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The impact of overactive bladder on health-related quality of life in Korea: based on the results of a Korean Community Health Survey

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Abstract

Purpose This study aimed to assess the impact of overactive bladder on health-related quality of life (HRQoL) in a community-based sample of Korean population.

Methods The data of adults aged 19 and over that who participated in the 2012 Korean Community Health Survey were analyzed. Overactive bladder severity was classified as normal, mild, moderate, or severe using the Overactive Bladder Symptom scores, and HRQoL was evaluated using EQ-5D-3L. Relations between HRQoL and the severities and symptoms of OAB were investigated. Sampling weighted adjusted multiple regression analysis was performed to determine the effect of OAB symptom severity on HRQoL.

Results Of the 226,867 study subjects, 12,303 (5.4%) had OAB, and 552 (0.2%) had an OABSS of ≥ 12, indicating severe OAB. The problem -reporting rate significantly increased in all EQ-5D-3L dimensions as OAB severity increased. After adjusting for other variables, OAB severity had a significant effect on EQ-5D-3L index. Urge incontinence had greatest impact on quality of life.

Conclusions As the severity of OAB increased from mild to severe, quality of life decreased significantly. OAB was found to negatively affect HRQoL.

Keywords EQ-5D-3L · Health-related quality of life · Overactive bladder · Community HealthSurvey

Introduction

Overactive bladder (OAB) is defined as urinary urgency and is usually accompanied by high frequency and nocturia with or without urge urinary incontinence, in the absence of a urinary tract infection or another obvious pathology [1]. The prevalence of OAB among adults varies by country and measurement method. However, it is estimated to be between 10 and 20% and tends to increase with advancing age [2–5].

Different symptoms within the OAB spectrum have significant effects on quality of life. Such symptoms can affect social, psychological, physical, and sexual health and work productivity [4, 6–9]. Previous studies investigated the effect of OAB on health-related quality of life (HRQoL) using a variety of OAB classification criteria and HRQoL assessment tools. However, as the number of subjects was not sufficient, HRQoL comparisons were made according to some symptoms. There is a limit to comprehensively examining the effects of OAB on the HRQoL by severity and each symptom after adjusting for various covariates.

HRQoL can be measured using general and disease-specific tools. However, disease-specific tools may be susceptible to changes in the HRQoL of patients with specific diseases, but are difficult to compare with those of patients with other diseases or the general population. While general tools may be less susceptible to changes in HRQoL of patients with specific diseases, they can be compared with the HRQoL of patients with other diseases or the general population. General quality of life measurement tools based on preference, such as EQ-5Ds, can be used to calculate health utility value for a wide range of conditions, and these values can be used for economic evaluations of healthcare intervention and to estimate quality-adjusted life-years [10].

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In OAB patients, health utility data of symptoms and severity are limited [11]. Snedecor suggested that additional research to understand how OAB symptoms are valued with respect to patients' HRQoL could improve the economic modeling of OAB treatments [12]. Desroziers et al. reported that EQ-5D can detect changes in the severity of OAB patients and that it can be useful in calculating health utility values using clinical trial data [11]. However, the majority of studies on HRQoL in Koreans with OAB have used the OAB-specific tools or non-preference-based general tools. In a Korean OAB patient study, the HRQoL was measured using the EQ-5D-3L and compared according to the level of incontinence. However, this study has a limitation (i.e., in the study, the UK value set was used, rather than the Korean one) [13]. Even if the same EQ-5D tool was used, the health utility value sets for each country were different; therefore, it is pivotal to understand the health utility values for each OAB symptom and severity in Koreans. The purpose of this study was to assess the impact of OAB symptoms and severity on HRQoL as measured by EQ-5D-3L, which can yield health utility in a large-scale community-based Korean sample. In addition, we also investigated the validity of EQ-5D-3L for evaluating HRQoL in OAB patients.

