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Occupational Health Management of Medical Radiation Staff in Chongqing's Jiulongpo District

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Abstract: ***Objective**: This study aimed to analyze the basic demographics, occupational health management, and the availability of personal protective equipment among radiation workers in radiological diagnosis and treatment institutions (excluding dental clinics) in Jiulongpo District from 2022 to 2024. The goal was to provide data to support the prevention of occupational radiation diseases in the district and offer evidence for health authorities to optimize regulatory measures. **Methods**: Based on the occupational radiation disease surveillance project in Jiulongpo District, a questionnaire survey was conducted to statistically analyze the number of radiation workers, their occupational health management status, and the provision of personal protective equipment in radiological institutions at various levels. **Results**: (1) Number of institutions: The total number of radiological diagnosis and treatment institutions in Jiulongpo District remained generally stable from 2022 to 2024, with no significant fluctuations observed. (2) Occupational health management: The individual dose monitoring rate for radiation workers and the filing rate for occupational health surveillance both reached 100%. The rate of possessing required qualifications increased year by year, rising from 89.8% in 2022 to 100% in 2024. (3) Availability of protective equipment: The availability rate of personal protective equipment in the field of X-ray image diagnosis showed an upward trend, while the availability rate in interventional radiology and nuclear medicine remained consistently at 100%. **Conclusions**: The occupational health management of radiation workers in Jiulongpo District showed significant improvement over the three-year period. However, the provision of personal protective equipment in the field of X-ray image diagnosis requires further implementation. It is recommended that health authorities strengthen macro-level regulation and promote the optimization of resource allocation to comprehensively enhance the occupational health management level of radiological diagnosis and treatment institutions.*

Keywords: Radiological Diagnosis and Treatment Institutions, Radiation Workers, Occupational Health Management, Personal Protective Equipment.

1. Introduction

In recent years, with the rapid proliferation of radiological diagnosis and treatment technologies and the continuous refinement of relevant standards, the occupational health of radiation workers had garnered increasing attention from various sectors of society [1]. To comprehensively understand the status of occupational health management in radiological diagnosis and treatment institutions in Jiulongpo District and to gain in-depth insight into the occupational health surveillance of radiation workers, the district had persistently carried out systematic monitoring of occupational radiation diseases [2-3]. The aim was to identify and control the risks of occupational radiation diseases, provide foundational data for their prevention and treatment, and offer a scientific basis for the national formulation of policies on the prevention and treatment of occupational radiation diseases and the revision of national radiological health standards, thereby protecting the occupational health rights and interests of radiation workers and improving the health level of the population [4-5]. In accordance with the explicit stipulations of the "Law of the People's Republic of China on the Prevention and Control of Occupational Diseases" and in strict compliance with the specific requirements of the "Chongqing Municipal Monitoring Plan for Occupational Radiation Diseases (2022-2024)", a three-year continuous investigation and monitoring was conducted among all radiological diagnosis and treatment institutions within Jiulongpo District. This effort not only effectively safeguarded the occupational health rights and interests of radiation workers but also comprehensively enhanced the occupational health management level of the district's radiological institutions through comprehensive measures such as optimizing work procedures, improving protective facilities, and strengthening training and education. These actions laid a solid foundation for building a safer and more standardized radiological diagnosis and treatment environment, ultimately achieving the synergistic development of safeguarding medical personnel's occupational health and improving the quality of medical services [6-9].

2. Objects and Methods

2.1 Survey Subjects

The subjects of this study were radiation diagnosis and treatment institutions (excluding dental clinics) in Jiulongpo District, Chongqing. Based on the monitoring protocol, an investigation and analysis were conducted on the number of radiation workers, occupational health management, and the availability of personal protective equipment in these institutions.

2.2 Survey Methods

The survey was developed in accordance with the *Chongqing Occupational Radiation Disease Monitoring Work Plan* (2022–2024), tailoring the content to suit the local context. Data were collected by completing the *Report on Occupational Health Management of Radiation Workers in Radiation Diagnosis and Treatment Institutions*.

2.3 Quality Control

This study strictly adhered to the "three unifications" principle in conducting the survey, namely unified methods,

unified standards, and unified quality control measures, to ensure research quality. During implementation, all survey forms were standardized questionnaires designed under the protocol, covering core content such as the basic information of radiation workers, occupational health surveillance records, and personal dose monitoring. To ensure data quality, all survey personnel received specialized training, and dual-person logical verification was employed to review the data, ensuring uniformity, completeness, and standardization of the collected data, thereby providing reliable support for subsequent analysis.

