Radiation Risk Perception of Co-Medical Students

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Abstract

Radiation risk perception of co-medical students, particularly university students majoring in radiological technology, was investigated through basic study in radiation risk communication. Twenty-five items concerning radiation and non-radiation activities were selected and a questionnaire on these items devised. States of dread and unknown were evaluated using a seven-point scale, and results were obtained through factor analysis. The results of the factor analysis show practically no difference between the first and fourth years, exclusive of the items associated with medical practice. The average score of the medical-related items was higher for the fourth than for the first. Nuclear weapons, earthquakes, drugs, nuclear power plants and smoking were selected as high-risk items. The responses of the fourth-grade students varied greatly. The reasons included "serious damage" and "many deaths".

Keywords; radiation risk, risk perception, co-medical student, radiological technology, factor analysis

Introduction

Japanese students were not taught about atomic energy, radiation, and their effects in high school science classes until recently. Thus, knowledge of these issues has not yet become widespread among the general public. Radiation education will be included in junior high school science courses this April for the first time in thirty years[1)].

The Fukushima nuclear power plant (NPP) accident occurred after a large earthquake in March of last year. Many Japanese are afraid of the health effects of radiation and radionuclides. Radiation protection experts should explain the effects of radiation to the public not only during emergency and existing exposure situations but also during the planted exposure situations.

Radiological technologists have a deep knowledge not only of radiological treatments and nuclear medicines but also of radiation protection and radiation effects. They can provide expertise to the public and are thus most suitable as the communicators of radiation risks.

The risk communication study's objective is to clarify whether the acquisition of knowledge related to radiation and the NPP accident have an effect on the risk estimations of experts and the general public. Questionnaire surveys were administered to university students majoring in radiological technology. Their results were analyzed using a factor analysis based on Slovic's method[2, 3)].

A similar Japanese analysis on medical students has been conducted [4-6)]. However, no survey on students majoring in radiological technology has yet been carried out.

Analysis Methods

A questionnaire survey was administered to students in the first, third, and fourth years specializing in

radiological technology at Fujita Health University. The composition of students who participated in the questionnaire survey of 2010 and 2011 were 129 and 156 respectively, as represented in Table 1. Twenty five activities, 9 radiation activities and 16 non-radiation activities, such as medical practices (X ray, CT, MRI examinations, etc.), natural disasters (earthquakes), energy sources (nuclear, thermal, and wind power), foods (food additive and Genetic recombination food), transportations (car, airplane, and train) were selected. The lists of survey items are shown in Table 2. For each item, nine questions expressing risks were prepared. The questions and numbers are shown in Table 3.

The score of dread and uncertainty for each question was evaluated using a seven-point scale. The factor analysis method based on Slovic's study was used to estimate two factors related to dread and unknown from the survey results [2, 3].

The top five high-risk items among the activities shown in Table 3 are chosen and questions about their selections and the peaceful uses of atomic energy are answered by the students. Weights for the selected answers were assigned values according to ranking priority.

Results and Discussion

Concerning radiation-related medical practices such as X and CT examinations and non-radiation medical practices such as MRI examination, answers to question No.2 (acute or delay effect) are higher than the other questions. Questions No.4, No.7, and No.8 have low scores. Thus, the students estimate that the risks of these items have been understood scientifically and are not catastrophic. For energy-related items such as nuclear, thermal, and wind power plants, the answers to No.7 and No.9 are higher than those about medical practices. However, the score of those items is lower than that of earthquakes and nuclear weapons. This indicates that the students consider the dread and understand ability of these items as moderate. For earthquakes and nuclear weapons, the answers have a similar pattern. In particular, questions No.2 through 5 are lower and No.1 and No.7 through 9 are very high. The questionnaire patterns of 2010 and 2011 are much the same.

For medical practices, the rates for questions No. 2, 5, and 6 differ between the first- and fourth-year students. For items such as energy-related activities, natural disasters, and nuclear weapons (but not medical practices), there is no difference between the years.

The results of the factor analysis on the questionnaires average responses of the first- and fourth-year students in 2011 are shown in Figure 1. The results for medical practices are classified in the upper half of the left side. The answers for transportation such as a car, airplane and train are located on the bottom left. The answers for energy-related activities are on the upper right, and those for earthquakes and nuclear weapons are plotted out on the lower right. The results for items such as energy-related activities, smoking, drinking, the earthquake, and nuclear weapons correspond between the first and fourth years. However, the fourth-year students' results for medical practices and transportation are lower than those for the first-year students. This would indicate that the fourth-year students have knowledge and experience of these activities. There is only little difference between the first- and third-year students' answers.

Figure 2 represents the risk perception of CT exams and nuclear power plants for each third-year student in 2010 and 2011 given by the factor analysis. The relative standard deviations for the average value of the CT examination in 2011 are 49% and 57% in the x and y axes, respectively. These values differ little

between 2010 and 2011. Furthermore, the standard deviations for the mean values of answers on nuclear power plants are about the same as that for the CT examination.

