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A Study to Check the Radiation Safety and Standard Operational Compliances Guidelines by AERB in Radio diagnosis Department of Western Uttar Pradesh Hospitals, India

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ABSTRACT

Background: For patient and healthcare worker safety, radio diagnosis departments must follow radiation safety and regulatory criteria. Hospital Radiation Safety Officers (RSOs) and technicians in Western Uttar Pradesh, India, are assessed for AERB knowledge and compliance.

Objective: The main goals is to examine RSOs and technicians' knowledge of ELORA (e-Licensing of Radiation Applications) compliance, safety device compliance, and general radiation safety compliance, especially in rural regions.

Material and Methods: In Western Uttar Pradesh, 306 RSOs and technicians working in radio diagnosis departments were given a structured questionnaire via Google Forms, which was used to conduct a cross-sectional survey. The questionnaire addressed ELORA compliance, safety device compliance, and general radiation safety compliance. It was created based on prior research and AERB ELORA compliance software. The institution provided ethical clearance before the data was collected, which took place in January–June 2024.

Results: The t-test indicated that there were large gaps in respondents' knowledge. Specifically, in rural regions, the t-values for general radiation safety compliance, safety device compliance, and ELORA compliance were -4.556 ($p < 0.05$), -4.871 ($p < 0.05$), and -4.741 ($p < 0.05$), respectively.

Conclusion: RSOs and technicians, particularly in rural areas, lack radiation safety and compliance skills, according to the report. To increase compliance and radiation safety, these gaps need focused education. Train and enforce safety requirements regularly, especially in rural locations where gaps in knowledge are greater.

Keyword

Radiation Safety, AERB Guidelines, ELORA Compliance, Knowledge Gaps, Educational Interventions

Introduction

Radiology is the area of medicine that uses X-ray radiation. The radiology department has multiple diagnostic radiology equipment's like - CT Scan, X-ray (Mobile and Fixed), OPG, BMD and mammography these equipment's generating the ionizing Radiation after applying the current. X-ray radiation is a type of energy or propagation of energy discovered by W. C. Roentgen, 8th November 1895. Radiation has the power to both save and harm lives. This radiation required a safety compliance and does not cause undue risk to the health of people, occupational and the environment Radiologic technologists use the radiation to provide quality medical

