Sleep quality among type 2 diabetes mellitus patients in a private hospital setting in Yangon, Myanmar

Hnin Nandar Htut
Department of Epidemiology, Faculty of Public Health, Mahidol University Rajvithi Campus, Bangkok, Thailand and B.K. Kee Foundation, Yangon, Myanmar
Nopporn Howteerakul
Department of Epidemiology, Faculty of Public Health, Mahidol University Rajvithi Campus, Bangkok, Thailand
Nawarat Suwannapong
Department of Public Health Administration, Faculty of Public Health, Mahidol University Rajvithi Campus, Bangkok, Thailand, and
Petch Rawdaree
Department of Internal Medicine, Faculty of Medicine Vajira Hospital, Navamindradhiraj University, Bangkok, Thailand

Received 11 September 2019
Revised 30 October 2019
Accepted 6 December 2019

Abstract

Purpose – This study aimed to assess the sleep quality and its associated factors among patients with type 2 diabetes mellitus (T2DM) in a private hospital in Yangon, Myanmar.

Design/methodology/approach – A cross-sectional study was conducted. A total of 289 T2DM patients were interviewed using a structured questionnaire. An English version of the Pittsburgh Sleep Quality Index (PSQI) was translated into Myanmar and used for assessing sleep quality.

Findings – Approximately 48.4% of T2DM patients had poor sleep quality (PSQI score > 5). The mean ± SD of the PSQI global score was 5.97 ± 3.45. About 36.0% of participants reported the presence of diabetes complications, and 14.9% used sleep medication. About 27.7% had depression and 8.3% had poor family relationships. Multiple logistic regression analysis revealed that the presence of complications (AOR = 1.86; 95%CI; 1.04–3.35), poor family relationships (AOR = 5.09; 95%CI; 1.55–16.68) and depression (AOR = 7.52; 95%CI; 3.83–14.76) were significantly associated with poor sleep quality.

Originality/value – The prevalence of poor sleep quality is rather high among T2DM patients. Healthcare personnel and hospital administrators should focus on the complication status, family relationships and

The study was partially supported for publication by Faculty of Public Health, Mahidol University, Bangkok, Thailand.

Journal of Health Research
Emerald Publishing Limited
e-ISSN: 2586-940X
p-ISSN: 0857-4421
DOI 10.1108/JHR-09-2019-0214

depression status of T2DM patients by providing regular screening for sleep quality and depression and by providing a program of sleep health education and counselling at diabetic clinics

Keywords Sleep quality, Type 2 diabetes mellitus, Family relationships, Depression
Paper type Research paper

Introduction

Sleep is very important and can impact every facet of our daily life. Poor sleep quality also affects our health and well-being [1]. People who sleep well have a better cognitive function, improved memory, healthier immune systems, increased attentiveness and show better performance throughout the day [2]. However, 29% of the general adult population is affected by sleep disorders [3]. Epidemiologic studies revealed that shorter sleep duration and poor sleep quality can increase the risk of obesity [4] and lifestyle-related diseases such as cardiovascular diseases [5], type 2 diabetes mellitus (T2DM) [1, 6], poor glycemic control [7–11] and poor quality of life (QoL) [12–14].

Sleep disorders are commonly seen in T2DM patients because of the disease itself, its complications and other comorbidities [15–17]. The prevalence of poor sleep quality among T2DM patients ranges from 45% to 70% [9, 15, 18–22]. It is estimated that 53.4% of diabetic patients have suffered from impaired sleep compared to 29% in the general population [3]. Patients who suffer from poor sleep quality also have a dramatically increased burden when trying to maintain a healthy diet and take regular exercise as part of self-care among diabetes patients [21].

Diabetes is a global health problem and is prevalent in Myanmar [23]. In 2014, the national prevalence of diabetes mellitus among Myanmar adults aged 25–64 years was 10.5%, higher than the global diabetes prevalence of 8.8% [24]. Poor glycemic control may lead to long-term complications such as neuropathy [25], nephropathy [26] and retinopathy [27], whereas good control significantly reduces the risk of cardiovascular diseases [28] and the rate of amputation in T2DM patients by 40% and 60% [29].

Sleep disorders are common alongside depressive symptoms among T2DM patients [13, 15, 30]. The combined effect of sleep disorders and depressive symptoms has been shown to increase the risk of a patient having a poor QoL [13]. Other studies have suggested that good family relationships are associated with good sleep quality [31–33] and a better QoL [12–14]. Sleep quality plays a significant role in physical and mental health outcomes [1] as well as better diabetes self-care behaviors in T2DM patients [12]. Numerous studies related to sleep quality among T2DM patients have been conducted and have been well covered in Western countries. However, this information is rare in and pertaining to Myanmar. To the best of our knowledge, there has been no published literature regarding sleep quality among T2DM patients using the Pittsburgh Sleep Quality Index (PSQI) in Myanmar. The factors determining sleep quality among T2DM patients in Myanmar are still unclear. Therefore, this study aimed to assess the prevalence of poor sleep quality as well as its associated factors among T2DM patients in a private hospital in Yangon, Myanmar, using PSQI, a validated tool for the subjective measure of sleep quality [34].

