Impact of nocturia on patients' health-related quality of life and healthcare resource utilisation compared with OAB and BPH: Results from an observational survey in European and American patients

Veronica Y. Zeng1 | Gary Milligan2 | James Piercy2 | Peter Anderson2 | Fredrik L. Andersson1,3

Abstract

Objective: To evaluate the impact of nocturia on patients' quality of life and healthcare resource utilisation (HRU) compared with overactive bladder (OAB) and benign prostatic hyperplasia (BPH).

Methods: Data were drawn from a multinational (France, Germany, Spain, UK and US) survey of physician and patient-reported outcomes. The patient groups of interests were those diagnosed with only nocturia, with only OAB, and with only BPH. Health-related quality of life (HRQoL) and productivity measures were derived from the EuroQoL-5D, OAB-q and the Work Productivity and Activity Impairment Questionnaire (WPAI). Measures of HRU included lower urinary tract symptoms (LUTS)-relevant surgeries, hospitalisations, current use of pads and related physician visits. Bivariate and multivariate regression analyses were used to evaluate associations between HRQoL/HRU/Productivity and nocturia status. Multivariate analysis was used to address any potential confounding factors among the groups, ie age, gender, body mass index (BMI), ethnicity and comorbidities.

Results: A total of 3552 patients were identified including 358 nocturia patients, 1415 OAB patients and 1779 BPH patients. The mean age of the nocturia patients was 61.2 years with a mean BMI of 27.3. About 60.6% were women, 87.2% were Caucasian, and their most common comorbidities included depression, hypertension and diabetes. In terms of impact, nocturia patients were significantly worse off than OAB patients in their HRQoL. There was no significant difference regarding HRU and productivity measurement. Nocturia patients also presented with significantly worse HRQoL and lower productivity compared with BPH patients. Nocturia patients also had more physician visits.

Conclusions: Nocturia should be emphasised as a standalone LUTS disease with substantial patient impact. Compared with OAB and/or BPH, nocturia patients presented
1 | INTRODUCTION

Nocturia is a common yet under-reported lower urinary tract symptoms (LUTS) condition. Recognised by the International Continence Society (ICS) as a standalone condition in 1999, nocturia is defined as the condition when an individual has to wake at night to void one or more times, with each of the voids followed by sleep. However, recent studies suggest that two voids per night is the threshold beyond which nocturia is burdensome and associated with impaired quality of life and this definition is used in this study.

Nocturia is often associated with or caused by nocturnal polyuria (NP), the excessive production of renal urine during the night. Current treatments for the more widely diagnosed overactive bladder (OAB) and benign prostatic hyperplasia (BPH) aim to increase bladder capacity and/or lower bladder outlet obstruction, but these do not always effectively treat those patients suffering from nocturia. Nevertheless, nocturia is increasingly recognised as one of the most bothersome symptoms for those suffering from LUTS and the leading cause of sleep disturbance. The sleep fragmentation experienced by individuals with nocturia can severely impact their sleep quality and daytime energy level, and negatively impact their health-related quality of life (HRQoL) and work productivity.

There has been an ongoing discussion on involving the patients’ voice and preferences during the development of medical products. Regulatory agencies (for example, the US Food and Drug Administration) and health technology assessment bodies (such as the UK’s National Institute for Health and Care Excellence [NICE]) have increasingly adopted new policies to assess the value of new products based on real-world patient-reported outcomes. For patients suffering from LUTS, previous studies conclude that some HRQoL measures are quite distinct and specific to different symptoms. However, there is a lack of clear evidence showing the difference on quality of life and healthcare resource utilisation (HRU) among all the LUTS conditions, especially when comparing nocturia with the more broadly diagnosed OAB and BPH.

The aim of this analysis was to compare nocturia patients with OAB and BPH patients with regards to HRQoL, productivity and HRU, and assess whether the disease and societal burden of nocturia is significantly different to that observed for OAB and BPH.

