



Identifying factors associated with sleep disturbances among health workers using WhatsApp in Malaysia

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Background: The intricate demand of 24/7 work-lifestyle in modern medical practice has prompted health care professionals to adopt the ubiquity of smartphones for virtual communications through multiple apps functionality like WhatsApp. While these mobile apps have shown a commensurate increase globally, studies have hypothesized that such technological addictions could potentially harm individual's sleep health. This preliminary investigation aims to explore the prevalence and factors associated with sleep disturbances (subjective poor sleep quality and perceived excessive daytime sleepiness) among health care workers using WhatsApp in Malaysia.

Methods: A cross-sectional study was conducted among 306 health care workers comprising of doctors and nurses in a Malaysian public health hospital. A self-administered questionnaire consisting of items on socio-demographics, WhatsApp usage characteristics, perceived sleep disturbances, addictive lifestyles and validated items on psychological factors was used. Data were analyzed at descriptive, univariate and multivariate logistic regression levels.

Results: The prevalence of sleep disturbances among health workers using WhatsApp in our study sample was relatively high. In multivariate analyses, respondents aged 30 years or younger and those being anxious when denied access to "WhatsApp-ing" activities had significantly higher odds of experiencing poor sleep quality and excessive daytime sleepiness. Women had significantly higher odds of experiencing poor sleep quality than men. Respondents who initiate WhatsApp-ing activities immediately after sleep experienced significantly higher odds of excessive daytime sleepiness as compared to those who don't.

Conclusions: Perceived sleep disturbances among health workers in our sample was significantly associated with demographics, usage characteristics and psychological factors. It warrants further robust research as the use of mobile phone applications among health workers is rising exponentially.

Keywords: Malaysia; mobile phone; sleep; health workers; psychology

Received: 22 August 2017; Accepted: 06 September 2017; Published: 08 September 2017.

doi: 10.21037/jhmhp.2017.08.01

View this article at: <http://dx.doi.org/10.21037/jhmhp.2017.08.01>

Introduction

The regulation of sleep is mediated by the triads of homeostatic, circadian and behavioral attributes (1). The sleep homeostat equate sleep duration and wakefulness to maintain an average level of sleep depth (2), while the endogenous circadian factor regulates the timing and overall duration of sleep (3) through external zeitgebers (4) with the environmental light-dark cycle as a primary synchronizer (5). This equilibrium may collapse when behavioral factors obtunds the physiological functions of the former two regulatory mechanisms to maintain individual's sleep health (1,6).

Cain and Gradisar (7) proposed a theoretical model postulating that increased mobile phone use, particularly in the bedroom before sleep, is related to sleep disturbance which impairs daytime functioning resulting from excessive daytime sleepiness. Being awoken by incoming text messages and calls after lights-out increases the odds of being tired during the day. A study conducted among Japanese adolescents showed that the use of mobile phones after lights-out was associated with poor sleep quality and excessive daytime sleepiness (8).

Addictive lifestyles and behaviors potentially disturb sleep. Increased arousal at bedtime and behaviors involving exposure to bright light from touch screens was shown to be associated with sleep disturbances (6). Existing literature that explored the association between smartphone use and sleep disturbances among adolescents found that mobile phone use after lights-out was associated with delayed bedtime and reduction in total sleep time causing fatigability and excessive daytime sleepiness (9). Few investigations reported significant associations between mobile phone use and sleep disturbances in adults; Brunborg *et al.* (10) observed significant correlation between bedtime mobile phone use and delayed sleeping time, causing poor sleep quality (11).

Studies have postulated that psychological attributes of high mobile phone usage (such as the need to be accessible) was related to sleep disturbances (12). Thomee *et al.* (12) hypothesized that frequent use of mobile phones and repeated awakenings overnight pose "high psychological stress," causing significant sleep disturbances. With smartphone app addiction, compulsive behavior prevails in mobile phone users who often expressed concern that their contacts would be upset if they did not immediately respond to texts or calls, including texts arriving in the middle of the night, elevating a state of anxiousness which predispose to

sleep disruption (8,13).