Figures 3 and 4 show the percentages of items selected as high risk by first- and fourth-year students in 2011 and the reasons for their choice. Nuclear weapons and earthquakes were selected by students of both years as the activities containing carrying the first- and second-highest risks. The nuclear power plant was considered to carry the third- and fourth-highest risk by the first- and fourth-year students, respectively. As reasons, the occurrence of serious damage and heavy mortality rank most highly, as shown in Figure 4. However, in 2011, 80% of first-year students and 44% of fourth-year students said that the nuclear power plant is necessary because of the need for electrical supply.

Conclusion

Questionnaire surveys on the risk perception of various activities were administered to given to 285 university students majoring in radiological technology. The students' risk perceptions were then explained by a factor analysis, revealing why they made their selections.

Through the factor analysis, risk perceptions for medical practices such as X ray, CT, and MRI examinations were estimated lower by the students, in the fourth year, particularly. However, there was no year difference in the risk perceptions of activities such as energy-related items, natural disasters, nuclear weapons, drinking, smoking, and transportation. This would indicate that learning and experience had an effect on the risk perception of these activities. The difference between the first- and fourth-year students' answers would flow from their different medical/scientific knowledge and experience levels.

The first- and fourth-year students indicated similar risk perceptions of the nuclear power plant. Furthermore, their risk perceptions were the same before and after the Fukushima NPP accident.

Nuclear weapons, earthquakes, drugs, nuclear power plants, and smoking were selected as high-risk activities because of 'serious damage' and 'many deaths'. The answers of the fourth-year students consisted of a wide variety.

References

1) MEXT HP, http://www.mext.go.jp/a_menu/shotou/new-cs/youryou/index.htm,(2012-03-09).
2) P. Slovic, Perception of Risk form Radiation, Radi. Prot. Dosim. 68(3) 165-180, 1996.
3) P. Slovic, Informing and educating the public about risk., Risk analysis, 6, 403-415, 1986.
4) K. Okamoto, Introduction to Risk psychology -Human Error and risk image-, Saiensu. Co., Tokyo, 1992.
5) R. Knda et. al., Preliminary Survey for Communicating Risk in Medical Exposure – Perception of Risk among Nurses Working in Radiology-, Japanese Society of Radiological Technology , 64(8), 937 -947, 2008.
6) S. Tsuji and R. Kanda., Factors Impacting Public Acceptance of Medical radiation Exposure, Japanese Society of Radiological Technology , 65(2), 254 -262, 2009.

Table 1 Number of target students

Date of survey	Level	Number of target students
April–June, 2010	First year	46 (male: 27, female: 19)
	Third year	54 (male: 32, female: 22)
April–October, 2011	First year	55 (male: 32, female: 23)
	Third year	54 (male: 32, female: 22)
	Fourth year	47 (male: 26, female: 21)

Table 2 List of survey items

Category	Item of activities and technology
Radiation relevant particulars (9 items)	X-ray examination, CT examination, Radioisotope examination, Radiation therapy, Food irradiation treatment, Nuclear power plant, Living near the nuclear power plant, Care of a radiation therapy patient, Nuclear weapon
Non-radiation relevant particulars (16 items)	Ultrasonography, MRI, Carcinostatic agent, Influenza, Drug (Cannabis), Smoking, Drinking alcohol Earthquakes, Ultraviolet ray, Car, Airplane, Train Wind power plant, Thermal power plant, Food additives, Genetic recombination food

Table 3 List of questions used for factor analysis

No.	Low score	High score
1	Voluntary	Involuntary
2	Delay effect	Acute effect
3	Unknown	Known
4	Risk unknown to science	Risk known to science
5	Controllable	Uncontrollable
6	New risk	Old risk
7	Not globally catastrophic	Globally catastrophic
8	Not dreadful	Dreadful
9	Consequences not fatal	Consequences fatal

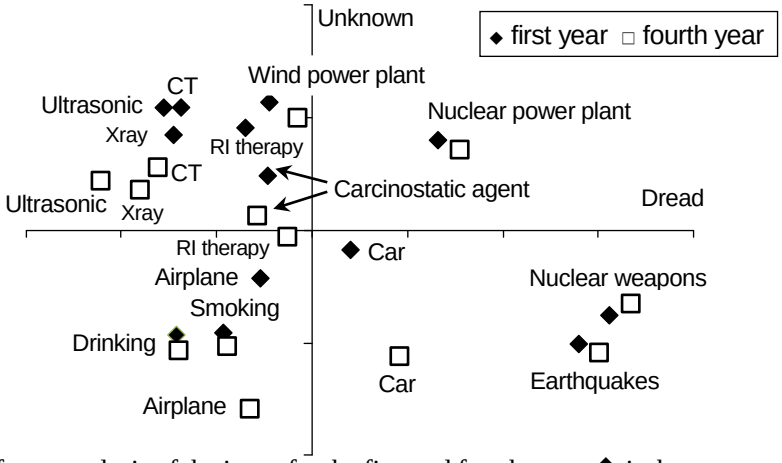

Figure 1 Results of factor analysis of the items for the first and fourth years.◆ is the average value for the first year, and □ is the average value for the fourth year in 2011.