2 | PATIENTS AND METHODS

This analysis was conducted using the LUTS Disease Specific Programme (DSP™), a multinational survey undertaken in the UK, France, Germany, Spain and the US in 2013. The DSP is a large-scale real-world cross-sectional survey of LUTS patients and their treating physicians. The detailed methodology of this type of survey has been published. The survey includes patient self-reported data including patient demographics, quality of life, management of disease, and productivity, as well as physician-reported data focusing on treatment practice and healthcare utilisation (see Table 1).

The data utilised in this study were collected from 635 physicians (primary care physicians, gynaecologists and urologists) and 8738 consulting patients with a physician-confirmed LUTS diagnosis. During the survey, physicians completed a patient record form for the next 14 consulting patients, who were diagnosed with one or any combination of OAB, BPH, nocturia and/or NP. The same patients were then invited to fill out a patient self-completion form (PSC), which recorded patient-reported outcomes (PROs) including the EQ-5D-5L, the OAB Questionnaire (OAB-q) and Work Productivity and Activity Impairment (WPAI). Patients were not tested or investigated prior to the survey and their questionnaire responses were not seen or influenced by their physician.

The DSP was conducted in accordance with the European Pharmaceutical Market Research Association code of conduct for international healthcare market research and the US Health Insurance Portability and Accountability Act 1996. Patients were required to sign the informed consent to agree on anonymously

with a significant reduction on patients’ quality of life, reduced work productivity and increased utilisation of healthcare resources.
reporting research findings as required. Data were collected by local partners who ensured compliance with patients' privacy. Ethical approval was not required for this type of survey, because the aim was to improve understanding and not to test any hypotheses or treatments. Clinical practice should not be affected by the survey.

Since the DSP contains a large pool of patient data, three stand-alone patient groups were selected for this study: nocturia-only, OAB-only and BPH-only. The selection ensured that patients diagnosed with multiple conditions were excluded. For instance, the BPH-only group would not contain patients diagnosed with BPH mixed with OAB (BPH + OAB), BPH mixed with nocturia (BPH + Nocturia) and a mixture of BPH, OAB and nocturia (BPH + OAB + Nocturia). Since NP is often associated with nocturia and there were only 34 NP-only patients (without a co-diagnosis of nocturia), they were included in the nocturia-only group. The nocturia-only group therefore includes patients with nocturia and/or NP. The Venn diagram (Figure 1) illustrates the composition of those patient groups included in the analysis.

**TABLE 1** Data source characteristics

| Year of data collection | 2013 |
|-------------------------|------|
| Survey type             | Cross-sectional |
| Respondent              | Patient-reported outcomes, with clinical data collected from physicians, self-reported completion method |
| Patient-reported outcome| EQ-5D-5L, WPAI, OAB-q |
| Physician-reported outcome | HRU |
| Confounding covariates  | Demographics, comorbidities, drugs prescribed, health/lifestyle indicators, income, home circumstances, treatment history, physician-reported outcomes |
| Geography               | UK, France, Germany, Spain, USA |

Abbreviations: DSP, Disease Specific Programme; EQ-5D-5L, EuroQoL 5 Dimension 5 Level; HRU, Health Resource Utilisation; OAB-q, overactive bladder questionnaire; WPAI, Work Productivity and Activity Impairment.

**TABLE 2** Outcome measurement, score range and interpretation

| Outcome measures                  | Score range | Interpretation                                              |
|-----------------------------------|-------------|-------------------------------------------------------------|
| HRQoL                             |             |                                                            |
| EQ-5D utility score               | −0.56 to 1.00 | The higher the score, the better quality of life |
| EQ-5D VAS                         | 0–100       | The lower the score, the better quality of life             |
| OAB-q symptom severity score      | 0–100       | The higher the score, the better quality of life             |
| OAB-q HRQoL total score           | 0–100       | The higher the score, the better quality of life             |
| Productivity (WPAI)               |             |                                                            |
| Activity impairment (%)           | 0–100       | The higher the percentage, the lower productivity           |
| Work time missed (%)              | 0–100       |                                                            |
| Impairment whilst working (%)     | 0–100       |                                                            |
| Overall work impairment (%)       | 0–100       |                                                            |
| Whether employed                   | Yes or no   | N/A                                                         |

| Healthcare Resource Utilisation* |             |                                                            |
| LUTS-related surgery             | Yes or no   | The higher number of pads, the more HRU                     |
| Hospitalisation in the last 12 mo| Yes or no   | The higher number of pads, the more HRU                     |
| Current use of pads              | Yes or no   |                                                            |
| Number of pads (if used)         | 0–80        | The higher number of pads, the more HRU                     |
| Number of physician visits in the last 3 mo | 1–24 | The higher number of visits, the more HRU                     |

