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Perception of Radiation Risk in Health Sciences Students with Different Majors

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The aim of this study was to clarify the perceptions of health sciences students on radiation risk. Subjects were first-year students of a health sciences school in 2010. A questionnaire survey regarding radiation was conducted among 201 students majoring in nursing, radiological technology, medical technology, physical therapy, and occupational therapy at H University. The survey consisted of questions associated with radiation itself and questions on "risk of damage to one's health by radiation or radioactive substances" (health risk of radiation). We compared answers among the students in each major. Students who did not study physics in high school were significantly more likely to report a fear of radiation from natural resources, such as rocks and soil, than radiological technology students. The rate of students selected the physics were significant differences between nursing students and radiological technology students. The items of "X-ray and CT photogram" and "Mr.And Madam Curie" and "Chernobyl" scored significantly lower in nursing students. We conclude that differences in risk perception of radiation may be due to educational background.

Key words: risk perception of radiation, risk communication, education, radiation protection, health sciences students

1. Introduction

Public concerns regarding medical exposure to radiation are comparatively high, as the risks regarding this exposure are generally unclear[1)]. Gonzalez reported that many people experience anxiety about radiation exposure received during medical diagnostic tests[2)]. Medical doctors and nurses also felt this anxiety[3, 4)]. Fear of radiation is highly communicable, and can negatively affect patient care[5)]. Therefore, systematic education about radiation exposure is needed to address unnecessary anxiety[5, 6)]. In addition, medical staff also play an important role in communicating the risks associated with radiation by sympathizing with and adequately dealing with patients' anxiety about radiation. However, there are few opportunities for students, other than those in medical and radiological technology courses, to receive education on radiation exposure in medical and health sciences schools[7)]. Furthermore, studies are needed to understand students' interest in, or knowledge about, radiation. The aim of this study was to clarify the perceptions of health sciences students on radiation risk and protection and use research findings to develop appropriate educational programs.

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Table 1. Background of the subjects

	Total	sex [*1]		Elective Subjects of Science in high school				Nuclear power plant
		Male	Female	Physics [*2]	Chemistry	Biolgy [*3]	Physical Geography	
Nursing (N)	80	11	69	23	79	59	0	50
Radiogical Technology (R)	40	29	11	38	39	5	0	20
Medical Technology (T)	40	15	25	18	39	24	0	25
Physical Therapy (P)	21	10	11	12	19	13	1	15
Occupational Therapy (O)	20	12	8	8	20	12	0	11
Total	201	77	124	99	196	113	1	121

Subjects data were 201 at all. The values are the numbers of people.
Nuclear power plant are the numbera of people that were bom and raised in the prefecture where the nuclear plant exisits.
Statistical Analysis was used by Chi-square test, and statistical was defined as $p<0.05$.
[*1] The rate of sex were statistically significant differences between N and R ($p<0.001$).
[*2] The rate of students selected the physics were significant differences between N and R ($p<0.001$).
[*3] The rate of students selected the biology were significant differences between N and R ($p<0.001$).

Table 2. Associations with "radiation" (not limits on choicese) (%)

	N	R	T	P	O	P-value
① X-ray and CT photogram	85.0	100.0	97.5	95.2	90.0	*
② Hiroshima Nagasaki (nuclear weapons)	81.3	67.5	80.0	75.0	80.0	
③ Mr. And Madam Curie	13.8	32.5	37.5	23.8	25.0	*
④ Food irradiation	5.0	15.0	5.0	0.0	0.0	
⑤ Chernobyl	58.8	75.0	82.5	61.9	85.0	*
⑥ Cancer treatment	77.5	95.0	80.0	75.0	80.0	*
⑦ Exposure	86.3	77.5	85.0	81.0	85.0	
⑧ Leukemia	35.0	35.0	17.5	33.3	30.0	
⑨ Nuclear waste	33.8	57.5	40.0	28.6	35.0	
⑩ Breeding (agricultural produce)	3.8	5.0	10.0	4.8	10.0	
⑪ Nuclear power generation	66.3	65.0	85.0	76.2	75.0	

Data analyses were done using the chi-square test. *=$p<0.05$
The items of "X-ray and CT photogram" and "Mr.And Madam Curie" and "Chernobyl" scored significantly lower in N students.
The item of "X-ray and CT photogram" and "Cancer treatment" scored significantly higher in R studens.
The item of "Mr.And Madam Curie" scored significantly higher in T students.