Materials and methods

Study design and population

This study was conducted using a population-based, cross-sectional design using the Korean Community Health Survey (KCHS; 2012) data. The KCHS is conducted annually by the Korea Center for Disease Control and Prevention to assess the health status of adults over 19 years of age. Sampling units were selected using the two-stage stratified sampling method, and approximately 900 people were recruited from each of the 253 sampling units [14]. Details on the sampling method used are available on the KCHS website [https://chs.cdc.go.kr/chs/examinCn/sampleSlctnMain.do]. The survey was conducted using a computer-assisted personal interview conducted by trained interviewers. This study was approved by the Institutional Review Board of the Korea Center for Disease Control and Prevention (IRB No. 2012-07CON-01-2C). Written informed consent was obtained from all participants.

Questionnaire

The survey consisted of 257 questions on topics like demographic information, health behaviors, medical history, and HRQoL. In this study, the Overactive Bladder Symptom Score (OABSS) and EQ-5D-3L (a HRQoL measurement tool) were used. Demographic information included gender, age, marital status, income, education level, subjective stress level, smoking status, and details on diabetes, stroke, ischemic heart disease, arthritis, and cancer history.

The OABSS was originally developed and validated in the Japanese population [15]. Good psychometric properties have been reported for the Korean version of the OABSS [16, 17], which is composed of four questions that address frequency, nocturia, urgency, and urge incontinence, which are scored as follows: 0–2 points for frequency, 0–3 points for nocturia, 0–5 points for urgency, and 0–5 points for urge incontinence. Total scores range from 0 to 15 points. OAB was defined as an urgency score of ≥ 2 points and a total score of ≥ 3 [16]. No 5-point response to urgency or urge incontinence questions was obtained in the present study. The severity of overactive bladder was classified as mild (total score ≤ 5), moderate (total score 6–11), or severe (total score ≥ 12) [18].

HRQoL was measured using the EQ-5D-3L, which is a globally used multi-attribute utility instrument developed by the EuroQoL Group used to measure HRQoL and has been shown to have good validity and reliability in the Korean population [19, 20]. Furthermore, social value sets have been generated for the general Korean population [21]. The EQ-5D-3L is composed of five dimensions (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression), which are measured using three levels (1 = no problem, 2 = some problem, and 3 = severe problem) [22]. The EQ-5D-3L indices are calculated by assigning weights according to the dimension levels. EQ-5D-3L indices were calculated using Korean social value sets and ranged from − 0.171 to 1, where a high score indicates better health status [21]. In addition, EQ-VAS scores were used to assess health conditions self-rated by respondents on a vertical, 0–100, visual analog scale, where 0 = worst imaginable health state and 100 = best imaginable health state [22].

Statistical analysis

In this study, the proportional differences of demographic characteristics were compared using the Rao–Scott chi-square test and linear regression analysis. The chi-square test was used to analyze problem-reporting rate distributions for each EQ-5D-3L dimension according to the severity of OAB. ANOVA with the post hoc Tukey's test was used to determine the significance of differences in EQ-5D-3L and EQ-VAS scores by OAB severity and symptoms. Adjusted multiple regression analysis was performed to examine the effects of OAB severity and symptoms on HRQoL. Age, sex, marital status, income level, education level, subjective stress, smoking status, diabetes, stroke, ischemic heart disease, arthritis, and cancer were included as covariates. All analyses were conducted using survey sampling weights to adjust for the complex sampling of the survey. In univariate

analysis, PROC SURVEYMEANS was used for continuous variables, PROC SURVEYFREQ was used for categorical variables, and PROC SURVEYREG was used for multivariate regression analysis. STRATA, CLUSTER, and WEIGHT statements were used to adjust weights. All analyses were performed with SAS for Windows version 9.2.3. *P* values of < 0.05 were considered statistically significant.

Results

Of the 228,921 participants in the KCHS (2012), 226,867 were included in the present study. We excluded 1,968 and 86 respondents who did not complete the OABSS or EQ-5D-3L, respectively. Of these 226,867 participants, 214,564 (94.6%) were assigned to a normal group, 4125 (1.8%) to a mild OAB group, 7626 (3.4%) to a moderate OAB group, and 552 (0.2%) to a severe OAB group (Fig. 1).

Those with mild, moderate, or severe OAB (the OAB group) were found to be individuals who were significantly older, had lower income and education levels, were more likely to be women, and had higher comorbidities (Table 1) compared to the non-OAB group, especially those with more severe OAB.