Abbreviations: EQ-5D, EuroQoL 5 Dimension; HRQoL, health-related quality of life; HRU, Health Resource Utilisation; LUTS, lower urinary tract symptoms; OAB-q, overactive bladder questionnaire; VAS, visual analogue scale; WPAI, Work Productivity and Activity Impairment.

*Among all factors of HRU, LUTS-related surgery, hospitalisation data were derived from the physician-filled patient record forms (PRFs). The information about current use of pads and number of physician visits was collected from the patient self-completion form.
To evaluate associations between HRQoL/HRU and nocturia status, bivariate and multivariate analyses were used. For the bivariate analyses, Student’s t tests, chi-squared tests and Fisher’s exact tests were used, depending on the type of variable being assessed.

For the HRQoL, multivariate analysis was used to address any potential confounding between the two groups, ie other factors (apart from nocturia status) that may bias the results. In particular, regression analysis was used. The type of regression was chosen depending on the type and distribution of the dependent variable. The coefficients and P-values for the group variable showed how the OAB-only and BPH-only groups compared with the nocturia-only group. The significance level was P < .05, and the significant values were highlighted when necessary.

Three categories of outcomes were examined in the multivariate analysis, referring to PROs and HRU measurement. PROs which measured HRQoL included the EuroQol-5D utility score, derived from a combination of 3L tariffs (from each country’s value set) and the 3L/5L crosswalk and the EQ-5D visual analogue scale (VAS). More disease-specific instruments included the OAB-q symptom severity score and OAB-q HRQoL total score.

Productivity was assessed using the WPAI Specific Health Problem questionnaire. More specifically, the WPAI questionnaire was adapted to LUTS in order to reflect the impact on those patients’ employment, absenteeism and presentism. Patients were also asked about their overall activity impairment.

HRU was estimated via both physician-reported measures (physician visits, proportion of patients who ever had LUTS-related surgery; proportion of patients with LUTS-related hospitalisation over the past 12 months) and patient-reported measures (proportion of patients using pads at the time of PSC completion; number of pads used per week).

Possible score range and score interpretation pertaining to the outcomes measures derived from each instrument are listed in Table 2.

The quality of life outcome measures and health resource utilisation level for each of the three patient groups were analysed using bivariate analysis. In order to compare the results of the nocturia-only

| Country, n (%) | Overall | OAB-only | BPH-only | Nocturia-only |
|---------------|---------|----------|----------|---------------|
| Total         | 3552 (100) | 1415 (39.8) | 1779 (50.1) | 358 (10.1) |
| France        | 761 (21.4) | 328 (23.2) | 389 (21.9) | 44 (12.3) |
| Germany       | 676 (19.0) | 302 (21.3) | 288 (16.2) | 86 (24.0) |
| Spain         | 902 (25.4) | 284 (20.1) | 505 (28.4) | 113 (31.6) |
| UK            | 537 (15.1) | 200 (14.1) | 285 (16.0) | 52 (14.5) |
| US            | 676 (19.0) | 301 (21.3) | 312 (17.5) | 63 (17.6) |
| Age, y        |         |          |          |               |
| Mean (SD)*    | 63.6 (12.3) | 58.9 (13.3) | 67.8 (9.1) | 61.2 (14.2) |
| Gender, n (%) |         |          |          |               |
| Male*         | 2105 (59.3) | 185 (13.1) | 1779 (100.0) | 141 (39.4) |
| Female*       | 1447 (40.7) | 1230 (86.9) | 0 (0.0) | 217 (60.6) |
| Ethnicity, n (%) |       |          |          |               |
| White/Caucasian | 3104 (87.4) | 1230 (86.9) | 1562 (87.8) | 312 (87.2) |
| Hispanic/Latino | 149 (4.2) | 64 (4.5) | 70 (3.9) | 15 (4.2) |
| Afro-Caribbean | 145 (4.1) | 55 (3.9) | 78 (4.4) | 12 (3.4) |
| Other         | 154 (4.3) | 66 (4.7) | 69 (3.9) | 19 (5.3) |
| Selected comorbidities, n (%) | | | | |
| Depression/anxiety/other psychological/psychiatric symptoms* | 716 (20.2) | 403 (28.5) | 211 (11.9) | 102 (28.5) |
| Hypertension* | 1563 (44.0) | 466 (32.9) | 960 (54.0) | 137 (38.3) |
| Diabetes*     | 572 (16.1) | 177 (12.5) | 316 (17.8) | 79 (22.1) |
| BMI |         |          |          |               |
| BMI N a       | 3286 | 1316 | 1629 | 341 |
| Mean (SD)*    | 27.2 (4.6) | 26.9 (5.3) | 27.5 (3.7) | 27.3 (5.0) |

