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Short Communication

Changes in the Psychological State of Medical Personnel in the Department of Radiotherapy at a Tertiary Care Teaching Hospital in China during the Epidemic

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Abstract

Objectives: The aim of the present study was to investigate changes in the psychological state of medical personnel in the Department of Radiotherapy during the COVID-19 epidemic.
Methods: Psychological state was evaluated using the Pittsburgh Sleep Quality Index (PSQI), Self-Rating Depression Scale (SDS), and Self-Rating Anxiety Scale (SAS). All three questionnaires were first completed by medical personnel on 17–18 February 2020 and were repeated every 3 months thereafter until 17–18 August. The number and intentions of patients receiving radiotherapy (RT) in our department were also collected.
Results: Twenty medical personnel participated in the present study. The global PSQI score recorded in August was significantly lower than that recorded in February ($P = 0.045$). Among the seven components of the PSQI, sleep quality ($P = 0.048$) and daytime dysfunction ($P = 0.006$) in August were significantly improved compared with February, whereas SDS and SAS did not significantly differ among the three different time points. The proportion of patients who received palliative radiotherapy was significantly higher on 18 May than on 17 February ($P = 0.005$).
Conclusions: Medical personnel in the Department of Radiotherapy experienced a significantly elevated incidence of sleeping problems during the early COVID-19 outbreak period. Multiple combinations of protective measures to avoid infection could improve sleep quality and ensure the safe delivery of RT to cancer patients.

What's important about this paper

Medical workers in the radiotherapy department off a tertiary care hospital experienced an elevated incidence of sleep problems early in the COVID-19 pandemic. The incidence of sleep problems improved over several months, during which time the number of patients also decreased and all patients with fever or respiratory systems entering the hospital were screened for COVID-19. Sleep quality can be an indicator of work-related stress, and has implications for the ability of medical personnel to perform their work safely and effectively.

Introduction

Coronavirus disease 2019 (COVID-19) is highly contagious and has spread worldwide. Zhejiang Province of the People's Republic of China, where the authors of this study are located, was severely affected by the virus, with a total of 1286 confirmed cases by 31 October 2020, and reached its peak in mid-February 2020 (Health Commission of Zhejiang Province, 2020).

Cancer patients, in addition to having comorbidities, have low immunity and are susceptible to viral infections (Hanna *et al.*, 2020). An early study showed that, compared with nontumor patients, cancer patients had a significantly increased risk of severe COVID-19 infection. Moreover, among patients who had recently received chemotherapy or surgery, there was an increased incidence of clinical symptoms of severe COVID-19 (Liang *et al.*, 2020). Unfortunately, although radiotherapy (RT) plays an extremely important role in cancer treatment, there is limited research on RT during the outbreak of COVID-19.

Typically, a conventional RT course is as much as several weeks in duration. In addition, the delivery of RT requires close contact with cancer patients, which would increase the risk of viral infection between cancer patients and medical personnel. These circumstances, in combination with the relatively special environment of administration (i.e. RT equipment is commonly situated in basements) (Wei *et al.*, 2020), place the personnel delivering RT under great psychological pressure. Based on the above background, we conducted this study to analyze changes in the psychological state of medical personnel in our department during the epidemic.

Data and methods

Study design

Forty-seven medical personnel had worked in our department before the epidemic. Before the survey started, all medical personnel were invited to participate.

However, due to the epidemic, the department adopted policies that kept some medical personnel on duty and others in self-isolation at home according to the requirements of the hospital. Thus, 28 colleagues participated in this survey in February. During the 3-month interval for the second survey, eight colleagues were unable to participate for various reasons, as indicated in the flow chat (Supplementary Fig. S1, available at *Annals of Work Exposures and Health* online). Thus, 20 colleagues were eligible for comparing changes in mental health. The patients/participants provided their written informed consent to participate in this study. We confirm that this study was performed in accordance with the Declaration of Helsinki.

The inclusion criteria of this study limited participation to medical personnel in our department who expected to be able to work normally for 6 months or more. The main exclusion criteria were as follows: (i) Staff who were on leave or not on duty, (ii) Staff who had fever or respiratory symptoms, and (iii) Staff who had to take necessary isolation measures.

Measurement tool

Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI) questionnaire, which measures seven components of sleep: sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medications, and daytime dysfunction. A total PSQI score greater than 6 points indicates poor sleep quality, with a diagnostic sensitivity of 89.6% and a specificity of 86.5% (Buysse *et al.*, 1989).