Materials and methods

Study site and study samples

This hospital-based cross-sectional study was conducted at an outpatient diabetic clinic of a private hospital with 180 beds, in Lanmadaw Township in Yangon, Myanmar. The study population was T2DM patients who were attending the diabetic clinic as outpatients during the study period.

In 2016, the total number of T2DM patients in the study hospital was 1300 [35]. The study sample size was estimated using the single-proportion formula with finite population

correction [36] and a 95% confidence interval (CI). Due to there being no published literature for sleep quality in Myanmar, the prevalence of poor sleep quality was assumed to be 50%. Precision was set at 0.0525% and the sample size was calculated to be 275. To represent the population of 1300 T2DM patients, a total of 289 T2DM patients were recruited to allow for a nonresponse rate of 5%. Inclusion criteria were: (1) patients who were diagnosed with T2DM by a physician and were treated with hypoglycemic medication for at least six months; and (2) a willingness to participate in the study. Exclusion criteria were: (1) patients aged under 30 years because it is difficult to differentiate between T2DM and other types; (2) patients aged above 80 years; (3) patients who had other endocrine disorders, such as thyroid disease or chronic use of glucocorticoids; (4) patients who were pregnant or lactating; (5) patients who were seriously ill or had cognitive impairment as determined by interaction with the researcher when asking for informed consent.

Instrumentations

The structured questionnaire comprised five parts.

Part 1. Baseline characteristics of patients had 12 questions: age, sex, highest education, family income, marital status, working status, living with someone, alcohol drinking, smoking, body mass index (BMI), exercise and daytime napping. "Never smoked" referred to patients who smoked less than 100 cigarettes in their lifetime and did not currently smoke. "Ex-smoker" referred to patients who had smoked 100 or more cigarettes in their lifetime but did not smoke in the last 28 days. "Current smoker" referred to patients who had smoked 100 or more cigarettes in their lifetime and had smoked in the last 28 days [37]. "Never drank" referred to patients who had never tried any kind of alcoholic beverages or had had less than 12 alcoholic drinks in their lifetime. "Ex-drinker" referred to patients who had had at least 12 alcoholic drinks but none during the past 12 months. "Current drinker" referred to patients who had up to one drink per day for females and up to two drinks for males [38, 39].

Part 2. Clinical factors had five questions: duration of diabetes, complication status, glycemic control, comorbidities and current medications.

Part 3. Family relationships had ten questions that were translated into Myanmar by the researcher team from the Thai version of a family relationships questionnaire. Answers to the questions were rated on a scale of 0–2: always = 2, sometimes = 1 and never = 0. Total scores ranged from 0 to 20 points. According to the Thai family relationship scale, a total score >10 defined a good relationship [40]. Cronbach's alpha was 0.795.

Part 4. Depression symptoms were assessed using the English version of the Patient Health Questionnaire-9 (PHQ-9) translated into Myanmar by the principal investigator. PHQ-9 comprises nine self-rated questions to screen for depression over the past two weeks, each question scores 0–3: "not at all" = 0, "several days" = 1, "more than half the days" = 2 and "nearly every day" = 3. Total scores ranged from 0 to 27 points. A score of <5 was defined as "normal"; a score of 5–9 as "mild depression"; a score of 10–14 as "moderate depression"; a score of 15–19 as "moderately severe depression"; and a score of ≥20 as "severe depression" [41]. Cronbach's alpha was 0.799.

Part 5. Sleep quality was assessed using the English version of PSQI [34] translated into Myanmar by the researcher. PSQI comprises 19 self-rated questions 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 0–3 points. A score of "0" is "no difficulty," while a score of "3" is "severe difficulty." The total scores of seven components were added to yield one "global score," which ranged from 0 to 21 points. Higher scores indicated poorer sleep quality. A cutoff point of >5 was defined as "poor sleep quality" and ≤5 as "good sleep quality" [42]. Cronbach's alpha was 0.741.

Data collection

Data were collected by the principal investigator and two trained research assistants. Interviews were conducted at the outpatient department of a private hospital and the interviewer sat down with the participant in a comfortable place with appropriate privacy for the participant. Selected relevant laboratory results were collected from the patients' medical records. After the interview, the questionnaires were checked and verified for completeness and kept securely by the principal investigator.

Data analysis

Data analysis was performed using SPSS version 18.0 (SPSS Inc. Released 2008. SPSS Statistics for Windows, Version 18.0. Chicago: SPSS Inc.). Descriptive statistics such as mean, standard deviation, frequency and percentage were used to describe all study variables. All study factors with a p-value of <0.05 in crude analysis and biological plausibility were tested for multicollinearity [43] before conducting the multivariate analysis. Multiple logistic regression was used to obtain the odds ratio (OR) and 95% CI to determine the association between study factors and sleep quality of T2DM patients. The significance level was set at a p-value < 0.05.