Abbreviations: BMI, body mass index; BPH, benign prostatic hyperplasia; OAB, overactive bladder.

*BMI could not be calculated for 266 patients.

**P < .05 using chi-squared test or student’s t test.
### TABLE 4  
Bivariate analysis on HRQoL, productivity and HRU

|                      | Overall | OAB-only | BPH-only | Nocturia-only | P value |
|----------------------|---------|----------|----------|---------------|---------|
| **HRQoL**            |         |          |          |               |         |
| EQ-5D-5L state valuation |        |          |          |               | .0611   |
| N                    | 3463    | 1373     | 1739     | 351           |         |
| Mean (SD)            | 0.85 (0.18) | 0.85 (0.19) | 0.85 (0.18) | 0.83 (0.18) |         |
| Median               | 0.91    | 0.91     | 0.91     | 0.88          |         |
| EQ-5D VAS            |         |          |          |               | .0001   |
| N                    | 3421    | 1355     | 1717     | 349           |         |
| Mean (SD)            | 74.2 (15.6) | 74.4 (16.1) | 74.6 (15.1) | 70.8 (16.0) |         |
| Median               | 75.0    | 75.0     | 75.0     | 70.0          |         |
| OAB-q symptom severity |         |          |          |               | <.0001  |
| N                    | 3392    | 1352     | NA       | 339           |         |
| Mean (SD)            | 29.9 (18.7) | 33.4 (19.7) | NA        | 36.3 (17.4)  |         |
| Median               | 26.7    | 30.0     | 33.3     |               |         |
| OAB-q total HRQoL score |         |          |          |               | <0.0001 |
| N                    | 3431    | 1372     | NA       | 350           |         |
| Mean (SD)            | 27.3 (17.4) | 30.2 (17.6) | NA        | 32.8 (16.8)  |         |
| Median               | 26.2    | 29.2     | 30.8     |               |         |
| **Productivity**     |         |          |          |               |         |
| % Employed, n (%)    |         |          |          |               | <.0001  |
| N                    | 3435    | 1363     | 1724     | 348           |         |
| Employed             | 2318 (67.5) | 817 (59.9) | 1265 (73.4) | 236 (67.8)  |         |
| Unemployed            | 1117 (32.5) | 54.6 (40.1) | 459 (26.6) | 112 (32.2)  |         |
| % work time missed   |         |          |          |               | .3150   |
| N                    | 919     | 440      | 381      | 98            |         |
| Mean (SD)            | 2.6 (11.1) | 2.7 (10.5) | 2.9 (12.8) | 1.0 (3.7)   |         |
| Median               | 0.0     | 0.0      | 0.0      | 0.0           |         |
| % impairment while working |         |          |          |               | <.0001  |
| N                    | 994     | 481      | 407      | 106           |         |
| Mean (SD)            | 21.4 (20.3) | 23.5 (21.0) | 17.7 (18.4) | 26.4 (21.7) |         |
| Median               | 20.0    | 20.0     | 20.0     | 20.0          |         |
| % overall impairment |         |          |          |               | <.0001  |
| N                    | 901     | 430      | 375      | 96            |         |
| Mean (SD)            | 22.5 (22.0) | 24.9 (22.8) | 18.6 (20.3) | 27.2 (22.4) |         |
| Median               | 20.0    | 20.0     | 10.0     | 23.2          |         |
| % activity impairment |         |          |          |               | <.0001  |
| N                    | 3320    | 1329     | 1649     | 342           |         |
| Mean (SD)            | 31.6 (23.1) | 33.8 (22.8) | 28.6 (23.1) | 37.5 (22.6) |         |
| Median               | 30.0    | 30.0     | 20.0     | 30.0          |         |
| **HRU**              |         |          |          |               |         |
| Ever had LUTS-related surgery, n (%) |        |          |          |               | .0280   |
| N                    | 3298    | 1316     | 1654     | 328           |         |
| No                   | 3101 (94.0) | 1252 (95.1) | 1537 (92.9) | 312 (95.1)  |         |
| Yes                  | 197 (6.0) | 64 (4.9) | 117 (7.1) | 16 (4.9)      |         |
| Hospitalisation in the last 12 mo, n (%) |        |          |          |               | .0067   |
| N                    | 3498    | 1394     | 1756     | 348           |         |

