FACTORS AFFECTING THE SLEEP QUALITY OF COVID-19 SURVIVOR: AN ANALYSIS IN KUPANG CITY, EASTERN INDONESIA

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ABSTRACT

With the success of COVID-19 vaccination program, number of COVID-19 survivors might increase significantly. Previous studies indicate that poor sleep quality might be one of the main problems experienced by COVID survivors that need to be addressed since it could disrupt immune system that help preventing re-infection or other health problems. This study examined factors associated with sleep quality of COVID-19 survivors at Kupang city, Eastern Indonesia. This is a cross-sectional survey, phone interviewed was used to collect data from COVID survivors regarding their perceived sleep quality using PSQI tools. Guided questionnaires used to collect information on demographic characteristics and COVID-19 infection characteristics. Multinomial logistic regression was conducted to test the proposed model of sleep quality predictors. Valid data of 148 COVID-19 survivors was collected in May to June 2021. The majority of participants were female (65.54%), aged between 21-50 years old (77.70%) and 12.16% were health workers. Most of participants were undergone self-isolation (79.73%), had no comorbidities (78.38%), had at least 3 organ systems affected during the infection (53.38%), had post COVID symptoms (58.78%), and 57.43% have poor sleep quality (PSQI score >5). The most common post COVID symptoms were fatigue (60.47%), followed by cough (25.58%), and joint/muscle pain (25.58%). The logistic regression model suggested prolonged hospitalization/self-isolation period more than 14 days and the presence of post COVID symptoms could predict higher risk of poor sleep quality. Additionally, higher number of organ systems affected during infection is increased the risk of having post COVID symptoms. Based on the findings of the factors affecting the sleep quality of COVID survivors, healthcare providers should concern sleep quality assessment as one of follow up protocols for COVID survivors, Health authorities should be aware of sleeping disorder as potential health problems in the future, thus a strategy to equip doctors in management of sleeping disorders should be considered, especially in the rural area of Eastern Indonesia.

Keywords: Sleep Quality, COVID-19 survivors, post COVID symptoms

INTRODUCTION

The outbreak of COVID-19 disease began in China on December 2019, and continued transmitted rapidly around the world thus declared as pandemic on March 2020 (World Health Organization, 2020). Indonesia exposure to COVID-19 started on 2 March 2020 with 3 cases, arising significantly to a peak of 14,518 cases on January 2021 (Kementerian Kesehatan Republik Indonesia, 2021). Kupang city, which is located in East Nusa Tenggara (ENT) Province, Eastern Indonesia, also affected by the pandemic. The COVID-19 cases had reached 13,782 by April 2021, of which 47% was from Kupang city (Pemerintah Provinsi Nusa Tenggara Timur, 2021). From direct observation during clinical practice, COVID-19 survivors still experiencing several post-COVID symptoms, which quite vary from fatigue, breathing disturbance, cough, arthritis, headache, muscle and joint pain, loss of memory, and some even experienced psychological distress like anxiety or depression. This in-line with several studies which found that the most frequent post-COVID symptoms are fatigue, dyspnea, anxiety and depression; both in self-quarantine and hospitalized patients (Fernández-de-las-Peñas et al., 2021; Garrigues et al., 2020; Moreno-Perez et al., 2021). Garrigues et al added attention

disorder and sleep disorder into the list for hospitalized patients, occurred even after 110 days of being discharged (Garrigues et al., 2020).

Sleep is an important factor affecting immune responses. Poor sleep quality may lead to hormonal disturbances and increased risk to infectious diseases and depression (Bozan et al., 2021; Vitale et al., 2020). Sleep difficulty can occur in all population group, one systematic review concludes that within the COVID-19 pandemic the prevalence rate of sleep difficulty was 40% approximately (Jahrami et al., 2021). Other study also mentioned the rate of sleep difficulties as a common symptom was 26%, emerged six months after being exposed to COVID-19 infection (Bozan et al., 2021; Huang et al., 2021).