Ethical issues

The research proposal was approved by the Human Research Ethical Review Committee of the Faculty of Public Health, Mahidol University (COA. No. MUPH 2018-51; March 13, 2018) and the Ethics Review Committee on Medical Research Involving Human Subjects, Department of Medical Research, Ministry of Health and Sports, Myanmar (Approval No. Ethics/DMR/2018/045; March 21, 2018).

Results

Baseline characteristics

Of the 289 T2DM patients, 77.9% were aged ≥50 years. The mean ± SD age was 59.1 ± 11.4 years. Ages ranged from 30 to 80 years. 68.5% were female. 71.7% finished high school or lower. 57.1% had a monthly family income ≤300,000 kyat (223 USD). 65.1% were married. 42.2% were still working. 96.9% were living with a spouse, children or other relatives. 9.7% were current smokers and 9.7% were current drinkers. Regarding BMI, 64.4% were obese while 17.3% were in the normal range. 66.8% did not exercise and 64.4% were accustomed to daytime napping (Table 1).

Clinical factors

Table 2 shows that 42.2% of patients had been diagnosed with diabetes for six years or more. 64.0% reported no complications. Among patients with complications, peripheral neuropathy was found in the highest proportion of 22.2%, followed by nephropathy at 10.4%. 70.6% had poor glycemic control, which was HbA1c level >7%. Only 21.1% had no comorbidities. Among the comorbid diseases, hypertension stood as the highest at 61.6%, while hyperlipidemia was the second highest at 42.2%. Regarding medication, the largest group, 45.0%, were treated with a two-drug combination of oral hypoglycemic agents; this was followed by 32.9% with a three-drug combination of oral hypoglycemic agents.

Baseline characteristics	Number	%
Age (yr)		
<50	64	22.1
≥50	225	77.9
Mean ± SD = 59.1 ± 11.4, Range = 30–80		
Sex		
Female	198	68.5
Male	91	31.5
Highest education		
≤High school	236	71.7
Bachelor's degree or higher	53	18.3
Family monthly income (Myanmar kyat)[a]		
≤300,000	165	57.1
>300,000	124	42.9
Median = 300,000, Range = 30,000–3,000,000		
Marital status		
Single	24	8.3
Married	188	65.1
Divorced/separated/widowed	77	26.6
Working status		
Yes	122	42.2
No	167	57.8
Living with		
Living alone	9	3.1
Spouse, children or relatives	280	96.9
Smoking status		
Never or ex-smoker	261	90.3
Current smoker	28	9.7
Alcohol drinking		
Never or ex-drinker	261	90.3
Current drinker	28	9.7
Body mass index (BMI) kg/m^2 [b]		
Underweight (<18.5 kg/m^2)	9	3.1
Normal (18.5–22.9 kg/m^2)	50	17.3
Overweight (23–24.9 kg/m^2)	44	15.2
Obese (≥25.0 kg/m^2)	186	64.4
Exercise		
No (<30 min/day and or <3 times/ wk)	193	66.8
Yes (≥30 min/day and ≥3 times/ wk)	96	33.2
Daytime napping		
No	103	35.6
Yes	186	64.4

Note(s): [a]one USD = 1350 kyat [b]the Asian cutoff point for obese was ≥23.0 kg/m^2 [44]

Table 1. Baseline characteristics of T2DM patients (n = 289)

Depression and family relationships

Concerning depression status, 72.3% of 289 T2DM patients had "normal" scores while 19.4% had mild depressive symptoms, 5.2% had moderate depression and 3.1% had moderate–severe depression. Regarding family relationships, 91.7% had good family relationships (Table 3).

Clinical factors	Number	%
Duration of diabetes (yrs)		
1	53	18.3
2–6	114	39.5
≥6	122	42.2
Mean ± SD = 6.8 ± 6.5, Range = 1–39		
Complication status[a]		
No	185	64.0
Peripheral neuropathy	64	22.2
Nephropathy	30	10.4
Cardiovascular disease	23	8.0
Retinopathy	14	4.8
Diabetes foot	5	1.7
Peripheral vascular disease	1	0.4
Glycemic control (HbA1c level, %)		
Controlled (≤7)	85	29.4
Uncontrolled (>7)	204	70.6
Comorbidities[a]		
No	61	21.1
Hypertension	178	61.6
Hyperlipidemia	122	42.2
Cardiovascular disease	15	5.2
Others	50	17.3
Medications		
Oral medication (one drug)	48	16.6
Oral medication (two drugs combination)	130	45.0
Oral medication (three drugs combination)	95	32.9
Combination of oral and injection therapy	16	5.5

Note(s): [a]Multiple responses were allowed

Table 2. Clinical factors of T2DM patients (n = 289)

Variables	Number	%
Depression (scores)		
Normal (0–4)	209	72.3
Mild depressive symptoms (5–9)	56	19.4
Moderate depression (10–14)	15	5.2
Moderate severe depression (15–19)	9	3.1
Median = 2.0, Mean ± SD = 3.5 ± 4.0, Range = 0–19		
Family relationship (scores)		
Good (>10)	265	91.7
Poor (≤10)	24	8.3
Median = 20, Mean ± SD = 17.6 ± 3.9, Range = 0–20		