(Continues)
group with those of the OAB-only and the BPH-only groups, a multivariate regression analysis was conducted.

3 | RESULTS

As shown in Table 3, a total of 3552 patients were eligible for the designed analysis, with 2876 patients coming from the four European countries plus 676 patients from the United States. Three hundred and fifty-eight nocturia-only patients were identified, accounting for 10.1% of the total sample analysed. The nocturia-only group had a mean body mass index of 27.3 and mean age of 61.2 years; 60.6% were women and 87.2% were Caucasian. In terms of comorbidities, nocturia-only patients were mainly diagnosed with depression and/or other psychiatric problems (28.5%), hypertension (38.3%) and diabetes (22.1%). The groups seem to be rather heterogeneous.

Therefore, Table 4 shows the bivariate analysis results on HRQoL, productivity and HRU. Statistically significant differences were observed for a number of outcomes including EQ-5D VAS, OAB-q (symptom severity, total HRQoL score), likelihood of employment, overall work impairment, activity impairment, hospitalisations, likelihood of surgery, likelihood of use and number of pads.

Results from the multivariate regression analysis are presented in Table 5. The analysis showed that most of the differences in the results were identified when comparing nocturia-only patients with the BPH-only group.

Table 4 (Continued)

| Current use pads, n (%) | Overall | OAB-only | BPH-only | Nocturia-only | P value |
|-------------------------|---------|----------|----------|---------------|---------|
| No                      | 3359 (96.0) | 1354 (97.1) | 1668 (95.0) | 337 (96.8) |         |
| Yes                     | 139 (4.0) | 40 (2.9) | 88 (5.0) | 11 (3.2) |         |
| Number of pads per week |          |          |          |               |        |
| N                       | 3479     | 1387     | 1738     | 354          | <.0001  |
| No                      | 2784 (80.0) | 880 (63.4) | 1647 (94.8) | 257 (72.6) |         |
| Yes                     | 695 (20.0) | 507 (36.6) | 91 (5.2) | 97 (27.4) |         |
| Number of physician visits in the last 3 mo |          |          |          |                | .1228   |
| N                       | 2764     | 1065     | 1406     | 293          |         |
| Mean (SD)               | 2.4 (1.8) | 2.4 (1.7) | 2.4 (1.8) | 2.6 (2.2) |         |
| Median                  | 2.0      | 2.0      | 2.0      | 2.0          |         |

Note: The number of observations may vary between the variables because of missing observations. Bold values indicate statistically significant differences between groups (P < 0.05).