Depression was evaluated using the Self-Rating Depression Scale (SDS, Chinese version) (Zung, 1965), and symptoms of anxiety were measured with the Self-Rating Anxiety Scale (SAS, Chinese version) (Zung, 1971). Both questionnaires were confirmed to be reliable and valid for the Chinese population (Liu *et al.*, 2018). A total score of greater than or equal to 50 was considered the threshold for determining anxiety, with a diagnostic sensitivity of 89.0% and a specificity of 69.0% (Dunstan *et al.*, 2017),

and a total score of greater than or equal to 50 on the SDS categorized individuals as suffering from depression with a diagnostic sensitivity of 97.0% and a specificity of 63.0% (Zung *et al.*, 1990).

Brief description of the RT process

The timing of the COVID-19 outbreak coincided with the Chinese Lunar New Year holidays (Spring Festival). After the holidays, the outpatient RT service was closed immediately. Patients who needed to resume RT were hospitalized and continued to receive RT according to the following standards. Based on the development of the epidemic, medical personnel were organized to study updated versions of the '*Novel Coronavirus Pneumonia Diagnosis and Treatment Plan*' and '*The Management Plan for Suspected* and *Close Contact with Novel Coronavirus Pneumonia*' published by the National Health Commission of the People's Republic of China. Upon patient admission, the responsible physicians were all made aware of the patient's situation in detail during the epidemic, ensured that the patient had no history of traveling to or living in the epidemic area within the past 2 weeks (with the epidemic area having been defined by the health commission for each period) and had no history of exposure to confirmed cases. The implementation of RT in our department has been described previously (Song *et al.*, 2020).

Evaluation indicators

The three questionnaires were first completed by medical personnel from 17 February 2020 to 18 February 2020. *Post hoc* data on the incidence of COVID-19 showed that the epidemic situation had reached its peak in Zhejiang Province. At the three different time points, the number and intentions of patients receiving RT were also collected and compared.

Statistical analysis

Paired comparisons were performed using Bonferroni analysis when the homogeneity requirement was met and nonparametric tests when it was not met. Mean scores and standard deviations are given as descriptive statistics. All analyses were performed using IBM SPSS, version 25.0 (SPSS, Armonk, NY). A two-tailed *P* value of less than 0.05 was considered statistically significant.

Results

Baseline information about the subjects

Twenty medical personnel met the final inclusion criteria and accounted for 42.6% of all medical personnel. The median age of the subjects was 35 years. Detailed information is shown in Supplementary Table S1, available at *Annals of Work Exposures and Health* online.

Questionnaire scores

The global PSQI score and the scores on the seven components are shown in Supplementary Fig. S2, available at *Annals of Work Exposures and Health* online. The average PSQI score was 8.0 ± 4.8 points in February, 5.1 ± 3.2 points in May, and 4.5 ± 2.5 points in August. A significant decrease ($P = 0.045$) in global PSQI score was observed between August and February (Table 1). Among the seven aspects of the PSQI, the scores on sleep quality ($P = 0.048$) and daytime dysfunction ($P = 0.006$) in August were significantly improved compared with February. Additionally, the score for sleep latency ($P = 0.017$) in May was also significantly decreased compared with February. The other four subscales did not significantly differ among the three time points (Supplementary Fig. S2, available at *Annals of Work Exposures and Health* online).

The SDS and SAS questionnaires revealed that there were no significant differences among the three time points (Table 1).

Implementation of RT

On 17 February 2020, 56 patients received RT at our department. Among these patients, 50 (89.3%) patients received non-palliative radiotherapy (NPRT) based on their diseases, which included 10 (17.9%) patients who received definitive RT/chemoradiotherapy (CRT), 40 (71.4%) patients who received neo-/adjuvant RT/CRT, and six (10.7%) patients who received palliative radiotherapy (PRT). The corresponding figures on 18 May 2020 were as follows: 19 (19.8%) patients received definitive treatment, 51 (53.1%) patients received neo-/adjuvant treatment, and 26 (27.1%) patients received PR. On 18 August 2020, 63 patients received RT at our cancer center. Similarly, 50 (79.4%) patients received NPRT and 13 (20.6%) patients received PRT. The proportion of patients who received PRT was significantly higher on 18 May than on 17 February ($P = 0.005$; Fig. 1).