Although sleep disorders could affect all population, the elderly might be more susceptible to this condition. Some studies indicate that 50% of elder people experiencing sleep disturbance and less quality of sleep, no matter the gender is (Dzierzewski J.M. et al., 2018; Ohayon MM et al., 2004). However, other studies by Alimoradi et al (2021), indicate that 37% prevalence of sleep disturbance occurred in the pandemic season was mostly affected the young adults' group, and further analysis discovered the relationship of mental health problems with sleep disorder. Studies in several countries (Cabarkapa S et al., 2020; Lorant V et al., 2021; Shi L et al., 2020) supported the previous findings, that younger age groups had been mostly impacted by limitation of social activities during lockdown regulation (Li X et al., 2020), which resulting in loneliness and thus have higher risk of showing psychological distress (Palgi Y et al., 2020). Health workers also prone to experience sleep disturbances during the outbreak. As frontline workers in dealing with COVID-19 pandemic, they face high workload and suffer physical and emotional distress, lots of them are COVID-19 survivors. Bozan and colleagues found that sleep quality of the health workers COVID-19 survivors decreased significantly compared to the pre-infection (Bozan et al., 2021).

Besides psychological problems, poor sleep quality could be influenced by physical condition. Illness, physical discomfort and pain could potentially lead to sleep difficulty. Several literatures mention association between pain and sleep in two-way direction: pain symptom may cause sleep disturbance, while poor sleep may induce the occurrence of pain symptom (Alsaadi SM et al., 2014; Tang NK et al., 2012). Further studies revealed relationship between subjective poor quality with pain occurred at night, but not if pain feels in the morning (Morelhão et al., 2021). Post-COVID symptoms are well documented in the previous studies, and this condition will potentially disturb the sleep quality of COVID-19 survivors, thus in turn will make them prone to re-infection or to other health problems. In Indonesia, number of COVID-19 survivors including health workers might increase in the future, due to the success of COVID-19 vaccination program and better health care provided, thus sleep difficulty might emerge as one of the future health problems. Therefore, this study aims to investigate factors affecting sleep quality, which might be used for designing appropriate treatment and prevention program for improving sleep quality.

METHOD

Study design and participants

This present study used cross-sectional approach, participants were selected using simple random sampling from the population of 536 COVID-19 survivors in the catchment area of 3 Public Health Centre (PHC) at Kupang city. In Indonesia' health system, all COVID-19 patients are recorded at the PHC, whether self-isolation or hospitalized, they will be monitored until recovered. We used the patient's registry from those PHC for sampling purpose, and 160 participants were selected. Two inclusion criteria were used, as follows:(a) participants were domiciled at Kupang city and whose treatment was completed at least 14 days ago (as required for the self-isolation protocols in Indonesia), and (b) participants needed to be older than age 9 years.

Data were collected through phone interviews in May – June 2021. The aims of the study and the procedures were shared with each participant, and a signed informed consent were obtained from them if they willing to participate. In the interview process, should they refused to continue, participants were able to withdraw without any consequences. The interviews were taking around 10-15 minutes. Questionnaires include demographic data of participants, namely: age, gender, occupation, and whether they were self-quarantine or hospitalized during the infection period. Data regarding COVID-19 related aspects also obtained from the questionnaires, such as: duration of treatment, availability of pre-existing comorbidities, symptoms experienced during infection period, and availability of post-COVID symptoms.

The sleep quality was assessed using The Pittsburgh Sleep Quality Index (PSQI), consist of 18 item questionnaires. PSQI measure 7 dimension of sleep quality, which are: subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. Every dimension is giving score of 0 to 3, with bigger number indicates poorer condition. Global PSQI score more than 5 is considered poor sleep quality. Validity and reliability of PSQI instruments using in Indonesia context were proven in previous research by Alim, with the Cronbach's alpha score of 0.79, and the content validity score of 0.89.

Statistical Analysis

From 160 participants, we excluded incomplete data set, and came up with 148 data set for further analysis. We conducted descriptive analysis to describe the frequency, percentage, mode and standard deviation of the variables. The independent variables include demographic characteristic of the respondents (age, gender, and occupation), and characteristic of COVID-19 infection (type of care, duration of treatment, pre-existing comorbidity, number of organ systems showing symptoms during COVID-19 infection, and the presence of post COVID-19 symptoms) while the dependent variable is the sleep quality of the respondent. The variables in this research were categorized as nominal and ordinal scales. Thus, we performed chi-square test to assess the association between variables, using coefficient contingency to define the correlation proximity level. Finally, we used the multinomial logistic regression to analyze factors correlated with sleep quality, also to test which characteristics of COVID-19 infection could predict the presence of post COVID-19 symptoms in COVID survivors We ran the model using stepwise method and odds ratio (OR) as regression coefficient with 95% confidence interval. All tests were conducted using computer software JASP (Version 0.16.1).