Shochat (14) advocated the "zeitgeist" theory, a concept revolutionized from the socio-cultural, technological and current lifestyle trends to characterize an era. One such demonstration was the evolvement of 24/7 work-lifestyle enforcement in modern medical practice, allowing health professionals to adopt sophisticated, portable and ubiquitous electronic media gadgets like smartphones for virtual communications through multiple apps functionality like WhatsApp (15). WhatsApp (WhatsApp Inc., Mountain View, CA, USA), an app compatible with smartphones allow users to text messages and media content via videos, voice messages or photographs to their contacts. It facilitates creation of group chats, allowing multiple users to participate, monitor and reply to conversations. Malaysians constitute the third leading global mobile internet population using WhatsApp as an interaction and communication tool (16). A recent study found that most Malaysian health care workers perceived WhatsApp as beneficial during clinical practice (15). Although perceived benefits was explored, to date, there were no studies focused on determining the negative health effects of WhatsApp use, particularly sleep disturbances among health workers.. Most literature that explored the associations between mobile apps use and sleep disturbances were focused among adolescents and young adults (8,9,17,18). To address existing gaps, this study aimed to determine the associations between WhatsApp use and sleep disturbances among a group of Malaysian health workers.

Methods

Study setting and population

This analytical hospital-based cross-sectional study was conducted between October 2015 and April 2016 among 306 health professionals at the Tengku Ampuan Rahimah Hospital Klang, Malaysia's second busiest public healthcare facility in terms of patient admissions (19). Health professionals involved in patient management (nurses and medical doctors) were approached using convenience sampling technique during Hospital Continuous Medical Education (CME) sessions. Study objectives and benefits were explained verbally and in a written form attached to the questionnaires. Respondents were assured that information obtained would be confidential and anonymous. A written consent was obtained from those who agreed to participate.

Sample size determination

With a population of over 1,000 medical and allied health care workers at the Tengku Ampuan Rahimah Hospital between January–December 2015 (20), a sample size of 278 health workers was calculated to allow the study to determine the prevalence of sleep disturbances with a confidence interval of $\pm 5\%$ (21). Additional 10% were included to the calculated sample (22) to compensate for possible missing data or non-response to achieve a final sample size of 306.

Ethical issues

The study complied with the guidelines convened in the Declaration of Helsinki. Ethical approval was obtained from the Medical Research Ethics Committee (MREC), Ministry of Health Malaysia (government approval number: NMRR-15-893-26047).

Study instrument

Respondents were surveyed using a self-administered structured questionnaire in Malay that consisted of baseline demographic data and four basic themes adapted from available literature and validated items: (I) WhatsApp usage characteristics; (II) perceived sleep disturbances from WhatsApp use—subjective poor sleep quality and excessive daytime sleepiness as primary outcome measures; (III) addictive lifestyles; and (IV) psychological factors.

Demographic data

Items on socio-demographic characteristics include gender, age, marital status and profession.

WhatsApp usage characteristics

Two items assessed WhatsApp usage characteristics: (I) time spent on WhatsApp per day—this was dichotomized according to the median of ratio level measurement (15); and (II) the use of WhatsApp at intervals between 5 and 10 minutes with a response option of “Yes” and “No” (23).

Perceived sleep disturbances

The primary outcome measures, perceived sleep disturbances were estimated on the basis of binary sleep-status items: (I) subjective poor sleep quality; and (II) excessive daytime sleepiness using previous reported

approach (8). The question about subjective poor sleep quality was adopted and modified as “*With reference to your WhatsApp-ing habits, how do you assess the quality of your sleep during the previous month?*” The response was scored on a four-point Likert scale (very good/good/bad/very bad) such that responses of “bad or very bad” was coded as “yes” and defined as “subjective poor sleep quality” (8). The question about daytime sleepiness was adopted and modified as “*With reference to your WhatsApp-ing habits, do you feel excessively sleepy during the daytime?*” The response was scored on a five-point Likert scale (never/seldom/sometimes/often/always) such that responses of “often or always” was coded as “yes” and defined as having “excessive daytime sleepiness” (8).

Addictive lifestyles

Three items utilized in this study to assess addictive lifestyle behaviors were adapted and modified from previous literature that determined smartphone addictive behaviors. These were: (I) WhatsApp-ing before sleep; (II) WhatsApp-ing immediately after sleep; and (III) WhatsApp-ing after midnight, to which participants choose response options of “Yes” or “No” (17,18,24,25).

Psychological factors

Psychological factors were assessed across two different domains in relation to WhatsApp-ing habits: (I) perceived anxiety; and (II) perceived stress. Self-perceived anxiety was assessed from answers to the question; “*Do you possibly have any of these; inconvenience with nervousness, uneasiness and anxiety when no access to WhatsApp-ing activities?*” (26). The response options were: “Yes, severe problems; yes, light problems; no.” The response option was re-coded as “yes” and “no” such that “no” made up the reference group to ease interpretation (26).

