

KNOWLEDGE OF RADIATION THERAPY: PRINCIPLES, CLINICAL APPLICATIONS, AND RADIATION SAFETY AMONG NURSING STUDENTS IN CHITWAN, NEPAL

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ABSTRACT

Radiation therapy uses high-energy radiation such as X-rays, protons, or gamma rays to destroy or shrink tumor cells. Nurses and nursing students play an important role in providing safe care to patients receiving radiation therapy; therefore, adequate knowledge is essential to minimize risks and enhance quality care. The objective of the study was to assess the level of knowledge regarding radiation therapy among BNS oncology nursing students at B.P. Koirala Memorial Cancer Hospital Nursing College. A descriptive cross-sectional study was conducted among 135 nursing students Census method was used. Data was collected using a self-administered structured questionnaire and analyzed with Statistical Package for Social Science (SPSS) version 22. Descriptive (frequency, percentage, mean and standard deviation) and inferential (Chi-square) statistics were calculated. Findings of the study revealed that the respondents' age ranged from 20 to 35 years with a mean and standard deviation 25.15 ± 2.99 . Most of the respondents were in the age group 23–27 years and unmarried 64.4%. More than three quarters (78.5%) of the respondents had good level of knowledge regarding radiation therapy followed by moderate knowledge (15.6%) and poor knowledge (5.9%). Knowledge was significantly associated with age and academic year ($p > 0.05$) but not with marital status, religion, or ethnicity. This study concludes that although the majority of nursing students had good knowledge regarding radiation therapy, a portion still demonstrated inadequate understanding. Continuous education, clinical exposure, and inclusion of radiation therapy in the nursing curriculum might help to enhance to strengthen competency and ensure safe nursing practice in oncology setting.

KEYWORDS: Radiation therapy, Radiation safety, Oncology.

LIST OF ABBREVIATIONS

RT	:	Radiation therapy
SD	:	standard deviation
FCHS	:	fatima college of health science
UCMS	:	Universal college of medical science
SPSS	:	Statistical Package For Social Science

CHAPTER I INTRODUCTION

1.1 Background

Radiation is the transmission of energy in the form of light or tiny particles that are too small to see.^[1] Radiation therapy is a type of cancer treatment that uses intense beams of energy to kill cancer cells. Radiation therapy often uses X-rays, but protons or other types of energy can also be used. It may be used as the primary

treatment for cancer or combined with surgery, chemotherapy and/or hormonal therapy. Most types of cancer can be treated with radiation in some way.^[2]

Radiotherapy is used with both curative and palliative intent: to treat early-stage or locally advanced tumours and for symptom management in advanced disease. It can be delivered systemically (external-beam RT) or internally (brachytherapy). Nearly 40% of the cancer patient receive at least 1 course of radiation therapy (RT).^[3]

According to GLOBOCAN 2022, there were approximately 20 million new cancer cases globally, with around 10 million patients requiring radiation therapy.^[4]

The Asia Ocean Federation of Organization for Medical Physics (AFOMP) reported that 62.5% of cancer require radiation therapy. A recent study conducted in 21 Asian countries showed that, out of 8.83 million cancer patient, 5.52 million therapy of radiation needed as a major treatment modality.^[5]

In the context of Nepal, the report of BPKMCH of 2023 showed that the number of cancer patients receiving radiation therapy is 2800 (External beam radiation therapy :1994 and brachytherapy; 806).^[6]

Globally, More than 14 million new cases of cancer are diagnosed each year and radiation therapy (RT) has the potential to improve the rates of cure of 3.5 million people and provide palliative relief for an additional 3.5 million people. These conservative estimates are based on the fact that approximately 50 percent of all cancer patients can benefit from RT in the management of their disease.^[7]

Radiation therapy utilization rates for cancer vary widely internationally. It has previously been suggested that approximately 50% of all cancer patients should receive radiation.^[5] In 2016, there were an estimated 3.05 million cancer survivors treated with radiation, accounting for 29% of all cancer survivors.^[8]

Radiation protection is the core of radiography for safe radiation-based imaging practice.^[9] Radiation protection shielding devices should be used to help maintain personnel exposures as low as reasonably achievable. Body protection tools include lead aprons, thyroid shields, radiation protection cabins, and floor- and table-mounted shields. Eye protection tools include leaded glasses, ceiling-mounted shields, and protective patient drapes. Hand protection tools include leaded surgical gloves and protective patient drapes.^[10]

Over the last 100 years, ongoing advances in the techniques of radiation treatment and progress made in understanding the biology of cancer cell responses to radiation will endeavor to increase the survival and reduce treatment related side effects for cancer patients.^[11] Although technique improvements have drastically reduced the occurrence of RT-related toxicity, most patients still experience burdensome RT side effects. Radiotherapy side effects may be local or general, and manifest in tissues or organs that were irradiated. Side effects manifesting within weeks after RT completion are termed as early and those occurring months or years after treatment are termed late.^[6]

1.2 Rational of the Study

Nurses and healthcare workers are potentially at risk of exposure to ionizing radiation. Awareness of the use and protection of radiation in everyday clinical practice is important for relevant professional groups.^[12]

Properly educating patients in radiation therapy requires competent, knowledgeable nurses. While nurses complete educational programs consisting of traditional, core didactic courses, few have received formal training in radiation therapy. Consequently, nurses who choose to specialize in oncology, and specifically radiation-oncology, rely primarily on their sole source of education.^[13]

A cross-sectional descriptive online survey was conducted at Sri Lanka with a pre-designed questionnaire among 108 nursing undergraduates Dec 31, 2022 about the awareness of radiation hazards and protection. The findings of the present study suggest that there is a lack of awareness of radiation protection among undergraduate nursing students. Therefore, enhancing medical education on radiation hazards and protection is essential.^[14]