Table 1. Changes in PSQI, SDS, and SAS during the study.

Time	PSQI score	SDS score	SAS score
February	8.0 ± 4.8	43.9 ± 13.2	43.5 ± 9.8
May	5.1 ± 3.2	45.9 ± 11.9	40.4 ± 10.3
August	4.5 ± 2.5	41.8 ± 9.5	39.0 ± 9.6
P value	0.045*	0.565	0.364

*Compared between February and August.
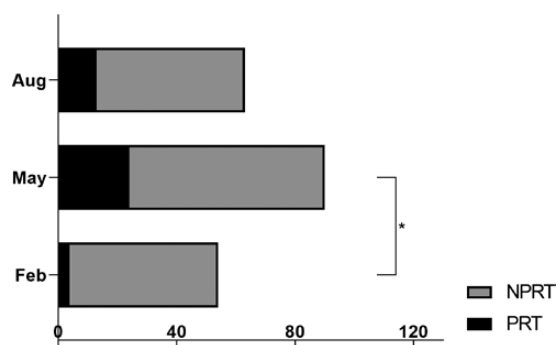
Figure 1. Changes in the proportion of cancer patients receiving RT during the study.

Discussion

This survey demonstrates that the sleep quality of medical personnel in the RT department during the early phase of the epidemic was significantly worse compared with 3 and 6 months later as measured with PSQI scores. A reasonable explanation for these results might be related to the medical personnel's understanding of the current progress of the COVID-19 epidemic through the media and other relevant channels (Chen *et al.*, 2020; Kang *et al.*, 2020). Another factor is that our hospital is a comprehensive grade-A tertiary hospital in Zhejiang Province, which is different from specialized hospitals. During the epidemic period, our hospital undertook the important task of screening suspected COVID-19 cases. All suspected patients with fever or respiratory symptoms were likely to enter the hospital through the outpatient system, which certainly increases medical personnel's risk of exposure to the virus. Based on the above considerations, all patients had to be hospitalized to receive RT. A longitudinal study evaluated the changes in mental health among the general population at two different time points (namely, during the initial outbreak and again at the epidemic's peak 4 weeks later) in China. Their results demonstrated no significant differences in stress, anxiety, or depression between the two time points. However, there was a statistically significant longitudinal reduction in Impact of Event Scale-Revised (IES-R) questionnaire scores, thereby indicating the presence of post-traumatic stress disorder symptoms (Wang *et al.*, 2020). Considering the close relationship between IES-R and PSQI, as revealed in other studies (Demartini *et al.*, 2020; Peng *et al.*, 2020), and the similar tendency found in our study, we should pay more attention to improving the psychological support provided to our medical personnel.

On the other hand, the number of patients receiving RT at our center on 17 February was smaller compared with the numbers in May and August. Previously, Xie *et al.* also reported a sharp decrease in patients receiving RT during the lockdown phase of the COVID-19 outbreak in Wuhan, China (Xie *et al.*, 2020). Conservativeness in resuming/delivering RT was the main factor driving this phenomenon. For patients who had to extend or suspend their RT, multidisciplinary treatment was the optimal choice in our department to better manage the patients' diseases.

Many questions remain unclear due to the limitations of the current study. First, it includes only a small sample collected at a single center. It might be underpowered to detect any findings within the enrolled participants. Second, the outcomes for psychological state were based on three self-reported questionnaires, which would lead to information bias. During the epidemic, a survey on the impact of social support on sleep quality among medical personnel also showed that medical personnel should receive timely social support (Xiao *et al.*, 2020). Furthermore, Zhejiang Province was not a hot spot of the COVID-19 outbreak. Thus, caution is warranted in citing the findings reported in this study, and its conclusions need to be confirmed by a study with a larger sample size and cannot be directly applied to high-incidence areas or other countries affected by the COVID-19 epidemic.

In summary, medical personnel in the Department of RT experienced a significantly higher incidence of sleeping problems during the epidemic period. Additionally, strict adherence to guidelines for the prevention of the virus could effectively prevent infections among cancer patients receiving RT and relevant medical personnel in the Department of RT.

Supplementary Data

Supplementary data are available at *Annals of Work Exposures and Health* online.

Supplementary Figure S1. Summary of participant flow through the study.