Radiography, ionizing radiation can cause harmful effects not only to the subject who is exposed to it, but also to their future generations. AERB guided us about how to use the radiation as per RPR-2004 and set the regulatory framework of radiation safety and standard compliances. The radiation safety and protection awareness of RSO- radiation safety officer and technicians is very important to minimize the occupational exposure hazards and they must be aware about the radiation safety an AERB regulatory compliances. The important parameter to rule out the dose measuring of the radiation workers how they are using the TLD badge, whether all workers have TLD badge, the proper storage of TLD badge, whether all staff know about how to wearing the TLD badge. the Periodic area surveillance and quality assurance of radiation generating equipment's is compulsory for radiation protection. Safety service report to be filed at least once in a year on AERB Elora software. Separate protocols for adults and pediatric patients displayed at console room. Since gonad shield may reduce the dosage to the testes, it can be very beneficial. Equipment's are safe and secure from radiation safety point of view operational status of equipment is updated in ELORA software. Every piece of radiation equipment should have a radiation on/off light indication attached to the radiation source at the entrance gate. Record of service and maintenance, Periodic QA should be updated and timely done. Shielding adequacy should be available and satisfactory with protective barrier, viewing window glass and lead lined doors. 53 articles were therefore obtained from three databases. Only fifteen of these are suitable for inclusion. "The International Commission on Radiological Protection (ICRP) provides guidelines about radiation protection based on three principles of justification, optimization, and limitation and also states as low as a reasonably achievable" [1]. Radiation usage rises as healthcare professionals advance in their careers. TLD Badges are a common radiation monitoring tool in radiology, although most professionals don't wear them since they are unaware of their purpose[2]. Perspective on the difficulties of radiation safety at work Perspective on the difficulties of radiation safety at work [3]. '' The lack of adequate and skilled occupational also a concern [4]. A radiographer's skill set as a professional involves a variety of qualities, such as critical thinking, safety, professionalism, knowledge, risk management, and collaboration [5].'A majority have neither a national regulatory framework for radiation safety nor a regulatory body. Most of developing countries have a shortage of qualified radiation protection experts, also a lack of formal education and training [6].'' The value of patient contact shielding has minimized the low risk of exposure[7]. The correct definition of radiation safety is inverse square law [8]. '' it was recommended that occupational should undergo education and safety training after qualification [9]. '' reduction the hereditary risk by gonad shield [10]. ''staff working in radiation wards should have adequate knowledge of the risk and safety measures [11]. The current study reveals that, currently, radiographers' practices are unsatisfactory in regard to reducing radiation exposure for patients and themselves. Thus, a systematic and harmonized approach should be initiated in the form of corrective actions to ensure that radiation protection measures and standards [12]. the measurement of the occupational radiation dose plays vital role in personal protection [13]. Radiographers must take practical steps to protect patient staff and themselves. In India, there are provisions in RPR 2004 to impose penalty actions, such as suspension or withdrawal of license, fine or imprisonment, or both, against the contravener of the said act, rule and safety code (RPR 2004, AERB 2016). In addition, AERB has a system of regulatory inspection of the facilities to find out the compliance status of the regulatory requirements. This inspection is based on the AERB safety manual, SM G-3, whose conceptual framework reflects the IAEA inspection model (IAEA 2007, AERB 2014). The AERB adopts a graded approach to enforcement actions that are commensurate with the possible effects of regulatory non- compliance found in the facilities during the inspection. Such actions include a written directive or warning, shut down of the facilities, modification, suspension or withdrawal of license, and imposing penalty actions [14]. The level of awareness is critical to reduction the radiation hazard [15].

Material and Methods

DATA COLLECTION

Data collection from RSO and technicians of radio diagnosis department of hospitals and centers

SAMPLE SIZE

In this study, a sample size of 306 informed google forms is selected for comprehensive analysis. The decision to use a sample size of 306 was determined based on available resources.While a larger sample size may provide more statistical power, the selected sample size is deemed sufficient to achieve the study objectives within the specified period.

METHOD

A questionnaire survey study is conducted through google form at the Radio diagnosis Department of multiple hospitals and centers in western UP region, data collected from RSO and Technicians. The questions include the Radiation Safety and Standard Operational Compliances Guidelines by AERB in Radio diagnosis Department. The Ethical approval was obtained from the institution. The questionnaire is developed based on previous studies and AERB Elora compliances software. The survey employed a structured questionnaire specifically designed to capture relevant aspects of the radiation safety interactions with RSO and technicians of the radio diagnosis departments.

INCLUSION CRITERIA

RSO/ Technicians – Radiation Safety Officer who had recently looked out the radiology department and technicians were selected to participate in the survey.

EXCLUSION CRITERIA

1-RSO/ Technician who are not cooperating.
2-Hospital does not registered with AERB.

DURATION OF STUDY

January to June 2024

ETHICAL APPROVAL

The Ethical approval was obtained from the institution.

DATA ANALYSIS TECHNIQUES

In this study, SPSS will be used.

Hypothesis testing (T-Test)

A key statistical technique for determining the viability of research ideas is hypothesis testing, which is often carried out using T-tests. It determines if the observed facts substantially differ from what would be predicted by chance. When comparing the means of two groups to see if observed differences are statistically significant, T-tests are very helpful. T-tests are often used in scientific research because they help researchers make data-driven judgements and reasonable inferences from empirical information. There are several ways to run the t-test, including the ones listed below:

One-sample t-test: This function compares the given and extrapolated mean from a population against the mean of one group.

