Original Article

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Quality of Sleep and Associating Factors among the Elderly with Urinary Incontinence

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Abstract:

Objective: This study aimed to assess the prevalence of poor quality of sleep, and its associating factors among Thai elderly with urinary incontinence (UI), in Chiang Rai province.

Material and Methods: Study samples from 419 individuals with UI, aged ≥60 years and living in Chiang Rai province were taken. Multi-stage random sampling was used to recruit study participants. Thai versions of the International Consultation on Incontinence Questionnaire-Short Form (TICIQ-UI SF) and the Pittsburg Sleep Quality Index (TPSQI) were used as data collection instruments.

Results: Overall, 84.2% of participants had poor quality of sleep (TPSQI >5); with the mean TPSQI score being 8.4±3.16. Approximately 21.5%, 69.2%, and 9.3% had severe, moderate, and mild UI, respectively. Multiple logistic regression analysis revealed that being female (OR=2.77; 95% confidence interval (CI), 1.47-5.24); having a moderate severity of UI (OR=3.63; 95% CI, 1.10-11.96); being a current smoker (OR=6.84; 95% CI, 2.09-22.33); monthly income of <5,000 Baht (<167 USD) (OR=4.27; 95% CI, 1.33-13.73); being a current alcohol consumer (OR=3.04; 95% CI, 1.47-6.28) and being depressed (OR=3.91; 95% CI, 1.44-10.56) were significantly associated with poor quality of sleep.

Conclusion: The prevalence of poor quality of sleep among the elderly with UI was rather high. The combined effects of several risk factors caused the elderly with moderate UI to have a poor quality of sleep. Healthcare personnel should regularly conduct screening for quality of sleep, UI, and depression and provide sleep health education to the elderly with UI, especially the elderly with depression, smokers, and alcohol consumers.

Keywords: depression, older adults, prevalence, quality of sleep, urinary incontinence

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Introduction

The International Continence Society defined urinary incontinence (UI) as the involuntary leakage of urine[1]. UI is a common geriatric syndrome and is a widespread health complaint among the elderly population[2]. In Thailand, the prevalence of UI is estimated to be from 54.9% to 60.9% among the elderly aged ≥60 years[3]. The prevalence of UI in females is higher than in males[4]. UI is usually underreported, as many women hesitate to seek help from medical doctors; due to the perceived embarrassing and culturally sensitive nature of the condition[5]. Untreated UI is related to depression, falls, fractures, sleep disturbance and urinary tract infections. UI substantially affects an individual's quality of life, especially their quality of sleep[6]. As the elderly population increases, the number of elderly with UI is increasing along with the associated healthcare costs.

Sleep disruption from UI is associated with the fear and stress of urine leakage and the need for frequent urination. This sleep disruption affects the quality of sleep. Elderly people with UI and poor quality of sleep often also suffer from difficulty in falling asleep, needing to wake up to use the toilet, and getting up during the night or in the early morning[7]. Previous studies have found the prevalence of poor quality of sleep among the elderly with UI to vary; from 21.7% to 89.3%[8,9], and its associating factors having greater frequency of UI[10] being:smoking[11–13], alcohol consumption[12,14] and physical exercise[15]; whilst other associating factors might be due to economic burden[16], and mental health problems[17,18]. To the best of the researchers' knowledge, there have been few published literature regarding the impact of UI on the quality of sleep among the Thai elderly. Therefore, this present study aimed to assess the prevalence of poor quality of sleep, and its associating factors among the Thai elderly with UI.

Material and Methods

This cross-sectional study was carried out in Chiang Rai province, in Northern Thailand. Chiang Rai has a high proportion of elderly; in 2019, during the study period, the elderly accounted for 21.8% of the total population (197,581/904,261)[19] The sample size was calculated by the single proportion formula, with finite population correction[20] and a 95% confidence interval (CI). Precision was set at 4.8%. Because, there are no previous publications regarding the prevalence of poor sleep quality among the Thai elderly aged ≥60 years with UI, an estimated prevalence of 50% was used to gain the maximum sample size. The sample size was calculated to be at least 416 to represent a population of 198,581 elderly. In total, 419 elderly with UI were recruited into the study.