Table 3. Depression and family relationships of T2DM patients (n = 289)

Assessing sleep quality

The T2DM patients usually went to bed on average at 10.00 pm and rose at 5.30 am. The mean ± SD of sleep latency was 32.17 ± 2.59 min. The mean ± SD of sleep duration per night was 6.48 ± 1.36 hours. Table 4 shows the number and proportion of seven components of sleep quality among 289 T2DM patients. Roughly, 14.2% had poor subjective sleep quality;

Sleep quality components or items	Number	%
Subjective sleep quality		
Good (0, 1)	248	85.8
Poor (2, 3)	41	14.2
Sleep latency (min)		
Good ≤15 (0)	116	40.1
Prolonged >15 (1–3)	173	59.9
Sleep duration (hrs)		
Good or recommended (>7 hrs)[a] (0)	140	48.4
Low, may be appropriate (6 to 7)[a] (1)	85	29.4
Poor (<6 hrs) (2, 3)	64	22.2
Habitual sleep efficiency (%)		
Good ≥85 (0)	183	63.3
Poor <85 (1–3)	106	36.7
Sleep disturbances (time per week)		
Low (0, 1)	213	73.7
High (2, 3)	76	26.3
Use of sleep medication		
Never in one month (0)	246	85.1
<1 time a week or ≥1 time/week (1–3)	43	14.9
Daytime dysfunction		
Never in one month (0)	184	63.7
<1 time a week or ≥1 time/week (1-3)	105	36.3
Sleep quality		
Poor (PSQI score >5)	140	48.4
Good (PSQI score ≤5)	149	51.6

Note(s): [a]defined according to the National Sleep Foundation definition [45]

Table 4.
Sleep quality and its components or items among T2DM patients (n = 289)

59.9% had prolonged sleep latency of >15 min; 22.2% had poor sleep duration of <6 h; 29.4% had low but appropriate sleep duration of 6–7 h; 36.7% had a poor sleep efficiency of <than 85.0%; 26.3% had high sleep disturbance of ≥1 time per week; 14.9% used sleep medication of <1 time a week or ≥1 time per week and 36.3% had daytime dysfunction of <1 time a week or ≥1 time per week. The total prevalence of poor sleep quality (PSQI global score >5) among T2DM patients was 48.4% (140/289), 42.9% (39/91) for men and 51.0% (101/198) for women.

The mean ± SD of the PSQI global score was 5.97 ± 3.45. The mean ± SD of the PSQI global score among T2DM patients with at least one complication, with depression or with poor family relationships, was higher than that of participants without complications (6.93 ± 3.46 vs 5.43 ± 3.33 for complication status, 8.53 ± 3.63 vs 5.00 ± 2.82 for depression and 8.87 ± 3.18 vs 5.71 ± 3.35 for family relationships) Table 5.

Factors associated with sleep quality

In the multiple logistic regression analysis, all significant factors from the crude analysis and biological plausibility were simultaneously entered in the final model. In model 1, the significant factors were older age (AOR = 2.06; 95% CI = 1.13–3.75), having completed ≤ high school as the highest education level (AOR = 2.59; 95% CI = 1.32–5.08)

and glycemic control (AOR = 1.94; 95% CI = 1.13–3.33). In model 2, the significant factors were the presence of complications (AOR = 1.86, 95% CI = 1.04–3.35), poor family relationships (AOR = 5.09, 95% CI = 1.55–16.68) and depression (AOR = 7.52, 95% CI = 3.38–14.76), as depicted in Table 6.

Table 5. Mean and standard deviation (SD) of PSQI global score across complication status, depression and family relationship of 289 T2DM patients

Variable	Mean	SD
Complication status		
No	5.43	3.33
Yes (such as peripheral neuropathy, nephropathy, etc.)	6.93	3.46
Depression (score)[a]		
No (0–4)	5.00	2.82
Yes (5–19)	8.53	3.63
Family relationship (score)		
Good (≥10)	5.71	3.35
Poor (<10)	8.87	3.18

Note(s): [a]score 0–4 = no to minimal depression, score 5–19 = mild to moderately severe depression

Table 6. Multiple logistic regression analysis of factors associated with poor sleep quality among T2DM patients (n = 289)