Ethical Approval

This research proposal was gain ethical approval from Medical Faculty Ethical Review Board of the Universitas Nusa Cendana (IRB ref: 31/UN15.16/KEPK/2021) prior to the data collection. We explained the research protocol to each respondent and asked their informed consent before implementing the survey. For adolescent group until the age of 16 years, the informed consent were given by their parents.

RESULTS AND DISCUSSION
Demographic Characteristics of COVID-19 Survivors

Demographic characteristic of the participants was presented in Table 1. In this study, COVID-19 survivors mostly female (65.54%) and aged between 21 to 50 years (77.7%). We categorized participant's occupation as health workers, non-health workers, student and those who were not engaged in formal jobs at the time of this study. Most of the respondents were non-health workers (47.97%), more than one fourth were student (25.68%), 14.19% were not

engaged in formal jobs, and 12.16% were health workers, which comprised of doctors, dentists, midwives, nurses, and laboratory analysts.

Table 1.

Demographic characteristics of the respondents

Demographic Characteristics	n	%
Total	148	100.00
Age Group		
Early adolescent (10 – 12 years)	2	1.35
Adolescent (13-20 years)	10	6.76
Adults (21- 50 years)	115	77.70
Elderly (> 50 years)	21	14.19
Gender		
Male	51	34.46
Female	97	65.54
Occupation		
Health Workers	18	12.16
Non-health workers	71	47.97
Student	38	25.68
Currently not working	21	14.19

Characteristic of COVID-19 infection

In table 2, we described characteristics of COVID-19 infection in five variables: type of care, duration of treatment, the presence of pre-existing comorbidities, number of organ systems showing symptoms during infection, and the presence of post COVID-19 symptoms. Most of COVID-19 survivors were self-isolated (79,73%), and has no pre-existing comorbidity (78.38%), half of them (50%) had received treatment for 0-14 days and the other 50% had been treated for more than 14 days. Most participants suffered multi organ symptoms affecting 3 or more organ systems (53.38%), and 58.78% had post-COVID symptoms.

Table 2.

Characteristics of COVID-19 infection

Characteristics of Infection	n	%
Total	148	100.00
Type of Care		
Self-isolation	118	79.73
Hospitalized	30	20.27
Duration of Treatment		
0-14 days	74	50.00
>14 days	74	50.00
Presence of Pre-existing comorbidity		
No comorbidity	116	78.38

Characteristics of Infection	n	%
1 comorbidity	30	20.37
2 or more comorbities	2	1.35
Number of organ systems showing symptoms during infection		
No symptoms	18	12.16
1 organ system showing symptoms	24	16.22
2 organ system showing symptoms	27	18.24
3 organ system showing symptoms	50	33.78
>3 organ system showing symptoms	29	19.60
post COVID-19 symptoms		
No symptoms	61	41.22
Presence of symptoms	87	58.78

Sleep quality

We measured sleep quality using PSQI, and the result shows that most of the COVID-19 survivors (57.43%) had poor sleep quality, indicated by the global sleep quality score more than 5. Table 3 shows the scoring of each dimension of sleep quality among participants at this study. Most participants stated that they had good quality on the three dimensions, which are: subjective sleep quality, sleep latency, and sleep disturbances. Sleeping duration of most participants is still considered good, which are 6-7 hours (44.59%) and more than 7 hours a day (41.89%). Almost all participants had >85% sleeping efficiency (90.54%) and not taking sleeping medication during past month (97.3%). However, in terms of daytime dysfunction, most participants (80.4%) shows bad quality (fairly bad and very bad).