2. Methods

2.1. Subjects

Subjects were first-year students in a health sciences school. A questionnaire survey was conducted among 201 students (79 men, 122 women) majoring in nursing (N), radiological technology (R), medical technology (T), physical therapy (P), and occupational therapy (O) (Table 1).

2.2. Education on radiation

All students majoring in N, T, P and O take a class concerning basic radiation protection in the April-June session titled "Introduction to Basic Radiation." This course provides a brief overview of radiation. However, our investigation took place before this course was offered. Therefore, none of the participants had taken this class yet.

2.3. Methods

Data collection and analysis were conducted between April and July in 2010. The survey consisted of ten questions about the perception of radiation, one question about general risk in daily life, and one question about risk of damage to one's health by radiation or radioactive substances (health risk of radiation). Ranking of 10 items about general risk in daily life was carried out from 1 to 10. And 10 items about health risk of radiation were evaluated on an 11-point scale from 0 to 10. The items on the survey were based on the study of Kanda[8]. We also assessed responses to four questions on risk perception and factors influencing risk perception (Table 2).

2.4. Statistical Analysis

All data are analyzed using SPSS 19.0 software. We compared answers among students in each major and those who took physics in high school and those who took other electives. The analysis was conducted using the chi-square test, one-way analysis of variance, and Bonferroni test for multiple comparisons.

2.5. Ethical considerations

The study protocol was approved by the Committee for Medical Ethics of Hirosaki University Graduate School of Medicine (Hirosaki, Japan), a registration number is 2010-025. All students gave informed consent.

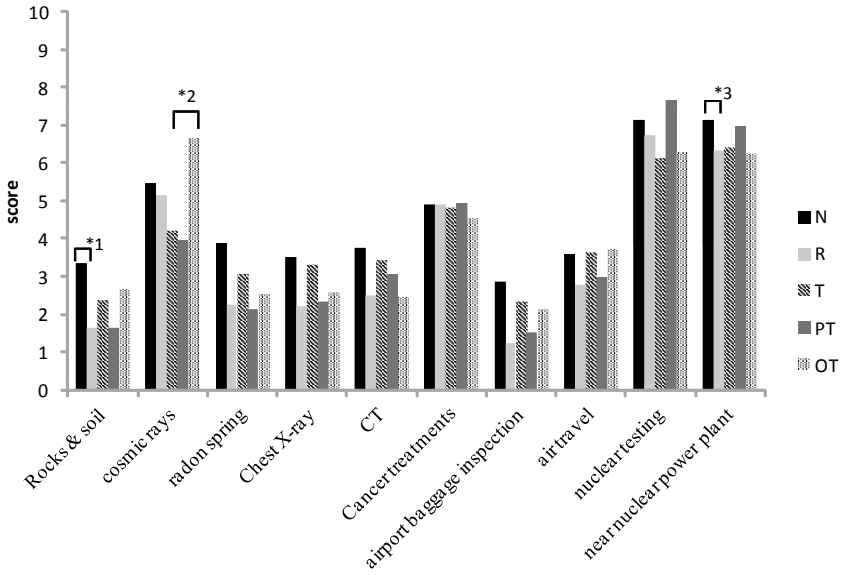

Fig. 1. Health risk about radiation.
Statistical analysis: one-way ANOVA and Bonferroni test for multiple comparison
*1:p<0.05, for comparison between N and R
*2:p<0.05, for comparison between T and O
*3:p<0.01, for comparison between N and R

3. Results

Backgrounds of subjects are shown in Table 1. The rate of students selected the physics were significant differences between the N students and the R students (p<0.001). Many N students had taken chemistry and biology in high school, whereas almost all the R students had taken physics (Table 1). In regard to items associated with radiation "X-ray and CT photogram," "Mr. and Madam Curie," and "Chernobyl" were significantly less likely to be chosen by the N students than other students (Table 2). R students were significantly more likely than other students to associate the terms "X-ray and CT photogram" and "Cancer treatment" with radiation, and the T students, were significantly more likely than other students to associate the term "Mr. and Madam Curie" with radiation. With regard to the health risks of radiation, "receiving chest X-rays" and "living near a nuclear power plant" were perceived as being significantly riskier by the N students than the R students. Ranking of general risk in daily life was not a significant difference. The risk from common radiation, such as cosmic radiation, was perceived as being significantly higher by the O students than the R students. Most students considered it a high-risk that "living near the nuclear power plant" (Fig. 1). In addition, the risk associated with natural radiation, radium, and airport baggage inspection was perceived to be significantly higher in students who did not take physics as an elective in high school compared with those who did take physics as an elective (p<0.05). There were no significant differences among those who took chemistry or biology in terms of the risk of radiation from living near a nuclear power plant. There were no significant differences in question of