The problem-reporting rate in each dimension of the EQ-5D-3L, EQ-5D-3L index, and EQ-VAS by OAB severity is shown in Fig. 2. As the severity of OAB increased, the problem-reporting rate of all dimensions of the EQ-5D increased significantly. In particular, the problem-reporting rate was high in the pain/discomfort and mobility dimensions. In the case of severe OAB, the problem-reporting rates of these dimensions were 85.3% and 80.3%, respectively. EQ-5D-3L indices and EQ-VAS scores also decreased significantly as OAB severity increased. It was further observed that the EQ-5D-3L index of the normal group was 0.944, while the average EQ-5D-3L indices in the mild, moderate, and severe OAB groups were 0.882, 0.767, and 0.659, respectively.

Table 2 shows EQ-5D-3L indices and EQ-VAS scores by OAB symptoms, both of which decreased as symptom frequencies increased. Urgency and incontinence tended to lower HRQoL more than frequency and nocturia. The EQ-5D-3L index was significantly lower for urgency group (2–4 times a day) than in the non-urgency group (0.741 vs. 0.949). The EQ-5D-3L index of non-urge incontinence group was 0.946, whereas the EQ-5D-3L indices of those who experienced urge incontinence once a week or more, about once a day, and 2–4 times a day were 0.776, 0.722, and 0.688, respectively.

After adjusting for covariates, OAB severity had a significant effect on the EQ-5D-3L index. Significant decreases in EQ-5D-3L indices were observed in the mild, moderate, and severe OAB groups (0.029, 0.089, and 0.179, respectively), as compared with the non-OAB group (Table 3).

In the multivariate analysis, each symptom of OAB had a significant effect on the EQ-5D-3L index, which was decreased by 0.044 when nocturia was ≥ 3, reduced by 0.034 when urgency was experienced 2–4 times a day, and reduced by 0.086 when urge incontinence was experienced 2–4 times a day (Table 4).

Discussion

In this study, we found that HRQoL significantly decreased as OAB severity and the frequency of each symptom increased, and that OAB negatively affected HRQoL even after adjusting for other variables such as gender, age, and medical history.

In terms of the problem-reporting rate in the EQ-5D-3L dimension, as OAB severity increased, reporting rates increased significantly in all five dimensions, but were