	Crude		Model 1		Model 2		
Variable	OR	95% CI	AOR	95% CI	AOR	95% CI	p-value
Age (years)							
≥50	2.11	1.18–3.75	2.06	1.13–3.75	1.71	0.84–3.50	0.141
<50	1.00		1.00		1.00		
Sex							
Female	1.39	0.84–2.29	1.17	0.69–1.97	0.92	0.51–1.66	0.789
Male	1.00		1.00		1.00		
Highest education							
≤High school	2.85	1.49–5.47	2.59	1.32–5.08	1.69	0.80–3.55	0.170
Bachelor's degree or higher	1.00		1.00		1.00		
Glycemic control							
>7% (uncontrolled)	1.86	1.11–3.13	1.94	1.13–3.33	1.44	0.79–2.62	0.236
≤7% (controlled)	1.00		1.00		1.00		
Duration of diabetes							
≥6 years	1.66	1.04–2.66			1.52	0.87–2.64	0.143
<6 years	1.00				1.00		
Complication status							
Yes	2.44	1.49–4.01			1.86	1.04–3.35	0.037
No	1.00				1.00		
Family relationship (score)							
Poor (<10)	6.04	2.01–18.16			5.09	1.55–16.68	0.007
Good (≥10)	1.00				1.00		
Depression (score)[a]							
Yes (5–19)	7.74	4.13–14.52			7.52	3.38–14.76	<0.001
No (0–4)	1.00				1.00		

Note(s): [a]score 0–4 = no to minimal depression, score 5–19 = mild to moderately severe depression

Discussion

This study revealed the prevalence of poor sleep quality among T2DM patients at 48.4%. This finding was similar to the studies conducted by Zhu *et al.* [18] – (47.1%) with T2DM patients who attended a university hospital in China – and Song *et al.* [19] – (49.0%) with T2DM patients using insulin therapy who attended a diabetes clinic or outpatient center at the Endocrinology Department, Zhejiang Provincial People's Hospital, Hangzhou, China. The prevalence of poor sleep quality in this current study falls in the range of previous epidemiologic studies [9, 15, 18–22], which ranges from 45 to 70%. The difference in the prevalence of poor sleep quality may be due to the sample size, whether the study site is in the community or hospital, socioeconomic status differences and lifestyle characteristics. However, this study's findings show that the prevalence of poor sleep quality among T2DM patients was much higher than among the general adult population where it is approximately 29% [3].

In the subgroup analysis, when the proportions of poor sleep quality components or items among the 140 poor sleep quality patients were assessed, the three most frequent complaints were prolonged sleep latency (80.7%), poor habitual sleep efficiency (68.6%) and daytime dysfunction (61.4%) (data not shown). This finding is in line with previous studies as discussed by Sakamoto *et al.* [10] and Skomro *et al.* [46].

In model 1 of the multivariate analysis, age, highest education level and glycemic control were significant predictors of sleep quality of T2DM patients although glycemic control attenuated the association between age, education and sleep quality. In model 2, only complication status, poor family relationships and depression were significant predictors of sleep quality when the duration of diabetes and those three factors were included in the final model. A possible explanation is that complication status, family relationship and depression are particularly important factors that affect sleep quality. These factors had a higher coefficient in the model for their potential to affect other variables (data not shown).

In this study, the presence of complications was a significant predictor of sleep quality. This finding is congruent with previous studies [22, 47, 48]. Of note, 36% of T2DM patients in this study reported the presence of complications including peripheral neuropathy (22.2%), nephropathy (10.4%), cardiovascular (8.0%) and retinopathy (4.8%). These complications caused nighttime awakenings and led to the development of sleep disorders, especially in older diabetes patients [47–49].

Poor family relationships were another important predictor of sleep quality in this study. Currently, there is little research into how family relationships affect the sleep quality of T2DM patients, but this finding is consistent with those of the studies by Ailshire and Burgard [31] and Thichumpa *et al.* [33], who found that a supportive family relationship was associated with less troubled sleep, whereas having strained family relationships was associated with more troubled sleep.

About 91.7% of T2DM patients had good family relationships, whereas 8.3% had poor family relationships. The most frequently reported problems of family relationships included never finding good compromises among family members (54.2%); never having the ability to share secrets within family (54.2%); never having the ability to share ideas among family members (41.7%); never having the ability to admonish one another (41.7%) (data not shown). Given the strong relationship between the quality of family relationships and the quality of sleep, healthcare providers should provide interventions that promote good relationships among family members. Good family relationships can be a buffer against loneliness and depression that negatively affect sleep quality [32].

Depression was the most important predictor of sleep quality. This might be due to the prevalence of depression being twice as high in diabetes patients than in the general population [50]. In addition, complications due to advanced T2DM may cause severe

depression in response to the impacts of these disease complications [48, 50]. In this current study, 27.7% had depression. In a subgroup analysis, 24 T2DM patients with depression also had poor family relationships. The combined effects of depression and poor family relationships caused this group of T2DM patients to have poor sleep quality. Finding an association between depression and poor quality is consistent with the previous studies as discussed elsewhere [13, 15, 30].

In this study, age, sex and BMI were not significantly associated with sleep quality. This is in contrast to the findings of a study conducted by Darraj *et al.* [22] that showed that being elderly, female and having an abnormal BMI were significantly associated with poor sleep quality. A possible reason why this current study did not find these factors to be significant is that the majority of the participants were elderly women with abnormal BMI, meaning age, sex and BMI differences could not be fully assessed.

