Status of radiotherapy staff during the coronavirus disease 2019 (COVID-19) epidemic in China

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Abstract
Objective: In December 2019, coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) broke out in Wuhan, China. The pandemic has posed a great challenge to radiation oncology departments, as interruptions in radiation therapy (RT) increase the risks of cancer recurrence or failure of the therapy as a whole. This study aimed to elucidate the impact of COVID-19 on radiation therapy staff in China.

Methods: As many working staff at different radiation oncology departments in China as possible were retrospectively enrolled from 23 January to 9 March 2020. They were then invited to answer a questionnaire, for essential data collection, from which their basic information, anxiety level, and workload were analyzed.

Results: Seven (0.39%) of the 1,755 radiation therapy staff who answered the questionnaire had contracted COVID-19, all of whom were from Wuhan. The factors influencing susceptibility were not sex (P = 1.000), age (P = 0.480), or comorbidities (P = 0.600), but geographic location (P < 0.001) and whether the respondent worked in a designated COVID-19 hospital (P = 0.003). In terms of protection procedures, four participants carried out basic, one second-level and two third-level protection procedures. The difference was not statistically significant (P = 0.720). The infected respondents’ anxiety level related to the outbreak (average score 6.57) was higher than that of their counterparts in Wuhan (5.18), as well as across the country (4.79), and 71.43% of those infected expressed the need for psychological interventions. During the epidemic, departments of 428 respondents (24.39%) shut down, while 76.71% of the respondents reported workload reduction.

Conclusion: The factors related to COVID-19 infection were the geographic location and whether the respondent worked in a designated COVID-19 hospital. The infected respondents experienced greater psychological pressure than their uninfected counterparts and, therefore, required more psychological interventions.

KEYWORDS
anxiety, coronavirus disease 2019, psychological interventions, radiotherapy staff, workload
1 | INTRODUCTION

Due to the highly contagious nature and rapid spread of coronavirus disease 2019 (COVID-19), medical practice has been highly constrained to prevent cross-infection in hospitals. However, for certain patients, such as those battling cancer, interruption in treatment can have worse consequences. Radiotherapy (RT) is one of the major treatments for cancer patients. Its interruption can increase the risk of cancer recurrence, decrease treatment efficacy, and result in failure of the therapy as a whole or even death. Therefore, it is crucial to maintain RT for patients during the COVID-19 epidemic.

RT staff is a high-risk and stressed group because of the heavy workload and close contact with cancer patients who are always immunosuppressed and, therefore, more vulnerable to COVID-19. Thus, the present study was carried out to elucidate the status of RT staff in China, and to try and provide clues to protect other medical professionals at high risk of infection during the pandemic.

2 | METHODS

We retrospectively investigated the work and health status of RT staff in 31 regions of mainland China (excluding Hong Kong, Macau, and Taiwan) from 23 January 2020 to 9 March 2020. We distributed a questionnaire to the staff through a WeChat workgroup. It was clarified that there would be no compensation, monetary or otherwise, for participating in the survey. The present study was approved by the Ethics Committee of Renmin Hospital of Wuhan University. The data collected included information on sex, age, workload, COVID-19 infection status and sources, comorbidities, and colleagues’ health status. All COVID-19 cases were confirmed according to the Diagnosis and Treatment Program of 2019 New Coronavirus Pneumonia (trial sixth version) issued by the Chinese National Health Commission on 18 February 2020 (https://www.nhc.gov.cn/yzygj/s7653p/202002/8334a8326dd949d23df351d7daaef2/files/b218cfeb1bc5446f922bf6b817.pdf). The cases were classified into four groups based on disease severity: mild, moderate, severe, and critical. Mild patients present with one or more of the following symptoms: mild clinical symptoms and no pneumonia manifestations in imaging; moderate patients present with fever, respiratory tract infection and other symptoms, and pneumonia manifestations in imaging; severe patients present with shortness of breath with a respiratory rate ≥30 times/min, oxygen saturation ≤93%, and arterial blood oxygen partial pressure/oxygen concentration ≤300 mmHg; and critical patients experience respiratory failure, requiring mechanical ventilation, and shock combined with organ failure, requiring intensive care unit care.