Perceived stress was assessed using the validated 10-items of the Malay version Perceived Stress Scale (PSS-10) (27). The PSS-10 measures the degree to which one perceives one’s life as stressful. It has a 5-point Likert scale and the response ranged from 0 (never) to 4 (very often), indicating how often they have felt stressed within the past month. Total scores ranged between 0 and 40, such that higher scores indicated greater perceived stress with reference to WhatsApp-ing activities (27). To ease interpretation, we dichotomized total scores according to the previous reported scoring rule, such that a score of ≥ 20 indicated high perceived stress level and a score of < 20 indicated low

Table 1 Socio-demographics and WhatsApp usage characteristics (n=296)

Characteristics	N	%
Gender		
Men	58	19.6
Women	238	80.4
Age (years)		
>30	53	17.9
≤30	243	82.1
Marital status		
Married	165	55.7
Single	131	44.3
Profession		
Doctors	81	27.4
Nurses & medical assistants	215	72.6
Time spent on WhatsApp per day		
4 hours or less	145	49.0
More than 4 hours	151	51.0
Use WhatsApp at intervals between 5 to 10 minutes		
No	48	16.2
Yes	248	83.8
Subjective poor sleep quality		
No	39	13.2
Yes	257	86.8
Excessive daytime sleepiness		
No	57	19.3
Yes	239	80.7

perceived stress level (28,29).

Statistical analyses

Data collected were analyzed using IBM SPSS version 23.0 software. Normality tests were done, and all quantitative data were normally distributed. Descriptive statistics were conducted for all variables. Chi-square test was used to assess the association between subjective poor sleep quality, excessive daytime sleepiness and categorical variables

in this study. Multiple logistic regression analysis using Backward Wald technique was performed to obtain predictors of subjective poor sleep quality and excessive daytime sleepiness among health workers in our sample. All variables that had significant associations in the univariate analyses were included in the multivariate analysis. A P value of less than 0.05 was considered as statistically significant ($P < 0.05$).

Results

Socio-demographics and WhatsApp usage characteristics of the respondents

Two hundred and ninety-six out of 306 respondents approached participated in this study (96.7% response rate). The sample comprised of 58 (19.6%) men and 238 (80.4%) women. The mean (\pm SD) age of the respondents was 27.7 (\pm 5.7) years, and the age ranged between 19 to 56 years. Most respondents were married (55.7%), comprising of nurses and medical assistants (72.6%). The mean (\pm SD) time spent on WhatsApp per day was 5.6 (\pm 5.0) hours and about half of the respondents spent more than 4 hours per day WhatsApp-ing (51.0%). The bulk of the respondents (83.8%) use WhatsApp at intervals between 5 and 10 minutes (Table 1).

The prevalence of sleep disturbances

Self-reported sleep disturbances as a consequence of WhatsApp-ing habits among health workers is shown in Table 1. The prevalence of subjective poor sleep quality was 86.8% while the prevalence of excessive daytime sleepiness was 80.7%.

Addictive lifestyles and psychological factors of the respondents

Sixty-five (22%) respondents adopted WhatsApp-ing habits before going to bed and 116 (39.2%) of them initiated WhatsApp-ing activities immediately after waking up from sleep. One hundred and twenty-nine (43.6%) of the respondents were engaged in WhatsApp-ing activities after midnight.

The majority of the respondents perceived an anxious state when denied access to WhatsApp-ing activities (64.9%). In contrast, 206 (69.6%) of the respondents perceived high stress levels while engaged in WhatsApp-ing activities (Table 2).

Table 2 Addictive lifestyles and psychological factors (n=296)

Characteristics	N	%
WhatsApp-ing before sleep		
No	231	78.0
Yes	65	22.0
WhatsApp-ing immediately after sleep		
No	180	60.8
Yes	116	39.2
WhatsApp-ing after midnight		
No	167	56.4
Yes	129	43.6
Anxious when no access to WhatsApp activity		
No	104	35.1
Yes	192	64.9
Perceived stress while WhatsApp-ing		
High	206	69.6
Low	90	30.4

Association between socio-demographics, usage characteristics and subjective poor sleep quality among respondents using WhatsApp

Table 3 exhibits the association between socio-demographics, usage characteristics and subjective poor sleep quality among respondents using WhatsApp. Women using WhatsApp had twofold the odds of men to be subjected to poor sleep quality (OR =2.4, 95% CI 1.1–4.9, P=0.020). Respondents aged ≤30 years who use WhatsApp had almost threefold the odds of those aged >30 years to be subjected to poor sleep quality (OR =2.7, 95% CI 1.3–5.7, P=0.007). Those using WhatsApp between intervals of 5 to 10 minutes had double the odds of those who do not to be subjected to poor sleep quality (OR =2.3, 95% CI 1.1–5.1, P=0.029). These associations were statistically significant (P<0.05).