Chiang Rai province has four zones, covering 18 districts. Multi-stage random sampling was used to recruit study participants. First, one district in each zone was randomly selected. Then, in each district, four sub-districts were randomly selected. Study participants from the 16 sub-districts were randomly selected from the list of elderly patients aged ≥60 years with UI, in each selected health center. Probability proportional to size sampling was used to gain study samples; representing each district and covering three age groups (60-69, 70-79, and 80-85 years). The number of participants in each sub-district ranged from 13 to 38. Inclusion criteria were: being a resident of the study site for at least three months; being aged 60-85 years; being already screened and determined by health personnel as a UI patient; according to Thai versions of the International Consultation on Incontinence Questionnaire-Short Form (TICIQ-UI SF) criteria; being able to voluntarily participate in the study; being able to communicate in Thai; and have no problem regarding the hearing. The elderly who were too ill or cognitively impaired to participate were excluded.

The study protocol was approved by the Human Research Ethical Review Committee of the Faculty of Public Health, Mahidol University, on January 30, 2020. (COA. No. MUPH 2020-012).

Assessment of outcome: sleep quality

The Thai version of the Pittsburgh Sleep Quality Index (TPSQI)[21] comprises of 19 self-rated items that generate seven component scores: 1) subjective sleep quality, 2) sleep latency, 3) sleep duration, 4) habitual sleep efficiency, 5) sleep disturbances, 6) use of sleeping medication, and 7) daytime dysfunction. Each component scores from 0-3 points, wherein: a score of "0" is "no difficulty" and a score of "3" is "severe difficulty". The total scores of the seven components are summed for the "global score", which ranged from 0-21 points. Lower scores indicated better sleep quality. A cutoff point of ≤5 was defined as "good sleep quality" and >5 as "poor sleep quality"[22]. Cronbach's alpha was 0.84.

Assessment of exposure of interest: urinary incontinence

The TICIQ-UI SF[23] consists of four items. The first item is concerning the frequency of UI, with scores of: "0=never losing urine" to "5=losing urine all the time". The second item is regarding the amount of urine loss; ranging from: "0=no loss" to "6=large amount". The third item measures the impact of UI on daily life; ranging from: "0=not at all" and "10=a great deal". The sum score of items 1-3 is categorized into four UI severity levels: "slight=1-5", "moderate=6-12", "severe=13-18" and "very severe=19-21"[24]. A fourth item was used to identify stress urinary incontinence (SUI), urgency urinary incontinence (UUI), and mixed urinary incontinence (MUI). A respondent was considered to have SUI when leaking urine with a cough or a sneeze and/or when physically active or exercising, but not before getting to the toilet. UUI is when the respondent leaks before getting to the toilet. A respondent with MUI experiences both SUI and UUI[25].

Assessment of other associating factors

Baseline characteristics covered 11 items: age, gender, education, marital status, occupation, monthly income, body mass index, smoking, alcohol consumption, caffeine intake and physical exercise.

Smoking status was defined according to the New Zealand Ministry of Health (2020). Never smoked referred to elderly who had never smoked, or who had smoked less than 100 cigarettes in his or her lifetime, and did not currently smoke. Former smokers referred to elderly who had smoked 100 or more cigarettes in his or her lifetime, but who had quit smoking in the last 28 days. Current smokers referred to elderly who had smoked 100 or more cigarettes in his or her lifetime, and who had smoked in the last 28 days[26].

Alcohol consumption was defined according to Rostron (2012). Never drinker was defined as a participant who had never tried any kind of alcoholic beverage or had <12 drinks in their lifetime. A former drinker was defined as a participant who had consumed at least 12 alcoholic drinks in their lifetime, but none during the past 12 months. A light drinker was defined as a participant who reported drinking one drink on average, on the days that he/she consumed alcohol during the previous year. Moderate drinker was a participant who reported drinking two drinks on average, and heavy drinker three or more drinks, on average, on days that he/she consumed alcohol during the previous year[27].

Clinical and environmental factors included four clinical factors: history of surgery or urinary tract diseases, other chronic conditions apart from UI, routine medications and depression. It also included: two items concerning the living situation and bedroom environment problems.

The Thai version of Geriatric Depression Scale-Short Form (TGDS-15)[28] consists of 15 items assessing the patient's mood. It is a "Yes" or "No" form that asks about feelings in the last seven days. A score of 1 was given to the answer "No" to items 1,5,7,11, and 13 and a score of 1 for "Yes" answer to all other items. A sum score of "0-4" was classified as normal, "5 -10" as mildly depressed, and "11-15" as depressed. A score of >5 suggests depression and warrants a follow-up evaluation, a ≥10 score almost always indicates depression.

