been found to increase with age, and about 30% of U.S. adults aged 65 or older were found to have OAB (3). More recent estimates suggest the prevalence of OAB among elderly people (aged 65 or

older) is higher, with 40.4% of elderly men and 46.9% of elderly women experiencing OAB symptoms sometimes or more often (4). OAB prevalence also differs by race and is higher for African-American and Hispanic adults than for White adults (5).

Overactive bladder poses a significant humanistic and economic burden for patients. Coyne et al. (2) estimated that almost 30 million adults over the age of 40 in the U.S. perceive their OAB symptoms to be somewhat to very bothersome. Other research has shown that the increased number of bothersome OAB symptoms were associated with more daily activity impairments and reduced work productivity (6). More bothersome OAB symptoms were associated with lower health-related quality of life (HRQoL) and higher depression, anxiety and health-care resource use (7). Among elderly adults, OAB

was related to decreases in general and OAB-specific HRQoL and higher rates of self-reported depression and anxiety (4). A previous study estimated that, in 2007, OAB resulted in \$1925 in direct and indirect costs per person. Projection of the per capita estimates to the entire population of Americans with OAB led to a total national cost of \$65.9 billion. OAB costs were anticipated to increase to \$1944 per person and \$76.2 billion nationally in 2015 and to \$1969 per capita and \$82.6 billion nationally by 2020 (8).

According to the current American Urological Association's guideline, the recommended first-line treatment for OAB symptoms comprises behavioural therapies (e.g. pelvic floor muscle training, fluid intake management, etc.), either alone or in conjunction with antimuscarinic medications (e.g. darifenacin, trospium, etc.) (1). Second-line OAB treatment generally consists of oral or transdermal antimuscarinics. However, these medications should be prescribed circumspectly to frailer patients or to patients taking concomitant medications that may interact with those for OAB (1). Furthermore, β -adrenergic receptor agonists (e.g. mirabegron) represent a new medication class that has recently been introduced for the treatment of OAB by relaxing the bladder and improving storage capacity. This new class may be an effective and safe alternative for patients who are poor responders to antimuscarinics (1,9,10).

Research has shown that antimuscarinics and behavioural treatments (i.e. pelvic floor muscle exercises, urge suppression and delayed voiding) were effective in reducing OAB symptoms (11,12). Previous studies have also indicated that antimuscarinic therapy was not only associated with an improvement in self-reported OAB symptoms (13) but also related to an increase in HRQoL (14). Other important patient-reported outcomes (PROs), such as work and activity impairments, have received little attention in the literature. The limited evidence indicates that adults, who were not being treated for their OAB, were more likely to report experiencing daily activity and work impairments than those receiving treatment (6). Indirect costs because of lower work productivity for untreated OAB patients were almost double those incurred by treated patients (\$17,477 vs. \$9670) (6). Appropriate treatment may thus help to reduce the economic and humanistic burden of OAB.

Existing research suggests that OAB is under-diagnosed. One study found that three-quarters of male veterans within an outpatient urology clinic setting reported symptoms consistent with a diagnosis of OAB, yet, less than half had actually been diagnosed

(15). Another previous study also found that only a small portion of elderly adults with OAB attempted to seek treatment to alleviate symptoms (4). These findings suggest there may be a lack of adequate awareness of OAB among both physicians and patients. Elderly adults with OAB may be particularly likely to be under-diagnosed. This is because older adults commonly have comorbidities and/or take medications that increase the likelihood of experiencing urinary symptoms, which makes OAB diagnosis less straightforward than when relevant symptoms occur in otherwise healthy adults (16).

Not only do elderly adults tend to be under-diagnosed but there is also evidence suggesting under-treatment of OAB. Elderly men and women who perceived their OAB symptoms to be more frequent were more likely to seek treatment than elderly adults who reported no or only minimal OAB symptoms (4). However, only 37.5% of elderly men and 22.1% of elderly women with more frequent OAB symptoms had sought treatment for their symptoms (4). These findings underscore the potential unmet need for OAB treatment, especially for elderly adults.

It is important to properly manage elderly patients with symptoms of OAB, as a lack of diagnosis and treatment may result in significant humanistic and economic burden of OAB. Particularly, these patients may continue to experience OAB symptoms, which may subsequently affect their daily activities and functioning at work (6) and reduce HRQoL (4). Furthermore, experiencing OAB symptoms may increase the risk of comorbidities, such as falls and fractures (17) and urinary tract infections (18). In turn, these additional comorbidities may increase healthcare resource use, thereby raising OAB-related costs.

The objective of this study was to examine the potential impact of diagnosing and treating elderly adults with OAB symptoms. Specifically, we compared health (e.g. activity impairment, mental and physical summary scores), OAB-related (e.g. symptoms experienced, incontinence status) and economic (e.g. healthcare resource use) outcomes between diagnosed and not diagnosed and between treated and never treated elderly adults with symptoms of OAB. We also examined whether the potential health, OAB-related, and economic outcomes associated with diagnosis and treatment were different between elderly (65+ years old) and middle-aged (45–64 years old) adults with symptoms of OAB.

Methods

Data source

This study used data ($N = 1820$) from the OAB Re-Contact Study ($N = 24,866$; fielded in 2010), a cross-

sectional, self-reported Internet survey in which respondents were identified via the 2009 U.S. National Health and Wellness Survey (NHWS). The U.S. NHWS is an annual survey of healthcare attitudes and behaviours of a nationally representative sample of the adult population in the U.S. NHWS participants are members of the Lightspeed Research (LSR) panel, who are recruited via opt-in email, co-registration with LSR partners, e-newsletter campaigns, banner placements, and internal and external affiliate networks. Panellists are limited in the number of surveys (24) in which they may participate per year.

The 2009 U.S. NHWS participants who had reported currently using prescription medications to control OAB symptoms or had scores > 14 (for men) or > 16 (for women) on the OAB Awareness Tool (19), a patient-administered screening tool to identify patients with bothersome OAB symptoms, were invited to participate in the OAB Re-Contact Study. Participants who met any of the following criteria were excluded from the OAB Re-Contact Study (and thus the present study, as well): current pregnancy, self-reported haematuria or pink-tinged urine, pain or burning sensation on urination because of a urinary tract infection, use of a catheter, diagnosis of benign prostate hyperplasia (BPH) or prostate cancer, or current use of medication for BPH (e.g. tamsulosin, dutasteride).

Study sample

This study included all elderly (aged 65 years or older) and middle-aged (45–64 years old) adults who participated in the OAB Re-Contact study ($N = 1820$; see Figure 1). All study subjects reported OAB symptoms, as they either had current use of medications to control OAB symptoms or had scores > 14 (for men) or > 16 (for women) on the OAB Awareness Tool (19).