Association between addictive lifestyles, psychological factors and subjective poor sleep quality among respondents using WhatsApp

Table 4 shows the association between addictive lifestyles, psychological factors and subjective poor sleep quality among respondents using WhatsApp. Those WhatsApp-ing after

midnight had twofold the odds of those who don't to be subjected to poor sleep quality (OR =2.2, 95% CI 1.1–4.5, P=0.038). Those who expressed anxiety while not WhatsApp-ing had triple the odds of those who don't to be subjected to poor sleep quality (OR =3.1, 95% CI 1.6–6.2, P=0.001). These associations were statistically significant (P<0.05).

Association between socio-demographics, usage characteristics and excessive daytime sleepiness among respondents using WhatsApp

Respondents aged ≤30 years who use WhatsApp had twofold the odds of those aged >30 years to experience excessive daytime sleepiness and this association was statistically significant (OR =2.1, 95% CI 1.1–4.2, P=0.026) (Table 5).

Association between addictive lifestyles, psychological factors and excessive daytime sleepiness among respondents using WhatsApp

Table 6 exhibits the association between addictive lifestyles, psychological factors and excessive daytime sleepiness among respondents using WhatsApp. Those initiating WhatsApp-ing activities immediately after sleep had almost threefold higher odds compared to those who do not, to experience excessive daytime sleepiness (OR =2.9, 95% CI 1.5–5.7, P=0.002). Those WhatsApp-ing after midnight had twofold the odds of those who do not, to experience excessive daytime sleepiness (OR =2.1, 95% CI 1.1–3.9, P=0.020). Those who expressed anxiety while not WhatsApp-ing had double the odds of those who do not, to experience excessive daytime sleepiness (OR =2.1, 95% CI 1.2–3.7, P=0.014). These associations were statistically significant (P<0.05).

Factors associated with poor sleep quality by multiple logistic regression analyses

The Adjusted R-squared (Nagelkerke R Square) shows 54% of subjective poor sleep quality is explained by the multivariable logistic model. The chi-square goodness of fit was not significant (P=0.918) showing that the model has an adequate fit. The final regression model yielded three factors to be significantly associated with subjective poor sleep quality: gender, age and perceived anxiousness when denied access to WhatsApp-ing activities. Women had significantly higher odds of perceived subjective poor sleep quality compared to men (aOR =2.5, 95% CI 1.1–5.5,

Table 3 Association between socio-demographics, WhatsApp usage characteristics and subjective poor sleep quality among health workers (n=296)

Characteristics	Subjective poor sleep quality		OR	95% CI	P value
	Yes, N (%)	No, N (%)			
Gender					
Men	45 (77.6)	13 (22.4)	1		
Women	212 (89.1)	26 (10.9)	2.4	1.1–4.9	0.020
Age (years)					
>30	40 (75.5)	13 (24.5)	1		
≤30	217 (89.3)	26 (10.7)	2.7	1.3–5.7	0.007
Marital status					
Married	138 (83.6)	27 (16.4)	1		
Single	119 (90.8)	12 (9.2)	1.9	0.9–3.9	0.069
Profession					
Doctors	71 (87.7)	10 (12.3)	1.1	0.5–2.3	0.796
Nurses & Medical Assistants	186 (86.5)	29 (13.5)	1		
Time spent on WhatsApp per day					
4 hours or less	121 (83.4)	24 (16.6)	1		
More than 4 hours	136 (90.1)	15 (9.9)	1.8	0.9–3.5	0.092
Use WhatsApp at intervals between 5 to 10 minutes					
No	37 (77.1)	11 (22.9)	1		
Yes	220 (88.7)	28 (11.3)	2.3	1.1–5.1	0.029

Table 4 Association between addictive lifestyles and psychological factors with subjective poor sleep quality among health workers using WhatsApp (n=296)