Data were collected during February 2020. All participants provided written informed consent and were interviewed by the principal investigator, either at their homes or at the Sub-District health-promoting hospitals. All information was kept confidential.

Data analysis was performed using Statistical Package for the Social Sciences (SPSS), version 18.0. Descriptive statistics; such as frequency, mean, and standard deviation (S.D.), were used to describe the study and outcome factors. Study factors with a p-value of <0.05 in univariate analysis and biological plausibility were tested for the absence of multicollinearity among study factors. In multivariate analysis, binary logistic regression analyses were used to gain odds ratio (ORs) and 95%CI to find out the associations between study factors and sleep quality among the elderly with UI. A p-value of <0.05 was considered statistically significant.

Results

Of the 419 participants, 66.1% were female, and 43.9% were aged 60-69 years. The mean±S.D. age was 72.2±7.5 years, 59.7% were married, 61.6% were unemployed or retired, 95.9% had monthly income <5,000 Thai Baht (<167 USD), 53.5% were overweight or obese, 22.0% were current smokers, 35.1% were caffeine drinkers, and 37.2% were current alcohol consumers; 19.6% did physical exercise. These results are shown in Table 1.

Clinical and environmental factors

Of the 419 participants: 2.6% had kidney stone surgery and 0.7% had had a urinary tract infection, 60.1% had other chronic conditions apart from UI, 60.1% had to take routine medications, 3.6% were depressed and 20.5% were mildly depressed; 18.4% reported a poor bedroom environment. These results are shown in Table 2.

The proportion of UI subtypes

All participants were assessed via TICIQ-UI SF to identify the subtype and severity of UI. Among the three UI subtypes, UUI was the most common in both men and women (44.2%), followed by MUI (35.6%) and SUI (20.3%). This pattern was also found in the separate male and female groups and by age group, except for the oldest group where the proportion of MUI was slightly higher than UUI (41.2% vs 39.2%) (data not shown).

Severity of UI

Of the 419 participants, 47.0% reported UI frequency of two or three times per week, and 58.0% reported a small amount of urine loss per episode. Based on TICIQ-UI SF, 82.3% reported a mild (35.8%) to moderate (46.5%) impact of UI on their daily life. Incontinence most commonly (71.8%) occurred when not reaching the toilet, followed by when coughing or sneezing (66.1%) and during sleep (24.3%). Among the sudy group, 8.5% reported a mild (9.3%) to moderate (69.2%) severity of UI. The mean±S.D. of the TICIQ-UI SF score of the participants was 9.8±4.0, with a range of 4-21 (data not shown).

Sleep quality

The global TPSQI scores ranged from 2 to 19, with a mean±S.D. of 8.4±3.16. Overall, 84.2% of participants had poor sleep quality (TPSQI >5). The mean±S.D. of sleep latency (minutes) was 29.9±24.0; whilst the mean ±S.D. of sleep duration per night (hours) was 5.9±0.8. The mean

TPSQI of participants who woke up during the night to use the bathroom ≥1 time/ week was higher than those who woke up during the night to use the bathroom <1 time/ week (8.6 vs 7.8). The mean TPSQI of participants with severe and moderate UI was higher than those with mild UI (9.1, 8.3 vs 7.4). Likewise, the mean TPSQI of participants with depression was higher than that of participants without depression (10.1 vs 7.9). These results are shown in Table 3.

Table 1 Baseline characteristics of 419 elderly with urinary incontinence.

Variables	Number	%
Gender		
Female	277	66.1
Male	142	33.9
Age (years)		
Youngest (60–69)	184	43.9
Middle (70–79)	138	32.9
Oldest (80–85)	97	23.2
Mean±S.D.=72.2±7.5, range=60.0–85.0		
Marital status		
Married	250	59.7
Widowed/single/divorced	169	40.3
Education		
Illiterate	142	33.9
Finished primary or secondary school	277	66.1
Occupation		
Unemployed or retired	256	61.1
Laborer or agriculturist	163	38.9
Monthly income (Thai Baht) (1 USD=30.05 Baht, average rate in 2019)		
<5,000	402	95.9
≥5,000	17	4.1
Mean±S.D.=1,627.6±1,533.7, range=600–12,000		
Body mass index (kg/m^2)		
Underweight (<18.5)	17	4.0
Normal (18.5 to 23.0)	178	42.5
Overweight, obese (≥23.0)	224	53.5
Mean±S.D.=23.2±3.0, range=16.0–29.0		
Current smoker (smoked ≥100 cigarettes in lifetime or smoked in the last 28 days)	92	22.0
Current caffeine drinker (at least 1 cup/day)	147	35.1
Current alcohol consumer (light/moderate/heavy consumer)	156	37.2
Physical exercise (≥30 minutes/day and ≥3 times/week)	82	19.6

Table 2 Clinical and environmental factors of 419 elderly with urinary incontinence.

