

RADIATION SCORE: AN ANALYSIS OF STUDENTS' PERCEPTION TO RISKS OF IONIZING RADIATION

Dannalyn D. Ibañez¹, Ralph Augustus B. Manaois², Miguel D. Soledad³, Kareen Grace F. Bracil^{4*}

Radiologic Technology Department - Davao Doctors College, Davao City, Philippines
**e-mail : cfifiles@gmail.com*

Abstract

Since the inception and early application of ionizing radiation, its side effects have proven to be very dangerous. Thus, the general public who are recipients to countless literature containing the dangerous effects of ionizing radiation became unknowingly frightened and resistant to the subject. This study aims to determine the students' risk perception to ionizing radiation. It follows the concept of Psychometric Paradigm, in which, high order factors such as emotional stability and intuitive ability were the factors associated with the subject of risk perception. The study was conducted in Davao City, Philippines. Following the descriptive survey involving 210 respondents, results showed using Chi-square test of association ($X^2_{@ \alpha=.05; p} = .000; df = 1$) that there is a significant association between the program the students are enrolled and their perception to ionizing radiation. Furthermore, results revealed ($X^2_{@ \alpha=.05; p} = .000; df = 1$) that there is a significant association between monthly family income and their perception to ionizing radiation. In terms of Psychometric Paradigm, following chi-square test of association, ($X^2_{@ \alpha=.05; p} = .000; df = 1$) result showed that there is a significant association between emotional stability and intuitive ability. It revealed that students with high emotional and intuitive ability are not afraid of ionizing radiation compared to students who have low emotional and intuitive ability test results. Since the use of ionizing radiation nowadays is one of the trends in the diagnosis and treatment of diseases, having factual information should be available to the public. In the case of education, schools from all levels should strengthen their curricula to incorporate this phenomenon in a more logical manner.

Keywords: ionizing radiation; risk perception; psychometric paradigm

Introduction :

According to Evans, K. et al (2015), ionizing radiation in general is a complex and often misunderstood subject, and in fact, as stated by Freudenberg and Beyer in University Hospital Essen at Essen Germany (2011), physicians, medical staff, patients and the general public are becoming increasingly sensitized to the issue of radiation exposure. After the discovery of x-ray in 1895, several scientists died of blood disorders or cancer primarily because of their work in the x-ray laboratory. While the public then already concluded that radiation is harmful, the event that truly marked peoples' fear of radiation was the nuclear bombings of Hiroshima and Nagasaki, Japan during the World War II in 1945. The radiation exposure brought immediate devastation, acute radiation injuries and increased incidence of leukemia among survivors (Prekeges, 2003). Although the tale of radiation horror took place several decades ago, its harmful effects prove to be existent until today. The effects of ionizing radiation on the human body are very popular in movies and TV series which

portray alterations of behavior and physical features after having been exposed to ionizing radiation, whether intentional or accidental. It has also been presented that exposure to radiation can give extraordinary powers which make a person resistant to pain and other types of ordeal. Because of these scenarios, the entertainment world has contributed greatly to the publics' apprehension of radiation and nuclear technology.

While these events have taken into account that ionizing radiation is detrimental to the human body, its significant contribution to medicine also became phenomenal such as the use of x-rays to diagnose and treat cancer; while radionuclides are believed to treat benign and malignant lesions (Prekeges, 2003). Furthermore, the field of radiation safety has also evolved through decades. Radiation safety devices and techniques are readily available today to monitor and to protect the people who will be exposed to ionizing radiation.

However, in spite of the attempts to educate people that ionizing radiation is safe because of the technology available today, people are still skeptical about ionizing radiation. They believe that ionizing radiation can directly cause sterility, baldness, and cancer. Several studies about publics' perception research have consistently shown that nuclear power plant and nuclear waste are perceived to be a high risk; while, medical x-rays and other naturally occurring gasses poses lower risks. According to Freudenberg (2011), laypersons consider x-rays as less risky in contrast with nuclear power plant; however, radiation experts described both x-rays and nuclear energy as acceptable and contribute to moderate health risk. Furthermore, misconceptions about ionizing radiation also come from health-care professionals themselves, in fact, as postulated by the media and even among medical professionals, the risks of exposure to ionizing radiation may be exaggerated in terms of diagnostic and interventional procedures and more often got confused with the risks associated with nuclear energy and nuclear weapons, (Hesse, B., et al, 2012). Also, in the Philippines, in a study of radiation risk perception conducted by Canlas (2016) at Leyte Normal University, the result revealed that a satisfactory perception of radiation and risks and the individual interviews concluded several misconceptions about radiation.

Because of this phenomenon, the study of risk perception to ionizing radiation has become a controversial topic in the field of Radiologic Technology. This study has similar undertakings in taking an effort to analyze peoples' perception to ionizing radiation; however, it follows the concept of Psychometric Paradigm to students of Davao Doctors College. This theory was developed by Melissa Finucane and Paul Slovic in which it primarily assumes that people tend to believe that if the benefit outweighs the risk, they tend to have a higher tolerance for perceived risk. Also, numerous researches employing Psychometric Diagram have shown that perceived risks are quantifiable and predictable. In this study, an analysis was established using Chi-square test of association, if it exists, to determine the connection between respondents' profile and Psychometric Paradigm factors to students' perception to ionizing radiation.