Paired sample t-test: Analyzes the similarities and contrasts between two measurement means obtained from the same person, item, or comparable unit. The paired sample t-test statistical approach may be used if a sample is taken from the same group as the group of individuals being studied.

An independent two-sample t-test: This is used to contrast and compare the mean values of two distinct groups. Like having two different learning groups.

Results

Introduction:

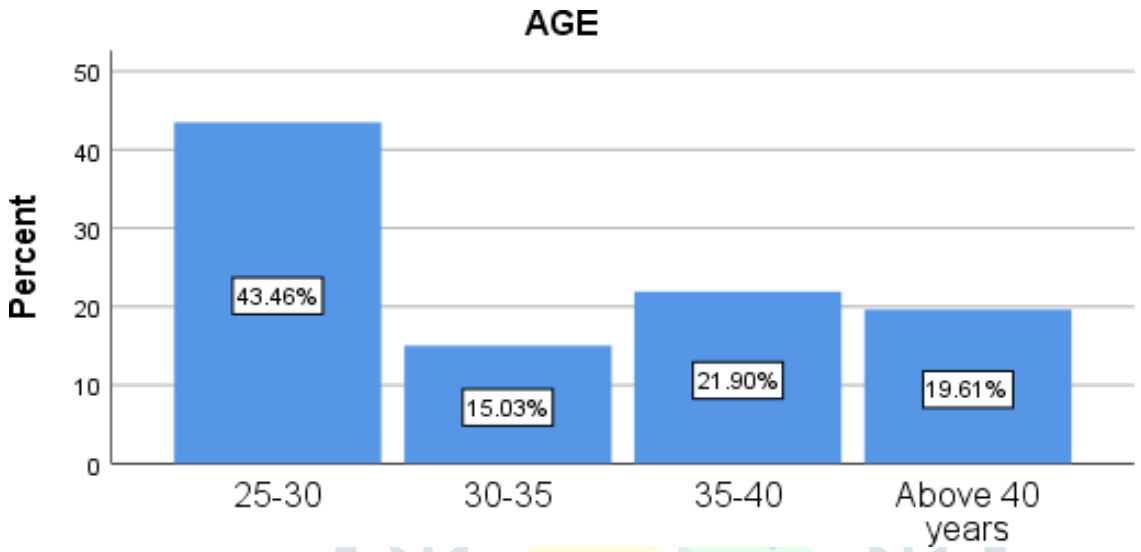
In the section under "Results," the findings of the study are presented, with a particular emphasis on outcomes that are in line with the conclusions of the research. In order to determine significant differences and connections among variables, statistical studies made use of independent t- tests. This was especially true when comparing the means of different groups. The efficiency of these tests in determining differences on continuous variables, such as scores on psychological constructs or outcome measures, was a primary factor in their selection. In order to offer context and improve comprehension of the research sample makeup, demographic data such as age, gender, and educational background were rigorously integrated into the study. The purpose of this demographic information is to bring to light possible impacts on the findings that were observed, providing insights into the ways in which participant characteristics may affect the outcomes of the research.

Table 1 Demographic Variable

		Frequency	Percent
AGE	25-30	133	43.5
	30-35	46	15.0
	35-40	67	21.9
	Above 40 years	60	19.6
	Total	306	100.0
GENDER	Male	221	72.2
	Female	84	27.5
	Others	1	0.3
	Total	306	100.0
Education	Diploma	141	46.1
	Bachelors	98	32.0
	Masters	44	14.4
	Others	23	7.5
	Total	306	100.0
Experience	1-3 years	65	21.2
	3-5 years	66	21.6
	5-7 Years	63	20.6
	Above 7 years	112	36.6
	Total	306	100.0
Employment	Private hospital	142	46.4
	Imaging Centre	89	29.1
	Clinic(Small/large)	49	16.0
	Government Hospital	11	3.6
	Others	15	4.9
	Total	306	100.0
Area	Gauthambudh Nagar	126	41.2
	Ghaziabad	59	19.3
	Bulandshahar	17	5.6