Variables	Number	%
History of surgery or urinary tract infection[a]		
None	403	96.2
Kidney stone surgery	11	2.6
Urinary tract infection prostate surgery	3	0.7
Prostate surgery	2	0.5
Other chronic conditions apart from UI[a]		
No	167	39.9
Hypertension	217	86.1
Dyslipidemia	107	25.5
Diabetes	64	25.4
Others	36	14.2
Routine medications[a]		
None	167	39.9
Antihypertensive drugs	225	53.7
Cholesterol–lowering drugs	126	30.1
Antidiabetic drugs	73	17.4
Others	43	13.4
Depression (TGDS–15 score)		
Normal (0–4)	318	75.9
Mildly depressed (5–10)	86	20.5
Depressed (11–15)	15	3.6
Mean±S.D.=3.3±2.9, range=0.0–14.0		
Living situation		
Live with immediate family or other relatives	384	91.6
Live alone	35	8.4
Bedroom environmental problems[a]		
None	342	81.6
Disturbance from roommate (snoring, coughing, others)	77	18.4
Too small a sleeping area, uncomfortable mattress or pillow	47	11.2
Disturbance from car noises, insects or animals	39	9.3

[a] multiple responses possible

UI=urinary incontinence, TGDS–15=Thai version of the Geriatric Depression Scale – Short Form 15 items

Table 3 Quality of sleep among 419 elderly with urinary incontinence; according to quality of sleep components, TICIQ–UI SF, and depression.

Characteristics	Number	%	Mean scale score±S.D. (range)
TPSQI			8.4±3.16 (2–19)
Good sleep quality (TPSQI ≤5)	66	15.8	4.42±0.82
Poor sleep quality (TPSQI >5)	356	84.2	9.14±2.86
Sleep latency (minutes)			29.90±24.04
Sleep duration (hours/night)			5.95±0.77 (2.00–8.00)
Habitual sleep efficiency (%)			69.36±12.15
Waking up during the night to use the bathroom			
<1 time/week	200	47.6	7.84±2.81
≥1 times/week	219	52.8	8.57±3.24
TICIQ–UI SF (score)			
Severity (≥13)	90	21.5	9.05±3.20
Moderate (6–12)	290	69.2	8.33±3.17
Mild (1–5)	39	9.3	7.41±2.63

Table 3 (continued)

Characteristics	Number	%	Mean scale score±S.D. (range)
Depression (TGDS-15 score)			
Yes (5–14)	101	24.1	10.12±3.46
No (0–4)	318	75.9	7.85±2.84

TPSQI=Thai version of the Pittsburgh Sleep Quality Index, TICIQ-UI SF=Thai version of the Consultation on Incontinence Questionnaire – Short Form, TGDS-15=Thai version of the Geriatric Depression Scale – Short Form 15 items

Table 4 Factors associating with quality of sleep among the elderly with urinary incontinence (n=419).

Variables	Crude		Model 1		Model 2		p-value
	OR	95% CI	aOR	95% CI	aOR	95% CI	
Age, years							
Oldest age (80–85)	1.38	0.61–3.13	1.41	0.61–3.28	1.43	0.59–3.48	0.425
Middle old (70–79)	2.19	1.03–1.62	2.13	0.96–4.68	1.84	0.80–4.24	0.149
Youngest old (60–69)	1.00		1.00		1.00		
Gender							
Female	1.66	0.97–2.84	2.28	1.28–4.05	2.77	1.47–5.24	0.002
Male	1.00		1.00		1.00		
Severity of UI (score)							
Severity (≥13)	2.41	1.05–5.53	2.09	0.88–4.96	1.74	0.70–4.34	0.231
Moderate (6–12)	4.08	1.42–11.73	4.60	1.49–14.14	3.63	1.10–11.96	0.034
Mild (1–5)	1.00		1.00		1.00		
Smoking status							
Current smoker	5.14	1.82–14.55	7.65	2.58–22.68	6.84	2.09–22.33	0.001
Never/former smoker	1.00		1.00		1.00		
Monthly income (Baht)							
≤5,000	4.06	1.49–11.11			4.27	1.33–13.73	0.015
>5,000	1.00				1.00		
Alcohol consumption							
Current alcohol consumer	2.77	1.46–5.28			3.04	1.47–6.28	0.003
Never/alcohol consumer	1.00				1.00		
Physical exercise (≥30 min/day and ≥3 times/week)							
No	2.04	1.12–3.69			1.94	0.99–3.75	0.051
Yes	1.00				1.00		
Depression (TGDS-15 score)							
Yes (5–15)	5.14	1.82–14.55			3.91	1.44–10.56	0.007
No (0–4)	1.00				1.00		