Methodology :

Following a descriptive research survey, this study was conducted in Davao Doctors College which is located at General Malvar St., Davao City, Philippines. The sample size was obtained following the Slovin's formula generated through random sampling. An expert-validated questionnaire which was used to gather the information involving 210 College students is composed of four parts: the first and second part consist of statements about radiation to measure respondents' risk perception and their sources of information about

radiation. The statements were tailored so as to acquire the respondents' perception to ionizing radiation. In the third part of the questionnaire, the study used the Big Five version to measure respondents' different dimensions of a personality trait. The Big Five version is a self-report inventory to measure multidimensional personality. Lastly, the fourth part consists of questions to measure the respondents' innate intuitive abilities. The respondents were advised that participation in the research was voluntary.

Results :

Table 1. Profile of the Respondents

The result shows that students who have a background in healthcare are not afraid of ionizing radiation compared to students who are enrolled in non health-related courses.

Variables	Categories of Variables	Frequency	Percentage
Sex	Female	157	75
	Male	53	25
	Total	210	100
Program	Health-related	125	60
	Non-health	85	40
	Total	210	100
Religion	Christian	150	71
	Islam	60	29
	Total	210	100
Monthly Family Income	P20,000 or above	127	60
Income	P10,000-P19,000	65	31
	Below P9,000	18	9
	Total	210	100

Table 1 shows that majority of the participants were female which comprised seventy-five percent (75%) of the total population, while twenty-five percent (25%) were male respondents. In terms of program, sixty percent (60%) were enrolled in health-related courses, while forty percent (40%) of them belong to the non health-related degrees. The result shows that students who have a background in healthcare are not afraid of ionizing radiation compared to students who are enrolled in non health-related courses. In the aspect of religion, seventy-one percent (71%) were Christian, while twenty-nine percent (29%) belong to Islam. Moreover, majority of the respondents belong to the family who earns a monthly income of P20000 or above which comprised of sixty percent (60%) of the total population, while thirty-one (31%) of the respondents belong to the middle-income and nine percent (9%) belong to the low-income bracket, respectively. The result suggests that the students who belong to the low-income bracket are not afraid of ionizing radiation compared to students who belong to the middle and high-income families. Several researches show that people who belong to low economic background have a higher tolerance to risks compared to their counterpart.

Table 2. General Perception of Students to Ionizing Radiation

GENERAL PERCEPTIONS	PERCEPTION	VERBAL DESCRIPTION
1. Ionizing radiation may cause sterility.	72	Agree
2. Ionizing radiation may cause cancer or other blood diseases such as leukemia, or death.	69	Agree
3. Ionizing radiation has a lot of medical benefits such as treatment to certain illnesses and cancers.	68	Agree
4. Ionizing radiation may cause genetic mutations or behavioral damage as seen on movies.	65	Agree
5. Ionizing radiation may cause baldness and skin burns.	60	Agree
6. Exposure to ionizing radiation can be tolerated by the human body.	58	Agree
7. Medical x-rays (e.g chest x-rays or CT-scan) are safe because they trust the x-ray personnel.	51	Agree
8. Ionizing radiation is a secure source of energy.	49	Disagree

Table 2 represents the percentage of the students' general perception of ionizing radiation. Seventy-two percent (72%) of the respondents agreed that they are afraid of radiation because of their perceptions that it might have side effects such as sterility followed by the perception that ionizing radiation may cause cancer or other blood diseases or death which is sixty-nine percent (69%). Furthermore, sixty-eight percent (68%) of the respondents believed that ionizing radiation has a lot of medical benefits followed by their belief that exposure to ionizing radiation may cause genetic mutations or behavioral damage as seen in movies which is sixty-five percent (65%). Sixty percent (60%) agreed that ionizing radiation may cause baldness and skin burns, while fifty-eight (58%) agreed that exposure to ionizing radiation can be tolerated by the human body. Fifty-one percent (51%) believed that medical x-rays (e.g chest x-rays or CT-scan) are safe because they trust the x-ray personnel. And, forty-nine percent (49%) of the respondents do not agree that ionizing radiation is a secure source of energy.