Table 3.
Dimension of sleep quality and the global PSQI score

Dimension of sleep quality	Category							
	Very good		Fairly good		Fairly Bad		Very Bad	
	n	%	n	%	n	%	n	%
Subjective Sleep quality	33	22.30	82	55.41	23	15.54	10	6.76
Sleep latency	42	28.38	53	35.81	36	24.32	17	11,49
Sleep disturbances	21	14.19	105	70.95	20	13.51	2	1.35
Daytime dysfunction	7	4.73	22	14.86	73	49.32	46	31.08
	>7 hours		6 – 7 hours		5 – 6 hours		<5 hours	
Sleep duration	n	%	n	%	n	%	n	%
	62	41.89	66	44.59	11	7.43	9	6.08
	>85%		75-84%		65-74%		<65%	
Sleep efficiency	n	%	n	%	n	%	n	%
	134	90.54	13	8.78	1	0.68	0	0

Dimension of sleep quality	Category							
	Very good		Fairly good		Fairly Bad		Very Bad	
	n	%	n	%	n	%	n	%
Use of sleeping medication	Not during past month		< 1x a week		1-2x a week		<3x a week	
	n	%	n	%	n	%	n	%
	144	97.3	0	0	1	0.68	3	2.03

Global PSQI score:

Good sleep quality (≤ 5) : 42.57%

Poor sleep quality (>5) : 57.43%

Factors associated with sleep quality and post COVID-19 symptom

We used chi-squared test to asses sleep quality related factors, and contingency coefficient to define the proximity of the association. Table 4 described the results. Only three out of eight factors show significant association with sleep quality (indicated by p-value <0.005), which were: occupation, number of organ systems showing symptoms during infection, and post COVID-19 symptoms. However, the association considered weak, shows by contingency coefficient of 0.235, 0.256, and 0.165, respectively. We also test association of number of organ systems showing symptoms during infection period with the post COVID-19 symptoms, and found that the two variables has significant association (p<0.001) with contingency coefficient of 0.350.

Multinomial logistic regression was used to test the correlation of demographic characteristic and COVID-19 infection characteristic variables with sleep quality. The result shows in figure 1. From the eight independent variables, only duration of treatment and post COVID-19 symptoms have significant correlation with the sleep quality of COVID-19 survivors, indicated by p-value of 0.047 and 0.029 respectively. Duration of treatment has negative relationship towards sleep quality (Odds ratio/OR=0.503), meaning that COVID-19 survivors who were recovered within 0-14 days has possibility 0.503 times obtain good sleep quality. Post COVID-19 symptoms can predict the sleep quality, the presence of post COVID-19 symptoms will raise possibility 2.135 times to have poor sleep quality (OR=2.135).

Table 4.

Factors associated with sleep quality

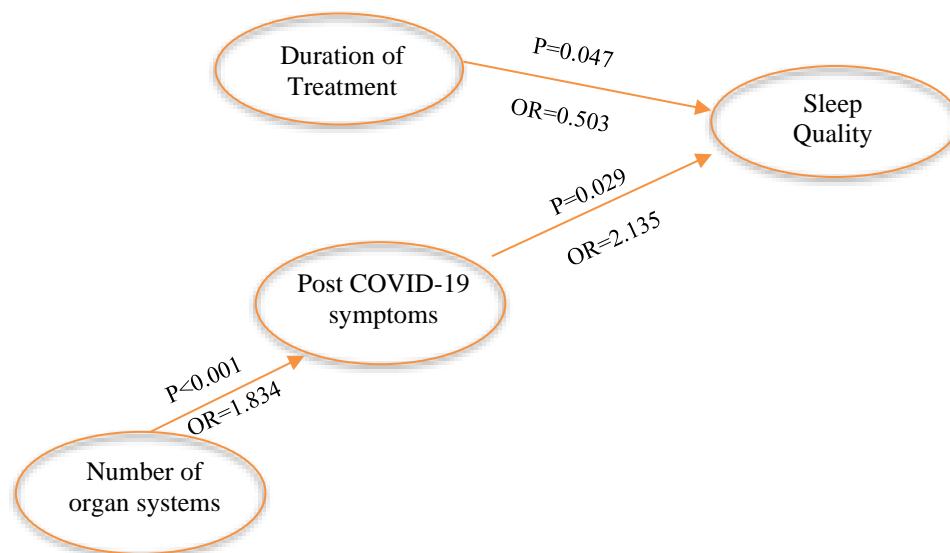| Factors	p-value	Contingency coefficient
Age Group	0.379	0.143
Gender	0.25	0.094
Occupation	0.034*	0.235
Type of care	0.252	0.094
Duration of treatment	0.067	0.149
existing comorbidity	0.933	0.031
Number of organ systems showing symptoms during infection	0.034*	0.256
post COVID-19 symptoms	0.042*	0.165