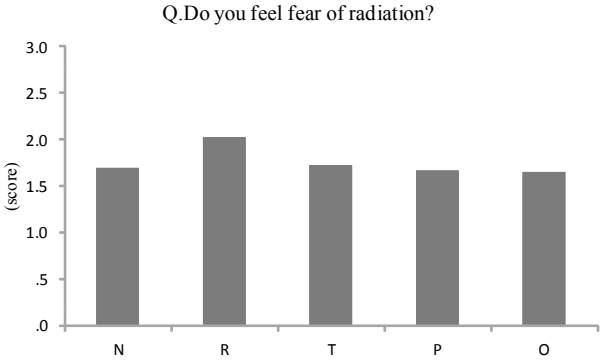

Fig. 2. Perceived fearfulness of radiation.

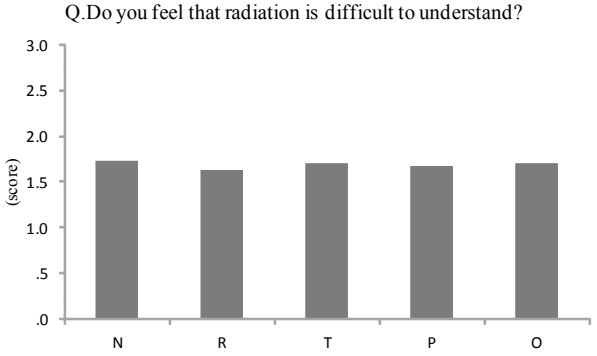

Fig. 3. Perceived difficulty in understanding radiation.

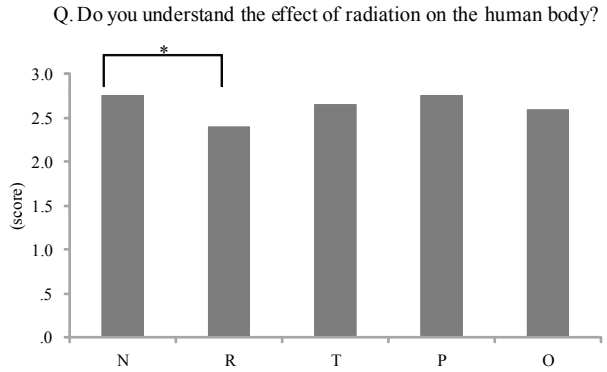

Fig. 4 Perceived understanding of the effects of radiation on the body.
* :p<0.05, for comparison between N and R

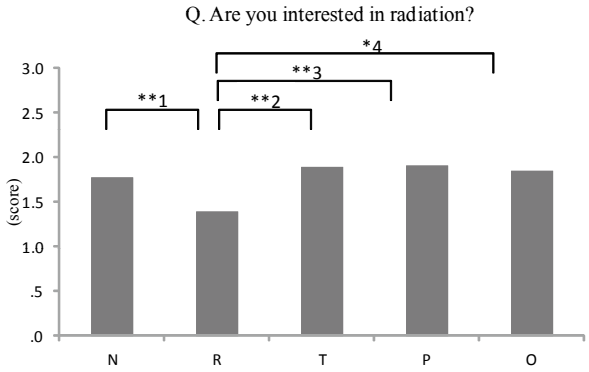

Fig. 5. Interest in radiation .
**1 :p<0.01, for comparison between N and R
**2 :p<0.01, for comparison between R and T
**3 :p<0.01, for comparison between R and P
*4 :p<0.05, for comparison between R and O