Characteristics	Subjective poor sleep quality		OR	95% CI	P value
	Yes, N (%)	No, N (%)			
WhatsApp-ing before sleep					
No	199 (86.1)	32 (13.9)	1		
Yes	58 (89.2)	7 (10.8)	1.3	0.6–3.2	0.516
WhatsApp-ing immediately after sleep					
No	153 (85.0)	27 (15.0)	1		
Yes	104 (89.7)	12 (10.3)	1.5	0.7–3.2	0.248
WhatsApp-ing after midnight					
No	139 (83.2)	28 (16.8)	1		
Yes	118 (91.5)	11 (8.5)	2.2	1.1–4.5	0.038
Anxious when no access to WhatsApp activity					
No	81 (77.9)	23 (22.1)	1		
Yes	176 (91.7)	16 (8.3)	3.1	1.6–6.2	0.001
Perceived stress while WhatsApp-ing					
High	184 (89.3)	22 (10.7)	1.9	0.9–3.8	0.055
Low	73 (81.1)	17 (18.9)	1		

Table 5 Association between socio-demographics, WhatsApp usage characteristics and excessive daytime sleepiness among health workers (n=296)

Characteristics	Excessive daytime sleepiness		OR	95% CI	P value
	Yes, N (%)	No, N (%)			
Gender					
Men	43 (74.1)	15 (25.9)	1		
Women	196 (82.4)	42 (17.6)	1.6	0.8–3.2	0.155
Age (years)					
>30	37 (69.8)	16 (30.2)	1		
≤30	202 (83.1)	41 (16.9)	2.1	1.1–4.2	0.026
Marital status					
Married	130 (78.8)	35 (21.2)	1		
Single	109 (83.2)	22 (16.8)	1.3	0.7–2.4	0.338
Profession					
Doctors	60 (74.1)	21 (25.9)	1		
Nurses & medical assistants	179 (83.3)	36 (16.7)	1.7	0.9–3.2	0.074
Time spent on WhatsApp per day					
4 hours or less	114 (78.6)	31 (21.4)	1		
More than 4 hours	125 (82.8)	26 (17.2)	1.3	0.7–2.3	0.364
Use WhatsApp at intervals between 5 to 10 minutes					
No	36 (75.0)	12 (25.0)	1		
Yes	203 (81.9)	45 (18.1)	1.5	0.7–3.1	0.270

Table 6 Association between addictive lifestyles, psychological factors and excessive daytime sleepiness among health workers using WhatsApp (n=296)

Characteristics	Excessive daytime sleepiness		OR	95% CI	P value
	Yes, N (%)	No, N (%)			
WhatsApp-ing before sleep					
No	183 (79.2)	48 (20.8)	1		
Yes	56 (86.2)	9 (13.8)	1.6	0.8–3.5	0.210
WhatsApp-ing immediately after sleep					
No	135 (75.0)	45 (25.0)	1		
Yes	104 (89.7)	12 (10.3)	2.9	1.5–5.7	0.002
WhatsApp-ing after midnight					
No	127 (76.0)	40 (24.0)	1		
Yes	112 (86.8)	17 (13.2)	2.1	1.1–3.9	0.020
Anxious when no access to WhatsApp activity					
No	76 (73.1)	28 (26.9)	1		
Yes	163 (84.9)	29 (15.1)	2.1	1.2–3.7	0.014
Perceived stress while WhatsApp-ing					
High	77 (85.6)	13 (14.4)	1.6	0.8–3.2	0.165
Low	162 (78.6)	44 (21.4)	1		

Table 7 Multiple logistic regression (backward Wald); factors associated with poor sleep quality

Predictors	B	SE	Wald	Exp (B)	95% CI	P value
Gender						
Men	Ref	Ref	Ref	Ref	Ref	Ref
Women	0.9	0.4	5.1	2.5	1.1–5.5	0.023
Age (years)						
>30	Ref	Ref	Ref	Ref	Ref	Ref
≤30	1.1	0.4	6.3	2.8	1.3–6.1	0.012
WhatsApp-ing after midnight						
No	Ref	Ref	Ref	Ref	Ref	Ref
Yes	0.7	0.3	3.1	2.0	0.9–4.2	0.082
Anxious when no access to WhatsApp activity						
No	Ref	Ref	Ref	Ref	Ref	Ref
Yes	0.9	0.3	8.3	2.8	1.4–5.7	0.004

Variables entered: all significant variables in univariate analyses. Exp (B) gives the adjusted odds ratio (aOR).

P=0.023). Those aged ≤30 years had significantly greater odds of perceived subjective poor sleep quality compared to those aged >30 years (aOR =2.8, 95% CI 1.3–6.1, P=0.012). Respondents being anxious when denied WhatsApp-ing activities had significantly higher odds of perceived subjective poor sleep quality compared to those not being anxious (aOR =2.8, 95% CI 1.4–5.7, P=0.004) (Table 7).