Statistical variables

Demographics and health characteristics

Gender, marital status, employment status, income, number of years experiencing bladder control symptoms, and frequency of seeing one's regular doctor were included. Scores based on the original version of the Charlson Comorbidity Index (CCI) (20), and using self-reported diagnoses by a physician, were also calculated. The CCI weights the presence of the following conditions and then sums the result: HIV/AIDS, metastatic tumour, lymphoma, leukaemia, any tumour, moderate/severe renal disease, hemiplegia, diabetes, mild liver disease, ulcer disease, connective tissue disease, chronic pulmonary disease, dementia,

cerebrovascular disease, peripheral vascular disease, myocardial infarction, congestive heart failure, and diabetes with end-organ damage. Higher CCI scores reflect a greater comorbid burden on the patient. The CCI in the survey did not include moderate/severe liver disease or paraplegia, as those conditions were not assessed.

OAB diagnosis status (diagnosed vs. not diagnosed)

Diagnosed respondents were defined as those individuals who reported a diagnosis of OAB or who were treated for OAB (even if they did not report having a diagnosis of OAB). Not diagnosed respondents were defined as those individuals who did not report a diagnosis of OAB or who were unaware of OAB.

Current OAB treatment status (treated vs. never treated)

Treated respondents were defined as those individuals currently using a prescription medication to treat their OAB. Never treated respondents were defined as those individuals who had never used a prescription medication for OAB previously, yet their self-reported OAB symptoms interfered with their life and were likely serious enough to require medication; this approach was utilised by Clemens et al. (6) using the same data. The purpose of this definition was to align never treated, but impaired, respondents with those treated (i.e. those who were impaired and inevitably did take prescription medication for their condition) to compare the effects of treatment and lack of treatment among similarly impaired individuals.

Health-related quality of life

Health-related quality of life was defined by the 12-Item Short Form Survey Instrument version 2 (SF-12v2), a multipurpose, generic health status instrument comprising 12 questions (21) designed to report on eight health domains (physical functioning, physical role limitations, bodily pain, general health, vitality, social functioning, emotional role limitations and mental health). Two summary scores were calculated: Physical Component Summary (PCS) and Mental Component Summary (MCS). PCS and MCS scores are normed to a mean of 50 and a standard deviation of 10 for the U.S. population; higher scores indicate better health status. The SF-12v2 was also used to generate health state utilities by applying the SF-6D algorithm. The SF-6D health utilities index has interval scoring properties and yields summary scores on a theoretical 0–1 scale; higher scores indicate better health status.

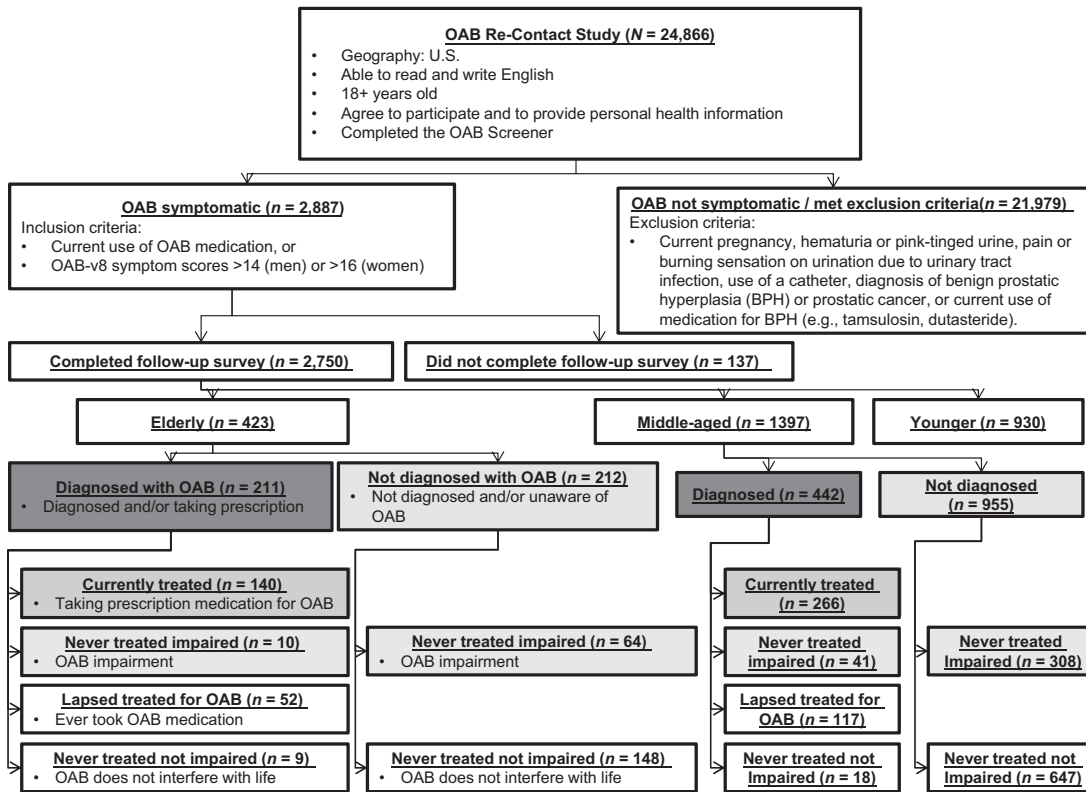


Figure 1 Study sample

Activity impairment

The activity impairment measure from the Work Productivity and Activity Impairment (WPAI) questionnaire (22) was used to assess the extent to which participants perceived their general health to have affected daily life activities. Higher percentages indicated greater activity impairment.

Bladder coping strategies

Different ways used to cope with bladder symptoms (e.g. limit intake of fluids/beverages, use incontinence undergarments, go to the bathroom often, avoid visiting public places) were assessed.

OAB symptom bother

The eight-item OAB Awareness Tool (OAB-V8) (19) was used to assess the amount of bother a participant feels about OAB symptoms. Items address urinary frequency, urgency, nocturia and incontinence (e.g. 'How bothered have you been by frequent urination during the daytime hours?'; 'How bothered have you been by an uncomfortable urge to urinate?'). Responses to each item are made on a 6-point scale ranging from 0 (not all) to 5 (a very great deal) for the degree of bother. The eight-item responses are added together to generate a total score ranging from 0 to 40.

Bladder condition assessment

To help classify respondents according to their general level of incontinence and its severity, the Patient Perception of Bladder Condition (PPBC) questionnaire was used, with scores ranging from 1 (bladder condition does not cause 'any problems at all') to 6 ('many severe problems') (23).

Incontinence status

To more specifically classify respondents according to their current incontinence status, they were identified as having no urinary incontinence, urge only or urge predominant (UUI), stress only/predominant (SUI), mixed (MUI) or other cause only/predominant (OUI) urinary incontinence, via the three Incontinence Questions (3IQ) (24). The first question of the 3IQ determines if incontinence has occurred in the past 3 months. The second question is used to identify types of incontinence: stress predominant (associated with physical activity, coughing, or sneezing), urge (associated with the feeling of urge or the need to empty bladder) or other (without physical activity or urgency). The third question determines the category of incontinence: stress, urge, other or mixed (stress and urge combined). For example, respondents may be classified as having UUI/MUI if they: 1. leaked urine ('even a small

amount') during the last 3 months; or they leaked urine 'most often', when 2. 'you had the urge or the feeling that you needed to empty your bladder, but you could not get to the toilet fast enough' (urge) or 3. 'about equally as often with physical activity as with a sense of urgency' (mixed).

