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Effectiveness of a Planned Teaching Programme on Knowledge Regarding Radiation Hazards and its Protection among Nursing Students of Selected Nursing Colleges in District Mandi, Himachal Pradesh

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ABSTRACT

Background: Ionizing radiation is extensively used in healthcare for both diagnostic and therapeutic purposes. However, it poses significant health risks to nursing students, healthcare workers, including nurses, due to occupational exposure. This study aimed to assess the planned teaching program in improving knowledge regarding radiation hazards and its protection among nursing students.

Objectives: To evaluate the effectiveness of a planned teaching program on knowledge regarding radiation hazards and its protection among nursing students. To determine the association between selected socio-demographic variables and the level of knowledge regarding radiation hazards and its protection.

Material and Method: Materials and Methods: A pre-experimental one-group pre-test post-test design was adopted, involving 60 nursing students (B.Sc. Nursing and GNM) selected through non-probability purposive sampling. A validated self-structured questionnaire (reliability = 0.82) was used to assess knowledge before and after the PTP. Descriptive statistics and inferential statistics were used for data analysis.

Result: The mean pre-test knowledge score was 12.63 (±4.25), while the mean post-test score increased to 19.31 (±3.51). The difference was statistically significant, ($p < 0.05$) indicating the effectiveness of the planned teaching programme there was no significant association was found between the pre-test knowledge scores and selected socio-demographic variables such as age, gender, or course, suggesting that the knowledge gap was widespread across all groups.

Conclusion: The study concluded that the planned teaching programme significantly improved students' knowledge regarding radiation hazards and its protection among nursing students. Educational interventions are essential to promote knowledge regarding radiation hazards and its protection among nursing students.

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KEYWORDS: *Radiation hazards & its protection, nursing students, planned teaching programme, knowledge.*

INTRODUCTION

Ionizing radiation is the physical process through which subatomic particles or electromagnetic waves with sufficient energy are transmitted from a source and absorbed through a substance or space. Medical imaging refers to the technology used to create images of various regions of the human body for diagnostic and treatment purposes. However, despite its many beneficial applications, radiation exposure poses considerable health hazards, including skin

erythema, burns, cataracts, infertility, and bone marrow suppression.

Radiation protection provides an adequate level of defence for humans without limiting the positive effects of radiation exposure. Various personal protective equipment (PPE), such as aprons, thyroid shields, glasses, and gloves, have been developed to shield workers from radiation exposure during interventional radiology procedures. During fluoroscopy, all operating room personnel must wear PPE unless they are standing behind a protective screen. Lead PPE garments provide radiation protection equivalent to 0.25- to 1-mm-thick lead. Most regulations require a lead-equivalent thickness of at least 0.5 mm since this can attenuate more than 90% of scatter radiation.

A general principle of radiation protection, which has been proposed by the International Commission on Radiological Protection (ICRP), states that radiation protection is based on three principles: justification, optimization (as low as reasonably achievable (ALARA)), and dose limitation This is the foundation of radiation protection strategies.

According to WHO, Ionizing radiation is a type of energy released by atoms in the form of electromagnetic waves or particles. People are exposed to natural sources of ionizing radiation, such as in soil, water, and vegetation, as well as in human-made sources, such as x-rays in medical devices. Ionizing radiation has many beneficial applications, including uses in medicine, industry, agriculture and research. As the use of ionizing radiation increases, so does the potential for health hazards if not properly used or contained. Acute health effects such as skin burns or acute radiation syndrome can occur when doses of radiation exceed very high levels. Low doses of ionizing radiation can increase the risk of longer-term effects such as cancer.

Need of Study: Rising Use of Radiation in Healthcare in recent decades, the use of ionizing radiation in healthcare has increased significantly due to advancements in medical imaging and radiation therapy. Procedures such as X-rays, CT and radiation therapy are now routinely performed across hospitals and clinics. While these technologies are invaluable in diagnosing and treating illnesses, they also expose patients and healthcare workers need to enhance awareness, knowledge, protective practices related to radiation hazards among nursing students need to maximize the benefits while minimizing the harms. Ionizing radiation poses serious health hazards if exposure is excessive or unprotected

Radiation protection, sometimes known as radiological protection, is defined by the International Atomic Energy Agency (IAEA) as "The protection of people from harmful effects of exposure to ionizing radiation, and the means for achieving this". The IAEA also states "The accepted understanding of the term radiation protection is restricted to protection of people.