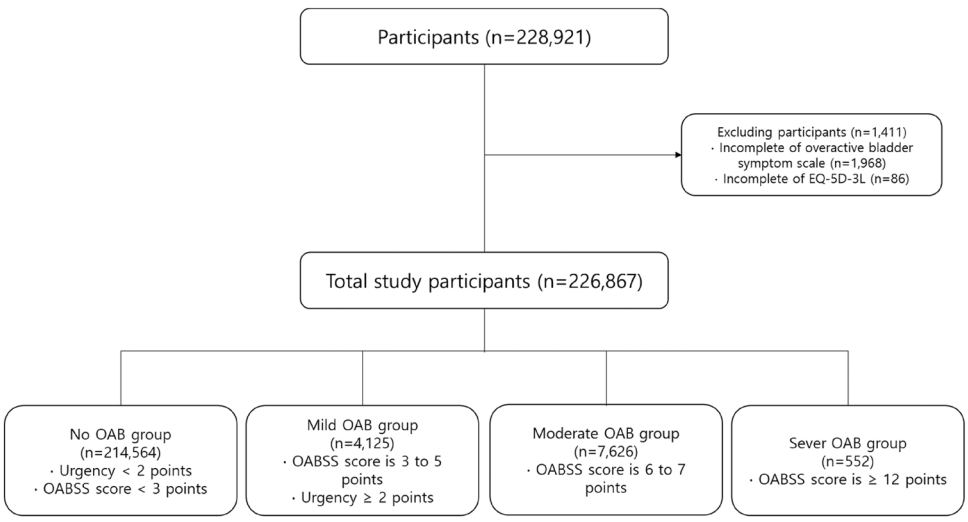

Fig. 1 Schematic of participant selection

Table 1 Demographic characteristics of the study subjects

Variables	Non-OAB ($n=214,564$)	Overactive bladder			p-value
		Mild ($n=4125$)	Moderate ($n=7626$)	Severe ($n=552$)	
	n (weighted %)	n (weighted %)	n (weighted %)	n (weighted %)	
Age, weighted mean[a]	45.2	48.7	64.6	72.5	< 0.001
Age					
19–39	60,572 (39.6)	939 (34.2)	320 (8.5)	6 (1.9)	< 0.001
40–59	87,301 (41.5)	1409 (37.3)	1211 (22.9)	44 (9.8)	
60–79	59,259 (17.1)	1528 (24.7)	4632 (54.4)	348 (63.3)	
> 80	7,432 (1.8)	249 (3.8)	1463 (14.2)	154 (25.0)	
Sex					
Male	98,270 (50.2)	1606 (44.6)	2170 (28.6)	140 (25.4)	< 0.001
Female	116,294 (49.8)	2519 (55.4)	5456 (71.4)	412 (74.6)	
Marital status					
Married	182,303 (77.5)	3627 (80.5)	7450 (95.6)	546 (97.1)	< 0.001
Unmarried	32,225 (22.5)	498 (19.5)	175 (4.4)	6 (2.9)	
Income					
Lowest	47,782 (14.1)	1254 (21.1)	4163 (44.0)	382 (63.6)	< 0.001
Low to middle	57,058 (26.3)	1032 (25.8)	1604 (25.6)	83 (17.9)	
Middle to high	48,141 (28.4)	780 (24.2)	777 (16.2)	37 (9.1)	
Highest	49,265 (31.3)	22 (28.9)	655 (14.2)	28 (9.5)	
Education					
Middle school or lower	76,852 (21.7)	1862 (28.2)	6061 (66.1)	497 (83.1)	< 0.001
High school	63,975 (31.2)	1047 (29.3)	971 (19.3)	39 (12.2)	
College or more	73,346 (47.1)	1211 (42.5)	587 (14.5)	14 (4.7)	
Subjective stress					
Little or less	159,373 (71.2)	2673 (61.8)	4823 (61.0)	294 (51.6)	< 0.001
A lot or more	55,062 (27.9)	1450 (38.2)	2779 (39.0)	258 (48.4)	
Smoking status					
None	134,389 (60.3)	2618 (59.3)	5453 (70.6)	412 (72.4)	< 0.001
Ex-smoker	34,306 (15.6)	690 (18.6)	1351 (17.2)	94 (17.5)	
Current smoker	45,843 (24.1)	816 (22.1)	822 (12.2)	46 (10.1)	
Diabetes					
No	197,101 (93.8)	3629 (90.4)	6069 (79.2)	418 (76.6)	< 0.001
Yes	17,422 (6.2)	496 (9.6)	1550 (20.8)	134 (23.4)	
Stroke					
No	211,101 (99.0)	3984 (97.4)	6988 (91.7)	469 (83.6)	< 0.001
Yes	3,432 (1.0)	140 (2.6)	629 (8.3)	82 (16.4)	
Ischemic heart disease					
No	208,844 (98.1)	3918 (96.2)	6945 (91.5)	492 (97.7)	< 0.001
Yes	5,565 (1.9)	200 (3.8)	643 (8.5)	55 (12.3)	
Arthritis					
No	189,045 (92.5)	3254 (86.0)	4463 (65.1)	261 (51.3)	< 0.001
Yes	25,455 (7.5)	869 (14.0)	3149 (34.9)	290 (48.7)	
Cancer					
No	207,801 (97.5)	3917 (95.8)	7037 (92.1)	493 (89.7)	< 0.001
Yes	3,734 (2.5)	208 (4.2)	583 (7.9)	59 (10.3)	