	Aligarh	20	6.5
	Hapur	16	5.2
	Meerut	24	7.8
	sharanpur	19	6.2
	Muradabad	25	8.2
	Total	306	100

Figure 1 AGE



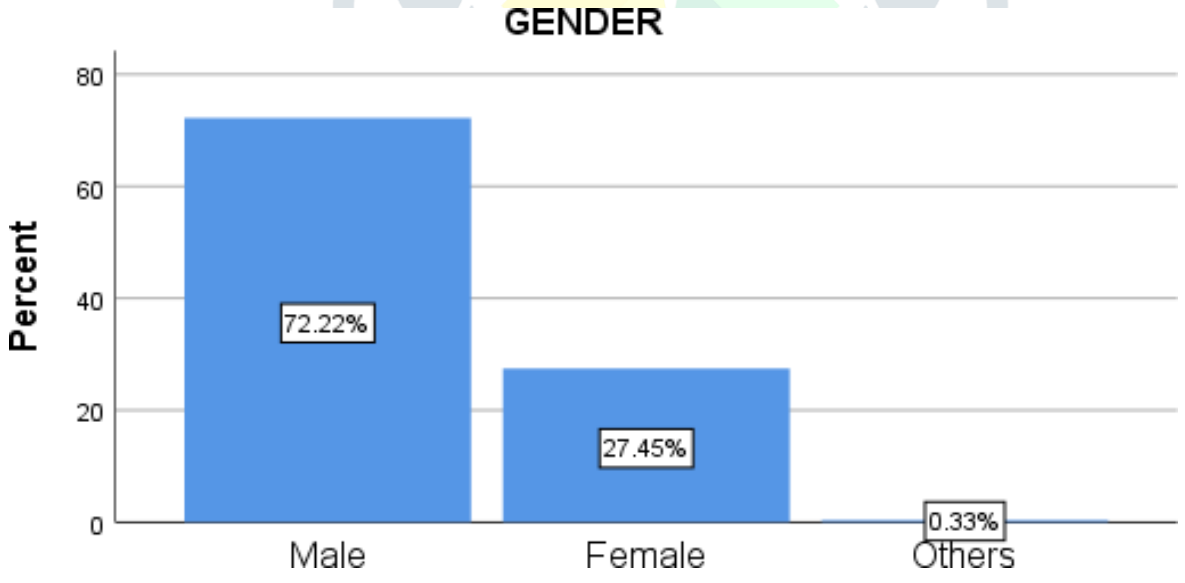


Figure 2 GENDER

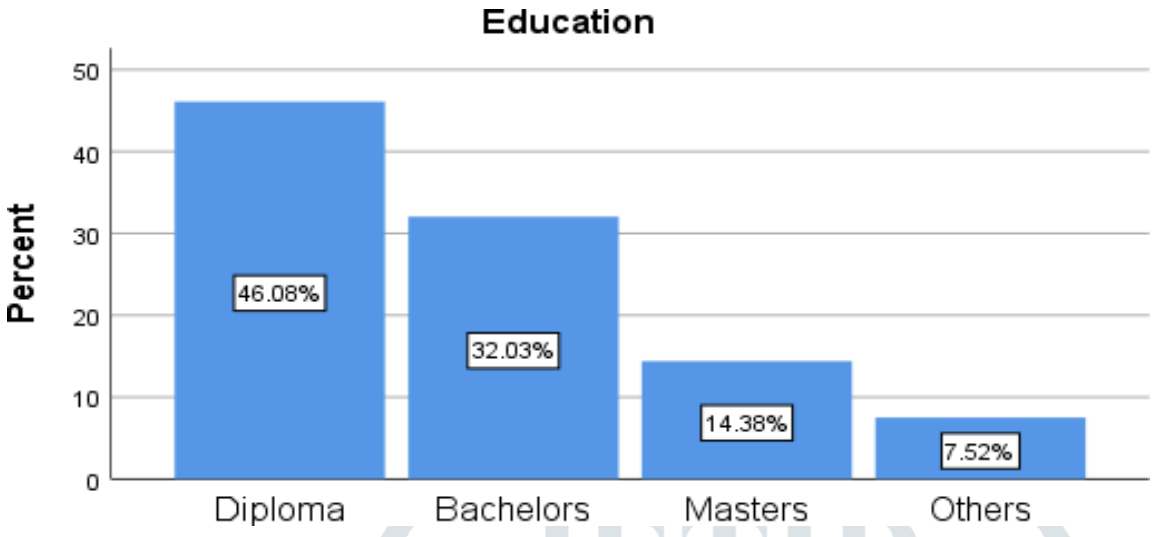


Figure 3 Education

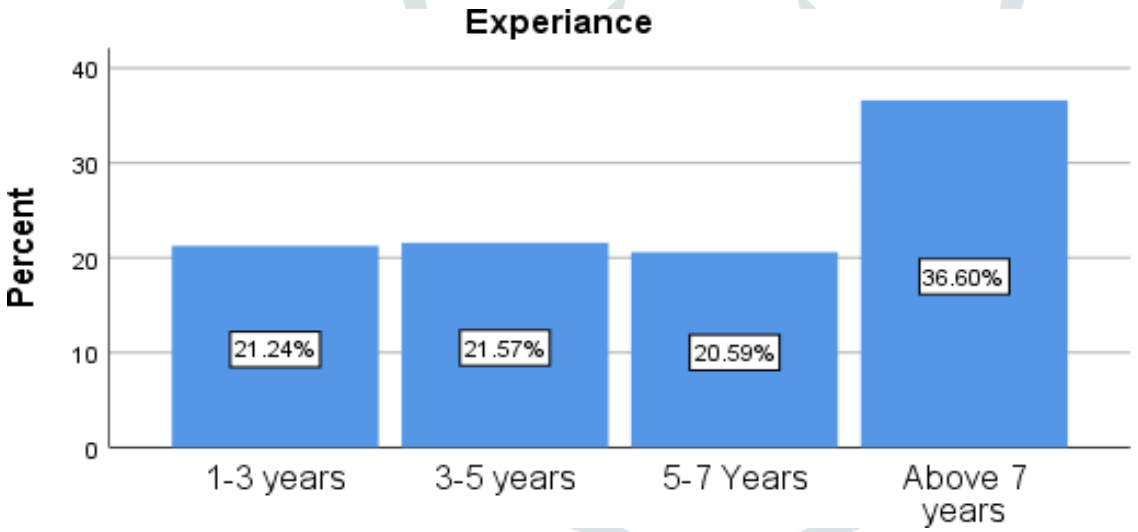


Figure 4 Experience

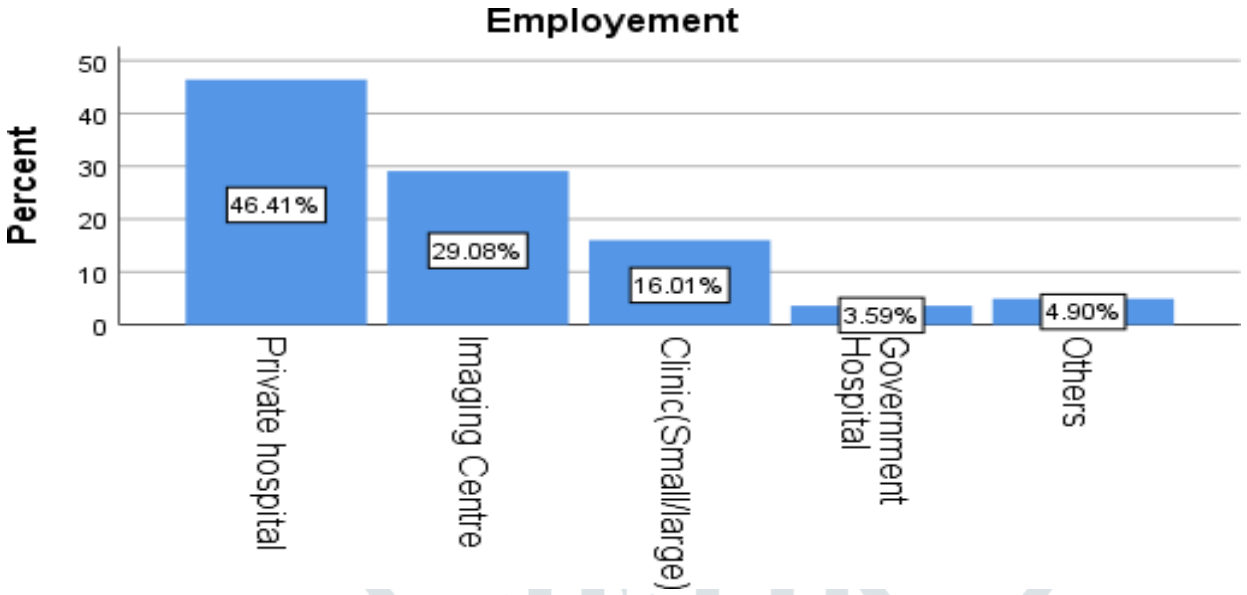


Figure 5 Employment

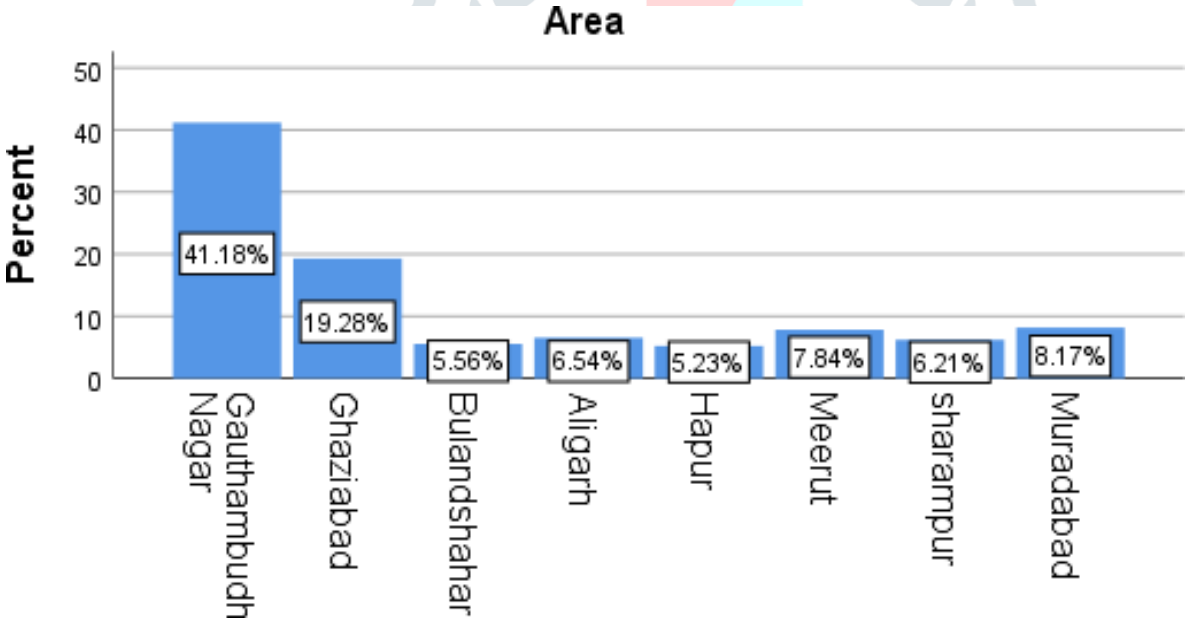


Figure 6 Are

Age: The age distribution of the respondents shows a wide range, with the bulk of respondents (n=133) falling into the 25–30-year age. The second biggest group, with 21.9% (n=67), is the 35–40-year-old age range. Respondents over 40 make up 19.6% of the sample (n = 60), with respondents between the ages of 30 and 35 making up the smallest group (n = 46). There are 306 individuals in all in this research.

Gender: Of the sample's 72.2% (n=221) male respondents, the gender distribution indicates a sizable majority of male respondents. Of the 84 respondents, 27.5% are female. Of these, one respondent, or 0.3%, identified as "Others." There have been 306 responders in all.