The medical use of ionizing radiation has expanded worldwide. Advanced technology has opened new horizons to diagnostics and interventional radiology, nuclear medicine and radiotherapy. While this has improved patient care, inappropriate or unsafe handling of radiation technology can also pose potential health risks for both patients and health workers. There is a need to maximize the benefits while minimizing the harms. As nurses are involved in the health care practices and get engaged with radiational modalities, hence it is important to enhance their knowledge regarding radiational hazards. So researcher decided to assess the effectiveness of planned teaching program regarding radiation hazards and its protection among nursing students of selected nursing colleges at Distt. Mandi HP

Objectives:

1. To assess the knowledge regarding radiation hazards and its protection among nursing students.
2. To assess the effectiveness of planned teaching programme regarding radiation hazards and protection among nursing students.
3. To find out association of level of knowledge regarding radiation hazards and protection among nursing students with their selected socio-demographic variable.

Conceptual Framework:

Theoretical framework used for the present study is based on Ludwig von Bertalanffy's General System Theory (GST) and the Input–process–Output (IPO) model. General System Theory, developed by Bertalanffy in the 1940s, views any system—biological, social, or educational—as a set of interconnected components that work together toward a common goal. the Input–Process–Output (IPO) model is applied. The IPO model simplifies system functioning into three core components and is particularly effective for evaluating the impact of educational interventions.

Input: The input includes the demographic details of nursing students such as age, gender, year of study, and prior knowledge and their baseline knowledge on

radiation hazards and its protection assessed through a pre-test.

Throughput: The throughput refers to the implementation of the teaching programme using methods such as interactive lectures with audiovisual aids, demonstrations, Q&A sessions, and distribution of handouts.

Output: The outcome is the post-test knowledge score. Re-administration of self structured knowledge questionnaire after 7 days.

Feedback: Collected through comparison of pre-test & post-test score, observation and students response**.** Feedback helped assess the interventions success.

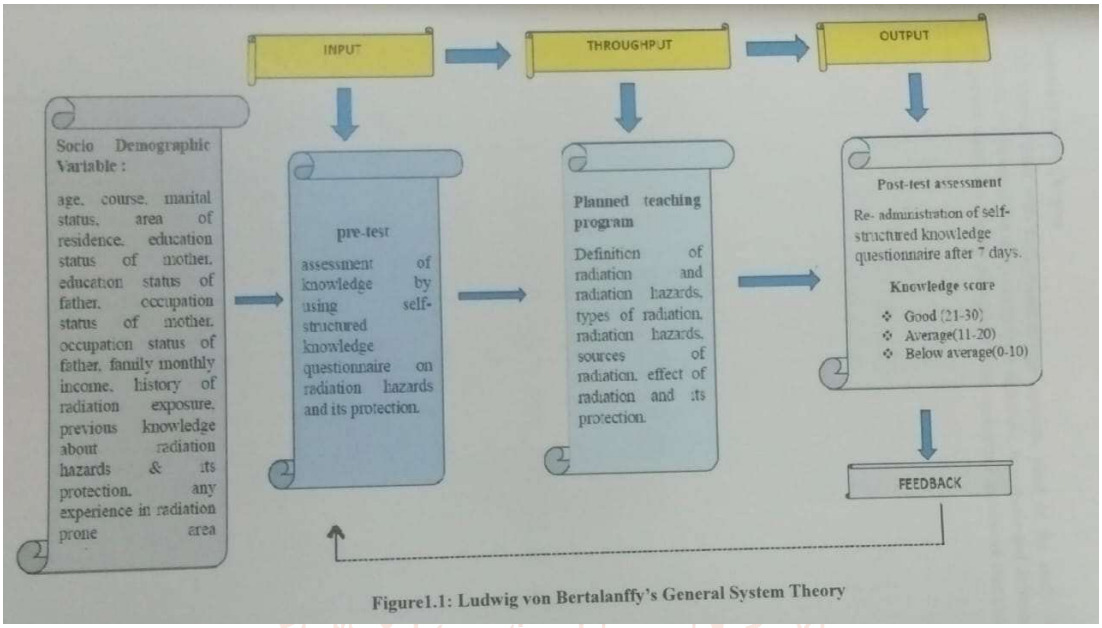


Figure1.1: Ludwig von Bertalanffy's General System Theory

Material and method:

Research approach and design: To accomplish the objective of the present study a quantitative approach, pre-experimental one group pre-test post-test research design was used to assess the knowledge among nursing students.