OAB disease symptoms

Bladder symptoms experienced in the past month included: frequent urination during the daytime hours, an uncomfortable urge to urinate, a sudden urge to urinate with little or no warning, accidental loss of small amounts of urine, night-time urination, waking up at night because you had to urinate, an uncontrollable urge to urinate and urine loss associated with a strong desire to urinate.

Healthcare resource use

Resource use was defined by the self-reported number of surgeries, emergency room (ER) visits, times hospitalised, provider visits and days hospitalised in the past 6 months. Total resource use was also calculated.

Statistical methods

Two-sample comparisons of diagnosed, relative to not diagnosed and treated, compared with never treated, were conducted by using tests of proportions for categorical variables and *t*-tests of the means for continuous variables. Multivariable analyses were conducted to assess the relationship of diagnosis and treatment with health (MCS, PCS, SF-6D, activity impairment), OAB-related (OAB Awareness Tool score, incontinence status, perception of bladder condition, OAB symptoms experienced) and economic (i.e. healthcare resource use) outcomes after adjusting for covariates. Multivariable models, including multiple regression, logistic regression, Poisson or negative binomial generalised linear models (GLMs), were tested with different health, OAB-related and economic outcome measures as a function of diagnosis and treatment, controlling for covariates. Covariates were chosen based on conceptual interest and significant two-sample results. Covariates for all multivariable models included: gender (female vs. reference group = male), marital status (married vs. reference group = single/divorced/widowed/separated), employed (vs. reference group = non-employed), income <\$50k or declined (vs. reference group = \$50k+), years experiencing bladder control symptoms, frequency of seeing one's regular doctor (vs. reference group = never/don't have one) and CCI score (1, 2, or 3+, vs. reference group = 0). Additional multivariable models were run with age

group by diagnosis and age group by treatment interactions to test whether the change in a specific outcome associated with diagnosis and treatment was different among elderly respondents, compared with middle-aged respondents.

Among the health and OAB-related outcome measures being assessed, MCS, PCS, SF-6D health utilities, OAB Awareness Tool Scores and OAB symptoms experienced had normal distributions; thus, normal GLMs were used. Activity impairment historically has a highly skewed distribution; thus, Poisson models were tested and fit indices were examined. The ratio of deviance to degrees of freedom (df) was found to be much greater than 1 in all of the Poisson models tested, indicating model over-dispersion, and therefore, negative binomial models were used instead, given their better handling of high mean-to-variance ratios. The PPBC and 3IQ had binary responses; thus, logistic regressions were used. Economic PRO measures included number of surgeries, ER visits, hospitalisations (times visited), provider visits and days hospitalised in the past 6 months. As with activity impairment, the healthcare resource use measures were highly positively skewed, and therefore, negative binomial models were found to be a better fit. Any two-sided *p*-values less than 0.05 were considered statistically significant.

Results

Sample characteristics and demographics

The sample selection process is depicted in Figure 1. A total of 2750 participants responded to the OAB Re-Contact Study and had symptomatic OAB. Of those with symptomatic OAB, 423 were elderly and 1397 were middle-aged. Among elderly respondents with OAB symptoms, 211 were diagnosed with OAB and 212 were not diagnosed with OAB. Additionally, 140 elderly respondents were treated and 74 were never treated but were impaired (i.e. OAB symptoms interfered with their life and were likely serious enough to require medication). Among middle-aged respondents with OAB symptoms, 422 were diagnosed and 955 were not diagnosed, and 266 were treated and 349 were never treated but impaired.

The average age of elderly respondents with OAB symptoms was 67.7 years old (SD = 1.83), 73.0% were women, 93.9% were White, 61.9% were married and 16.3% were employed. Among middle-aged respondents with OAB symptoms, the average age was 53.7 years old (SD = 5.56), 55.4% were women, 77.4% were White, 64.0% were married and 44.0% were employed.

Two-sample comparisons among elderly respondents diagnosed with OAB vs. not diagnosed with OAB

Patient demographics and characteristics

Elderly respondents with OAB symptoms who were diagnosed with OAB were more likely to be women (80.1% vs. 66.0%), had a household income of less than \$50K (60.7% vs. 49.5%), had been experiencing bladder control related symptoms for 6 years or longer (53.1% vs. 31.6%) and saw their doctor more frequently (twice a year or more: 64.9% vs. 53.8%) than those not diagnosed with OAB, all $p < 0.05$ (Table 1).

Health-related patient-reported outcomes

Among the health outcomes being assessed, the MCS score of the SF-12 was the only one that differed significantly between the diagnosed and not diagnosed. Elderly respondents with OAB symptoms who were

diagnosed on average scored higher on MCS than those not diagnosed with OAB (means = 49.8 vs. 46.6, $p < 0.05$) (Table 2). Need for using bladder symptom coping strategies (Table 2) was also examined among health outcomes of diagnosis or treatment because diagnosis and subsequent treatment may help limit the nuisance of using coping strategies. The only difference in coping strategies found was that diagnosed elderly respondents tended to use incontinence undergarments more often than those not diagnosed (45.5% vs. 34.4%, $p < 0.05$).

Economic patient-reported outcomes (healthcare resource use)

Elderly respondents with symptoms of OAB who were diagnosed on average utilised total healthcare resources (surgeries, ER visits, traditional provider visits and days hospitalised) to a greater extent than elderly respondents not diagnosed with OAB (means = 5.82 vs. 4.54, $p < 0.05$) (Table 2).

Table 1 Patient demographics and characteristics between diagnosed and not diagnosed, treated and never treated elderly respondents with symptoms of OAB

	Not diagnosed (n = 212)		Diagnosed (n = 211)		Never treated (n = 74)		Treated (n = 140)	
	%/Mean	n/SD	%/Mean	n/SD	%/Mean	n/SD	%/Mean	n/SD
Age	67.6	1.81	67.8	1.86	68.0	2.81	67.7	1.58
Gender								
Male	34.0%*	72	19.9%*	42	21.6%	16	23.6%	33
Female	66.0%*	140	80.1%*	169	78.4%	58	76.4%	107
Ethnicity: White	92.5%	196	95.3%	201	93.2%	69	95.0%	133
Marital status: married	70.3%*	149	53.6%*	113	70.3%	52	59.3%	83
Education: College+	31.1%	66	26.1%	55	20.3%	15	27.9%	39
Income: \$50k+	44.8%*	95	30.8%*	65	39.2%	29	33.6%	47
Income: < \$50k	49.5%*	105	60.7%*	128	59.5%	44	58.6%	82
Income: Missing	5.7%	12	8.5%	18	1.40%*	1	7.90%*	11
Employed (full time or self-employed)	20.3%*	43	12.3%*	26	23.0%*	17	10.7%*	15
Charlson comorbidity index (CCI) scores	0.990	1.28	1.04	1.33	1.19	1.31	1.19	1.49
Years experiencing bladder control related symptoms								
≤1	15.1%*	32	8.10%*	17	16.2%	12	10.0%	14
2–3	32.1%*	68	17.5%*	37	23.0%	17	21.4%	30
4–5	21.2%	45	21.3%	45	14.9%	11	20.7%	29
6+	31.6%*	67	53.1%*	112	45.9%	34	47.9%	67
Frequency of seeing one's regular doctor								
Never/don't have regular doctor	7.10%*	15	0.50%*	1	10.80%	8	0.00%	0
Less than once every 2 years	1.40%	3	0.50%	1	1.40%	1	0.00%	0
Once every 2 years	2.80%	6	0.90%	2	1.40%	1	0.70%	1
Once a year	9.40%	20	9.00%	19	5.40%	4	7.90%	11
Twice a year	25.5%	54	24.2%	51	13.5%*	10	27.1%*	38
More than twice a year	53.8%*	114	64.9%*	137	67.6%	50	64.3%	90