Education: Of the respondents, 46.1% (n=141) of the sample have a diploma,

Making up the greatest portion of their educational background.

Education: Of the respondents, 46.1% (n=141) of the sample have a diploma, making up the greatest portion of their educational background. Of the respondents, 32.0% (n = 98) have a bachelor's degree, and 14.4% (n = 44) have a master's degree. A lesser percentage, 7.5% (n=23), is categorized as "Others." There have been 306 responders in all.

Experience: The sample consisted of 112 respondents, or 36.6% of the total, who had more than 7 years of experience. The respondents' degrees of experience varied. The group with 3-5 years of experience makes up 21.6% (n=66), while the group with 1-3 years of experience is not far behind at 21.2% (n=65). Of the total respondents (n = 63), 20.6% had five to seven years of experience. There have been 306 responders in all.

Employment: Of the respondents, 46.4% (n=142) are employed in private hospitals, which accounts for over half of their work environments. Of the respondents, 29.1% (n = 89) work at imaging facilities, and 16.0% (n = 49) are employed in clinics, both small and big. Those working at government hospitals make up 3.6% (n=11), while 4.9% (n=15) fall into the "Others" group. There have been 306 responders in all.

Area: The respondents are dispersed across different regions of the country; the biggest group, accounting for 41.2% (n=126) of the sample, lives in Gautam budh Nagar. Other noteworthy places include Muradabad (8.2%, n=25), Meerut (7.8%, n=24), and Ghaziabad (19.3%, n=59). Bulandshahr (5.6%, n = 17), Aligarh (6.5%, n = 20), Hapur (5.2%, n = 16), and Sharanpur (6.2%, n = 19) include smaller groupings. There have been 306 responders in all.

Proposed Hypothesis:

H1. Knowledge of RSO/Technicians about Elora compliances.

The t-test table is shown in Table 2 below. The null hypothesis of "Levene's Test for Equality of Variances" states that variances between groups should be equal when comparing the means of two distinct groups; the alternative hypothesis is that variances differ between groups. As can be seen, this test's significant value is more than 0.05. As a result, the null hypothesis cannot be rejected. With equal variances assumed, the test's alternative hypothesis can therefore be accepted. The first row's

results are examined, and if the significance value in "Levene's Test for Equality of Variances" is less than 0.05, the null hypothesis is rejected and the second row is taken into consideration for the analysis that follows. In this case, significance value is greater than 0.05 for ELORA Compliances, so the first row is considered for the remaining analysis. From the above t-test table the t-value is -4.871 and significance value is 0.000 which The first row is taken into consideration for the remainder of the study in this instance as the significance value for ELORA Compliances is larger than 0.05. The t- value is -4.871 and the significance value is 0.000, which is less than 0.05 (the 5% significance threshold) according to the t- test table above. We are forced to accept the null hypothesis that "There is a significant difference in Knowledge of RSO/Technicians about Elora compliances" since the obtained t-value is less than -2 and the significance value is less than 0.05.