3. Results

3.1 Basic Information of Radiation Workers

According to statistical data from radiation diagnosis and treatment institutions in Jiulongpo District from 2022 to 2024, the number of institutions and staffing configurations showed dynamic trends. In 2022, there were 63 radiation diagnosis and treatment institutions in the district, with 354 radiation workers. Among these, tertiary, secondary, primary, and unrated institutions accounted for 3.2% (2 institutions), 33.3% (21 institutions), 25.4% (16 institutions), and 38.1% (24 institutions), respectively, corresponding to 26, 193, 33, and 102 radiation workers. The institutions had an average of 5.6 staff members. By 2023, the total number of institutions increased to 68, with 396 workers. The number of tertiary institutions doubled to 4 (accounting for 5.9%), and their workers significantly increased to 59. Secondary institutions rose to 23 (205 workers), primary institutions to 18 (35 workers), and unrated institutions decreased to 23 (97 workers). The average staffing per institution increased to 5.8. By 2024, the total number of institutions decreased to 65, with 379 workers. Tertiary institutions continued to grow to 6 (9.2%), with workers exceeding 100 (102 workers). Secondary institutions decreased to 20 (145 workers), primary institutions remained at 18 (40 workers), and unrated institutions dropped to 21 (92 workers). The average staffing per institution stabilized at 5.8. Details are shown in Table 1.

3.2 Basic Information of Occupational Health Management

According to the occupational health management data of radiological diagnosis and treatment institutions in Jiulongpo District from 2022 to 2024, the establishment rate of individual dose monitoring and occupational health surveillance records for medical radiation workers remained at 100% for three consecutive years, corresponding to 354, 396, and 379 individuals, respectively. During the same period, the proportion of practitioners holding radiation worker certificates showed a increasing trend, with 318 individuals (89.8%), 364 individuals (91.9%), and 379 individuals (100.0%), respectively. In 2024, full certification was achieved. See Table 2 for details.

Table 1: Basic Information Questionnaire of Radiation Workers (2022–2024)

Year	*Institution Level*	*No. of Institutions*	*Male Radiation Workers*	*Female Radiation Workers*	*Total Radiation Workers*	*Ave. per Institution*
2022	Tertiary	2	14	12	26	13.0
	Secondary	21	111	82	193	9.2
	Primary	16	13	20	33	2.1
	Unrated	24	57	45	102	4.3
	Total	63	195	159	354	5.6
2023	Tertiary	4	33	26	59	14.8
	Secondary	23	105	100	205	8.9
	Primary	18	16	19	35	1.9
	Unrated	23	55	42	97	4.2
	Total	68	209	187	396	5.8
2024	Tertiary	6	54	48	102	17.0
	Secondary	20	82	63	145	7.3
	Primary	18	21	19	40	2.2
	Unrated	21	53	39	92	4.4
	Total	65	210	169	379	5.8

Table 2: Questionnaire on Basic Information of Occupational Health Management (2022-2024)

Year	*Radiation Workers*	*Monitored*	*Monitoring Rate (%)*	*Records Filed*	*Filing Rate (%)*	*Certified*	*Certification Rate (%)*
2022	354	354	100.0	354	100.0	318	89.8
2023	396	396	100.0	396	100.0	364	91.9
2024	379	379	100.0	379	100.0	379	100

3.3 Availability of Personal Protective Equipment

According to the *Requirements for Radiological Protection in Diagnostic Radiology* (GBZ 130-2020), radiological diagnosis and treatment institutions are required to provide corresponding protective equipment for both workers and patients based on the nature of the work [9]. This survey statistically analyzed the availability of personal protective equipment in radiological diagnosis and treatment institutions in Jiulongpo District from 2022 to 2024, covering three categories: X-ray imaging diagnosis, nuclear medicine, and interventional radiology. In the field of X-ray imaging diagnosis, the availability rate of lead rubber aprons increased from 92.5% in 2022 to 95.4% in 2024; lead rubber caps rose from 88.8% to 93.9%; lead rubber thyroid collars increased from 89.4% to 94.9%; the availability rates of lead rubber gloves and lead protective eyewear remained at a high level, increasing from 97.5% and 97.5% to 99.0%, respectively. In contrast, the availability rates of protective equipment (including lead aprons, lead caps, lead thyroid collars, lead gloves, and protective eyewear) in nuclear medicine and interventional radiology all reached 100.0% over the three years, meeting the requirements of national standards. See Tables 3 and 4 for details.