Model 1: adjustment for gender, age, severity of urinary incontinent (UI) and current smoking.
Model 2: adjustment for gender, age, severity of UI, current smoking, monthly income, current alcohol consumption, physical exercise and depression.
OR=odds ratio, aOR=adjusted OR, CI=confidence interval

Factors associating with sleep quality

In multivariate analysis, age coupled with seven variables was associated with sleep quality at a p-value <0.05 in univariate analysis, and with no multicollinearity problems being simultaneously entered for multiple logistic regression analysis with the entered method. As shown in Table 4, six variables remained significantly associated with poor sleep quality; these being: female (OR=2.77; 95% CI, 1.47-5.24); severity of UI (OR=1.74; 95% CI, 0.70-4.34 for severe; OR=3.63; 95% CI; 1.10-11.96 for moderate UI); being a current smoker (OR=6.84; 95% CI, 2.09-22.33); monthly income of <5,000 Baht (<167 USD) (OR=4.27; 95% CI, 1.33-13.73); being a current alcohol consumer (OR=3.04; 95% CI, 1.47-6.28) and being depressed (OR=3.91; 95% CI, 1.44-10.56).

Discussion

The findings of this present study indicate that the prevalence of poor sleep quality among the elderly with UI in the study settings was 84.2%; with the mean TPSQI global score being 8.4±3.2. This rate is higher than the prevalence of 62.4% found in elderly people in Songkhla, Thailand[29]. However, this prevalence of poor sleep quality is comparable with the prevalence (83.5%) and the mean TPSQI global score (8.3±4.2) found in a study conducted with the elderly in four nursing home settings in Turkey[30]. However, the prevalence is lower than that found by Yilmaz Bulut and Altay in Iran (89.3%)[9]. The slight difference in prevalence might be due to the different study settings. Patients who were receiving care in the gynecology and obstetrics clinics[9] tended to have a more severe UI and poorer sleep quality than those elderly with UI within communities. The mean TPSQI score of the elderly with UI from the current study is higher than that of the elderly without UI from the study, also from Thailand, by Thichumpa et al.[17] (8.4±3.2 vs 5.9±2.5). This indicates elderly with UI have poorer sleep quality compared to the elderly without UI.

In this study, UUI was the most common subtype of incontinence (44.2%), which was consistent with the study of Ofori and Osarfo[31]; whereas, SUI[3,32] or MUI[33] were reported to be the most prominent subtypes in other studies. The order of prevalence of UI subtypes differs from study to study. This lack of consistency might be due to studies employing different definitions of UI as well as methods of sampling[34]. Another explanation is that UI status is dynamic and subtypes will transition from one to another during follow up[35]. Follow-up studies are required to confirm the exact prevalence of UI subtypes in different age groups.

In the multivariate analysis, gender, severity of UI, monthly income, current alcohol consumption, current smoking and depression were significantly associated with poor sleep quality. In model 1, gender changed from a nearly significant factor (p-value=0.062) in the univariate analysis to a significant factor (p-value<0.05) in sleep quality. This was because, it was found through analyses of the subgroup, which was stratification-based, females who smoked had poorer sleep quality than females who did not smoke. (97.7 vs 84.5%) Additionally, the proportions of moderate and severe UI were higher for females than males (66.2 vs 33.8% for moderate severity of UI and 70.0 vs 30.0% for severe UI). These findings suggest that gender alone does not account for sleep quality. Instead, sleep quality is partially influenced by other variables in the model. This result is consistent with that of Thichumpa et al.[17]