The vast majority of nurses (93.2%) stated that their knowledge about radiation oncology was which were about the curative indications of radiotherapy ($p=0.001$), its use in oncological emergencies ($p=0.01$), and radiotherapy equipment ($p=0.01$). and concludes that, it is of great significance for nurses to be aware of the general aspects and side effects of radiation therapy as one of the main modalities in oncology. It must be considered to create both graduate and post-graduate education programs about radiation oncology to increase the exposure among nurses.^[12] inadequate. Furthermore, nurses with work experience of 12 years and more, who were defined as an experienced group, gave statistically significantly better answers to the three questions.^[15]

Although the exposure to nursing staff is generally lower than the allowable radiation worker dose limits, awareness and overcoming fears of radiation exposure is essential in order to perform routine activities in certain departments. Furthermore, the nursing staff, whether they are defined as radiation workers or not, must be able to respond to any radiological emergencies and provide care to any patient affected by radiation.^[15]

Overall, the knowledge of radiation protection and awareness of radiation hazards among the participants were poor (51.55% and 37.17%, respectively).^[16]

There are different study conducted on knowledge regarding radiation therapy among medical student, nursing student and radiology department in different countries. Those studies shows student have the inadequate knowledge regarding radiation therapy.

In Nepal, There are limited studies regarding radiation therapy. The research has not been conducted on B.P Koirala Memorial Cancer Hospital yet.

Hence, the study on knowledge regarding radiation therapy among BNS oncology nursing student are not done till date so, the researcher wants to assess the

knowledge regarding radiation therapy among BNS oncology nursing student at BPKMCHNC.

1.3 Objective of the Study

1.3.1 General Objective

To assess the knowledge regarding radiation therapy among BNS oncology nursing student.

1.3.2 Specific Objective

To find out the level of knowledge regarding radiation therapy.

To find out the association between level of knowledge and selected socio demographic variable.

1.4 Significance of the Study

Finding of the study might be helpful to identify the knowledge regarding radiation therapy among nursing student's.

Finding Might be helpful the college to prepare for students before appearing practical exposure.

The findings of the study might be helpful in providing baseline information for further researcher.

1.5 Conceptual Framework

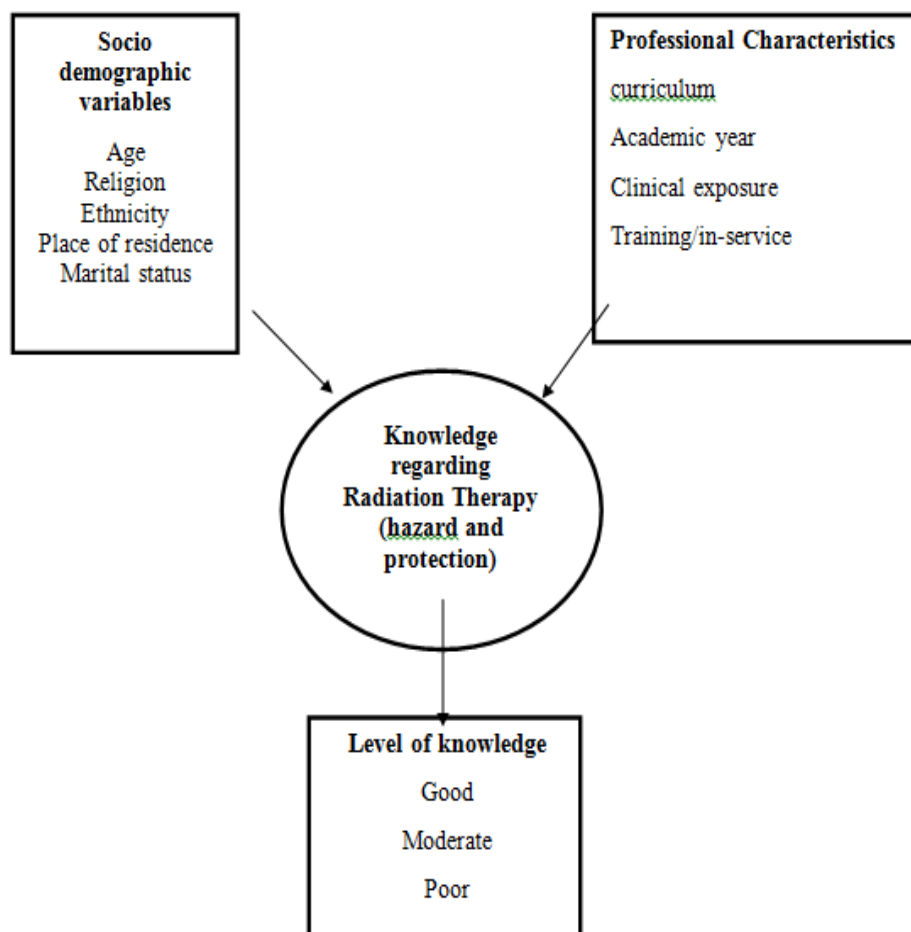


Figure 1: Conceptual Framework of Radiation Therapy Among Nursing Student at BPKMCHNC.

1.6 Research Variables

Dependent Variable

Dependent variable: Knowledge regarding Radiation therapy.

Independent Variable

Independent variables: socio demographic variables (age, religion, ethnicity, place of residence, marital status) professional characteristic (curriculum, academic year, Clinical exposure, job experience, training/in-service).

1.7 Research Question

What is the level of knowledge regarding radiation therapy among BNS oncology nursing student?

What is the association between level of knowledge and selected socio demographic variable?