Two-sample comparisons were between diagnosed vs. not diagnosed and treated vs. never treated. *Significantly different at $p < 0.05$ in the two-sided test of equality for column proportions (categorical variables) and column means (continuous variable).

Table 2 Health, economic and OAB-related outcomes between diagnosed and not diagnosed, treated and never treated elderly with symptoms of OAB

	Not diagnosed (n = 212)		Diagnosed (n = 211)		Never Treated (n = 74)		Treated (n = 140)	
	%/Mean	n/SD	%/Mean	n/SD	%/Mean	n/SD	%/Mean	n/SD
Health outcomes								
SF-12v2: Mental Component Summary (MCS)	46.6*	10.9	49.8*	11.2	41.8*	10.7	50.7*	10.7
SF-12v2: Physical Component Summary (PCS)	40.1	11.3	38.1	12.8	36.4	11.7	37.9	12.8
SF-12v2: Health Utilities (SF-6D algorithm)	0.682	0.136	0.691	0.147	0.615*	0.131	0.702*	0.154
Activity impairment (%)	32.5	25.7	28.0	27.4	53.5*	26.7	23.6*	25.4
Coping strategies								
Limit intake of fluids/beverages	64.2%	136	56.4%	119	71.6%*	53	51.4%*	72
Limit caffeine intake	49.1%	104	51.2%	108	58.1%*	43	42.9%*	60
Limit alcohol intake	30.7%	65	34.1%	72	31.1%	23	29.3%	41
Perform Kegel (pelvic floor muscle) exercises	28.8%	61	35.5%	75	31.1%	23	35.0%	49
Tightly clench legs	25.5%	54	18.5%	39	36.5%*	27	16.4%*	23
Use incontinence undergarments	34.4%*	73	44.5%*	94	51.4%	38	40.7%	57
Avoid visiting public places	9.0%	19	5.7%	12	18.9%*	14	4.30%*	6
Learn in advance where bathrooms are located	40.6%	86	46.4%	98	64.9%*	48	42.1%*	59
Carry a change of clothes	12.3%	26	16.1%	34	25.7%	19	16.4%	23
Avoid intimate/sexual activities	2.80%	6	5.70%	12	10.8%*	8	3.60%*	5
Go to the bathroom often, even without the urge	54.7%	116	47.9%	101	67.6%*	50	42.1%*	59
Avoid or limit exercising	9.40%	20	10.0%	21	20.3%*	15	6.40%*	9
Sit in an aisle seat at movies and other gatherings, in order to have easier access to the bathroom	31.1%	66	32.2%	68	51.4%*	38	30.0%*	42
Take an herbal medication	4.20%	9	2.40%	5	1.40%	1	1.40%	2
Not sure	7.10%	15	8.50%	18	0.00%	2	10.0%	14
Healthcare resource use for past 6 months								
Total resource use for any condition: surgeries, ER & traditional provider visits, & days hospitalized	4.54*	5.54	5.82*	6.61	5.62	6.25	6.12	7.16
Number of times had surgery	0.2	0.510	0.17	0.400	0.24	0.520	0.170	0.400
Number of times to the emergency room	0.28	0.980	0.23	0.810	0.390	0.89	0.260	0.940
Number of times hospitalized	0.17	0.560	0.180	0.540	0.270	0.820	0.200	0.590
Number of days hospitalized (overnight)	0.41	2.01	0.530	2.51	0.730	2.93	0.600	2.87
Number of traditional provider visits (total)	3.65*	3.58	4.90*	4.900	4.26	3.48	5.09	5.27

Table 2 Continued

	Not diagnosed (n = 212)		Diagnosed (n = 211)		Never Treated (n = 74)		Treated (n = 140)	
	%/Mean	n/SD	%/Mean	n/SD	%/Mean	n/SD	%/Mean	n/SD
OAB-related outcomes (treated vs. never treated only)								
PPBC categories								
My bladder condition does not cause me any problems at all			0.00%	2	10.7%	15		
My bladder condition causes me some very minor problems			4.10%*	3	25.0%*	35		
My bladder condition causes me some minor problems			20.3%	15	27.1%	38		
My bladder condition causes me (some) moderate problems			60.8%*	45	27.1%*	38		
My bladder condition causes me severe problems			12.2%	9	7.10%	10		
My bladder condition causes me many severe problems			2.70%	2	2.90%	4		
3IQ urinary incontinence categories								
Stress only or stress predominant			16.2%	12	21.4%	30		
Urge only or urge predominant			47.3%	35	41.4%	58		
Other cause or other cause predominant			4.10%	3	2.10%	3		
Mixed			28.4%*	21	14.3%*	20		
Not incontinent			4.10%*	3	20.7%*	29		
OAB Awareness Tool total score			25.2*	6.8	16.8*	10.3		
Experience of symptoms (in the past month)								
Frequent urination during the daytime hours			100%	742	86.4%	121		
An uncomfortable urge to urinate			98.6%*	73	85.0%*	119		
A sudden urge to urinate with little or no warning			98.6%*	73	83.6%*	117		
Accidental loss of small amounts of urine			95.9%*	71	81.4%*	114		
Nighttime urination			95.9%	71	92.1%	129		
Waking up at night because you had to urinate			97.3%	72	91.4%	128		
An uncontrollable urge to urinate			98.6%*	73	76.4%*	107		
Urine loss associated with a strong desire to urinate			94.6%*	70	70.7%*	99		

Two-sample comparisons were between diagnosed vs. not diagnosed and treated vs. never treated. *Significantly different at $p < 0.05$ in the two-sided test of equality for column proportions (categorical variables) and column means (continuous variables).

Two-sample comparisons among elderly respondents treated for OAB vs. never treated for OAB

Patient demographics and characteristics

Most demographic characteristics did not differ between elderly respondents with OAB symptoms who were treated and never treated for OAB. However, those treated with OAB were more likely to be employed than those never treated (23.0% vs. 10.7%, $p < 0.05$) and those treated saw their regular doctor more frequently (twice a year: 27.1% vs. 13.5%, $p < 0.05$) (Table 1).