In model 2, only moderate severity of UI was still significantly associated with poor sleep quality, after adjustment for all other variables in the model. This was because, as was found through analyses of the subgroup, which was stratification-based, participants who had a moderate severity of UI tended to have higher proportions of other risk factors of poor sleep quality than participants who had severe UI. These risk factors were: income less than 5,000 Thai Baht (<167 USD) (64.7% vs 23.5%), current alcohol consumption (73.3 vs 20.5%), current smoking (65.2

vs 18.5%) and depression (53.5 vs 38.6%). The combined effects of these risk factors of poor sleep caused the participants who had moderate UI to have poor sleep quality; whereas, participants who had severe UI, but did not have or had fewer of these risk factors of poor sleep quality, did not suffer from poor sleep quality. This finding was partially confirmed in the results of Nazaripanah et al.'s study[8]; in that UI was significantly associated with poor sleep quality since in the present study UI was categorized into three levels, slight, moderate and severe, which included different covariates; such as, depression symptoms in the study of elderly with UI. However, this finding is not consistent with the findings of Dasdemir Ilkhan and Celikhisar[30] that reported that severity of UI was not associated with poor sleep quality. This might be because the Dasdemir Ilkhan and Celikhisar's study[30] did not include smoking, alcohol consumption, monthly income and depression as covariates in multivariate analysis. Severity alone does not account for the quality of sleep. Instead, quality of sleep is partially influenced by the four covariates in the multivariate analysis; especially in the elderly with moderate UI.

The elderly who smoked were 6.84 times more likely to have poor sleep quality compared with non-smokers. This result confirmed the findings of previous studies[11,12]. As nicotine is a stimulant it disrupts sleep, and can also raise the risk of developing sleep conditions[36]. A previous study has shown that smokers spend more time sleeping lightly, with less time in deep sleep than non-smokers[13].

The elderly with a monthly income less than 5,000 Thai Baht (<167 USD) were 4.27 times more likely to have poor sleep quality compared with elderly having a higher monthly income. This result matches the previous study of Patel et al.[16], which found that people with lower incomes have poorer sleep quality. A lower income places greater pressure on an individual in terms of survival; therefore, poor sleep quality might be due to negative emotions, such as anxiety, caused by survival pressure[16].

The association between alcohol consumption and sleep disturbance is complex[14]. There is evidence that alcohol consumption disrupts sleep by increasing sleep discontinuation and lengthening the period of rapid eye movement (REM) sleep in the second half of the night[37]. In this study, elderly with UI who were current alcohol consumers were 3.04 times more likely to have poor sleep quality compared with those that did not consume alcohol. This result is confirmed in previous studies[12,14] that showed alcohol consumption is associated with poor sleep quality. Consistent with previous literature[18,19], this present study indicated that the elderly who have depression are at greater risk of poor sleep quality. In this current study, 24.1% (101/419) of participants had depression. The combined effects of depression and UI caused this group of elderly to have poor sleep quality. Depression can have a significant impact on health-related quality of life. The effects of depression can range from a minor annoyance to the risk of suicide[38].

The elderly who practiced physical exercise regularly reported better sleep quality in addition to reduced daytime sleepiness[15]. However, physical exercise in this study was only nearly associated with sleep quality, as other strong predictors in Model 2 attenuated the association between physical exercise and sleep quality.

The strength of this study is that it provides updated information on the quality of sleep situations among the elderly with UI in Chiang Rai province, Thailand. The results enhance the understanding of the severity of UI, and external factors associated with the quality of sleep among the elderly with UI. However, the limitations of the cross-sectional study mean only associations, not causal associations, can be concluded. Additionally, sleep quality, UI, and depression were assessed by self-reporting screening tests only. There were no objective measures, such as polysomnography, to assess sleep quality, nor any clinical interview and observation by a psychiatrist to

assess depression. Furthermore, there were no urodynamic investigations to assess the severity of UI. Additional clinical studies using a sleep lab should be conducted to examine the severity of UI and quality of sleep. An interesting area for further study is to examine the prevalence of UI among the elderly with poor quality of sleep.

Despite these limitations, the findings of this study indicate that healthcare personnel should regularly conduct screening for sleep quality and UI. Additionally, the elderly with UI should be encouraged by healthcare personnel and families to go to bed at the same time each night, quit smoking and cease alcohol consumption. Healthcare personnel should also provide non-pharmacological interventions, such as community exercise, to help reduce stress and depression, so as to improve the sleep quality of the elderly with UI.

Conclusion

This study shows UI is a very common problem in health care practice. The combined effects of several risk factors (being female, being a current smoker, consuming alcohol, having a lower monthly income and having depression) caused the elderly with moderate UI to have poor sleep quality. The study results could be applied in screening for the risk factors of UI.

Conflict of interest

The authors declare that there are no conflicts of interest.

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