2.1 | Statistical analysis

The data were analyzed using SPSS 19.0 software (SPSS, Chicago, IL, USA). The ratios of categorical data between the infected and uninfected respondents were analyzed by the χ²-test. The independent-samples t-test was used to analyze measurement data between the groups. P < 0.05 was considered statistically significant.

3 | RESULTS

3.1 | Epidemiological characteristics

From 23 January to 9 March 2020, we distributed the questionnaire to 2,036 RT staff, receiving completed copies from 1,755 (a response rate of 86.2%). In the present study, 239 respondents were aged <30 years, 779 between 30 and 40 years, 481 between 40 and 50 years, and 256 >50 years; and 859 (48.95%) were women. Furthermore, 229 (13.04%) had comorbidities, including hypertension, diabetes, coronary heart disease, and tumors. The 1,755 comprised 953 radiologists, 241 technicians, 203 physicists, 227 nurses, and 131 other personnel, such as management and cleaning staff; among the respondents, 353 (20.11%) worked in the designated COVID-19 hospitals and 556 (31.68%) in hospitals that accepted some COVID-19 patients (partially designated) – seven (0.39%) had contracted the infection (Table 1).

3.2 | Infected RT staff analysis

As shown in Table 1, all of the seven infected respondents were from Wuhan (P < 0.001), three of whom were women (43%); also, two were aged <30 years (29%), three between 30 and 40 years (43%), and two between 40 and 50 years (29%). None of them had any underlying disease.

Among the seven infected participants, one was from a fully designated hospital, and six from a partially designated hospital (P = 0.003) – five clinical oncologists, one physicist, and one nurse. In terms of protection procedures, four of the patients carried out basic, one second-level, and two third-level protection procedures, the difference was not statistically significant (P = 0.720).

3.3 | Clinical features

Among the seven infected participants, three were categorized as mild (42.86%) and four as moderate (57.14%). Their main symptoms were fever, fatigue, chest tightness, and diarrhea, while two of them also had sore limbs and a cough.

All seven contracted the infection through nosocomial transmission – four of them had contact with patients who had tested positive for COVID-19 (57.14%). One of the seven (14.29%) passed on the infection to his/her whole family, and among the Wuhan respondents, family members of three were infected (3/114, 2.63%).

3.4 | Psychological assessment

The study found that the average score (anxiety level related to the outbreak) of the infected respondents was 6.57, that of the Wuhan respondents was 5.18, and that of those in other regions was 4.79.
TABLE 1  Epidemiological characteristics