Health-related patient-reported outcomes

Elderly respondents treated for OAB on average scored higher on MCS than elderly respondents not treated for OAB (means: 50.7 vs. 41.8, $p < 0.05$) (Table 2). Additionally, elderly respondents treated for OAB scored higher on SF-6D health utilities, indicating better health status than those never treated for OAB (means: 0.702 vs. 0.615, $p < 0.05$). Elderly respondents treated for OAB experienced less activity impairment than those never treated (means: 23.6% vs. 53.5%, $p < 0.05$) (Table 2).

Treated vs. never treated elderly respondents utilised many coping strategies less frequently to deal with their bladder symptoms. Treated elderly respondents were less likely to utilise 'situating' types of coping strategies such as learning bathroom locations in advance (treated = 42.1% vs. never treated = 64.9%, $p < 0.05$), sitting in an aisle seat (treated = 30.0% vs. never treated = 51.4%, $p < 0.05$) and going to the bathroom often (treated = 42.1% vs. never treated = 67.6%, $p < 0.05$) than never treated elderly respondents. Treated compared with never treated elderly respondents were less likely to use 'avoidance and accident management' types of coping behaviours, such as avoiding visiting public places (treated = 4.30% vs. never treated = 18.9%, $p < 0.05$), avoiding intimate/sexual activities (treated = 3.60% vs. never treated = 10.8%, $p < 0.05$) and avoiding/limiting exercising (treated = 6.40% vs. never treated = 20.3%, $p < 0.05$). Additionally, treated elderly respondents were less likely to limit fluid or beverage intake (treated = 51.4% vs. never treated = 71.6%, $p < 0.05$) or caffeine intake (treated = 42.9% vs. never treated = 58.1%, $p < 0.05$). A behavioural strategy, tightly clenching legs (treated = 16.4% vs. never treated = 36.5%, $p < 0.05$), was also less likely to be utilised by treated than never treated elderly individuals.

OAB-related patient-reported outcomes

Based on the responses to 3IQ, treated and never treated elderly respondents had no significant differences

on the incidences of stress only or stress predominate incontinence, nor urge only or urge predominate incontinence. However, treated elderly respondents had fewer incidences of mixed UI compared with never treated (14.3% vs. 28.4%, $p < 0.05$), and treated elderly respondents were more likely to report being continent (20.7% vs. 4.10%, $p < 0.05$) (Table 2). Treated elderly respondents were also more likely to indicate that their bladder condition causes them some very minor problems (25.0% vs. 4.10%, $p < 0.05$), but less likely to indicate that their bladder condition caused them some moderate problems compared with the never treated (27.1% vs. 60.8%, $p < 0.05$). Treated elderly respondents had lower OAB Awareness Tool scores than the never treated, indicating lower level of bother by bladder symptoms compared with the never treated (16.8 vs. 25.2, $p < 0.05$). Treated respondents were also less likely to have several OAB-related symptoms, such as uncomfortable urge to urinate, a sudden urge to urinate with little or no warning or an uncontrollable urge to urinate, compared with the never treated (Table 2).

Economic patient-reported outcomes (healthcare resource use)

There were no statistically significant differences in healthcare resources (total resource use, number of surgeries, ER visits, number of times hospitalised, days hospitalised and number of provider visits in the past 6 months) between never treated and treated elderly with OAB symptoms (Table 2).

Multivariable results among elderly respondents diagnosed with OAB vs. not diagnosed with OAB

Health-related patient-reported outcomes

For all multivariable models, multicollinearity diagnostics were within acceptable levels for the chosen covariates: CCI categories, frequency of doctor visits, employment, gender, marital status, income categories and years experiencing OAB symptoms.

Adjusting for covariates, diagnosed vs. not diagnosed elderly respondents with OAB symptoms scored higher on MCS [adjusted means: 50.0 (CI: 48.6–51.5) vs. 46.4 (CI: 44.9–47.8), $p = 0.001$] and higher on SF-6D health utilities [adjusted means: 0.701 (CI: 0.683–0.719) vs. 0.671 (CI: 0.654–0.689), $p = 0.027$] (Table 3). There were no significant differences on PCS between those diagnosed and not diagnosed. Diagnosed elderly respondents also experienced less activity impairment [adjusted means: 25.0% (21.9–28.5%) vs. 33.3% (29.3–38.0%), $p = 0.004$] than elderly respondents not diagnosed with OAB (Table 3). Goodness of fit was $\chi^2 = 46.9$,

Table 3 Summary of multivariable results: health-related, economic-related and OAB-related outcomes as a function of OAB diagnosis and treatment among elderly respondents with symptoms of OAB

Variable	Diagnosed (reference group is not diagnosed)				Treated (reference group is never treated)					
	<i>b</i>	SE	RR	Lower bound of the 95% CI	Upper bound of the 95% CI	<i>b</i>	SE	RR	Lower bound of the 95% CI	Upper bound of the 95% CI
Health outcomes										
SF-12:MCS	3.69*	1.09		1.55	5.82	8.79*	1.56		5.73	11.9
SF-12:PCS	0.174	1.09		-1.97	2.32	1.94	1.64		-1.28	5.17
SF-6D	0.030*	0.013		0.003	0.056	0.088*	0.02		0.048	0.127
Activity Impairment	-0.288	0.099	0.750*	0.618	0.910	-0.907	0.147	0.404*	0.303	0.539
Economic outcomes										
Total resource use	0.136	0.113	1.15	0.918	1.43	0.037	0.160	1.04	0.759	1.42
Number of surgeries	-0.294	0.255	0.746	0.452	1.23					
Number of times hospitalised	0.037	0.292	1.037	0.586	1.84	-0.215	0.385	0.807	0.379	1.72
Days hospitalised	0.309	0.529	1.36	0.483	3.84	-0.455	0.684	0.634	0.166	2.42
Number of provider visits	0.175	0.096	1.19	0.987	1.44	0.162	0.136	1.18	0.901	1.53
OAB outcomes (treated vs. never treated only)										
3IQ						-2.09	0.724	0.123*	0.030	0.509
PPBC						-3.18	0.67	0.042*	0.011	0.155
OAB awareness tool total						-9.11*	1.32		-11.7	-6.52
OAB symptoms						-1.22*	0.242		-1.69	-0.743

b, unstandardised beta coefficient; SE, standard error; RR, rate ratio; CI, confidence interval. *Significant at $p < 0.05$, two-tailed. Covariates included: employed (vs. non-employed), female (vs. male), married (vs. single/divorced/widowed/separated), income: $< \$50K$, missing (vs. $\geq \$50K+$), CCI +1, 2, 3 (vs. 0), frequency of seeing doctor (vs. never/don't have one) and years experiencing OAB.

$p < 0.001$ for MCS, $\chi^2 = 76.7$, $p < 0.001$ for SF-6D health utilities and $\chi^2 = 45.6$, $p < 0.001$ for activity impairment, demonstrating good overall model fit for these outcome measures.