Figure 1. Result of Logistic Regression in Explaining Sleep Quality among COVID-19 Survivors

In this study we investigated the sleep quality of COVID-19 survivors, and found inconsistency in the results, while most participants perceived subjective good sleep quality (77.71%), the global PSQI score shows 57.43% had poor sleep quality. If we look through each dimension, the two dimension that mostly perceived as bad are daytime dysfunction (80.4%) and sleep latency (35.81%). However, 86.48% participants have good sleep duration at least 6 hours, 97.3% did not use sleeping medication, 99.32% have good sleep efficiency, and only 14.86% having bad sleep disturbances. It can be assumed that most respondents more perceived good sleep quality as enough sleeping duration, less sleep disturbance, better sleep efficiency and never use sleeping medication, while daytime dysfunction and sleep latency were not considered as factors to interfere their sleep quality. Daytime dysfunction also contains questions on how much enthusiasm to get things done, and while the answers might reveal less enthusiasm it might not been perceived to influence sleep quality by the participants. Poor sleep quality could deteriorate immune system to fight against infection, a study by Zhang mentioned the association between poor-sleep quality and slow recovery from lymphopenia, as well as increased risk of longer hospitalization. Healthcare policy should also include assessment of objective sleep quality in following up care of COVID-19 survivors, since subjective sleep quality may hinder the real condition of the patients.

This study also indicates the association between occupation and sleep quality of COVID-19 survivors, with p value of 0.034, and OR = 0.235. We categorize occupation as 4 groups: health workers, non-health workers, student and non-job (currently not engaging in formal job). Several studies found that sleeping disturbance was a common problem in health workers during COVID-19 pandemic. A study by Herrero San Martin et al in Spain during first wave pandemic in 2020, revealed that poor sleep quality (PSQI >6), insomnia, nightmares and sleepwalking were more frequent in health worker. Similar study involving Chinese frontline medical workers (FMW) by Qi et al, also found that FMW have higher prevalence of anxiety and depression, and worse sleep quality compared to non-FMW(26) Another study to asses healthcare worker's sleep quality before and post COVID-19 infection in Turkey revealed that sleep quality decreased in post COVID-19 state, indicate by increasing median PSQI score from 5.0 before to 7.0 after the infection.

Although previous study identified that female gender was more prone to depressive symptoms and poor sleep quality, in this present finding there was no difference across gender and age group related to sleep quality. Depressive symptoms in the previous study seemingly contribute to the significant correlation of female gender and poor sleep quality, while in our study depressive symptoms was not included in the assessment.

Number of organ systems showing symptoms during COVID-19 infection shows significant association with sleep quality (table 4). The most prevalent symptoms found were: cough and sneezing (58.78%), fever (56.76%), anosmia (50.68%), fatigue (48.65%), shortness of breath (25%), and sore throat (25%). Other symptoms that also found were: headache, diarrhea, and joint pain. This result in line with the finding of a multicenter study in COVID-19 pre-hospitalized patients, which identified that higher number of symptoms at admission were associated with poor sleep quality. Previous study conducted in older adults' population had found that pain symptom occurred in the night was related to poor subjective sleep. Other study revealed the bidirectional association between pain and sleep quality; poor sleep could trigger the pain, which in turn will cause a worsen sleep quality.