Research setting: The present study conducted in selected colleges at Distt. Mandi HP. Present study was conducted among nursing colleges students of Aroma college of nursing Khilra, HP Distt. Mandi and Jeevan Rekha college of nursing Sunder Nagar Distt. Mandi.

Sample and sampling technique: Sample consist of 60 students under selected setting. Non- probability purposive sampling technique was adopted for the study.

Sample Selection Criteria:

Inclusion Criteria: All the nursing student who were:

- were enrolled in B.Sc. Nursing or GNM programs.
- willing to participate in the study.
- were available during the data collection period.

Exclusion Criteria: The study were exclude students who:

- Have previously participated in a similar study on radiational hazards and protection.
- Are enrolled in Auxiliary Nurse Midwife (ANM), Post Basic B.Sc. Nursing, or M.Sc. Nursing programs.

Research Variables:

Independent Variable: Planned teaching programme on radiation hazards and protection.

Dependent Variable: Knowledge level of nursing students regarding radiation hazards and its protection.

Socio-Demographic Variables: Age, course of study, academic year, prior knowledge of radiational hazards and protection, history of radiation exposure, experience with medical imaging modalities.

Validity of the Tool: The content validity of the tool was determined by the expert's opinion the relevance of items. These experts were from the specialty of Medical Surgical Nursing. The suggestions were incorporated after consultation with the reach supervisor. The self structured knowledge questionnaire was finalized with 30 items for assessment of knowledge regarding radiation hazards and its protection among nursing students. The

self-structured knowledge questionnaire was prepared in English by language experts for the purpose of data collection Validity of tool.

Table1: Criteria for Measuring Knowledge Scores

Sr. No.	Level of Knowledge	Score Range
1	Good	21-30
2	Average	11-20
3	Below average	0-10

Maximum =30
Minimum=0

Pilot study: The pilot study was conducted in the month of July, 2025, to determine the reliability of the tool and feasibility of the study. The study was conducted in Nandini college of Nursing Kanaid District Mandi, Himachal Pradesh. Pilot Study was conducted on 10% samples. Nursing students. Written informed consent was taken from each student and prior instructions were given to students. Pre-test knowledge of both course was assessed by self-structured knowledge questionnaire. Planned Teaching Programme was given for 40 minutes pre experimental group. After seven days, post-test knowledge of groups was assessed with the help of same self-structured knowledge questionnaire.

Data collection procedure: The data collection procedure of the study was carried out in July 2025. The Investigator, prior to commencing the task of data collection by taking formal permission from the higher authorities from selected colleges of district Mandi namely Aroma college of Nursing, khilra Mandi HP & Jeevan Rekha College of Nursing Sunder Nagar Mandi HP to conduct the study. Data was collected from nursing college students from selected nursing colleges of Mandi by using self-structured knowledge questionnaire related to radiation hazards & its protection. The researcher had taken written informed consent from the college students. (The researcher introduced herself to the respondents and explained the purpose of gathering the information. On the first day pre-test was taken from group by using self-Structured Knowledge questionnaire related to radiation hazards & its protection. Planned teaching programme was administered to group and on the seventh day of post-test was taken from the group by using self-Structured Knowledge questionnaire.

Ethical considerations:

- Ethical Approval: Permission will be obtained from the Ethical Committee of Abhilashi College of Nursing, Tanda, Mandi, Himachal Pradesh.
- Institutional Permission: Consent was sought from the principals of the selected nursing colleges.
- Informed Consent: Participants were provide written informed consent after being informed about the study's purpose and procedures.
- Confidentiality: Anonymity and confidentiality of participants' data was maintained throughout the study.