Economic patient-reported outcomes

Generalised linear models showed that diagnosed and not diagnosed elderly respondents with symptoms of OAB did not differ significantly in total resource use, number of surgeries, number of times hospitalised, days hospitalised and number of provider visits in the past 6 months (Table 3). The model for ER visits failed to converge.

Multivariable results among elderly respondents treated for OAB vs. never treated for OAB

Health-related patient-reported outcomes

Adjusting for covariates, treated scored higher on MCS [adjusted means: 50.6 (48.9–52.4) vs. 41.9 (39.4–44.3), $p < 0.001$] and higher on SF-6D health utilities [adjusted means: 0.703 (0.680–0.725) vs. 0.615 (0.584–0.646), $p < 0.001$] vs. never treated among elderly respondents with OAB symptoms (Table 3). There were no significant differences on PCS (Table 3).

Compared with never treated elderly respondents, those treated experienced less activity impairment [adjusted means: 21.6% (18.3–25.4%) vs. 53.4% (42.6–67.0%), $p < 0.001$] (Table 3). Goodness of fit was $\chi^2 = 46.2$, $p < 0.001$ for MCS, $\chi^2 = 56.0$, $p < 0.001$ for SF-6D health utilities and $\chi^2 = 60.5$, $p < 0.001$ for activity impairment, demonstrating a good overall model fit for these outcome measures.

OAB-related patient-reported outcomes (3IQ, PPBC, OAB awareness tool, and symptoms experienced)

As a result of high inter-correlations among the experience of symptom items (Table 2), an overall OAB symptom experience score (0–8) was used instead of individual symptoms. For example, night-time urination and waking up at night were highly inter-correlated, while correlated at similar levels with diagnosis and treatment. For 3IQ, categories were collapsed as no incontinence vs. urge, stress or mixed incontinence. For PPBC, categories were collapsed as no bladder problems vs. minor to very severe problems.

Treated compared with never treated elderly respondents had significantly lower odds of having urge, stress or mixed incontinence (adjusted percentages: treated = 89.0% vs. never treated = 98.0%, $p = 0.004$) (Table 3). The *c* statistic (a measure of successful model discrimination between those classified at one level of the outcome vs. the other) was

0.876, classification rates were 85.5% and omnibus tests of model coefficients were significant at $p < 0.001$, indicating that the models and their covariates did an adequate job of predicting incontinence status.

Treated compared with never treated elderly respondents had significantly lower odds of having minor to very severe problems caused by bladder conditions as measured by the PPBC (adjusted percentages: treated = 63.0% vs. never treated = 98.0%, $p < 0.001$) (Table 3). The *c* statistic was 0.817, classification rates were 78.5%, and omnibus tests of model coefficients were significant at $p < 0.001$, indicating that the models and their covariates did an adequate job of predicting PPBC problem categories.

Additionally, treated vs. never treated elderly respondents had lower OAB awareness scores [adjusted means: 16.6 (15.1–18.0) vs. 25.7 (23.6–27.7)] and fewer overall symptoms experienced [adjusted means: 6.64 (6.37–6.91) vs. 7.86 (7.48–8.23)], all $p < 0.001$ (Table 3). Goodness of fit was $\chi^2 = 61.7$, $p < 0.001$ for OAB awareness scores and $\chi^2 = 25.4$, $p < 0.001$ for overall symptoms experienced, demonstrating good overall model fit.

Economic patient-reported outcomes

Negative binominal models showed that treated and never treated elderly respondents with OAB did not differ significantly in total resource use, times hospitalised, days hospitalised and provider visits in the past 6 months (Table 3). The models for number of surgeries and ER visits failed to converge.

Multivariable models examining health and economic outcomes associated with diagnosis and treatment: comparing elderly vs. middle-aged respondents with OAB symptoms

Age group by diagnosis interaction

A significant age group by diagnosis interaction on MCS indicated that the increase in MCS scores associated with diagnosis was 2.93 points greater among elderly than among middle-aged respondents (Table 4). Figure 2 shows adjusted means for MCS among elderly diagnosed (50.8; CI: 49.2–52.4) vs. not diagnosed (46.9; CI: 45.4–48.4) respondents, compared with middle-aged diagnosed (42.4; CI: 41.4–43.8) vs. not diagnosed (41.5; CI: 40.7–42.2) respondents. Goodness of fit was $\chi^2 = 218.0$, $p < 0.001$ for MCS.

A significant age group by diagnosis interaction on activity impairment indicated that the reduction in activity impairment associated with diagnosis was 1.24 times as great among elderly respondents, compared with that among middle-aged respondents (Table 4). Figure 3 shows adjusted percentage of

Table 4 Summary multivariable results: diagnosis by age group (elderly vs. middle-aged) and treatment by age group interactions on health-related, economic-related and OAB-related outcomes

Variable	<i>b</i>	SE	RR	Lower bound of the 95% CI	Upper bound of the 95% CI
<i>Diagnosed (Reference group is not diagnosed) × Age group (Reference group is elderly)</i>					
Health outcomes					
SF-12: MCS					
Diagnosed	3.91*	1.10		1.75	6.06
Middle-aged	−5.44*	0.865		−7.14	−3.75
Diagnosed × Middle-aged	−2.93*	1.27		−5.41	−0.445
SF-12: PCS					
Diagnosed	0.131	1.02		−1.88	2.14
Middle-aged	−0.935	0.805		−2.51	0.643
Diagnosed × Middle-aged	−0.535	1.18		−2.85	1.78
SF-6D					
Diagnosed	0.028*	0.013		0.003	0.052
Middle-aged	−0.061*	0.010		−0.081	−0.042
Diagnosed × Middle-aged	−0.020	0.014		−0.048	0.009
Activity impairment					
Diagnosed	−0.253	0.077	0.777*	0.667	0.904
Middle-aged	0.246	0.060	1.28*	1.14	1.44
Diagnosed × Middle-aged	0.218	0.088	1.24*	1.05	1.48
Economic outcomes					
Total resource use					
Diagnosed	0.086	0.146	1.09	0.819	1.45
Middle-aged	0.067	0.116	1.07	0.851	1.34
Diagnosed × Middle-aged	−0.042	0.168	0.959	0.690	1.33
Number of surgeries					
Diagnosed	−0.220	0.293	0.802	0.452	1.43
Middle-aged	−0.493	0.233	0.611*	0.387	0.965
Diagnosed × Middle-aged	0.365	0.347	1.44	0.729	2.85
Number of ER visits					
Diagnosed	−0.416	0.288	0.660	0.375	1.16
Middle-aged	0.186	0.223	1.21	0.779	1.86
Diagnosed × Middle-aged	0.318	0.331	1.37	0.718	2.63
Number of times hospitalised					
Diagnosed	0.024	0.336	1.02	0.531	1.98
Middle-aged	−0.154	0.273	0.857	0.502	1.46
Diagnosed × Middle-aged	0.168	0.391	1.18	0.550	2.55
Days hospitalised					
Diagnosed	0.461	0.589	1.59	0.500	5.03
Middle-aged	0.360	0.449	1.43	0.594	3.46
Diagnosed × Middle-aged	−0.627	0.647	0.534	0.150	1.90
Number of provider visits					
Diagnosed	0.106	0.125	1.11	0.871	1.42
Middle-aged	0.033	0.100	1.03	0.849	1.26
Diagnosed × Middle-aged	−0.011	0.143	0.989	0.747	1.31
<i>Treated (Reference group is never treated) × Age group (Reference group is elderly)</i>					
Health outcomes					
SF-12: MCS					
Treated	8.74*	1.61		5.57	11.9
Middle-aged	−3.74*	1.44		−6.56	−0.929
Treated × Middle-aged	−4.49*	1.83		−8.08	−0.896
SF-12: PCS					
Treated	2.13	1.51		−0.835	5.10
Middle-aged	−0.464	1.35		−3.11	2.18
Treated × Middle-aged	−0.369	1.72		−3.74	3.00