Supplementary Figure S2. Changes in the global PSQI score and the seven component scores across the study. PSQI, Pittsburgh Sleep Quality Index.

Supplementary Table S1. Baseline participant characteristics.

Funding

Acknowledgements

Ethical approval

This study was registered with the Chinese Clinical Trial Registry on 13 February 2020 (ChiCTR2000029782) and was approved by the institutional review board of the Zhejiang Provincial People's Hospital (No. 2020QT049). We confirm that written informed consents were obtained from all participants and patients for the publication of any potentially identifiable images or data included in this article.

Conflict of interest

The authors declare that they have no competing interests.

Data availability

The datasets generated for this study are available on request to the corresponding author.

References

Buysse DJ, Reynolds CF III, Monk TH *et al*. (1989) The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Res*; **28**: 193–213.

Chen Q, Liang M, Li Y *et al*. (2020) Mental health care for medical staff in China during the COVID-19 outbreak. *Lancet Psychiatry*; **7**: e15–6.

Demartini B, Nisticò V, D'Agostino A *et al*. (2020) Early psychiatric impact of COVID-19 pandemic on the general population and healthcare workers in Italy: a preliminary study. *Front Psychiatry*; **11**: 561345.

Dunstan DA, Scott N, Todd AK. (2017) Screening for anxiety and depression: reassessing the utility of the Zung scales. *BMC Psychiatry*; **17**: 329.

Hanna TP, Evans GA, Booth CM. (2020) Cancer, COVID-19 and the precautionary principle: prioritizing treatment during a global pandemic. *Nat Rev Clin Oncol*; **17**: 268–70.

Health Commission of Zhejiang Province. (2020) The epidemic situation of the 2019 novel coronavirus disease in Zhejiang province (2020/06/01) [EB/OL] [2020-09-01]. Available at http://www.zjwjw.gov.cn/art/2020/9/1/art_1202101_44345606.html. Accessed 1 September 2020.

Kang L, Li Y, Hu S *et al*. (2020) The mental health of medical workers in Wuhan, China dealing with the 2019 novel coronavirus. *Lancet Psychiatry*; **7**: e14.

Liang W, Guan W, Chen R *et al*. (2020) Cancer patients in SARS-CoV-2 infection: a nationwide analysis in China. *Lancet Oncol*; **21**: 335–7.

Liu R, Tang A, Wang X *et al*. (2018) Assessment of quality of life in Chinese patients with inflammatory bowel disease and their caregivers. *Inflamm Bowel Dis*; **24**: 2039–47.

Peng M, Mo B, Liu Y *et al*. (2020) Prevalence, risk factors and clinical correlates of depression in quarantined population during the COVID-19 outbreak. *J Affect Disord*; **275**: 119–24.

Song T, Xu H, Li Q *et al*. (2020) [Implementation of radiotherapy in a tertiary hospital in Zhejiang province during the epidemic of COVID-19]. *Chin J Radiol Med Prot*; **40**: 268–72.

Wang C, Pan R, Wan X *et al*. (2020) A longitudinal study on the mental health of general population during the COVID-19 epidemic in China. *Brain Behav Immun*; **87**: 40–8.

Wei W, Zheng D, Lei Y *et al*. (2020) Radiotherapy workflow and protection procedures during the Coronavirus Disease 2019 (COVID-19) outbreak: experience of the Hubei Cancer Hospital in Wuhan, China. *Radiother Oncol*; **148**: 203–10.

Xiao H, Zhang Y, Kong D *et al*. (2020) The effects of social support on sleep quality of medical staff treating patients with Coronavirus Disease 2019 (COVID-19) in January and February 2020 in China. *Med Sci Monit*; **26**: e923549.

Xie C, Wang X, Liu H *et al*. (2020) Outcomes in radiotherapy-treated patients with cancer during the COVID-19 outbreak in Wuhan, China. *JAMA Oncol*; **6**: 1457–9.

Zung WW. (1965) A Self-Rating Depression Scale. *Arch Gen Psychiatry*; **12**: 63–70.

Zung WW. (1971) A rating instrument for anxiety disorders. *Psychosomatics*; **12**: 371–9.

Zung WW, Magruder-Habib K, Velez R *et al*. (1990) The comorbidity of anxiety and depression in general medical patients: a longitudinal study. *J Clin Psychiatry*; **51** (Suppl.): 77–80; discussion 81.