Table 2 Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
ELORA	Equal variances assumed	3.745	.054	-4.871	304	.000	-.23253	.04774
	Equal variances not assumed			-5.067	146.485	.000	-.23253	.04589

H2. Knowledge of RSO/Technicians about the safety devices compliances

Table 3 Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Safety Device Compliances	Equal variances assumed	3.260	.072	-4.741	304	.000	-.18673	.03939
	Equal variances not assumed			-5.132	158.864	.000	-.18673	.03639

The first row is taken into consideration for the remainder of the study in this instance as the significance value for Safety Device Compliances is larger than 0.05. The t-value is -4.741 and the significance value is 0.000, which is less than 0.05 (the 5% significance threshold), according to the t-test table 3 above. We are forced to accept the null hypothesis that "There is a significant difference in Knowledge of RSO/Technicians about safety device compliances" since the obtained t-value is less than -2 and the significance value is less than 0.05.

H3. Knowledge of RSO/Technicians in general radiation safety compliances,Especially in rural areas.

The first row is taken into consideration for the remainder of the study in this instance as the significance value for Safety Device Compliances is larger than 0.05. The significance value is 0.000, which is less than 0.05 (the 5% significance threshold), and the t-value is -4.556 from the t-test table 4 below. Since the obtained t-value is less than -2 and the significance value is less than 0.05, the null hypothesis—that is, "There is a significant difference in Knowledge of RSO/Technicians in general radiation safety compliances, especially in rural areas" must be accepted because we are unable to reject it.

Table 4 Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
General Radiation Safety Compliances	Equal variances assumed	.950	.330	-4.331	304	.000	-.15141	.03496
	Equal variances not assumed			-4.556	149.824	.000	-.15141	.03323

Discussion

During the process of examining the knowledge of RSOs and Technicians with respect to Elora compliances (H1), safety device compliances (H2), and general radiation safety compliances, especially in rural regions (H3), a number of patterns and insights have arisen. The majority of respondents, the majority of whom were male and many of whom had credentials, demonstrated various degrees of comprehension across all of these categories. When it comes to Elora compliances, important information gaps have been found, particularly in areas relating the operating status and the decommissioning of equipment. As a result, there is a need for educational interventions that are specifically designed to improve compliance knowledge. Compliance with safety devices indicated that respondents had a modest level of knowledge, with particular weaknesses being observed in the appropriate storage and maintenance of protective equipment. Because of the results, there is a possibility that radiation safety might be compromised owing to the insufficient application of safety standards. General radiation safety compliances brought to light the fact that knowledge gaps were more severe in rural areas, highlighting the need of enhancing training and resources in these sections of the country. In general, the research highlights the need of continuous training and the regular implementation of safety standards in order to guarantee full radiation safety compliance among RSOs and technicians. Particular attention should be paid to improving awareness in rural regions, where weaknesses are more obvious.

Conclusion

According to the findings of the investigation into the knowledge of RSOs and technicians about a variety of compliance areas, we found that all hypotheses were supported by substantial findings. The t-value for the Elora compliances t-test yielded was -4.871, witha significance level of 0.000. Since this number is less than the significance level of 0.05, we may accept the null hypothesis, which states that there is a significant difference in RSO/Technicians' understanding of Elora compliances. Furthermore, with regard to safety device compliances, the t-value was -4.741, and the significance value was 0.000, which is once again less than 0.05. Consequently, the significance value was 0.000 and the null hypothesis, which states that there is a significant difference in their understanding of radiation safety compliances, was -4.556. This indicates that there is a considerable disparity in the knowledge of RSOs and technicians in rural regions as well. This is particularly true in rural areas. The results that were similar across all tests, with t-values that were substantially less than -2 and p-values that were below 0.05, show major gaps in the knowledge of RSO/Technicians about Elora, safety equipment, and general radiation safety compliances. As a result, focused educational interventions are required

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