Organization and presentation of data

Data analysis and interpretation of data was done according to the objectives of the study. Analysis was done by using descriptive and inferential statistics.

Section I: Description of Socio-demographic Variables.

Section II: Assessment of pre-test and post-test knowledge regarding radiation hazards and its protection.

Section III: Comparison of pre-test and post-test level of knowledge regarding radiation hazards and its protection among nursing students.

Section IV: Association of level knowledge with selected demographic variables regarding radiation hazards and its protection

Section I

Distribution of selected Socio-demographic Variables

Table no. 4.1: frequency and percentage distribution of socio-demographic variables. Among students of selected college at Distt. Mandi

N=60

Sr. no.	Socio-demographic variables	Frequency (f)	Percentage (%)
1	**Age (in years)**		
	1.1 18-23years	51	85.0
	1.2 24-29 years	9	15.0
	1.3 30-35 years	0	0.0
2	**Course**		
	2.1 GNM	30	50.0
	2.2 BSc Nursing	30	50.0
3	**Marital status**		
	3.1 Single	53	88.3
	3.2 Married	7	11.7
	3.3 Divorced	0	0.0
4	**Residence**		
	4.1 Urban	35	58.3
	4.2 Rural	25	41.7
5	**Education status of mother**		
	5.1 No formal Education	10	16.7
	5.2 Primary education	26	43.3
	5.3 Secondary education	18	30.0
	5.4 Graduate & above	6	10.0
6	**Education status of father**		
	6.1 No formal Education	4	6.7
	6.2 Primary education	15	25.0
	6.3 Secondary education	25	41.7
	6.4 Graduate & above	16	26.7
7	**Occupation status of mother**		
	7.1 Home Maker	22	36.7
	7.2 Self employed	12	20.0
	7.3 Private employee	10	16.7
	7.4 Government employee	16	26.7
8	**Occupation status of father**		
	8.1 Unemployed	12	20.0
	8.2 Self employed	22	36.7
	8.3 Private employee	12	20.0
	8.4 Government employee	14	23.3
9	**Monthly income of family**		
	9.1 Rs. <10000/-	3	5.0
	9.2 Rs.10001-20000/-	11	18.3
	9.3 Rs.20001-30000/-	20	33.3
	9.4 Rs.>30001/-	26	43.3
10	**History of Radiation exposures**		
	10.1 Yes	4	6.7
	10.2 No	56	93.3
11	**Have any Knowledge about radiation hazards its protection**		
	11.1 Yes	35	58.3
	11.2 No	25	41.7

12	**Source of information**		
	12.1 Health Personal	5	8.3
	12.2 Peer group	9	15
	12.3 Mass Media	11	18.3
	12.4 Others	10	16.7

Table 4.1 show the frequency and percentage distribution of pre-experimental group according to their sociodemographic variables.

According to the age group, the majority of participants (85%) were in the age group of 18–23 years. As per courses, equal representation was observed in the course of study. Half of the participants (50%) were enrolled in the GNM program, while the remaining 50% were pursuing B.Sc. Nursing. According to the marital status, most of the participants (88.3%) were single, According to residences, majority 58.3% of participants came from urban areas. As per educational status of mothers showed that 16.7% had no formal education, 43.3% had primary education, 30% had secondary education, and 10% were graduates or above. Educational status of fathers revealed that 6.7% had no formal education, 25% had completed primary education, 41.7% had studied up to secondary level, and 26.7% were graduates or above. Among the mothers, 36.7% were homemakers, 20% were self-employed, 16.7% were private employees, and 26.7% were government employees. Higher percentage of father were self employed 36.7% & 20% were unemployed, 20% worked as private employees, and 23.3% were government employees. According to monthly family income, Higher percentage family monthly earned more than 43.3% Rs.30,001. A small proportion (6.7%) of participants reported a history of radiation exposure, while the majority (93.3%) had no such history. Majority of the participants (58.3%) reported having knowledge about radiation hazards and its protection, while 41.7% did not possess such knowledge. The sources of information regarding radiation hazards varied. About 8.3% received information from health professionals, 15% from peer groups, 18.3% through mass media, and 16.7% from other sources.

Section II

Assessment of the pre-test and post test level of knowledge regarding radiation hazards and its protection among nursing students.