Table 4 Continued					
Variable	b	SE	RR	Lower bound of the 95% CI	Upper bound of the 95% CI
SF-6D					
Treated	0.088*	0.018		0.052	0.124
Middle-aged	-0.042*	0.016		-0.074	-0.010
Treated × Middle-aged	-0.039	0.021		-0.080	0.002
Activity impairment					
Treated	-0.890	0.111	0.411*	0.330	0.510
Middle-aged	0.129	0.098	1.14	0.938	1.38
Treated × Middle-aged	0.315	0.126	1.37*	1.07	1.75
Economic outcomes					
Total resource use					
Treated	0.00	0.161	1.00	0.729	1.37
Middle-aged	-0.034	0.144	0.967	0.729	1.28
Treated × Middle-aged	0.036	0.183	1.04	0.724	1.48
Number of ER visits					
Treated	-0.660	0.365	0.517	0.253	1.06
Middle-aged	0.129	0.309	1.14	0.621	2.08
Treated × Middle-aged	0.328	0.414	1.39	0.616	3.13
Number of times hospitalised					
Treated	-0.194	0.407	0.824	0.371	1.83
Middle-aged	-0.294	0.363	0.824	0.371	1.83
Treated × Middle-aged	0.119	0.477	1.13	0.443	2.87
Days hospitalised					
Treated	-0.355	0.756	0.701	0.159	3.08
Middle-aged	-0.621	0.622	0.537	0.159	1.82
Treated × Middle-aged	0.237	0.808	1.27	0.260	6.18
Number of provider visits					
Treated	0.114	0.147	1.12	0.841	1.50
Middle-aged	0.052	0.132	1.05	0.813	1.36
Treated × Middle-aged	-0.056	0.167	0.945	0.682	1.31
OAB outcomes					
3IQ					
Treated	2.11	0.664	8.23	2.24	30.2
Middle-aged	0.191	0.298	1.21	0.675	2.17
Treated × Middle-aged	0.363	0.734	1.44	0.341	6.07
PPBC					
Treated	2.84	0.630	17.1*	4.97	58.9
Middle-aged	0.246	0.241	1.28	0.798	2.05
Treated × Middle-aged	-0.430	0.677	0.651	0.172	2.46
OAB awareness tool total					
Treated	-8.22*	1.29		-10.8	-5.68
Middle-aged	1.34	1.15		-0.917	3.60
Treated × Middle-aged	-0.399	1.47		-3.28	2.48
OAB symptoms					
Treated	-1.18*	0.231		-1.63	-0.722
Middle-aged	0.249	0.206		-0.154	0.651
Treated × Middle-aged	-0.337	0.262		-0.851	0.177

b, unstandardised beta coefficient; SE, standard error; RR, rate ratio; CI, confidence interval. *Significant at $p < 0.05$, two-tailed. Reference categories: Non-diagnosed, elderly (65+ years old). Covariates included: employed (vs. non-employed), female (vs. male), married (vs. single/divorced/widowed/separated), income: <\$50K, missing (vs. =>\$50K+), CCI +1, 2, 3 (vs. 0), frequency of seeing doctor (vs. never/don't have one) and years experiencing OAB.

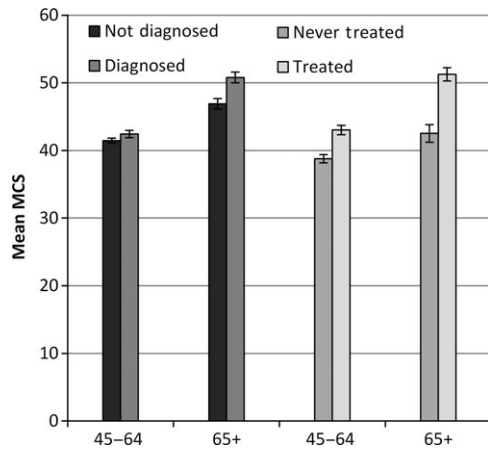


Figure 2 Mean MCS between diagnosed vs. not diagnosed and treated vs. never treated respondents by age group (elderly: 65+ vs. middle-aged: 45–64), adjusting for covariates. MCS, Mental Component Summary Score. Error bars depict standard error of the mean

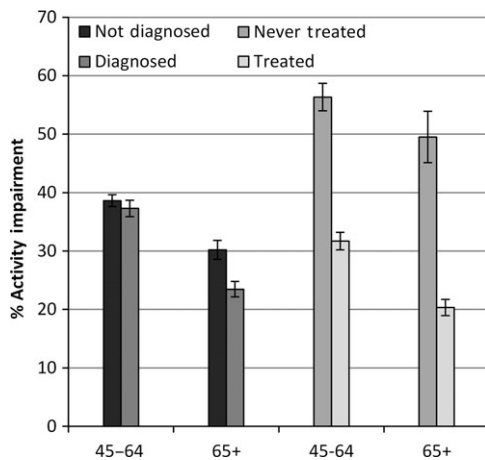


Figure 3 Percentage of activity impairment between diagnosed vs. not diagnosed and treated vs. never treated respondents by age group (elderly: 65+ vs. middle-aged: 45–64), adjusting for covariates. Error bars depict standard error of the mean

activity impairment among elderly diagnosed (23.5%; CI: 21.00–26.2.00) vs. not diagnosed (30.2%; CI: 27.17–33.6) respondents, compared with middle-aged diagnosed (37.3%; CI: 34.6–40.2) vs. not diagnosed (38.6%; CI: 36.7–40.6) respondents. Goodness of fit was $\chi^2 = 160.6$, $p < 0.001$ for activity impairment.

The interaction for age group and diagnosis on SF-6D health utilities was not significant, but trending towards an increase in SF-6D health utilities associated with diagnosis among elderly vs. middle-aged respondents. There was not a significant interaction between age group and diagnosis on PCS or any of the economic outcomes (including total healthcare resource use, number of surgeries, ER visits, times

hospitalised, days hospitalised and number of traditional provider visits in the past 6 months) (Table 4).