| Characteristics                             | All (n = 1 755) | Infected (n = 7) | Uninfected (n = 1 748) | P† |
|--------------------------------------------|-----------------|-----------------|------------------------|----|
| Sex (female)                               | 859 (49%)       | 3 (43%)         | 856 (49%)              | 1.00|
| Age (pears)                                |                 |                 |                        | 0.480|
| < 30                                       | 239 (14%)       | 2 (29%)         | 237 (14%)              |     |
| 30–40                                      | 779 (44%)       | 3 (43%)         | 776 (44%)              |     |
| 40–50                                      | 481 (27%)       | 2 (29%)         | 479 (27%)              |     |
| > 50                                       | 256 (15%)       | 0               | 256 (15%)              |     |
| Comorbidities                              | 1 521 (87%)     | 7 (100%)        | 1 514 (87%)            | 0.600|
| Workplace                                  |                 |                 |                        | <0.001†|
| Wuhan                                      | 114 (7%)        | 7 (100%)        | 107 (6%)               |     |
| Outside Wuhan, within Hubei               | 291 (17%)       | 0               | 291 (17%)              |     |
| Outside Hubei                              | 1 350 (77%)     | 0               | 1 350 (77%)            |     |
| Designated COVID-19 hospital               |                 |                 |                        | 0.003†|
| Yes                                        | 353 (20%)       | 1 (14%)         | 352 (20%)              |     |
| Partially                                  | 556 (32%)       | 6 (86%)         | 550 (32%)              |     |
| No                                         | 846 (48%)       | 0               | 846 (48%)              |     |
| Occupation                                 |                 |                 |                        | 0.900|
| Radiologist                                | 953 (54%)       | 5 (71%)         | 948 (54%)              |     |
| Radiotherapy physicist                     | 203 (12%)       | 1 (14%)         | 202 (12%)              |     |
| Radiotherapy technician                    | 241 (14%)       | 0               | 241 (14%)              |     |
| Radiotherapy nurse                         | 227 (13%)       | 1 (14%)         | 226 (13%)              |     |
| Other                                      | 131 (8%)        | 0               | 131 (8%)               |     |
| Workload reduction (%)                     |                 |                 |                        | 0.012†|
| > 90                                       | 250 (14%)       | 0               | 250 (14%)              |     |
| > 50–90                                    | 488 (28%)       | 0               | 488 (28%)              |     |
| 10–50                                      | 530 (30%)       | 1 (14%)         | 529 (30%)              |     |
| < 10                                       | 487 (28%)       | 6 (86%)         | 481 (28%)              |     |
| Patients infected with COVID-19 (yes)      | 121 (7%)        | 5 (72%)         | 116 (7%)               | <0.001†|
| Colleagues infected with COVID-19 (yes)    | 111 (6%)        | 6 (86%)         | 105 (6%)               | <0.001†|
| Department operating normally (yes)        | 1 327 (76%)     | 1 (14%)         | 1 326 (76%)            | 0.001†|
| PPE level                                  |                 |                 |                        | 0.720|
| Primary                                    | 706 (40%)       | 4 (57%)         | 702 (40%)              |     |
| Secondary                                  | 559 (32%)       | 1 (14%)         | 558 (32%)              |     |
| Three-level                                | 421 (24%)       | 2 (29%)         | 419 (24%)              |     |
| None                                       | 69 (4%)         | 0               | 69 (4%)                |     |

†P-values were derived from the χ²-test or Fisher’s exact test. *Represents statistical significance.

COVID-19, coronavirus disease 2019; PPE, personal protective equipment.

Figure 1 shows that the anxiety level of 59.94% of the respondents was ≥5 points.

Furthermore, 71.43% of those infected expressed the need for psychological interventions. However, just 14.04% of the Wuhan respondents and 11.74% in other regions sought psychological support. In addition, 42.85% of the respondents reported that their workload reduced drastically compared with that before the outbreak, 22.96% felt more pressure, 33.50% reported neither an increase nor a decrease in stress, and 0.68% were on vacation.

4  | DISCUSSION

As we all know, Wuhan was the epicenter of the epidemic, where COVID-19 was first detected and reported.6,7 The risks of early exposure and infection for medical staff in Wuhan were higher than those for their counterparts in other areas. Furthermore, as a high-risk COVID-19 group, cancer patients have a much higher disease prevalence rate than other groups – this might be why the infection rate of the RT staff in Wuhan was much higher than that of their...
In addition, the risk of infection in designated COVID-19 hospitals is higher than that in other hospitals, possibly due to more contact with COVID-19 patients.

After the outbreak, the psychological pressure felt by medical staff as a result of contact with COVID-19 patients was significantly higher than that as a result of contact with uninfected patients, as was the anxiety induced by COVID-19, with its symptoms including cough, breathing difficulties, and fatigue among those infected. Therefore, psychological interventions are necessary. The anxiety might also arise from insufficient knowledge about the disease. Meanwhile, workload reduction has helped lower stress among medical staff and improve their immunity. However, the shutdown of some radiation oncology departments, or workload reduction after the outbreak, affected cancer patients, as well as RT staff, which caused a great deal of concern.

The results of the present study must be interpreted cautiously, and this study had several limitations. First, being a retrospective study based on data from an online questionnaire, it is susceptible to recall bias. In addition, the older staff might have been unaccustomed to mobile software and, therefore, not participated in the survey, while those with severe symptoms must not have been able to as well – this is a limitation of online surveys. Furthermore, the number of infected RT staff was too small.

In conclusion, the present study provides information about the status of RT staff during the epidemic, which might help other regions or countries take action to protect their RT personnel from COVID-19, as well as maintain RT appropriately.

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CONFLICT OF INTEREST
The authors declare that they have read the article and there are no competing interests.

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