Abbreviations: BPH, benign prostatic hyperplasia; EQ-5D-5L, EuroQoL 5 Dimension 5 Level; HRQoL, health-related quality of life; HRU, health resource utilisation; LUTS, lower urinary tract symptoms; OAB-q, overactive bladder questionnaire; VAS, visual analogue scale.

less likely to be employed, and more impaired at work. There was also a significant difference observed for activity impairment. For HRU, the BPH-only group visited physicians less frequently and used fewer pads than the nocturia group.

For OAB-only, outcomes with a statistically significant difference were observed in EQ-5D VAS and OAB-q total score, indicating that nocturia-only patients were likely to suffer from a lower HRQoL compared with the OAB-only group.

4 | DISCUSSION

The results showed that nocturia-only patients experienced a significantly lower HRQoL compared with OAB-only patients. Such differences were not observed regarding productivity score and HRU.

Stronger results were derived from the comparison between nocturia-only group and BPH-only group. Overall, the HRQoL in patients with nocturia was worse, and some aspects of the lower productivity score and more frequent physician visits also indicated that nocturia caused a higher burden to patients’ daily life. It was more likely for BPH patients to receive surgery, which might explain the more pads used.

Literature has pointed to a delay in the proper diagnosis, or even misdiagnosis and poor management of the nocturia condition. Kobelt’s study confirms that nocturia significantly reduces the general quality of life and work productivity for those who conduct active professional activities. This important aspect has recently been confirmed in a huge, comprehensive (90 000 plus) workplace survey in the UK, Australia and five Asian countries.

Sleep disturbance as a result of waking up to void during night is another burden to the nocturia patients. Similarly, the expert
what's more, several recent studies reveal that the negative impact of nocturia on HRQoL associated with an increasing number of voids (>2 voids per night). what's more, several recent studies reveal that the negative impact of nocturia on HRQoL associated with an increasing number of voids (>2 voids per night). what's more, several recent studies reveal that the negative impact of nocturia on HRQoL associated with an increasing number of voids (>2 voids per night).

This study has therefore provided further evidence of the impact of this condition. As nocturia can be underdiagnosed—and therefore can go unrecognised—there is a clear need for better diagnosis, as well as a targeted treatment to reduce the bothersome aspects of nocturia.

The strengths of this study include the richness of patient data, the pragmatic selection of a targeted population based on real-world treatment practice and the variety of outcomes assessed. The large sample size allowed us to focus exclusively on patients with a single-diagnosis (n = 3552) so the results would potentially not be confounded by a combination effect of other LUTS conditions. But this kind of real-world data also comes with some potential weaknesses. While it should be highlighted that all patients included in the survey had a physician-confirmed diagnosis, the authors do rely on the accuracy of the physician diagnosis and recording. To support the physician in correctly diagnosing the patient, we included several questions relating to symptoms and ways of arriving at the diagnosis. It is of course still possible that patients with de facto nocturia condition might have been diagnosed with a combination of nocturia and other LUTS (and thus excluded), or even incorrectly diagnosed as OAB and/or BPH patients. Diagnosis bias may also go in the other direction. The fact that 27% of nocturia-only patients wear pads may indicate this. However, we would then anticipate that the differences between the groups might in fact be greater than stated in this analysis.

one key aspect in HRQoL research is of course whether these differences are clinically meaningful or not. While the different instruments clearly point to a large impact on their daily life, the average differences between the different groups are most likely not clinically meaningful.

To conclude, nocturia patients in major European countries and the US experienced statistically significant worse quality of life compared with patients with OAB or BPH. Taking all factors into consideration, nocturia can severely impact patients' quality of life. Thus, the