[a]Groups were significantly different by post hoc Tukey–Kramer testing

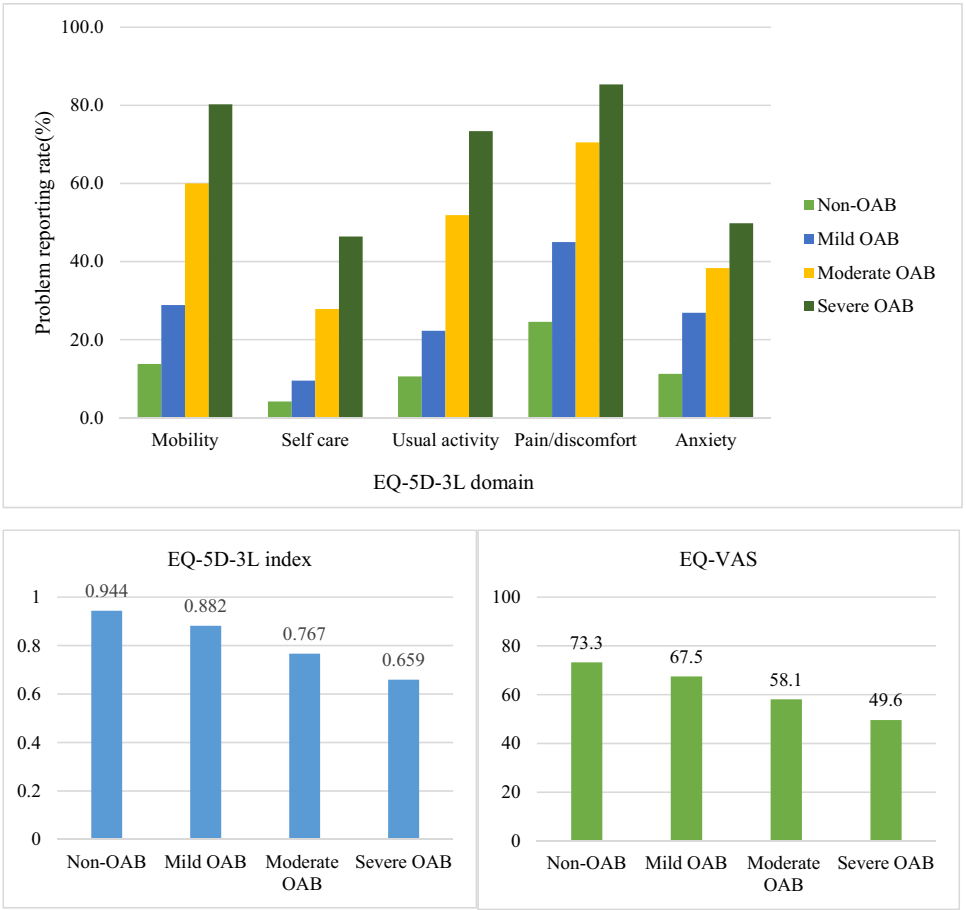

Fig. 2 EQ-5D-3L descriptive system, index, and EQ-VAS according to overactive bladder severity. Note: All groups were significantly different by chi-square test and by the post hoc Tukey test

particularly high in the pain/discomfort, mobility, and usual activity dimensions. In a study with OAB patients with urge incontinence, Herdman et al. showed problem-reporting rates of 45–48% for pain/discomfort, 46–48% for anxiety/depression, 35–36% for usual activity, 34–36% for mobility, and 14–17% for self-care, which were within the problem-reporting rate ranges observed in the present study among mild to moderate OAB subjects.

The EQ-5D-3L indices of mild, moderate, and severe OAB were 0.882, 0.767, and 0.659, respectively. In the EPIC study conducted by Coryne et al., although EQ-5D valuation sets differed from those used in our study, the EQ-5D-3L index of OAB patients was 0.85 [8], and a study by Herdman et al., EQ-5D-5L indices of OAB patients at baseline ranged from 0.82 to 85 [23]. In a study of Chinese, Korean, and Taiwanese subjects, as the severity of OABSS increased, HRQoL, depression, and anxiety scores significantly decreased [24].

In the current study, multivariate analysis adjusted for covariates showed health utility values decreased in mild, moderate, and severe OAB by 0.029, 0.089, and 0.179, respectively, compared to the non-OAB controls. Although no consensus has been reached regarding the estimation of minimal important differences (MIDs), MIDs of EQ-5D-3L indices have been reported to range from 0.074 to 0.12 [25, 26]. Based on reported MIDs, moderate and severe OAB is associated with significant reductions in HRQoL.

We also observed that subject health utility decreased as the frequency of urinary urgency, urinary frequency, nocturia, and urge incontinence increased. Multivariate analysis showed that these symptoms were negatively associated with HRQoL, which we considered to be clinically meaningful, as urinary incontinence once a day decreases in health utility by 0.091.