Some limitations should be considered when interpreting these findings. Firstly, sleep quality information relied on the patient's self-reported data. The results should be confirmed using polysomnography or actigraphy tests, which give an objective assessment of sleep quality. However, the use of these tests is limited by the need for well-trained staff and higher costs [18]. In addition, PHQ-9 is a screening test for depression, the screening result should be confirmed by clinical interview and observation by a psychiatrist. Secondly, data were collected from a single private hospital, the results could not be generalized to T2DM patients in public hospitals or other study areas. Thirdly, the cross-sectional study design limited the investigation of the causality relationship between the significant predictors and poor sleep quality. Finally, some patients might have poor relationships with nonfamily members, such as neighbors or friends that could also be a cause of their poor sleep quality. This reason was not assessed in the current study.

Implications of the study

Based on the findings of this study, healthcare providers and hospital administrators should provide regular screening for sleep quality and depression and provide sleep health education at diabetic clinics. Healthcare personnel should focus on complication status, family relationships and depression status of T2DM patients and provide counseling programs at diabetic clinics. Nurses should be trained to provide consultations in order to improve family relationships and provide psychosocial support to relieve depression. Also, the prevalence of obstructive sleep apnea is quite high among diabetes patients and could contribute to poor sleep quality [12]. Further study is needed within this population to thoroughly describe the factors related to the reported sleep-related issues with coughing, intense snoring and breathing difficulties.

Conclusions

The prevalence of poor sleep quality among adults with T2DM was rather high. Further study should be conducted in Myanmar with a greater sample size and larger sample area covering a wider range of social and cultural contexts to improve the accuracy of estimated prevalence and predictors of poor sleep quality among T2DM patients in Myanmar.

References

1. Lee JA, Sunwoo S, Kim YS, Yu BY, Park HK, Jeon TH, Yoo BW. The effect of sleep quality on the development of type 2 diabetes in primary care patients. J Korean Med Sci. 2016 Feb; 31(2): 240-6. doi: 10.3346/jkms.2016.31.2.240.

2. Sleep Number Cooperation. Quality sleep: the center of a healthy life. Evidence of the essential role of sleep - and what happens when we don't get enough of it. [cited 2017 Dec 10]. available from: https://blog.sleepnumber.com/wp-content/uploads/2017/01/SleepNumber_Quality-Sleep.pdf.
3. Sokwalla SM, Joshi MD, Amayo EO, Acharya K, Mecha JO, Mutai KK. Quality of sleep and risk for obstructive sleep apnoea in ambulant individuals with type 2 diabetes mellitus at a tertiary referral hospital in Kenya: a cross-sectional, comparative study. BMC Endocr Disord. 2017 Feb; 17(1): 7. doi: 10.1186/s12902-017-0158-6.
4. Knutson KL, Van Cauter E. Associations between sleep loss and increased risk of obesity and diabetes. Ann N Y Acad Sci. 2008; 1129: 287-304. doi: 10.1196/annals.1417.033.
5. Ayas NT, White DP, Manson JE, Stampfer MJ, Speizer FE, Malhotra A, Hu FB. A prospective study of sleep duration and coronary heart disease in women. Arch Intern Med. 2003 Jan; 163(2): 205-9. doi: 10.1001/archinte.163.2.205.
6. Yaggi HK, Araujo AB, McKinlay JB. Sleep duration as a risk factor for the development of type 2 diabetes. Diabetes Care. 2006 Mar; 29(3): 657-61. doi: 10.2337/diacare.29.03.06.dc05-0879.
7. Engeda J, Mezuk B, Ratliff S, Ning Y. Association between duration and quality of sleep and the risk of pre-diabetes: evidence from NHANES. Diabet Med. 2013 Jun; 30(6): 676-80. doi: 10.1111/dme.12165.
8. Tang Y, Meng L, Li D, Yang M, Zhu Y, Li C, Jiang Z, *et al.* Interaction of sleep quality and sleep duration on glycemic control in patients with type 2 diabetes mellitus. Chin Med J (Engl). 2014; 127(20): 3543-7.
9. Lou C, Liao WC, Huang CN, Kuo CP, Hwang SL. The association of the sleep quality on glycemic control in patients with type II Diabetes. Taiwan J Public Health. 2017; 36(5): 497-510. doi: 10.6288/TJPH201736106048.
10. Sakamoto R, Yamakawa T, Takahashi K, Suzuki J, Shinoda MM, Danno H, Tsuchiya H, *et al.* Association of usual sleep quality and glycemic control in type 2 diabetes in Japanese: a cross sectional study. Sleep and Food Registry in Kanagawa (SOREKA). PloS One. 2018; 13(1): e0191771. doi: 10.1371/journal.pone.0191771.
11. Knutson KL, Ryden AM, Mander BA, Van Cauter E. Role of sleep duration and quality in the risk and severity of type 2 diabetes mellitus. Arch Intern Med. 2006 Sep; 166(16): 1768-74. doi: 10.1001/archinte.166.16.1768.
12. Chasens ER, Luyster FS. Effect of sleep disturbances on quality of life, diabetes self-care behavior, and patient-reported outcomes. Diabetes Spectr. 2016 Feb; 29(1): 20-3. doi: 10.2337/diaspect.29.1.20.
13. Zhang P, Lou P, Chang G, Chen P, Zhang L, Li T, Qiao C. Combined effects of sleep quality and depression on quality of life in patients with type 2 diabetes. BMC Fam Pract. 2016 Apr; 17: 40. doi: 10.1186/s12875-016-0435-x.
14. Zeng Y, Wu J, Yin J, Chen J, Yang S, Fang Y. Association of the combination of sleep duration and sleep quality with quality of life in type 2 diabetes patients. Qual Life Res. 2018 Dec; 27(12): 3123-30. doi: 10.1007/s11136-018-1942-0.
15. Yücel ŞÇ, Güler EK, Ak İ. Investigation of sleep quality, quality of life, anxiety and depression in patients with diabetes mellitus. Int J Diabetes Dev C. 2015 Mar; 35(1): 39-46. doi: 10.1007/s13410-014-0206-y.
16. Khandelwal D, Dutta D, Chittawar S, Kalra S. Sleep disorders in type 2 diabetes. Indian J Endocrinol Metab. 2017 Sep-Oct; 21(5): 758-61. doi: 10.4103/ijem.IJEM_156_17.
17. Zhu B, Xie M, Park CG, Kapella MC. Adaptation of the Pittsburgh sleep quality index in Chinese adults with type 2 diabetes. J Chin Med Assoc. 2018 Mar; 81(3): 242-7. doi: 10.1016/j.jcma.2017.06.021.
18. Zhu B, Li X, Wang D, Yu X. Sleep quality and its impact on glycaemic control in patients with type 2 diabetes mellitus. Int J Nurs Sci. 2014; 1(3): 260-5. doi: 10.1016/j.ijnss.2014.05.020.