Table 4.2: Showing frequency & percentage distribution of knowledge scores.

N=60

Level of Knowledge	Pre-Test		Post-Test	
	f	%	f	%
Good	0	0.0	11	18.3
Average	15	25.0	49	81.7
Below average	45	75.0	0	0.0

Maximum = 30
Minimum=0

Table 4.2 illustrates the distribution of the participants according to their level of knowledge regarding radiation hazards and its protection shows a significant improvement after the intervention. In the pre-test, a majority of participants (75%) had below average knowledge, while 25% demonstrated an average level of knowledge. None of the participants were in the good knowledge category during the pre-test. However, in the post-test, remarkable progress was observed. No participant remained in the below average category, while 81.7% attained an average level of knowledge, and 18.3% achieved good knowledge.

Section III:

Table 4.4: Comparison of pre-test and post-test level of knowledge regarding radiation hazards and its protection among nursing students.

(n =60)

Group	Mean	S.D.	t-value	p-value
Pretest	12.63	4.25	4.156	0.000053 *
Posttest	19.31	3.51		

Maximum=30 highly significant ($p < 0.05$)
Minimum=0

Table 4.4: revealed that Comparison of pre-test and post-test level of knowledge regarding radiation hazards and its protection among nursing students. The mean pre-test knowledge score was 12.63 ± 4.25, while the mean

post-test score increased to 19.31 ± 3.51. The calculated *t*-value was 4.156 with a corresponding *p*-value of 0.000053, which is highly significant ($p < 0.05$). This indicates that the difference between pre-test and post-test knowledge scores was statistically significant. Hence, the planned teaching programme was effective in improving the knowledge of participants regarding radiation hazards and its protection.

Section IV:

Table 4.5: Association of level knowledge with selected socio- demographic variables regarding radiation hazards and its protection.

N=60

Sr. no.	Socio-demographic variables	Below Average	Average	DF	Chi-square	p-Value
1	**Age (in years)**					
	1.1 18-23years	37	14	1	0.107	.744
	1.2 24-29 years	7	2			
	1.3 30-35 years	0	0			
2	**Course**					
	2.1 GNM	22	8	1	0.00	1
	2.2 BSc Nursing	22	8			
3	**Marital status**					
	3.1 Single	38	15	1	0.621	.431
	3.2 Married	6	1			
	3.3 Divorced	0	0			
4	**Residence**					
	4.1 Urban	25	10	1	22	8
	4.2 Rural	19	6			
5	**Education status of mother**					
	5.1 No formal Education	7	3	3	0.376	.945
	5.2 Primary education	19	7			
	5.3 Secondary education	13	5			
	5.4 Graduate & above	5	1			
6	**Education status of father**					
	6.1 No formal Education	2	2	3	1.227	.746
	6.2 Primary education	11	4			
	6.3 Secondary education	19	6			
	6.4 Graduate & above	12	4			
7	**Occupation status of mother**					
	7.1 Home Maker	16	6	3	0.527	.913
	7.2 Self employed	8	4			
	7.3 Private employee	8	2			
	7.4 Government employee	12	4			
8	**Occupation status of father**					
	8.1 Unemployed	8	4	3	0.490	.921
	8.2 Self employed	16	6			
	8.3 Private employee	9	3			
	8.4 Government employee	11	3			
9	**Monthly income of family**					
	9.1 Rs. <10000/-	1	2	3	3.144	.370
	9.2 Rs.10001-20000/-	9	2			
	9.3 Rs.20001-30000/-	14	6			
	9.4 Rs.>30001/-	20	6			
10	**History of Radiation exposures**					
	10.1 Yes	2	2	1	1.193	.275
	10.2 No	42	14			

11	**Have any Knowledge about radiation hazards its protection**					
	11.1 Yes	25	10	1	0.156	.696
	11.2 No	19	6			
12	**Source of information**					
	12.1 Health Personal	3	2	4	0.695	.982
	12.2 Peer group	7	2			
	12.3 Mass Media	8	3			
	12.4 Others	7	3			