1.8 Operational Definition

For the purpose of this study, nursing student knowledge regarding radiation therapy refers to having information on radiation protection and radiation hazards. It was measure by using structured questionnaire. Total question was 33 each correct answer was given score a 1 and for wrong answer 0. The level of knowledge was measured by calculating the total score and converted into percentage calculated based on Bloom's cut off point.^[17]

Good knowledge: (80-100)%
 Moderate knowledge: (60-79)%
 Poor knowledge: (≤ 59)

CHAPTER II

LITERATURE REVIEW

Literature review is the initial and most important step in a research process. Which include comprehensive, thorough, and methodological exploration of relevant research article based on the research topic. It aimed to increase knowledge on the topic regarding its problem and its consequences, formulate research tool, and refine research methodologies. This research is based on scrutinizing the literature related to out of pocket expenditure in cancer treatment among cancer patients and ensuring its consequences in their life. To gather information on the subject electronic platform such as Pub Med, Google Scholar has been used to review the findings.

2.1 Review of Related Literature

In radiation therapy high – energy radiation such as x-ray or gamma rays are used to destroy cancer cells and stop them from growing and multiplying. Most of cancer patient require radiation therapy at some point during their illness. During the 20th century radiation oncology barged from the experimental application of basic x-rays to specialized high technique, discipline, delivering sophisticated cancer treatment. Today 60% of patient are treated with radiation therapy.^[18] (mannual, 2019)

An online cross-sectional survey was conducted among 200 final-year nursing students of Fatima College of Health Sciences (FCHS) campuses between March and April 2022. The results of the last section of the survey indicate a lack of awareness of basic radiation protection knowledge among final-year nursing students in FCHS campuses (less than 80%).^[19]

A cross-sectional descriptive online survey was conducted at Sri Lanka with a pre-designed questionnaire among 108 nursing undergraduates Dec 31, 2022. The mean scores of awareness of radiation hazards and protection of the 4th year, 3rd year, 2nd year and 1st year were 64.04% (SD=2.5725), 63.68% (SD=3.8269), 56.41% (SD= 5.0112) and 38.35% (SD=3.287), respectively. The findings of the study suggest that there is a lack of awareness of radiation protection among undergraduate nursing students. Therefore, enhancing medical education on radiation hazards and protection is essential.^[20]

A questionnaire survey was carried out among 35 radiology staff and students at Universal College of Medical Sciences (UCMS), Bhairahawa, Nepal, 2020. Out of total 35 participants, 28 were male and 7 were female with mean age 26.09 ± 7.18 years, range 18–54. The average radiation level of awareness was 9.6 (68.57 %), which was adequate, maximum 13 and minimum 4. Taking academic qualification, the level of knowledge of

diploma graduates was inadequate 7.76 (55.42 %), and lower than other higher academic qualifications.^[10]

A questionnaire-based cross-sectional study was conducted among the anesthesia personnel and surgical subspecialists of a quaternary care academic center in Bangkok, Thailand, January 22, 2020. A total of 270 potential participants were emailed and invited to respond to an online questionnaire, and the response rate was 79.3 The mean score for knowledge about radiation hazards and protection was 6.4 ± 2.0 (maximum possible score=15) Therefore, there is a need to improve anesthetic personnel and surgical subspecialists' knowledge about radiation protection, especially with regard to the use of lead goggles and harmful doses of radiation.^[21]

A descriptive cross-sectional design was employed, targeting nurse and health care staff in diagnostic radiology, oncology, and nuclear medicine departments, November 2019. A random sample of 105 participants (25 nurses and 80 technicians) was selected. Statistical analysis was performed using SPSS version 22, with significance set at $p < 0.05$. The study revealed that 38.1% of participants were under 30 years old, with 51.4% having less than 10 years of experience. Despite the availability of personal protective equipment (PPE), only 5.7% of participants found it sufficient, and only 17.1% had attended training on PPE usage. Knowledge levels were predominantly poor, with over two-thirds of participants demonstrating inadequate safety practices. A significant correlation was found between knowledge and practice levels ($p < 0.05$).^[22]

A questionnaire survey was performed during continuing medical education program at Tribhuvan University Teaching Hospital, 2014 sample size 28. The mean pretest score was 57.8 ± 29.7 , which increased to 83.5 ± 16.8 after the lecture session. Twelve (42.86%) participants scored less than 50%, which increased significantly comparable to the rest (scoring more than 50%) in posttest score. The update on radiation hazards and methods of protection is inadequate among radiologists in Kathmandu.^[23]

A cross-sectional study was conducted at Teaching Hospitals in Makah at Saudi Arabia among 300 participants. during the August to September 2022. Results: show the remaining sociodemographic characteristics of the participant regarding age most of participants 40-50 years were (33.0%) the gender majority of participants were (59.0%) were male the department the most of participant radiology were (44.0%). This study demonstrated poor radiation protection.^[24]

A cross-sectional study conducted on Saudi Arabia's general population The study included 1074 participants. Participants' knowledge about protective measures of radiation was reported as 24.1% had good perception,

49.2% had neutral perception, and 26.7% had poor perception. In conclusion, knowledge, attitude, and perception regarding radiation hazards and protection are inadequate among the Saudi general population.^[25]

A cross-sectional questionnaire-based study among 200 medical personnel, including consultant surgeons, physicians, radiologists, nurses, and radiographers, across five hospitals in Jordan between November 2022 and February 2023. Results Overall, the knowledge of radiation protection and awareness of radiation hazards among the participants were poor (51.55% and 37.17%, respectively).^[14]