Factors associated with excessive daytime sleepiness by multiple logistic regression analyses

The Adjusted R-squared (Nagelkerke R Square) shows 48% of excessive daytime sleepiness is explained by this multivariable logistic model. The chi-square goodness of fit was not significant (P=0.335) showing that the model has an adequate fit. The final regression model yielded three factors to be significantly associated with excessive daytime sleepiness: age, WhatsApp-ing immediately after sleep and perceived anxiousness when denied access to WhatsApp-ing activities. Those aged ≤30 years experienced significantly greater odds of excessive daytime sleepiness as compared to those aged >30 years (aOR =2.2, 95% CI 1.1–4.4, P=0.031). Those who initiate WhatsApp-ing activities immediately after sleep experienced significantly higher odds of excessive daytime sleepiness as compared to those who don't (aOR =2.7, 95% CI 1.1–5.5, P=0.006). Respondents being anxious when denied access to WhatsApp-ing activities experienced

significantly greater odds of excessive daytime sleepiness as compared to those who are not (aOR =3.3, 95% CI 1.4–5.0, P=0.003) (Table 8).

Discussion

Summary of main findings

The prevalence of sleep disturbances in our study population was relatively high. We found in this study that respondents who were 30 years or younger and were anxious when denied access to WhatsApp activity had significantly higher odds of experiencing poor sleep quality and excessive daytime sleepiness. Women had significantly higher odds of experiencing poor sleep quality than men. Respondents who initiate WhatsApp-ing activities immediately after sleep experienced significantly higher odds of excessive daytime sleepiness as compared to those who don't.

Comparison with existing literature

Prevalence of sleep disturbances

The prevalence of sleep disturbances among health care workers involved in this study was significantly higher than reported in other similar studies. Ours is one of the highest prevalence of poor sleep quality (86.8%) reported anywhere in the world, and particularly in Asia. We report a higher

Table 8 Multiple logistic regression (backward Wald); factors associated with excessive daytime sleepiness

Predictors	B	SE	Wald	Exp (B)	95% CI	P value
Age (years)						
>30	Ref	Ref	Ref	Ref	Ref	Ref
≤30	0.8	0.4	4.7	2.2	1.1–4.4	0.031
WhatsApp-ing immediately after sleep						
No	Ref	Ref	Ref	Ref	Ref	Ref
Yes	0.9	0.4	7.7	2.7	1.1–5.5	0.006
Anxious when no access to WhatsApp activity						
No	Ref	Ref	Ref	Ref	Ref	Ref
Yes	0.9	0.3	8.9	3.3	1.4–5.0	0.003

Variables entered: all significant variables in univariate analyses. Exp (B) gives the adjusted odds ratio (aOR).

prevalence of subjective poor sleep quality (86.5%) than other similar studies among nurses in Malaysia (57.8%) (30), China (72.1%) (31), Taiwan (57%) (32), and nurses and healthcare workers in Iran (78% *vs.* 43.1%) (33,34) and Nigeria (42.7% *vs.* 54.2%) (35). Interestingly, we found that subjective poor sleep quality was equally highly prevalent among medical doctors (87.7%) involved in this study. Despite being one of very few studies to examine this phenomenon among medical doctors, we found more than twice higher prevalence of subjective poor sleep quality among doctors in the current study as compared to a similar study among Pakistani junior physicians (house officers) (36.8%) (36). It is possible that the use of a single item scale for measuring subjective sleep quality in the current study, as against the use of the more popular, standardized Pittsburgh Sleep Quality Index (PSQI) instrument utilized by all the afore-mentioned studies might have been responsible for this difference. Not only is the prevalence of subjective poor sleep quality reported in this study higher than that reported among healthcare workers elsewhere in Malaysia, the findings show reasonably higher than average prevalence of poor sleep quality among other work groups, age groups or general population in Malaysia. For example, a study conducted among Myanmar migrant workers in Malaysia reported a 62.5% prevalence of poor sleep quality (37), while another study conducted among residents of an old folks' home in Malaysia reported a prevalence of 76.8% (38). Although adjudged to be generally healthy, the fact that information regarding the health status or presence of chronic physical and/or emotional illnesses/problems among the healthcare workers involved in the current study

was not collected, making it difficult to understand what contributions such issues would have made to their poor sleep situation.