Table 3. Factors that Influence Students' Perception to Ionizing Radiation

GENERAL PERCEPTIONS	PERCEPTION	VERBAL DESCRIPTION
1. Radiation was featured in one of the Sci-fi (Science fiction) movies or TV programs.	87	Strongly Agree
2. Radiation was in one of the Science programs in television (e.g Nat Geo., Discovery)	74	Agree
3. Radiation was featured on a certain TV news featuring Japan during World War II.	62	Agree
4. Radiation/radiation effects were part of the topic in a certain Science subject/fair.	58	Agree
5. They learned that exposure to radiation can cause genetic mutations and behavioral/neurological damage as reflected in the movies.	56	Agree

6. They learned about the medical benefits of radiation on TV.	47	Agree
7. They learned about the medical benefits of radiation in a Science Journal.	43	Agree
8. They learned radiation in one of the programs of the government such as DOH.	39	Disagree

Table 3 shows several factors that influence students’ perception of ionizing radiation. The majority of the respondents or eighty-seven percent (87%) of them agreed that they have learned about ionizing radiation in one of the Science Fiction movies or TV programs, while seventy-four percent (74%) of the respondents agreed that they have seen or heard about radiation in a Science TV programs such as National Geographic or Discovery Channel. Sixty-two percent (62%) agreed that radiation was featured on a certain TV news featuring Japan during World War II. Meanwhile, fifty-eight percent (58%) believed that radiation or radiation effects were part of the topic in a certain Science subject or Science fair. Fifty-six percent (56%), agreed that they learned that exposure to radiation can cause genetic mutations and behavioral or neurological damage as reflected in the movies. While forty-seven percent (47%) claimed that they learned about the medical benefits of radiation on TV. Forty-three percent (43%) agreed that they learned about the medical benefits of radiation in a Science Journal. And, thirty-nine percent (39%) of the respondents do not agree that they learned or heard about radiation in one the programs of the government such as DOH, respectively. Based on the findings, it revealed that respondents got their main knowledge on ionizing radiation in movies and TV programs and few acquired it from their lessons in school and government programs. Because of the existing gap in knowledge and understanding in ionizing radiation, many of them believe that ionizing radiation may cause sterility, cancer, blood disorders or even death.

Association of Respondents’ Profile and Perception to Ionizing Radiation

Results confirmed following Chi-square test of association ($X^2_{@α=.05;p} = .000; df = 1$) that there is a significant association between the program the students are enrolled and their perception to ionizing radiation. Students enrolled in the non health-related programs are more apprehensive about ionizing radiation than in health-related programs. Healthcare curricula are incorporated with an intensive background in general, chemical and physical Sciences which made students more aware of the environmental phenomena. Moreover, healthcare curriculum programs have integrated patient care and ethics in the health care profession which made them trust the personnel working in a healthcare institution.

Meanwhile, in terms of the respondents’ monthly family income, results revealed following Chi-square test of association ($X^2_{@α=.05;p} = .000; df = 1$) that there is a significant association between the respondents’ monthly family income and their perception to ionizing radiation. Results showed that the respondents coming from the high and middle-income families are more anxious and fearful of ionizing radiation. Children coming from affluent families were pampered and cared for in the comfort of their home. They tend to be more dependent on their parents and have little effort to seek opportunities outside their comfortable environment. On the other hand, children belonging to poor families are less dependent on their parents. In fact, some poor children try their best to make their living rather than playing with their peers. Because of this, they have reached their maturity in their early years.

They focus more on survival rather than knowing the risks that surround them (Weigner, 1998).

Association of Psychometric Paradigm and Students' Perception to Ionizing Radiation

This study focused on the two factors attributed to Psychometric Paradigm, which are emotional stability and intuitive ability. Results revealed following Chi-square test of association ($\chi^2_{@ \alpha = .05; p = .000; df = 1}$) that there is a significant association between emotional stability and intuitive ability to students' perception of ionizing radiation.

The result showed that respondents who have high emotional stability test scores were not afraid of ionizing radiation compared to the respondents who scored low in the test. According to Slovic, one of the developers of Psychometric Paradigm, this theory has identified peoples' emotional reactions to risky scenarios which affect their judgment on a particular situation. People who have reached emotional maturity believed that the benefit always outweighs the risk. They believe that they have to give up something in return for something greater. They also believe that they are more in control of the environment rather than the environment controls them. On the other hand, according to Lerner and Keltner in the Journal of Personality and Social Psychology (2001), fearful people often express a pessimistic risk perception or a distasteful response. People who are pessimistic often predict that worst will always happen. They tend to avoid risk, although, in that risk, something beneficial might happen.

Meanwhile, in terms of intuitive ability, the participants who scored high in the intuitive ability test were not afraid of ionizing radiation compared to the respondents who scored low in the test. People who have higher intuition perceive risk differently. They tend to be more rational on a certain risky situation because they believed to have possessed an open mind. They focus more on facts and logic rather than hearsays and gossips. In general, people who have high intuitive ability often give sound decisions compared with people who have low intuition.

Recommendations

It may be essential that factual knowledge be available not just to the respondents but to the general public as well. Having a working knowledge on the effects of ionizing radiation will give them a better understanding of its likely effects and its medical benefits. Furthermore, it will also lessen their apprehensions when undergoing certain x-ray or nuclear medicine procedures.

Moreover, it may be necessary to include the effects of ionizing radiation in the science curricula in primary or secondary level. Introducing the subject in the early years of study will give students better judgment and perspective of its advantages and disadvantages.

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