A descriptive cross-sectional study conducted on the level of knowledge of nursing and healthcare students regarding the use of ionizing radiation and protection among 786 students at Dicle University between March and April 2024 showed a significant difference for department, grade point average, radiation training, and risk awareness. The correct answer rate for all participants and radiation trainees was found to be 38.6% and 51.6%, respectively. Only 9% of students have good knowledge; it was found that 52% were moderate and 39% were poor. Among all radiological examinations, the proportion of those who thought that magnetic resonance imaging (MRI) and ultrasound imaging contained ionizing radiation was determined as 80.3% and 66%, respectively. The results showed that the students had insufficient knowledge of radiology and radiation protection. Formal training in basic radiology and radiation is recommended in nursing and healthcare programs so that they can work safely in clinics.^[6]

A cross-sectional study was conducted among 134 MBBS students in Dakshina Kannada district. date may 2021. 93.27% of subjects had good knowledge of radiation hazards. 78 % of subjects had good knowledge of radiation personal protective devices. 6 % of subjects had poor knowledge of both radiation hazards and radiation protection.^[26]

2.2 Summary of Literature

After reviewing different literature, journals, books, national and international research report, the knowledge regarding radiation therapy that is found to moderate to poor. There are limited research in Nepal about the knowledge regarding radiation therapy. Most of the study revealed that there is inappropriate knowledge in nursing students.

CHAPTER III

METHODOLOGY

3.1 Research Design

A Cross sectional research design was used to find out the knowledge regarding radiation therapy among nursing students.

3.2 Research Setting

The study was carried out in BP Koirala Memorial Cancer Hospital Nursing college Bharatpur 7, chitwan. BPKMCHNC was established in 2075 B.S with joint constituent of Pokhara University and B.P Koirala Memorial Cancer Hospital. It's main aim is to prepare the students academically sound and skilled nurse as per the country demand.

3.3 Research Population

The study Population was 1st, 2nd year (new and old) and 3rd year BNS oncology nursing students at BP Koirala Memorial Cancer Hospital Nursing college. Census method was used.

3.4.1 Sample Size

Total sample population was 135 nursing student.

3.4.2 Exclusion Criteria

Those students who were diagnosed with cancer and underwent radiation therapy.

3.5 Research Instrumentation

Self-administered structured questionnaire was used to collect data. The instrument was consist of two parts:

Part 1: Questionnaire related to socio demographic variables.

Part 2: Questionnaire related to knowledge regarding Radiation therapy.

3.5.1 Validity

Validity of the instrument was maintained by extensive reviewing of the literature and consulting subject expert, research advisor. The necessary modification was made on their suggestion.

3.5.2 Reliability

The reliability of instrument was established by pretesting 10 % of sample study in the similar settings and those samples was excluded in the main study. Necessary modification was done.

3.6 Data Collection Procedure

Research data was collected after getting the approval of a research proposal from concerned authority at B.P Koirala Memorial Nursing College and institutional review committee (IRC) of B.P. Koirala Memorial Cancer Hospital. Data was collected within two weeks. The informed written consent was obtained from all the respondents. Data was collected by using English version structured questionnaire schedule.

3.7 Data Analysis Procedure

The collected data was checked, reviewed and organized for completeness and accuracy. Then all the collected data was coded, enter and analyzed in statistical package for social science (SPSS) version 22. Data was analyzed by using descriptive (frequency, percentage, mean and median and standard deviation) and inferential (chi

square) statistical method. P-value <0.05 was considered as statistically significant.

3.8 Ethical Consideration

Ethical approval for the study was obtained from the institutional review committee of BP Koirala Memorial Cancer Hospital. The permission was obtained from BP Koirala Memorial Cancer Hospital nursing college for data collection. An informed written consent from was taken from the nursing student before data collection. Confidentiality was maintained throughout the study and

the information collected will be used only for the research purpose.

CHAPTER IV

FINDINGS OF THE STUDY

The chapter deals with the analysis and interpretation of the data on Knowledge Regarding Radiation therapy among Nursing Students. A total 135 respondents were included in this study. All the data obtained were analyzed and interpreted based on research objective and are presented in different table.

Table 1: Sociodemographic Characteristics of Respondents: Age Academic year, Marital status.

n=135

Characteristics	Frequency (n)	Percentage (%)
Age		
≤22	23	17.0
23-27	90	66.7
28-32	19	14.1
≥33	3	2.2
Mean ± SD	25.15 ± 2.991	
Min(Max)	20 (35)	
Academic Year		
1st year	34	25.2
2nd Year (new)	33	24.4
2nd Year(old)	29	21.5
3rd Year	39	28.9
Marital Status		
Married	48	35.6
Unmarried	87	64.4

Table 1 showed that, out of 135 respondents, 90(66.7%) respondents belongs to the age group 23-27 years. The mean ± SD of age was 25.15 ± 2.991 years. Likewise, regarding academic year, 39(28.9%) respondents belongs

to 3rd year, 2nd year(old) 29(21.5%), 2nd year(new) 33(24.4%) and 1st year 32(25.2%). Moreover 87(64.4%) respondents were unmarried and 48(35.6%) respondents was married.

Table 2: Sociodemographic Characteristics of Respondents: Religion, Ethnicity, Province.

n=135

Characteristics	Frequency (n)	Percentage (%)
Religion		
Hindu	121	89.6
Buddhist	10	8.1
Christian	1	7
Muslim	2	1.5
Ethnicity		
Brahmin/chettri	82	60.7
Madhesi	11	8.1
Dalit	7	5.2
Janajati	33	24.4
Muslim	2	1.5
Province		
Koshi	5	3.7
Madhesh	12	8.9
Bagmati	66	48.9
Gandaki	24	17.8
Lumbini	15	11.1
Karnali	5	3.7
Sudur pachim	8	5.9

Table 2 shows that, out of 135 respondents, majority 121(89.6%) of the respondents were Hindu. Likewise, in ethnicity, 82(60.7%) of respondents were belongs to

Brahmin/ Chettri and 66(48.9%) respondents were from Bagmati province.