| TABLE 5 | Multivariate regression results comparing OAB-only and BPH-only groups to the nocturia-only group on HRQoL, productivity and HRU* |
|---------|---------------------------------------------------------------------------------------------------------------|
| HRQoL   |                                                                                                                                                           |
| EQ-SD-5L state valuationa | 0.009 | .371 | 0.039 | .001 | 0.206 |
| EQ-SD VASa | 2.48 | .006 | 5.36 | 0.180 |
| OAB-q symptom severitya | −1.9 | .108 | NA | 0.095 |
| OAB-q Total HRQoL Scorea | −2.7 | .013 | NA | 0.074 |
| Productivity |                                                                                                                                                           |
| WPAI: %Employedb | 1.46 | .053 | 1.8 | .011 | 0.365 |
| WPAI: % work time missedd | 1.51 | .259 | 3.2 | .066 | 0.029 |
| WPAI: % impairment while workinga | −2.1 | .365 | −6.53 | .031 | 0.059 |
| WPAI: % overall work impairmenta | −1.55 | .551 | −5.66 | .096 | 0.051 |
| WPAI: % activity impairmenta | −1.96 | .182 | −8.71 | <.001 | 0.071 |
| HRU     |                                                                                                                                                           |
| Ever had LUTS-related surgery:hb | 1.24 | .516 | 0.97 | .921 | 0.085 |
| Hospitalisation in the last 12 mo?b | 1.26 | .584 | 1.46 | .39 | 0.050 |
| Currently use pads due to urine leakageb | 1.21 | .222 | 0.39 | <.001 | 0.233 |
| Number of pads per weeka | 0.09 | .267 | 0 | .979 | 0.037 |
| Number of physician visits in the last 3 mocea | −0.05 | .24 | −0.16 | .002 | 0.017 |

Note: The number of observations may vary between the variables because of missing observations.
Abbreviations: BPH, benign prostatic hyperplasia; EQ-SD-5L, EuroQoL 5 Dimension 5 Level; HRQoL, health-related quality of life; HRU, health resource utilisation; LUTS, lower urinary tract symptoms; OAB-q, overactive bladder questionnaire; VAS, visual analogue scale; WPAI, Work Productivity and Activity Impairment.

| Coefficient provided from a linear regression |
| Odds ratio provided from a logistic regression |
| Coefficient provided from a Poisson regression |

*P < .05 are highlighted in bold.
appropriate practices need to be established for the recognition and treatment of patients with nocturia.

ACKNOWLEDGEMENTS

This paper specifically refers to the analytical methodology used to assess the quality of life and HRU in patients with nocturia, OAB and BPH. The patient-reported data were extracted from the LUTS Disease Specific Programme™ developed by Adelphi Real World.

CONFLICT OF INTEREST

FA is employed by Ferring Pharmaceuticals A/S, and VYZ is a former employee of Ferring. GM, JP and PA are employees of Adelphi Group Ltd. Funding to Adelphi for this study came from Ferring Pharmaceuticals A/S.