Despite significantly associated with sleep quality, number of organ systems did not fit in the multiple regression logistic model. The model including age group, gender, occupation, type of care, duration of treatment, number of organ systems showing symptoms during the infection, self-reported comorbidities, and self-reported post COVID symptoms. Only two variables could predict the sleep quality of COVID-19 survivors in this study, which were duration of treatment and availability of post COVID symptoms. However, previous study by Goertz et al, revealed that number of symptoms during infection period served as the biggest contribution to the presence of post COVID symptoms. Thus, in additional to the main model in describing predictors for sleep quality, we also test which variable in the characteristic of infection that might predict post COVID symptom. The present finding strengthened Goertz' model, only number of organ systems showing symptoms during infection period had significant contribution to the presence of post COVID symptom (figure 1). The higher number of organ systems affected during infection period will raise the possibility of 1.834 times to have post COVID symptoms (OR=1.834).

This present study identified two variables as predictor of sleep quality in COVID survivors. Duration of treatment has negative correlation towards the sleep quality of COVID-19 survivors. Duration of treatment classified into 2 groups, between 0-14 days which also include patients without any symptoms, and more than 14 days. We used cut-off points of 14 days in line with the guideline COVID-19 management in Indonesia, mentioning that COVID-19 patients with mild symptoms or without symptoms, could undergo self-isolation protocol for at least 14 days.

We did not collect medical record data to assess the severity of COVID-19 infection among participants, however duration of treatment might indicate this aspect. We assumed that prolong recovery time might indicate the severity of the infection, in this study 53.38% participants experienced multiple symptoms affecting at least 3 organ systems (respiratory, digestive, muscular-skeletal, sensory and nervous system), and only 12.16% had no symptoms. Multiple symptoms may interfere disease course and took longer convalescence period. This present finding similar to the result of a study by Zhang et al, found that patients classified as poor-sleep group had longer duration of hospitalization (33 days) compared to the good-sleep group with only 25 days of hospitalization.

Another significant contributor to predict sleep quality was the presence of post COVID symptoms in COVID survivors, those who obtain post COVID symptom will have possibility 2.135 times higher to have worsen sleep quality compare to those who did not have post COVID symptoms (OR=2.135). In this study, post COVID symptoms found in 58.78% COVID survivors, and the most common post COVID symptoms were fatigue (60.47%),

followed by cough (25.58%), joint and muscle pain (25.58%), headache (18.60%), less sleep (17.44%), loss of taste and smell (12.79%), and loss of memory (11.63%). This finding supports previous meta-analysis study, that more than 60% participants show post COVID symptoms. In addition, several studies had identified fatigue and dyspnea as the most common post COVID symptoms, followed by loss of memory, concentration and sleep disorders (5,29)

To the best of our knowledge, study to analyze factor of COVID infection characteristics towards sleep quality of COVID survivors in Eastern Indonesia context not yet been done. Recognizing the predictor of poor sleep quality in COVID survivors is important for improving health condition during the convalescence period, and minimize the risk of re-infection or becoming ill from other diseases due to weak immune system. As implication of this study, we suggest doctors to include assessment of objective sleep quality in follow up treatment of COVID survivors with post COVID symptoms and prolonged treatment longer than 14 days during the previous infection period. Healthcare system should also consider training for doctors in rural area in management of sleep disorders, to prevent further health problems. Furthermore, healthcare management should consider regular screening of sleeping disorders for their health workers, since the finding suggests that they more reluctant to experience poor sleep quality.

There are some limitations in this study. First, we assessed the sleep quality using PSQI score and not measured by actigraphy to determine objective sleep parameters. Second, we did not directly examine medical condition of the participants, but relied on self-reported post COVID symptoms, self-reported comorbidities, and self-reported number and type of symptoms during infection period; all of this can be source of recall bias. However, from the feasibility of study, during the research period when vaccination still not widely used, the minimal contact with COVID survivors was more acceptable, both for the researcher and participants viewpoint.

KESIMPULAN

Prolonged hospitalization or self-isolation more than 14 days and the presence of post COVID symptoms are predictors of worsen sleep quality in COVID-19 survivors. The higher number of organ systems affected during COVID-19 infection is at risk for getting post COVID symptoms. Older age and gender difference did not associate with sleep quality, however certain occupation such as health worker might be more prone to have poor sleep quality. Healthcare provider suggested to include sleep quality assessment in the follow up protocols for COVID-19 survivors. Health authorities should consider sleeping disorder as emerging health problems, thus equipping doctors in rural area in management of sleeping disorders is crucial.

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