Table 3: Questionnaire on Basic Information of Personal Protective Equipment (2022-2024)

Year	*Category*	*Lead Rubber Aprons*	*Lead Rubber Caps*	*Lead Rubber Thyroid Collars*	*Lead Rubber Gloves*	*Lead Protective Eyewear*
2022	X-ray Imaging Diagnosis	159	160	164	64	56
	Nuclear Medicine	5	5	5	5	5
	Interventional Radiology	17	13	18	9	10
	Total	181	178	187	78	71
2023	X-ray Imaging Diagnosis	164	161	170	57	54
	Nuclear Medicine	5	5	5	5	5
	Interventional Radiology	17	13	18	7	10
	Total	186	179	193	69	69
2024	X-ray Imaging Diagnosis	178	192	200	53	51
	Nuclear Medicine	8	7	7	5	6
	Interventional Radiology	24	22	22	17	17
	Total	210	221	229	75	74

Table 4: Personal Protective Equipment Availability Rate (2022-2024)

Year	*Category*	*Number of Equipment*	*Lead Rubber Apron Availability Rate (%)*	*Lead Rubber Cap Availability Rate (%)*	*Lead Rubber Thyroid Collar Availability Rate (%)*	*Lead Rubber Glove Availability Rate (%)*	*Lead Protective Eyewear Availability Rate (%)*
2022	X-ray Imaging Diagnosis	160	92.5	88.8	89.4	97.5	97.5
	Nuclear Medicine	1	100.0	100.0	100.0	100.0	100.0
	Interventional Radiology	3	100.0	100.0	100.0	100.0	100.0
2023	X-ray Imaging Diagnosis	177	92.1	89.3	89.3	98.3	98.9
	Nuclear Medicine	1	100.0	100.0	100.0	100.0	100.0
	Interventional Radiology	3	100.0	100.0	100.0	100.0	100.0
2024	X-ray Imaging Diagnosis	197	95.4	93.9	94.9	99.0	99.0
	Nuclear Medicine	3	100.0	100.0	100.0	100.0	100.0
	Interventional Radiology	6	100.0	100.0	100.0	100.0	100.0

4. Discussion

Monitoring data from the past three years indicate that the total number of radiological diagnosis and treatment institutions in Jiulongpo District remained stable between 63 and 68 (excluding dental clinics). The number of tertiary hospitals increased by 200%, while the total number of radiation workers ranged from 354 to 396. The average number of workers per institution increased from 5.6 to 5.8, with males significantly outnumbering females (sex ratio 1.2:1), reflecting the impact of occupational exposure risks on female career choices. Notable achievements were observed in occupational health management: the establishment rate of personal dose monitoring and health surveillance records remained at 100% for three consecutive years, the certification rate increased by 10.2% over the three years, and the total availability of protective equipment grew by 16.4%. The average availability rate of personal protective equipment for X-ray imaging diagnosis rose from 93.1% to 96.4%. The workforce in tertiary institutions expanded by 292%, indicating a clear trend of resource concentration toward higher-level institutions. However, certain shortcomings persist: several institutions failed to fully comply with the standards set forth in *GBZ 130-2020: Requirements for Radiological Protection in Diagnostic Radiology*, particularly regarding the provision of personal protective equipment for X-ray imaging diagnosis. Furthermore, secondary and lower-level institutions experienced a 15.5% loss of personnel, contrasting sharply with the development of tertiary institutions [10]. By analyzing the number of radiation workers, the status of occupational health management, and the availability of radiological protective equipment in the district, gaps and deficiencies in the local radiological health work were identified. It is recommended that training, personal dose monitoring, and occupational health surveillance for radiation workers be carried out strictly in accordance with the *Administrative Measures on Occupational Health of Radiation Workers*. The provision and use of radiological protection equipment and devices in medical institutions must be rigorously implemented following *GBZ 130-2020: Requirements for Radiological Protection in Diagnostic Radiology* [11]. A tiered supervision mechanism should be adopted, with a focus on inspecting the use efficiency of equipment in tertiary institutions and strengthening compliance reviews of equipment availability in primary institutions. A “tertiary-level guidance + equipment sharing” model should be established to balance resource allocation, and a digital platform should be introduced to enable dynamic management of training, dose monitoring, and health records. Institutions failing to meet the standards should be subject to “rectification orders within a specified time limit,” and the availability of protective equipment should be incorporated as a core indicator in institutional accreditation. Future efforts should focus on developing an evaluation system for the use efficiency of protective equipment and tracking the long-term health effects of occupational exposure to promote the continuous optimization of the regional radiological diagnosis and treatment service system.

5. Conclusion

Over the past three years, the number of radiodiagnosis and treatment institutions in Jiulongpo District remained stable at

63 to 68. The count of tertiary hospitals grew by 200%, with their staff expanding by 292%, indicating a concentration of resources in higher-level institutions. While occupational health management achieved significant results, the implementation of the GBZ130-2020 standard was inadequate, and there was a shortage of protective equipment. Additionally, staff turnover in secondary and lower-level institutions reached 15.5%. It is recommended that tiered supervision be implemented, a "tertiary-led teaching + equipment sharing" model be established, and the inclusion of protective equipment allocation as a core indicator in institutional accreditation be enforced to promote the continuous optimization of the service system.

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