The prevalence of excessive daytime sleepiness reported in this study was relatively high (80.7%). Nurses and medical assistants had higher (83.3%) prevalence of excessive daytime sleepiness than medical doctors (74.1%) in our sample. This finding is significantly higher than the prevalence of excessive daytime sleepiness reported in a study conducted by Gomez-Garcia and colleagues among nurses in Spain (51.6%) (39). Among Norwegian nurses, the average prevalence of excessive daytime sleepiness was reported to be around 25.9% (40), and varied by number of quick returns (short rest periods in-between-shifts). Similarly, we report about thrice higher prevalence of excessive daytime sleepiness than that reported in a multicenter Japanese study among 4,407 nurses (26.0%) (41). Despite the limited research literature on this topic, it is clear that ours is one the highest prevalence of excessive daytime sleepiness reported among healthcare workers. We note that in contrast to our study, most of the similar studies available in literature had used the internationally acclaimed and validated Epworth Sleepiness Scale (ESS) to measure excessive daytime sleepiness, and this might have contributed to the observed differences in prevalence. Whereas there appeared to be a consensus regarding the association of shift-work (especially night shift) with excessive daytime sleepiness and poor sleep quality among nurses (42,43) including Malaysians (30), we did not examine the patterns of shift duties and work characteristics (number of daily work hours, rest between

shifts, and off-days) that could potentially explain the differences between Malaysian nurses and nurses in countries where prevalence of sleep disturbances were reported to be relatively lower than ours. Although an increasing trend in sleep disturbances, particularly excessive daytime sleepiness, has been reported among Malaysians in recent years, it remains unclear why such a huge disparity in prevalence was observed between previous estimates among general adult population (14.8%) (44) and healthcare workers in this study. Perhaps, urban dwelling, psycho-behavioral characteristics, and late-night use of social media—the core subject of this study, are some of the factors that may explain such differences.

Association of sleep disturbances with age and gender

Similar to the finding in this study, women have been reported in several other studies around the world, to experience poorer sleep quality compared to men. We found almost threefold higher odds of experiencing poor sleep quality among women than men. This finding is consistent with a Pakistani study which reported about twice higher odds of poor sleep quality among female than male junior doctors (36). Similarly, higher odds of poor sleep quality was reported among female healthcare workers (34) and general population (45) in Tehran, Iran. In contrast, other studies reported no association between gender and sleep disturbances. For example, a study conducted among healthcare workers in Nigeria reported that gender was not a significant predictor of poor sleep quality (35). Like our study, Espuga and colleagues, in a study conducted among 501 Spanish health care workers which reported one of the lowest prevalence of excessive daytime sleepiness in literature (6.6%), also found no significant association between gender and excessive daytime sleepiness (46). At the level of the general population, a study conducted among a sample of Saudi population revealed no overall association between gender and excessive daytime sleepiness, however, stratified analysis revealed higher odds of excessive daytime sleepiness among female respondents with shorter hours of sleep per night (47). The reasons behind these inconsistencies remain unclear, but may not be unrelated to higher prevalence of chronic diseases among elderly females (48,49), suggesting that the association may be mediated by advancing age and poor health status. That said, cautious interpretation is required with regards to the association of female gender with poorer sleep quality reported in the current study. All things being equal,

the predominantly higher number of female than male respondents in this study may have influenced the results in its current direction.

In the current study, we found more than twice higher odds of subjective poor sleep quality and excessive daytime sleepiness among healthcare workers who were aged 30 years and below compared to those who were older. This finding contrasts with what has been previously reported in several other studies in literature. Whereas older literature evidences support the fact that age-related changes in sleep patterns lead to higher prevalence of objective and subjective poor sleep quality among older adults (50-52), recent evidence from a multi-country study among 40,000 respondents from Africa and Asia suggest that increased prevalence of sleep problems among older adults may not be due to age per se, but secondary to poor health status (53,54). For this reason, and the fact that our sample included healthy population of healthcare workers who are perceived to have better knowledge, attitude and health-related practices for their own health than the general population, it is therefore not surprising that younger, rather than older age was associated with higher odds of sleep disturbances in this study. Additionally, the likelihood that younger respondents are single, with higher tendency to socialize after work, and engage in use of social media until late at night, might explain why the observed prevalence of sleep disturbances is higher among them.