In a study by Tang et al., EQ-5D-3L indices ranged from 0.83 to 0.88 in the incontinent OAB group and from 0.90 to 0.91 in the continent OAB group, and the health utility index of the incontinent group was 0.04 lower than that of the continent group after adjusting for covariates [27]. It was also reported in a Korean study that as OAB patient incontinence episodes increased to 0, 1, 2–3, and 4 per day, health utility values decreased significantly to 0.848, 0.784, 0.777, and 0.742, respectively [13]. In a Spanish study, EQ-5D-3L index values decreased as urge incontinence increased to a mean value of 0.71 in subjects experiencing ≥ 4 urge incontinence episodes per day, which compared with 0.84 in patients with incontinent OAB ($p < 0.001$) [28]. In the multivariate analysis conducted by Lee et al., al four symptoms of

Table 2 EQ-5D-3L indices and EQ-VAS scores by OAB symptoms

OAB symptoms	EQ-5D-3L index			EQ- VAS		
	Mean	SD	*p*-value	Mean	SD	*p*-value
Frequency						
≤7	0.945	0.114	< 0.001	73.5	17.1	< 0.001
8–14	0.909	0.147		70.0	18.7	
≥15	0.804	0.223		61.3	22.1	
Nocturia						
0	0.969	0.080	< 0.001	76.1	15.6	< 0.001
1	0.937	0.114		72.5	17.0	
2	0.881	0.161		67.1	19.4	
≥3	0.813	0.195		61.3	21.1	
Urgency						
Not at all	0.949	0.108	< 0.001	73.8	16.9	< 0.001
Less than once a week	0.878	0.155		66.8	19.0	
Once a week or more	0.827	0.192		62.7	20.1	
About once a day	0.794	0.215		60.6	21.0	
2–4 times a day	0.741	0.234		56.6	22.7	
Urge incontinence						
Not at all	0.946	0.110	< 0.001	73.5	17.0	< 0.001
Less than once a week	0.834	0.176		63.2	19.9	
Once a week or more	0.776	0.208		58.9	20.5	
About once a day	0.727	0.241		56.1	21.5	
2–4 times a day	0.688	0.246		52.7	23.2	

All groups were significantly different by post hoc Tukey testing

Table 3 Changes in EQ-5D-3L indices according to overactive bladder severity as determined by sampling weighted adjusted multiple linear regression analysis

Variables	Coefficient	95% CI	
		Lower	Upper
Overactive bladder severity (ref: non-OAB)			
Mild	– 0.029	– 0.034	– 0.025
Moderate	– 0.089	– 0.095	– 0.083
Severe	– 0.179	– 0.207	– 0.152
Age	– 0.002	– 0.002	– 0.002
Sex (ref: male)	– 0.017	– 0.018	– 0.016
Marital status (ref: married)	– 0.023	– 0.024	– 0.022
Income (ref: lowest)	0.008	0.007	0.008
Education (ref: middle school or below)	0.006	0.006	0.007
Stress (ref: little or less)	– 0.033	– 0.034	– 0.032
Smoking status (ref: none)	– 0.0004	– 0.001	0.0002
Diabetes (ref: no)	– 0.016	– 0.019	– 0.013
Stroke (ref: no)	– 0.122	– 0.133	– 0.112
Ischemic heart disease (ref: no)	– 0.029	– 0.035	– 0.023
Arthritis (ref: no)	– 0.076	– 0.079	– 0.073
Cancer (ref: no)	– 0.023	– 0.028	– 0.018

OAB were independently associated with poorer HRQoL, as measured by the Overactive Bladder Questionnaire (OAB-q). On the other hand, urge incontinence and frequency did not remain a significant factor in multivariate analysis of EQ-5D health utility ($p = 0.174$, $p = 0.098$, respectively) [13]. In a US community-based study, HRQoL in incontinent OAB patients was lower than that of continent OAB patients, and frequency and urgency symptoms caused mild to moderate HRQoL impairment in them [29]. Andersson et al. reported a reduction in health utility of 0.135 among patients with nocturia (2 + voids per night) [30] and Desroziers et al. reported that health utility decreased as the frequency of urination and urinary incontinence increased [11]. Despite differences among studies, the symptoms of OAB have been consistently reported to negatively affect HRQoL. About one-third of OAB patients have urge incontinence [4], and this appears to have a great influence on HRQoL. These findings show that appropriate management of overactive bladder symptoms, including urinary incontinence, is needed.