Table 3: Respondents' Knowledge regarding Concept of Radiation Therapy.

n=135

Statements	Correct Response	
	Frequency (n)	Percentage (%)
Use of high energy radiation to destroy cancer cells and reduce the size of tumor	125	92.6
Radiation therapy as most important treatment therapy	134	99.3
Ionizing radiation are used for medical purpose	131	97.0
Types of radiation therapy are External and internal radiation therapy	135	100.0
Rapidly dividing cells are more affected than normal cells	114	84.4
In your opinion is it important to include radiation therapy in nursing curriculum	135	100.0

Table 4 reveals that, majority of the respondents answered radiation therapy means use of high energy radiation to destroy cancer cells and reduce the size of tumor 125(92.6%), and radiation therapy is the most important treatment 134(99.3%). Likewise, majority of the respondents answered that ionizing radiation are used for

medical purpose 131(97.0%) and rapidly dividing cells are more affected than normal cells 114(84.4%). Cent percent 135(100.0%) of the respondents answered the type of radiation therapy and external and internal radiation therapy are also called teletherapy and brachytherapy respectively.

Table 4: Respondents' Knowledge Regarding Goals and Principle of Radiation Therapy.

n=135

Statements	Correct Response	
	Frequency (n)	Percentage (%)
Goals of radiation therapy		
Kills cancer cells	117	86.7
Shrink tumors to cure early – stage cancer	123	91.1
Stop cancer from recurring in another area	102	75.6
Treat symptoms caused by advanced cancer	99	73.3
Principle of radiation therapy		
Tumor receive maximum possible dose and normal tissue receive dose within tolerance limit.	126	93.3

Table 5 shows that, goal of radiation therapy are kill cancer cells 117(86.7%), shrink tumors to cure early – stage cancer 123(91.1%), stop cancer from recurring 102(75.6%) and treat symptoms caused by advanced

cancer 99(73.3%). Majority of the respondents answered that, tumor receive maximum possible dose and normal tissue receive dose within tolerance limit is the principle of radiation therapy 126(93.3%).

Table 5: Radiation Knowledge Regarding Radiation Exposure.

n=135

Statements	Correct Response	
	Frequency (n)	Percentage(%)
Personal protective device for reducing radiation exposure		
Lead goggles	104	77.0
Lead apron	131	97.0
Lead gloves	95	70.4
Thyroid shield	83	61.5
A nurse can decrease the radiation exposure by increasing distance from the source of radiation.	122	90.4
Frequent exposure to higher ionizing radiation is harmful	132	97.8
Ionizing radiation can affect pregnant women	134	99.3
Dose limit for occupational exposure is 20mSv/year	87	64.4

Table 7 reveals that, personal protective device for reducing radiation exposure are lead goggles

104(77.0%), lead apron 131(97.0%), lead gloves 95(70.4%) and thyroid shield 83(61.5%). Likewise,

majority of the respondents answered that, a nurse can decrease the radiation exposure by increasing the distance from the source of radiation 122(90.4%), frequent exposure to higher ionizing radiation is harmful

132(97.8%) and ionizing radiation can affect pregnant women 134(99.3%). While, 87(64.4%) respondents answered dose limit for occupational exposure is 20mSv/year.

Table 6: Respondents' Knowledge Regarding Radiobiology.

n=135

Statements	Correct Response	
	Frequency (n)	Percentage(%)
Hypoxic cells are resistant to radiation therapy	119	88.1
Repopulation is rapid proliferation of surviving tumor cell after radiation therapy	97	71.9
Radiation exposure can change molecular structure of the cell and damage biological system	130	96.3

Table 6 shows that, 119(88.1%) of the respondents answered hypoxic cells are resistant to radiation therapy. Likewise, 97(71.9%) answered repopulation is rapid

proliferation of surviving tumor cell after radiation therapy and 130(96.3%) respondents answered radiation exposure can change molecular structure of the cell and damage biological system.

Table 7: Respondents' Knowledge Regarding Safety Precaution.

n=135

Statements	Correct Response	
	Frequency(n)	Percentage(%)
Time, distance and shielding are the fundamental principle to minimize radiation exposure	134	99.3
Dosimeter measure the amount of radiation exposed to the worker	131	97.0
Radiation therapy room should be thick and heavy shield door and loud when close, concrete walls creating a vault	121	89.6
Color code of radiation hazard is purple	101	74.8

Table 8 reveals that, out of 135 respondents, 134(99.3%) respondents answered time distance and shielding are the fundamental principle to minimize radiation exposure. Likewise, 131(97.0%) of the respondents answered Dosimeter measure the amount of radiation exposed to

the worker. Likewise, 121(89.6%) answered that Radiation therapy room should be thick and heavy shield door and loud when close, concrete walls creating a vault and 101(74.8%) respondents answered that, color code of radiation hazard is purple.

Table 8: Respondents' Knowledge Regarding Side-effect.

n=135

Statements	Correct Response	
	Frequency (n)	Percentage(%)
General side effects		
Nausea/ vomiting	111	82.2
Fatigue	116	85.9
Bone marrow suppression	117	86.7
Skin reaction	122	90.2
Anorexia	112	83.0
Specific side effects		
Infertility	124	91.9
Hair loss	113	83.7
Pneumonitis	98	72.6
Cough	96	71.1
Mucositis	113	83.7
Is there any late side effects of radiation therapy?		
Yes	124	91.9
No	11	8.1

Table 9 reveals that, general side effects of the radiation therapy are nausea/vomiting 111(82.2%), fatigue 116(85.9%), bone marrow suppression 117(86.7%), skin

reaction 122(90.2%), anorexia 112(83.0%). Likewise, specific side effects are infertility 124(91.9%), hair loss 113(83.7%), pneumonitis 98(72.6%), cough 96(71.1%),

mucositis 113(83.7%). Likewise, 124(91.9%) answered about late side effects are scarring, carcinogenicity, genetic effects.