Association of sleep disturbances with WhatsApp-ing habits

We found in the current study that respondents who were anxious when denied access to WhatsApp activity had significantly higher odds of experiencing poor sleep quality and excessive daytime sleepiness than those who didn't. Like other forms of addiction, social anxiety has been shown to be associated with social media (Facebook, WhatsApp etc.) usage (55,56). This effect is even more profound with instant messaging applications like WhatsApp which has features that indicate the users' online status and delivery report with checkmarks. For most users, according to the study by Lin Si in 2012 (57), there's a tendency to feel anxious if they didn't hear from friends to whom they had sent instant message within 5 minutes. For them, the slight delay in communication stokes the feeling of disinterest and rejection. The association between social media usage and sleep disturbance is well documented in literature (58). This association has been described in terms of volume and

frequency of social media usage. Findings from our study further confirmed this association, albeit from a slightly different perspective/pathway. In a cohort with significantly high frequency of WhatsApp usage like ours (88.7% used WhatsApp at 5–10 minutes intervals), denial of access to WhatsApp activity may provoke social anxiety to a level significant enough to cause sleep disturbances, especially among those with the habit of late-night WhatsApp-ing (91.5% of respondents in this study). This would be more profound among healthcare workers like doctors and nurses who work at night and may have limited access to WhatsApp activity for social connections during this period. The result may be excessive daytime sleepiness, which could be further compounded by the tendency to engage in WhatsApp activity immediately after sleep. This was confirmed by our finding in this study of about thrice higher odds of excessive daytime sleepiness among respondents who engaged in WhatsApp-ing immediately after sleep. Regardless of its directionality, the association between sleep disturbance and social anxiety from social media usage (either excessive or limited use) remains undisputable. Further studies are required to expose the exact causal pathways in these relationships.

Strengths

To the best of our knowledge, this is the first study to examine prevalence and association of sleep disturbances with WhatsApp usage characteristics among Malaysians. Findings from this study calls to attention, the undeniably high prevalence of sleep disturbances among Malaysian healthcare workers, and the addictive pattern of WhatsApp usage for social connections among them.

Limitations

This study is not without limitations. Because we did not collect any specific data on the health status of respondents whom we had generally adjudged to be healthy, it is difficult to determine whether the prevalence of sleep disturbances exposed in this study might have been associated with any underlying physical (medical, surgical) or emotional conditions or distress. Although we adopted a previous approach from literature that used fewer items to measure sleep disturbances in this study, it was difficult to compare our results with that of other studies that reported mean scores for subjective sleep quality, based on the more popular PSQI, and excessive

daytime sleepiness using ESS scale. In addition, we did not collect any information on work shifts to determine if persons who worked on night shifts were more likely to report sleep disturbances than those who did not. Hence, the findings of this study should be interpreted with caution in this regard. We did not expressly determine an association between poor sleep quality and excessive daytime sleepiness in this study, although several literature evidences suggest a positive association between these variables. Because healthcare workers routinely use WhatsApp for their job functions, it is possible that this might have mediated or exaggerated the observed effect of WhatsApp usage on sleep disturbances. Future studies should be designed to distinctively isolate and examine association between time spent on WhatsApp for social connections or job-related functions and sleep disturbances among this special group. Finally, and perhaps most importantly, the results of this study are at best descriptive and should be interpreted with caution, as they may not be generalizable to the population of healthcare staff across Malaysia owing to the non-probability sampling technique employed to select study participants.

Conclusions

The prevalence of subjective poor sleep quality and excessive daytime sleepiness among healthcare workers in our study was relatively high. Female gender, younger age, being anxious when denied access to WhatsApp activities and WhatsApp-ing immediately after sleep were significant predictors of sleep disturbances among our study cohort. This is of clinical significance, given that sleep disturbances and insufficient sleep negatively affects cognitive performance, mood, immune function, cardiovascular risk, weight, and metabolism. It has become pertinent to explore innovative educational and psycho-behavioral strategies to deal with WhatsApp addictive behaviors among healthcare workers in the study location.

Acknowledgments

Funding: None.

Footnote

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at <http://dx.doi.org/10.21037/jhmhp.2017.08.01>). The authors have no

conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study complied with the guidelines convened in the Declaration of Helsinki (as revised in 2013). Ethical approval was obtained from the Medical Research Ethics Committee (MREC), Ministry of Health Malaysia (government approval number: NMRR-15-893-26047). A written consent was obtained from those who agreed to participate.

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doi: 10.21037/jhmhp.2017.08.01

Cite this article as: Ganasegeran K, Abdulrahman SA, Al-Dubai SA, Rashid A, Perumal M, Renganathan P. Identifying factors associated with sleep disturbances among health workers using WhatsApp in Malaysia. *J Hosp Manag Health Policy* 2017;1:2.