This study has a limitation of lack of originality as there have already been many reports on the relationship between HRQoL and OAB. However, this study is significant in confirming the independent effects of the severity and symptoms of OAB on HRQoL after correcting for several covariates using a large population sample. This study particularly

Table 4 Changes in EQ-5D-3L indices according to overactive bladder symptoms as determined by sampling weighted adjusted multiple linear regression

Variables	Coefficient	95% CI	
		Lower	Upper
Frequency (ref: ≤ 7)			
8–14	– 0.005	– 0.006	– 0.004
≥ 15	– 0.033	– 0.043	– 0.024
Nocturia (ref: 0)			
1	– 0.002	– 0.003	– 0.001
2	– 0.016	– 0.019	– 0.014
≥ 3	– 0.044	– 0.048	– 0.040
Urgency (ref: not at all)			
Less than once a week	– 0.016	– 0.018	– 0.013
Once a week or more	– 0.022	– 0.027	– 0.017
About once a day	– 0.016	– 0.024	– 0.007
2–4 times a day	– 0.034	– 0.048	– 0.020
Urge incontinence (ref: not at all)			
Less than once a week	– 0.028	– 0.033	– 0.024
Once a week or more	– 0.052	– 0.062	– 0.042
About once a day	– 0.091	– 0.108	– 0.074
2–4 times a day	– 0.086	– 0.108	– 0.064
Age	– 0.001	– 0.001	– 0.001
Sex (ref: male)	– 0.015	– 0.016	– 0.013
Marital status (ref: married)	– 0.021	– 0.022	– 0.019
Income (ref: lowest)	0.007	0.006	0.008
Education (ref: middle school or below)	0.006	0.005	0.007
Stress (ref: little or less)	– 0.031	– 0.032	– 0.030
Smoking status (ref: none)	– 0.001	– 0.001	– 0.0001
Diabetes (ref: no)	– 0.013	– 0.016	– 0.010
Stroke (ref: no)	– 0.116	– 0.126	– 0.105
Ischemic heart disease (ref: no)	– 0.026	– 0.031	– 0.020
Arthritis (ref: no)	– 0.071	– 0.074	– 0.069
Cancer (ref: no)	– 0.021	– 0.025	– 0.016

examined health utility changes according to the degree of each OAB symptom using EQ-5D. Clinicians or health care professionals can comprehend how much treatment provided to OAB patients can improve the HRQoL and consider symptoms that should be treated first.

Desroziers et al.'s study, which pooled three randomized trials, showed the responsiveness of EQ-5D, which increased the health utility value as OAB symptoms improved [11]. A review study reported that the cost-utility analysis of OAB treatment mostly used health utility values derived from disease-specific tools applied during clinical trials, and there is substantial variation and/or uncertainty in its HRQoL valuation [12]. Using the findings of this study, the health utility reduction value can be used according to the level of OAB symptoms, which will improve the economic evaluation modeling. In addition, EQ-5D is a general preference-based instrument and its findings are more advantageous as compared to outcomes of other studies, treatments, and populations via EQ-5D [23].

The results of this large community-based study suggest that EQ-5D-3L is a valid tool for assessing HRQoL in individuals with OAB. EQ-5D may not capture all aspects of health status relevant to patients with a particular condition [31] but can be useful to elicit health utility values in OAB patients.

Conclusions

The results of this large community-based study of adults aged ≥ 19 years suggest that OAB symptoms significantly contribute to poor HRQoL. Furthermore, the study shows that EQ-5D-3L is valid for assessing the impact of HRQoL in adults with OAB. Health utility by symptom and severity can be used for cost-utility analysis of healthcare policies and interventions in OAB. Considerable attention should be given to interventions that provide optimal outcomes in patients with overactive bladder.

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Compliance with ethical standards

Conflicts of interest The authors declare that they have no conflict of interest.

Ethical approval This study was approved by the Institutional Review Board of the Korea Center for Disease Control and Prevention (IRB No. 2012-07CON-01-2C).

Informed consent Informed consent was obtained from all participants.

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