Table 9: Respondents Overall Knowledge Regarding Radiation Therapy.

n=135

Level of Knowledge	Frequency (n)	Percentage (%)
Poor	8	5.9
Moderate	21	15.6
Good	106	78.5

Table 9 shows that the overall level of knowledge regarding radiation therapy. It shows that, 106(78.5%) of the respondents had good, 21(15.6%) had moderate and 8(5.9%) had poor level of knowledge regarding radiation therapy.

Table 10: Association Between Overall Level of Knowledge with Socio-demographic Characteristics.

n=135

N=153					
Level of Knowledge					
Variables	Poor	Moderate	Good	Chi- square	P - value
Age					
≤22	4(17.4%)	8(34.8%)	11(47.8%)	16.358	0.012
23-27	4(4.4%)	10(11.1%)	76(84.4%)		
28-32	0(0.0%)	2(10.5%)	17(89.5%)		
≥33	0(0.0%)	1(33.3%)	2(66.7%)		
Academic year					
1st year	8(23.5%)	13(38.2%)	13(38.2%)	55.641	0.00
2nd year (new)	0(0.0%)	6(18.2%)	27(81.8%)		
2nd year (old)	0(0.0%)	2(6.9%)	27(93.1%)		
3rd year	0(0.0%)	0(0.0%)	39(100.0%)		
Marital status					
Married	3(6.3%)	9(18.8%)	36(75.0%)	0.607	0.738
Unmarried	5(5.7%)	12(13.8%)	70(80.5%)		
Religion					
Hindu	8(6.6%)	19(15.7)	94(77.7%)	2.921	0.819
Buddhist	0(0.0%)	2(18.2%)	9(81.8%)		
Christian	0(0.0%)	0(0.0%)	1(100.0%)		
Muslim	0(0.0%)	0(0.0%)	2(100.0%)		
Ethnicity					
Brahmin/chhetri	4(4.9%)	14(17.1%)	64(78.0%)	7.965	0.437
Madhesi	2(18.2%)	0(0.0%)	9(81.8%)		
Dalit	0(0.0%)	2(28.6%)	5(71.4%)		
Janajati	2(6.1%)	5(15.2%)	26(78.8%)		
Muslim	0(0.0%)	0(0.0%)	2(100.0%)		

Table 10 shows that, there is association between overall level of knowledge with age and academic year. But there is no association between overall level of knowledge with marital status, religion, ethnicity as P value is more than 0.05% which is statistically insignificant.

Table 11: Association Between Overall Level of Knowledge with Socio-Demographic Characteristics.

Table 11 shows that, there is no association between overall level of knowledge with province.

n=135

Level of Knowledge					
Variables	Poor	Moderate	Good	Chi- square	P - value
Age					
≤22	4(17.4%)	8(34.8%)	11(47.8%)	16.358	0.012
23-27	4(4.4%)	10(11.1%)	76(84.4%)		
28-32	0(0.0%)	2(10.5%)	17(89.5%)		
≥33	0(0.0%)	1(33.3%)	2(66.7%)		
Academic year					

1st year	8(23.5%)	13(38.2%)	13(38.2%)	55.641	0.00
2nd year (new)	0(0.0%)	6(18.2%)	27(81.8%)		
2nd year (old)	0(0.0%)	2(6.9%)	27(93.1%)		
3rd year	0(0.0%)	0(0.0%)	39(100.0%)		
Marital status					
Married	3(6.3%)	9(18.8%)	36(75.0%)	0.607	0.738
Unmarried	5(5.7%)	12(13.8%)	70(80.5%)		
Religion					
Hindu	8(6.6%)	19(15.7)	94(77.7%)	2.921	0.819
Buddhist	0(0.0%)	2(18.2%)	9(81.8%)		
Christian	0(0.0%)	0(0.0%)	1(100.0%)		
Muslim	0(0.0%)	0(0.0%)	2(100.0%)		
Ethnicity					
Brahmin/chhetri	4(4.9%)	14(17.1%)	64(78.0%)	7.965	0.437
Madhesi	2(18.2%)	0(0.0%)	9(81.8%)		
Dalit	0(0.0%)	2(28.6%)	5(71.4%)		
Janajati	2(6.1%)	5(15.2%)	26(78.8%)		
Muslim	0(0.0%)	0(0.0%)	2(100.0%)		

CHAPTER V DISCUSSION, CONCLUSION, AND RECOMMENDATIONS

This chapter presents the study's discussion, conclusion, limitations and recommendation. The discussion presents all the findings compared to those studies from reviewed literature and the conclusion drawn from each of the findings. It also deals with the recommendations for future studies.

5.1 DISCUSSION

5.1.1 Socio- Demographic Characteristics of the Students

The findings of the study show that, 66.7% of the respondents were from the age group 23 – 27. The age was ranged from 20 to 35 years with the mean $\pm$ SD 25.15 ± 2.991 . while the another cross sectional study done on Northern Nigeria showed that the Mean age $\pm$ SD of participant was 34.04 ± 8.83 .

This study finding showed that, majority of respondents (28.9%) were 3rd year. While Another cross- sectional study conducted at the Faculty of Allied Health Sciences, University of Peradeniya showed that, Majority (63.68%) of the respondents were 3rd year.

This study finding showed that, 35.6% respondents were married. While Another cross- sectional study conducted in Saudi arabias showed that, 47.9% of respondents were married.