ORCID

Fredrik L. Andersson https://orcid.org/0000-0001-6304-5781

REFERENCES

1. Oelke M, De Wachter S, Drake MJ, et al. A practical approach to the management of nocturia. Int J Clin Pract. 2017;71(11):1-11.
2. Van Kerrebroeck P, Abrams P, Chaikin D, et al. The standardization of terminology in nocturia: report from the standardization subcommittee of the International Continence Society. BJU Int. 2002;90(suppl 3):11-15.
3. Tikkinen K, Johnson TM, Tammela T, et al. Nocturia frequency, bother, and quality of life: how often is too often? A population-based study in Finland. Eur Urol. 2010;57(3):488-498.
4. Holm-Larsen T, Malmberg A, Van Der Meulen E, Nørgaard JP. 274 Is the reduction to less than two nocturnal voids a relevant clinical treatment goal in nocturia patients? Eur Urol Suppl. 2015;14(2):e274-e274a.
5. Van Kerrebroeck P, Hashim H, Holm-Larsen T, Robinson D, Stanley N. Thinking beyond the bladder: antidiuretic treatment of nocturia. Int J Clin Pract. 2010;64(6):807-816.
6. Everaert K, Anderson P, Wood R, Andersson FL, Holm-Larsen T. Nocturia is more bothersome than daytime LUTS: results from an Observational, Real-life Practice Database including 8659 European and American LUTS patients. Int J Clin Pract. 2018;72(6):1-7.
7. Bliwise DL, Foley DJ, Vitilello MV, Ansari FP, Ancoli-Israel S, Walsh JK. Nocturia and disturbed sleep in the elderly. Sleep Med. 2009;10(5):540-548.
8. Bliwise DL, Dijk DJ, Juul KV. Nocturia is associated with loss of deep sleep independently from sleep apnea. Neurourol Urodyn. 2015;34(4):392.
9. Coyne K, Zhou Z, Bhattacharyya S, Thompson C, Dhawan R, Versi E. The prevalence of nocturia and its effect on health-related quality of life and sleep in a community sample in the USA. BJU Int. 2003;92:948-954.
10. de Bekker-Grob EW, Berlin C, Levitan B, et al. Giving patients' preferences a voice in medical treatment life cycle: the PREFER public-private project. Patient. 2017;10(3):263-266.
11. FDA. Patient-focused drug development: collecting comprehensive and representative input. Guidance. 2018.
12. Oyinlola JO, Campbell J, Kousoulis AA. Is real world evidence influencing practice? A systematic review of CPRD research in NICE guidances. BMC Health Serv Res. 2016;16(1):299.
13. Anderson P, Benford M, Harris N, Karavali M, Piercy J. Real-world physician and patient behaviour across countries: Disease-Specific Programmes – a means to understand. Curr Med Res Opin. 2008;24(11):3063-3072.
14. EuroQol - a new facility for the measurement of health-related quality of life. Health Policy. 1990;16(3):199-208.
15. Coyne K, Revicki D, Hunt T, et al. Psychometric validation of an overactive bladder symptom and health-related quality of life questionnaire: the OAB-q. Qual Life Res. 2002;11(6):563-574.
16. Reilly MC, Zbrozek AS, Dukes EM. The validity and reproducibility of a work productivity and activity impairment instrument. Pharmacoeconomics. 1993;4(5):353-365.
17. ICC (the International Chamber of Commerce); ESOMAR (European Society for Opinion and Marketing Research), International Code on Market, Opinion and Social Research and Data Analytics. International Code. 2016.
18. EQ-5D-5L Valuation, Crosswalk Index Value Calculator [Internet]. https://euroqol.org/eq-5d-instruments/eq-5d-5l-about/valuation-standard-value-sets/crosswalk-index-value-calculator/. Accessed August 21, 2018.
19. Oelke M, Anderson P, Wood R, Holm-Larsen T. Nocturia is often inadequately assessed, diagnosed and treated by physicians: results of an observational, real-life practice database containing 8659 European and US-American patients. Int J Clin Pract. 2016;70(11):940-949.
20. Kobelt G, Borgström F, Mattiasson A. Productivity, vitality and utility in a group of healthy professionally active individuals with nocturia. BJU Int. 2003;91(3):190-195.
21. RAND Corporation. How frequent nighttime bathroom visits can negatively impact sleep, well-being and productivity - Examining the associations between nocturia, well-being and economic outcomes in a working-age population. https://www.rand.org/pubs/research_reports/RR3043.html. Accessed June 17, 2019.
22. Holm-Larsen T, Albei C, Andersson F, Nørgaard JP. “My sleep pattern is a series of naps”. Subjective patient-reported data about what is most bothersome about nocturia. Eur Urol Suppl. 2013;12:e405.
23. Andersson F, Anderson P, Holm-Larsen T, Piercy J, Everaert K, Holbrook T. Assessing the impact of nocturia on health-related quality-of-life and utility: results of an observational survey in adults. J Med Econ. 2016;19(12):1200-1206.
24. Chapple CR, Batista JE, Berger R, et al. The impact of nocturia in patients with LUTS/BPH: need for new recommendations. Eur Urol Suppl. 2006;5(1):12-18.
25. Everaert K, Hervé F, Bosch R, et al. International Continence Society consensus on the diagnosis and treatment of nocturia. Neurourol Urodyn. 2019;38:478-498.

How to cite this article: Zeng VY, Milligan G, Piercy J, Anderson P, Andersson FL. Impact of nocturia on patients’ health-related quality of life and healthcare resource utilisation compared with OAB and BPH: Results from an observational survey in European and American patients. Int J Clin Pract. 2019;73:e13408. https://doi.org/10.1111/ijcp.13408