19. Song Y, Ye X, Ye L, Li B, Wang L, Hua Y. Disturbed subjective sleep in Chinese females with type 2 diabetes on insulin therapy. PloS One. 2013; 8(1): e54951. doi: 10.1371/journal.pone.0054951.
20. Mahmood WAW, Yusoff MSD, Behan LA, Di Perna A, Tun TK, McDermott J, Sreenan S. Association between sleep disruption and levels of lipids in caucasians with type 2 diabetes. Int J Endocrinol. 2013; Artn 341506. doi: 10.1155/2013/341506.
21. Nefs G, Donga E, van Someren E, Bot M, Speight J, Pouwer F. Subjective sleep impairment in adults with type 1 or type 2 diabetes: results from Diabetes MILES–The Netherlands. Diabetes Res Clin Pract. 2015 Sep; 109(3): 466-75. doi: 10.1016/j.diabres.2015.07.008.
22. Darraj A, Mahfouz MS, Alsabaani A, Sani M, Alameer A. Assessment of sleep quality and its predictors among patients with diabetes in Jazan, Saudi Arabia. Diabetes Metab Syndr Obes. 2018; 11: 523-31. doi: 10.2147/DMSO.S178674.
23. World Health Organization [WHO]. Diabetes. [updated: 2018 Oct 30; cited 2018 Dec 10]. available from: https://www.who.int/news-room/fact-sheets/detail/diabetes.
24. World Health Organization [WHO]. Report on national survey of diabetes mellitus and risk factors for non-communicable diseases in Myanmar 2014. [updated 2017; cited 2018 December 10], available at: https://www.who.int/ncds/surveillance/steps/Myanmar_2014_STEPS_Report.pdf.
25. Zhang J, Zhang L, Guo L. The relationship between sleep quality and diabetic autonomic neuropathy in elder patients with type 2 diabetes mellitus. Zhonghua Nei Ke Za Zhi. 2016 Mar; 55(3): 196-201. doi: 10.3760/cma.j.issn.0578-1426.2016.03.008 (in Chinese).
26. Ohkuma T, Fujii H, Iwase M, Ogata-Kaizu S, Ide H, Kikuchi Y, Idewaki Y, *et al.* Association between sleep duration and urinary albumin excretion in patients with type 2 diabetes: the Fukuoka diabetes registry. PloS One. 2013; 8(11): e78968. doi: 10.1371/journal.pone.0078968.
27. Jee D, Keum N, Kang S, Arroyo JG. Sleep and diabetic retinopathy. Acta Ophthalmol. 2017 Feb; 95(1): 41-7. doi: 10.1111/aos.13169.
28. Barengo NC, Katoh S, Moltchanov V, Tajima N, Tuomilehto J. The diabetes-cardiovascular risk paradox: results from a Finnish population-based prospective study. Eur Heart J. 2008 Aug; 29(15): 1889-95. doi: 10.1093/eurheartj/ehn250.
29. Moxey PW, Gogalniceanu P, Hinchliffe RJ, Loftus IM, Jones KJ, Thompson MM, Holt PJ. Lower extremity amputations–a review of global variability in incidence. Diabet Med. 2011 Oct; 28(10): 1144-53. doi: 10.1111/j.1464-5491.2011.03279.x.
30. Skomro RP. Sleep and quality of life in diabetes. in: Verster JC, Pandi-Perumal SR, Streiner DL, editors. Sleep and quality of life in clinical medicine. Totowa, NJ: Humana Press; 2008. 461-8.
31. Ailshire JA, Burgard SA. Family relationships and troubled sleep among US adults: examining the influences of contact frequency and relationship quality. J Health Soc Behav. 2012; 53(2): 248-62. doi: 10.1177/0022146512446642.
32. Kent RG, Uchino BN, Cribbet MR, Bowen K, Smith TW. Social relationships and sleep quality. Ann Behav Med. 2015 Dec; 49(6): 912-7. doi: 10.1007/s12160-015-9711-6.
33. Thichumpa W, Howteerakul N, Suwannapong N, Tantrakul V. Sleep quality and associated factors among the elderly living in rural Chiang Rai, northern Thailand. Epidemiol Health. 2018; 40: e2018018. doi: 10.4178/epih.e2018018.
34. Buysse DJ, Reynolds CF, 3rd, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. Psychiatry Res. 1989 May; 28(2): 193-213. doi: 10.1016/0165-1781(89)90047-4.
35. Bahosi Private Hospital. Hospital patient record data 2016. Yangon: Bahosi Private Hospital; 2017. (in Myanmar).
36. Daniel WW, Cross CL. Biostatistics: a foundation for analysis in the health sciences. 10th ed. Hoboken, NJ: Wiley; 2013.