This study finding showed that, majority 89.6% of the respondents were Hindu. Another cross sectional study conducted at Medical College Students in Coastal Karnataka showed that, Majority 70.14% of the respondents were Hindu.

This study finding showed that, 60.7% of respondents were belongs to Brahmin/ Chettri and 48.9% respondents were from Bagmati province.

This study finding showed that, 85.9% of the respondents were attended radiation therapy course, likewise, 85.9% respondents attended their formal course at college, and 50.4% of the respondents were posting to radiation unit.

5.1.2 Knowledge regarding Radiation Therapy

Findings of this study showed that, majority of the respondents 92.6% answered correctly that Use of high energy radiation to destroy cancer cells and reduce the size of tumor. While another study conducted in the Middle Euphrates Oncology center of Iraq shows consistent findings that 89.0% of Respondents Correctly answered, mass describe that Radiation therapy is a type of cancer treatment that uses intense beams of energy to kill cancer cells.^[2]

Findings of this study showed that, 99.3% of the students answered the radiation therapy as most important treatment therapy. While another study conducted on 2023 in Asia Oceania federation of organizations for medical physics region respondents correctly answered , mass describe that radiation therapy is the main and essential modality of cancer treatment.^[5]

Findings of this study showed that, 97.0% of the respondents Correctly answered that ionizing radiation are used for medical purpose. While another study conducted on UAE 2023, the respondents correctly answered that ionizing radiation is use in the medical field offers great advantages.^[8]

Findings of this study showed that, 100.0% of the students answered correctly about the type of radiation therapy. While another study conducted in Canada on 2020 Respondents correctly answered, that RT can be delivered systemically, referred to as external-beam RT, or internally via brachytherapy.^[3]

Findings of this study showed that, 84.4% of respondents answered correctly the rapidly dividing cells are more affected than normal cells. While another study conducted in Kathmandu Nepal, on 2014 The respondents answered correctly that radiation has been used for more than a century to treat the cancer based on the rationale that the rapidly proliferating cancer cells are sensitive to the radiation treatment than normal cells.^[22]

Findings of this study showed that, 100% respondents correctly answered that, radiation therapy course is important to include in curriculum. While another study that conducted in 2022 on New Zealand the Respondents answered correctly that, it is important that common education and training standards and associated curricula should be promoted internationally.^[28]

Finding of this study showed that, the respondents correctly answered on goal of radiation therapy that are 86.7% answered Kills cancer cells, 91.1% answered Shrink tumors to cure early – stage cancer, 75.6% answered Stop cancer from recurring in another area, 73.3% answered Treat symptoms caused by advanced cancer. While another study conducted in 2018 on UK the respondents correctly answer that the main goal of radiation therapy is to deprive cancer cells of their multiplication potential and eventually kill the cancer cells. Cancer cells whose DNA is damaged beyond repair stop dividing and die.^[6]

Finding of this study showed that, 93.3% of the respondents correctly answered on principle of radiation therapy. while another study conducted in India on 2015 The respondents correctly answered that The most basic principle is to deliver maximum dose to tumor with minimum dose to surrounding normal structures thus achieving a higher cure rate with acceptable morbidity. Different doses are required for different malignancies and the setting at which delivered.^[30]

Findings of this study showed that, 99.3% respondents correctly answered about the fundamental principle to minimize radiation exposure. While another study conducted in Korea on 2018, The respondents correctly answered that, for reducing radiation exposure, there are 3 principle: time, distance, and shielding.^[31]

Findings of this study showed that, respondents correctly answered on personal protective device for reducing radiation exposure, 77.0% answered lead goggle, 97.0% answered lead apron, 70.4% answered lead gloves, 61.5% answered lead thyroid shield. While another study conducted in 2021 on Dakshina Kannada district. among MBBS students, The respondents answer correctly that, 88.05%, 95.52%, 88.05%, 62.68% of the respondents answered respectively.^[26]

Findings of this study showed that, 90.4% of the respondents answered as a nurse increase his/her the distance from the source of radiation dose can decrease

the radiation exposure. while another study conducted in turkey on 2023, The respondents answered correctly that, 57.50% of the respondents were correctly answered to the similar question.^[11]

Findings of this study showed that, 97.8% of the respondents answered Frequent exposure to higher ionizing radiation is harmful. while another study conducted in turkey on 2023 the respondents 73.50% were correctly answered to the similar question.^[11]

Findings of this study showed that, 99.3% of respondents answered that ionizing radiation can affect pregnant women.

Finding of this study showed that, 64.6% Of the respondents answered about Dose limit for occupational exposure is 20mSv/year. while another study cross-sectional survey was conducted between March and April 2022 in UAE The respondents 46.73% were correctly answered to the similar question.^[8]

Finding of this study showed that, 88.1% of the respondents answered that hypoxic cells are resistant to radiation therapy. While another study published in 2021 On ionizing radiation also suggest that Resistance of hypoxic cells to irradiation is attributed to lower induction of DNA damage in hypoxic cells.^[32]

Findings of this study showed that, 71.9% of the respondents answered the Repopulation is rapid proliferation of surviving tumor cell after radiation therapy.

Findings of this study showed that, 96.3% of the respondents answered that Radiation exposure can change molecular structure of the cell and damage biological system.

Findings of this study showed that, 97.0% of the respondents answered that the Dosimeter measure the amount of radiation exposed to the worker.