Table 4.5: Association of level knowledge with selected socio- demographic variables regarding radiation hazards and its protection**.** The Chi-square analysis revealed that none of the socio-demographic variables had a significant association with the level of knowledge regarding radiation hazards and its protection. Age (χ^2 = 0.107, p = 0.744), course of study (χ^2 = 0.000, p = 1), marital status (χ^2 = 0.621, p = 0.431), and place of residence (χ^2 = 0.156, p = 0.693) showed no significant relationship with knowledge. Similarly, the educational status of the mother (χ^2 = 0.376, p = 0.945) and father (χ^2 = 1.227, p = 0.746), occupational status of the mother (χ^2 = 0.527, p = 0.913) and father (χ^2 = 0.490, p = 0.921). As well as monthly family income (χ^2 = 3.144, p = 0.370) were not significantly associated with knowledge levels. History of radiation exposure (χ^2 = 1.193, p = 0.275), prior knowledge about radiation hazards and its protection (χ^2 = 0.156, p = 0.696), and source of information (χ^2 = 0.695, p = 0.982) also did not show any significant association. Thus, it can be concluded that socio-demographic characteristics of participants had no influence on their knowledge level regarding radiation hazards and protection.

Discussion:

To assess the knowledge of regarding radiation hazards and its protection among nursing students the distribution of participants according to their level of knowledge regarding radiation hazards and its protection shows a significant improvement after the intervention. In the pre-test, a majority of participants (75%) had below average knowledge, while 25% demonstrated an average level of knowledge. None of the participants were in the good knowledge category during the pre-test. However, in the post-test, remarkable progress was observed. No participant remained in the below average category, while 81.7% attained an average level of knowledge, and 18.3% achieved good knowledge.

To assess the effectiveness of planned teaching programme regarding radiation hazards and protection among nursing students the mean pre-test knowledge score was 12.63 ± 4.25, while the mean post-test score increased to 19.31 ± 3.51. The calculated t-value was 4.156 with a corresponding p-value of 0.000053, which is highly significant ($p < 0.05$). This indicates that the difference between pre-test and post-test knowledge scores was statistically significant. Hence, the planned teaching programme was effective in improving the knowledge of participants regarding radiation hazards and its protection.

To find out association of level of knowledge score with their selected sociodemographic variable the Chi-square analysis revealed that none of the socio-demographic variables had a significant association with the level of knowledge regarding radiation hazards and its protection. Age (χ^2 = 0.107, p = 0.744), course of study (χ^2 = 0.000, p = 0.614), marital status (χ^2 = 0.621, p = 0.431), and place of residence (χ^2 = 0.156, p = 0.693) showed no significant relationship with knowledge. Similarly, the educational status of the mother (χ^2 = 0.376, p = 0.945) and father (χ^2 = 1.227, p = 0.746), occupational status of the mother (χ^2 = 0.527, p = 0.913) and father (χ^2 = 0.490, p = 0.921), as well as monthly family income (χ^2 = 3.144, p = 0.370) were not significantly associated with knowledge levels. History of radiation exposure (χ^2 = 1.193, p = 0.275), prior knowledge about radiation hazards and its protection (χ^2 = 0.156, p = 0.696), and source of information (χ^2 = 0.695, p = 0.982) also did not show any significant association. Thus, it can be concluded that socio-demographic characteristics of participants had no influence on their knowledge level regarding radiation hazards and protection.

Conclusion:

The study demonstrated that the planned teaching programme significantly improved nursing students' knowledge regarding radiation hazards and their protection. The shift from 73% Below average knowledge in the pre-test to 80% average and 20% good knowledge in the post-test highlights the effectiveness of the intervention.

Recommendations

1. Replicate the study with a larger sample size across multiple nursing colleges to enhance generalizability.

2. Conduct comparative studies between nursing students in different regions or institutions to identify regional variations in knowledge levels.
3. Implement a true experimental design with a control group to further validate the effectiveness of the PTP.
4. Use random sampling techniques to improve the representativeness of the sample.
5. Explore additional educational interventions, such as simulation-based training or e-learning modules, to enhance radiation safety knowledge.
6. Assess students' attitudes and practices alongside knowledge to provide a holistic evaluation of the PTP's impact.
7. Investigate the long-term retention of knowledge and its application in clinical settings post-intervention.

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