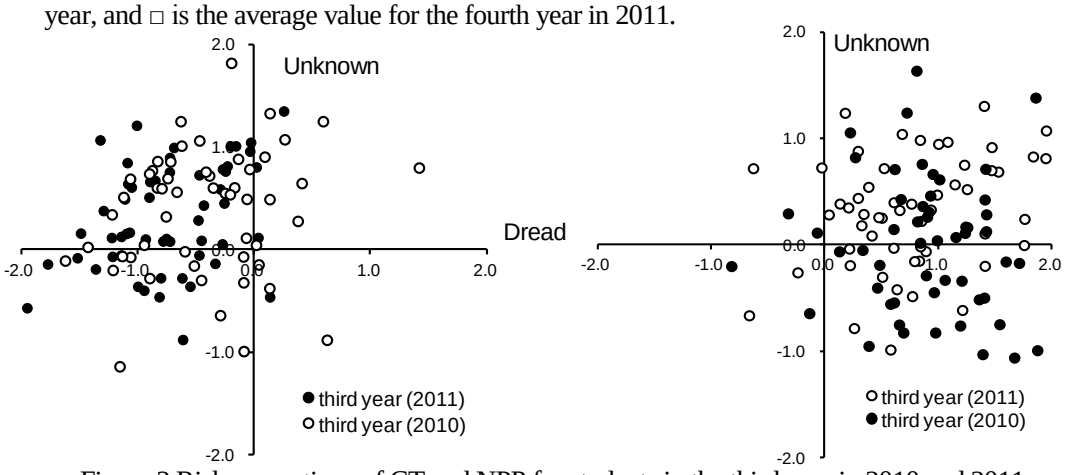

Figure 2 Risk perceptions of CT and NPP for students in the third year in 2010 and 2011.

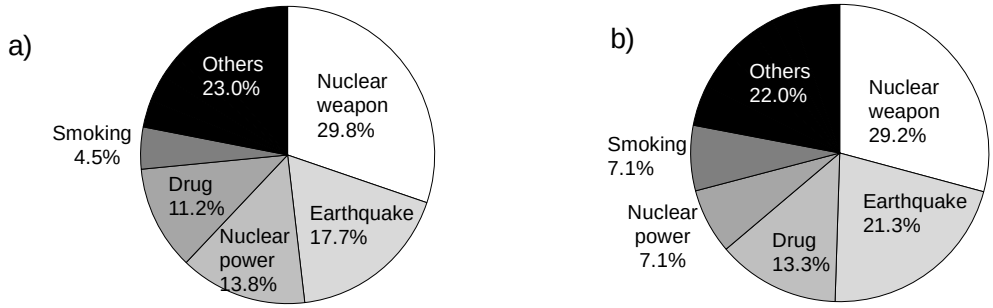

Figure 3 High-risk items selected by the students in the first and fourth years in 2011: a) answers of students in the first year b) answers of students in the fourth year.

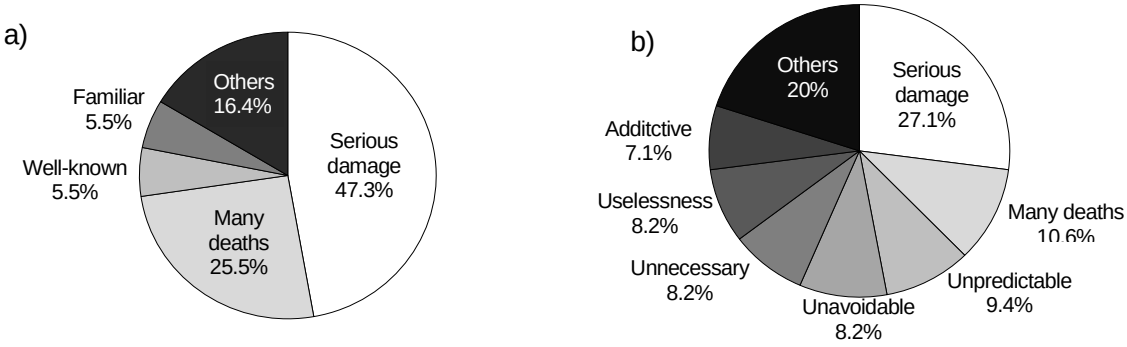

Figure 4 The reasons chosen as high risky items： a) and b) are the same above mentioned.