37. Ministry of Health, Manatu Hauora. Definitions of smoking status. [updated 2015 Jun 4; cited 2017 Dec 10]. available from: https://www.health.govt.nz/our-work/preventative-health-wellness/tobacco-control/tobacco-control-information-practitioners/ definitions-smoking-status.

38. Rostron B. Alcohol consumption and mortality risks in the USA. Alcohol Alcohol. 2012 May-Jun; 47(3): 334-9. doi: 10.1093/alcalc/agr171.

39. National Institute on Alcohol Abuse and Alcoholism. Drinking levels defined. [cited 2017 Dec 10]. available from: https://www.niaaa.nih.gov/alcohol-health/overview-alcohol-consumption/moderate-binge-drinking.

40. Technical Promotion and Support Office. Sub-district social welfare for the elderly with community participation. Bangkok: Technical Promotion and Support Office; 2012. (in Thai).

41. Kroenke K, Spitzer RL. The PHQ-9: a new depression diagnostic and severity measure. Psychiat Ann. 2002 Sep; 32(9): 509-15. doi: 10.3928/0048-5713-20020901-06.

42. Hawkins J. Pittsburgh sleep quality index (PSQI). [cited 2017 Dec 10]. available from: http://www.goodmedicine.org.uk/files/assessment,%20pittsburgh%20psqi.pdf.

43. Chan YH. Biostatistics 202: logistic regression analysis. Singapore Med J. 2004 Apr; 45(4): 149-53.

44. The World Health Organization Western Pacific Region, The international association for the study of obesity [IASO], the international obesity task force. The Asia-Pacific perspective: redefining obesity and its treatment. Sydney: Health Communications Australia; 2000.

45. Hirshkowitz M, Whiton K, Albert SM, Alessi C, Bruni O, DonCarlos L, Hazen N, *et al.* National Sleep Foundation's updated sleep duration recommendations: final report. Sleep Health. 2015 Dec; 1(4): 233-43. doi: 10.1016/j.sleh.2015.10.004.

46. Skomro RP, Ludwig S, Salamon E, Kryger MH. Sleep complaints and restless legs syndrome in adult type 2 diabetics. Sleep Med. 2001 Sep; 2(5): 417-22. doi: 10.1016/s1389-9457(01)00110-1.

47. Knutson KL. Sleep duration and cardiometabolic risk: a review of the epidemiologic evidence. Best Pract Res Clin Endocrinol Metab. 2010 Oct; 24(5): 731-43. doi: 10.1016/j.beem.2010.07.001.

48. Öztürk ZA, Yesil Y, Kuyumcu ME, Savas E, Uygun Ö, Sayiner ZA, Kepekçi Y. Association of depression and sleep quality with complications of type 2 diabetes in geriatric patients. Aging Clin Exp Res. 2015 Aug; 27(4): 533-8. doi: 10.1007/s40520-014-0293-0.

49. Luyster FS, Dunbar-Jacob J. Sleep quality and quality of life in adults with type 2 diabetes. Diabetes Educ. 2011 May-Jun; 37(3): 347-55. doi: 10.1177/0145721711400663.

50. Kinder LS, Katon WJ, Ludman E, Russo J, Simon G, Lin EH, Ciechanowski P, *et al.* Improving depression care in patients with diabetes and multiple complications. J Gen Intern Med. 2006 Oct; 21(10): 1036-41. doi: 10.1111/j.1525-1497.2006.00552.x.

Corresponding author
Nopporn Howteerakul can be contacted at: nopporn.how@mahidol.ac.th