Table 3. Ranking of health risk

rank	item	ranking total score	N	R	T	P	O
1	HIV (AIDS)	1.9	1.9	2.0	1.7	2.1	1.9
2	Hepatic fever	2.8	2.9	3.1	2.5	2.7	2.8
3	O-157 (bacteria)	3.7	3.6	3.9	3.5	3.7	4.0
4	Smoking (sigarettes)	5.0	5.1	4.7	5.4	4.6	4.7
5	Surgery	5.5	5.8	5.6	5.0	5.3	5.1
6	Antibiotics	6.5	6.6	6.5	6.5	7.0	6.0
7	Riding a motorcycle	6.7	6.5	6.4	6.5	7.4	7.9
8	Obesty (over weight)	6.9	7.0	6.7	7.4	6.2	6.6
9	X-ray and CT photogram	7.9	7.7	8.2	7.9	8.2	8.2
10	Drinking (alcoholic bevarage)	7.9	7.9	7.9	8.2	8.2	7.9

"Do you feel fear of radiation? (Fig. 2)", "Do you feel that radiation is difficult to understand? (Fig. 3)" The R students had less understanding of the effect of radiation on the human body than the N students (Fig. 4), and less interest in radiation than other students (Fig. 5).

4. Discussion

Health sciences students are not educated about radiation before starting college, although some basic knowledge is provided in elective high school physics classes. Another study showed that life science students have a high-risk perception of radiation compared with engineering students[9]. According to a report from the Japan Atomic Energy Relations Organization[10], 50% of civilians do not know about natural radiation, and they believe that radiation was created by contemporary science. It appears that students who did not take physics as an elective in high school also lacked information regarding natural radiation sources (Table 1).

In risk cognitive research, the general public recognizes an uncertain thing as a high risk superfluously, or it is judged that it is zero risk. On the other hand, a specialist recognizes a risk calmly and is said to receive a low risk. Moreover, specialists have been shown to address the risks associated with radiation calmly or perceive the risk as being low[3]. We consider that medical staff recognizes the risks associated with radiation appropriately. The medical staffs were daily concerned with radiation. Therefore, it seems that they had the radiation recognition which is different compared with the students. Iida et al.[4] reported that almost none of the doctors or nurses properly explained the risks of medical radiation to patients. In many cases, the explanation was "Since medical exposure to radiation is little, it is reliable." We consider that basic education regarding radiation protection is required to help medical staff provide suitable explanations of risk to patients (Table 3).

With regard to the health risks of radiation, the risk from common radiation due to "living near a nuclear power plant" was perceived as being significantly higher by the N students than the R students. It is possible that before the earthquake in Japan in March 2011, nuclear power accidents were perceived as being highly unlikely, and thus, nuclear power plants were perceived as being safe. However, it seemed after the accident at the Fukushima Daiichi Nuclear Power Plant, people began to believe that "living near a nuclear power plant" represented a high risk. Unfortunately, risk perception does not change quickly. Thus, appropriate educational programs are needed to help patients avoid unnecessary anxiety about exposure to medical radiation (Fig. 1).

In this study, the N students felt radiation effect on the

human body with more seriously than the R students even before they underwent any education about radiation. Takanami et al.[12] investigated the need to protect against radiation exposure and reported that in response to the question "How do you protect yourself against radiation exposure," nurses responded with "I do not approach the room where radiation is irradiated" and "I do not care for patients who undergo radiation treatment or diagnostic tests because a radiological technologist cares for the patient." Iida et al.[4] reported that nurses are apt to remind of "exposure to radiation" more frequently than the general public. The medical staffs should be always concerned with the patients. Therefore, the health sciences students need to have the knowledge which copes with influence to the human body of radiation. It is required to educate the right knowledge and the right radiation protection concretely to them. The R students had lower interest in radiation than the students of other major. The R students began to learn the special subjects early. It may be a reason of their low interest in radiation (Fig. 2–5).

5. Conclusion

This study clarifies the perception of health sciences students on radiation risk. In regard to items associated with radiation "X-ray and CT photogram," "Mr. and Madam Curie," and "Chernobyl" were significantly less likely to be chosen by the N students than other students. The R students had less understanding of the effect of radiation on the human body than the N students, and less interest in radiation than other students. The R students began to learn the special subjects. It is considered that the interest in radiation is low. Educational content affects differences in risk perception about radiation and background regarding radiation. The content of educational programs regarding radiation should be examined further.

Acknowledgements

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