Finding of this study showed that, 89.6% of respondents answered Radiation room therapy room should be Thick shield door, concrete walls creating a vault, shield doors are heavy and loud when close and while another study cross-sectional survey was conducted between March and April 2022 in UAE 74.8% students answered correctly.^[8]

Findings of this study showed that, 82.2% of the respondents answered that the radiation therapy general side effects are nausea/vomiting, 85.9% answered fatigue, 86.7% answered bone marrow suppression, 90.2% answered skin reaction, 83.0% answered anorexia. Likewise, 91.9% answered infertility, 83.7% answered hair loss, 72.6%) answered pneumonitis, 71.1% answered cough, 83.7% answered mucositis as it's specific side effects. Likewise, 91.9% answered

about late side effects are scarring, carcinogenicity, genetic effects.

5.2 CONCLUSION

Based on the findings and discussion of the study, it was concluded that more than half of the respondents had good level of knowledge on radiation therapy. Of the 135 respondents, 78.5% had a good level of knowledge, 15.6% had a moderate level of knowledge, and 5.9% had a poor level. The study also found a significant association between the overall level of knowledge and the students age and academic year. The increasing knowledge that will help to enhance quality nursing care for cancer patients.

5.3 Limitations of the Study

This study was conducted in only one setting.

Data collection time was 2 weeks

Research findings can't be generalized.

5.4 Recommendations

Similar study can also be conducted in large sample size so the result can be generalized.

5.5 Plan for Dissemination

Submission to library

Publish in peer review journal

Conference presentation

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APPENDIX B

RESEARCH INSTRUMENT

Knowledge of Radiation Therapy: Principles, Clinical Applications, and Radiation Safety among Nursing Students in Chitwan, Nepal.

Respondent Code: Date of data collection

Direction: the researcher will appreciate your help in responding questionnaire. Please choose appropriate answer and tick (✓) in a corner/ separate rooms as feasible. The obtained information will be used for the study purpose only and it will be kept confidential with anonymity. Thank you!

Part 1: Socio-demographic variables

S. N.	Question	Responses
1	What is your age? (in completed year)	
2	What is your academic year?	a. 1 st year b. 2 nd year c. 3 rd year
3	What is your marital status?	a. Married b. Unmarried
4	What is your religion?	a. Hindu b. Buddhist c. Christian d. Muslim e. Others
5	Which ethnicity group do you belong ?	a. Brahmin/Chhetri b. Madhesi c. Dalit d. Janajati e. Muslim f. Others
6	Which province do you live ?	a. Koshi b. Madhesh c. Bagmati d. Gandaki e. Lumbini f. Karnali g. Sudur pachim
7	Have you attended any radiation therapy course?	a. Yes b. No
8	Which method of education have you attended? (multiple response)	a. Online course b. Formal course at college c. Training d. Workshop e. Other (specific)
9	Have you posting to radiation therapy unit during your clinical placement?	a. Yes b. No

Part 2: Knowledge Related Question.

S. N.	Questions	Response
1	What is radiation therapy?	a. Diagnostic measure that uses high energy radiation. b. Use of high energy radiation to destroy cancer cell only. c. Use of high energy radiation to reduce size of tumor only. d. Use of high energy radiation to destroy cancer cells and reduce the size of tumor.

2	Radiation therapy is one of the most important cancer treatment modalities?	a. Yes b. No
3	Ionizing radiation are used for medical purpose?	a. Yes b. No
4	What are the type of radiation therapy?	a. External radiation b. Internal radiation c. Both d. None
5	What are the goal of radiation therapy? (Multiple responses)	1. Kills cancer cells 2. Shrink tumors to cure early-stage cancer 3. Stop cancer from recurring in another area 4. Treat symptoms caused by advanced cancer
6	The principle of radiation therapy is that, tumor receive maximum possible dose and normal tissue receive dose within tolerance limit.	a. Yes b. No
7	Radiation therapy mostly affect	a. Rapidly dividing cells are more affected than normal cells. b. Normal cell are more affected than rapidly dividing cells. c. Both normal and rapidly dividing cells are equally affected. d. Only rapidly dividing cells are affected.
8	Rad is the unit of radiation dose calculation	a. Yes b. No
9	Hypoxic cells are resistant to radiation therapy.	a. Yes b. No
10	Rapid proliferation of surviving tumor cells after radiation therapy is known as,	a. Repair b. Repopulation c. Redistribution d. Reoxygenation
11	Time, distance and shielding are the fundamental principle to minimize radiation exposure.	a. Yes b. No
12	Which of the following do you know as a personal protective device for reducing radiation exposure? (Multiple response)	a. Lead goggles b. Lead apron c. Lead gloves d. Thyroid shield
13	As a nurse, Increase his/her the distance from the source of radiation dose can	a. Increase the exposure b. Decrease the exposure c. Remain same d. Don't know
14	Frequent exposure to higher ionizing radiation is harmful.	a. Yes b. No
15	Ionizing radiation can affect pregnant women.	a. Yes b. No
16	What is the dose limit for occupational exposure (worker) ?	a. 20 mSv/year b. 50 mSv/year c. 150 mSv/year d. 500 mSv/year

17	Dosimeter measures the amount of radiation exposed to the worker.	a. Yes b. No
18	Radiation therapy room should be	a. Thick shielded door b. Concrete walls creating a vault c. Shield doors are heavy and loud when close d. All of the above
19	Radiation exposure can change molecular structure of the cell and damage biological systems.	a. Yes b. No
20	What are the general side effects of radiation therapy? (multiple response)	a. Nausea/vomiting b. Fatigue c. Bone marrow suppression d. Skin reaction e. Anorexia
21	What are the specific side effects of radiation therapy?(multiple response)	a. infertility b. Hair loss c. Pneumonitis d. Cough e. Mucositis
22	Is there any late side effects of radiation therapy ?	a. Yes b. No
23	What is the color code of radiation hazard ?	a. Purple b. White c. Black d. Green
24	In your opinion is it important to include radiation therapy in nursing curriculum ?	a.Yes b.No