Age group \times treatment interaction

A significant age group by treatment interaction on MCS showed that the increase in MCS scores associated with treatment was 4.49 points greater among elderly than among middle-aged respondents (Table 4). Figure 2 shows adjusted means of MCS among elderly treated (51.3; CI: 49.4–53.2) vs. never treated (42.5; CI: 40.0–45.1), compared with middle-aged treated (43.0; CI: 41.7–44.4) vs. never treated (38.8; CI: 37.6–40.0) respondents. Goodness of fit was $\chi^2 = 175.6$, $p < 0.001$ for MCS.

A significant age group by treatment interaction on activity impairment indicated that the reduction in activity impairment associated with treatment was 1.37 times as great among elderly respondents, compared with that among middle-aged respondents (Table 4). Figure 3 shows adjusted percentage of activity impairment among elderly treated (20.3%; CI: 17.8–23.2) vs. never treated (49.5%; CI: 41.6–58.9), compared with middle-aged treated (31.7%; CI: 28.9–34.8) vs. never treated (56.3%; CI: 51.9–61.1) respondents. Goodness of fit was $\chi^2 = 205.7$, $p < 0.001$ for activity impairment.

None of the interactions of age group by treatment on PCS, SF-6D health utilities, OAB-related outcomes or any of the economic outcomes were significant (Table 4). The model for number of surgeries in the past 6 months failed to converge.

Discussion

The current study sought to examine the potential health (e.g. activity impairment, mental and physical summary scores), OAB-related severity and symptoms, and economic (i.e. healthcare resource use) benefits of diagnosis or treatment among elderly people with OAB symptoms. Respondents diagnosed with OAB were compared with those not diagnosed. Those treated for OAB were compared with those never treated for this condition. Additionally, this study examined whether the benefits of diagnosis or treatment were greater for elderly respondents with OAB symptoms than for their middle-aged counterparts.

Despite controlling for a number of patient characteristics, including demographic variables, comorbidities, and years experiencing OAB, diagnosis and treatment were each associated with better health outcomes than lack of diagnosis or treatment among elderly respondents with OAB symptoms. Being diagnosed was associated with higher scores on the MCS, higher SF-6D health utilities, and less activity impairment. Being treated was associated with higher MCS

scores, higher SF-6D health utilities and less activity impairment. Additionally, being treated was associated with better OAB-related outcomes, including less OAB symptom bother (i.e. lower OAB Awareness Tool total scores), fewer OAB symptoms experienced, lower odds of having urge, stress or mixed urinary incontinence (3IQ), and lower odds of having bladder condition problems (PPBC). Differences on MCS and SF-6D health utilities (treated vs. never treated) met or exceeded the minimally important differences of 3 and 0.041, respectively, suggesting a meaningful level of health benefits associated with treatment (25,26). Additionally, being treated was associated with less frequent utilisation of various bladder symptom coping strategies, such as avoiding visiting public places, learning in advance where bathrooms are located, or going to the bathroom often even without the urge. These findings illustrate concrete ways in which treatment provided OAB sufferers improved quality of life in their daily activities by not having to resort to nuisance coping strategies. In turn, the benefits of not having to use coping strategies may be reflected in the finding that treated elderly respondents experienced less activity impairment. Healthcare utilisation (i.e. total resource use, ER visits, number of surgeries, hospitalisations, and number of traditional provider visits) did not differ significantly between diagnosed and not diagnosed or between treated and never treated elderly respondents with OAB symptoms.

Diagnosis and treatment benefits appeared to be particularly impactful for elderly respondents, compared with middle-aged respondents with OAB symptoms. A significant age group (elderly vs. middle-aged) by diagnosis interaction showed that elderly respondents, who were diagnosed, had higher MCS scores than elderly respondents who were not diagnosed and this benefit was greater among elderly than the middle-aged respondents. Additionally, elderly respondents who were diagnosed had less activity impairment than elderly respondents who were not diagnosed, and this benefit was greater among elderly than middle-aged respondents. A similar pattern of findings for MCS and activity impairment occurred when treatment and age group interactions were examined.

The current study has several strengths. First, there is a lack of research examining the potential impact of diagnosing and treating symptomatic OAB among elderly people, specifically, assessing the potential impact beyond OAB symptom-related measures. In addition to assessing OAB-related outcomes, this study evaluated a range of health and economic outcomes not typically included in other studies at the same time. More often than not, in prior research, only one type of outcome, such as HRQoL (3) or cost

(8), was examined in isolation. By reporting on multiple outcomes simultaneously, the present study allowed for a more comprehensive depiction of the potential benefits of diagnosis and treatment of OAB among elderly people with symptoms of OAB. Second, the results from this study were derived from a real-world population, which enhances their external validity. Third, this study focused on the PROs of elderly people with symptoms of OAB, as the health-related perceptions of older individuals with OAB are often overlooked in the literature (4). Finally, by comparing the outcomes of diagnosis and treatment between middle-aged and elderly adults, this study provides a more nuanced context to interpret the results, as these comparison groups are infrequently examined in the literature (3).

Results indicated that elderly people with symptoms of OAB who were diagnosed with or treated for OAB had better HRQoL, compared with their not diagnosed or never treated counterparts. These findings were generally in accord with previous research demonstrating that elderly people with more frequent OAB symptoms reported lower HRQoL than those who experienced minimal or no OAB symptoms (4). Therefore, OAB diagnosis and treatment may help decrease the humanistic burden of OAB among affected elderly people.

Research has indicated that adults who experienced frequent OAB symptoms did not often seek treatment (4). Even for those who reported urinary symptoms consistent with OAB to a physician, only a minority of patients actually received a diagnosis of OAB (15). As treatment can only follow from diagnosis, there is a need for greater awareness among patients and physicians alike, regarding the diagnosis of OAB.

Limitations

β 3-adrenergic receptor agonists were not introduced when this study was conducted and potential benefits associated with this medication class were not examined. Given the cross-sectional nature of this study, results may not reflect changes over time in the relationships of interest. A prospective longitudinal study will be needed to evaluate temporal effects. Furthermore, causal relationships could not be established, as this study was not a randomised, controlled experiment. As all responses were self-reported, the findings may be limited by any inaccuracies in participants' recollections about the study variables. A future study could collect data from patient charts, for example, to independently corroborate respondents' self-reported data regarding diagnosis and treatment. Findings may additionally be limited to the extent that the NHWS panel was biased towards capturing data of younger,

healthier participants, as well as those who have more convenient access to the technology needed to complete the study. Thus, it is possible that results may not provide an accurate representation of older, frailer patients, who may have been less likely to participate in the NHWS panel.

Conclusions

Diagnosis and treatment were associated with better self-reported health outcomes among elderly people with OAB symptoms. The benefits in health outcomes associated with diagnosis and treatment were larger for elderly, relative to middle-aged, adults with OAB symptoms. Overall, these findings highlight the importance, particularly for older adults, of effectively diagnosing and managing OAB symptoms to decrease the humanistic burden of this condition.

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