BEHAVIORAL CHANGES IN KOREAN ELEMENTARY, MIDDLE, AND HIGH SCHOOL STUDENTS FOLLOWING BASIC EDUCATION IN MEDICAL RADIATION

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Abstract- by providing objective information regarding medical radiation for elementary, middle, and high school students in Korea, who are expected to have a high ripple effect in education, and by analyzing behavioral changes in the selection of medical radiation, this study aimed to deduce the basis for educational intervention. The tools used in the study were a questionnaire, including questions about perception, knowledge, attitude, and behavior toward medical radiation; video and Power-point materials for the lesson; simulated radiation diagnosis selection form; and radiation treatment selection form to find out about behavior. A post-test demonstrated that the objective knowledge about medical radiation of all the students turned out to be significantly higher ($p<0.000$) after the lesson compared to before the lesson. However, there were no statistically significant behavioral changes. Rather, for high school students, the behavior of selecting medical radiography and treatment was significantly lower ($p<0.000$) after the lesson. For the more impressionable children in the lower grades, the lesson must not only provide an opportunity to understand and pay attention to diverse viewpoints, but also encourage them to make ethical decisions based on value. Since it can be predicted that attitude or behavioral changes through education or publicity can be expected from adults older than high school students, issues regarding dangers like radiation exposure must be treated as an issue of value judgment predicated on multifaceted considerations

Keywords: Behavior, Change, Student, Education, Medical radiation

1. INTRODUCTION

According to many international organizations such as the Governmental Nuclear Regulatory Commission (NRC) and the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), it is presumed that cancer and genetic disorders have no threshold value as to low dose radiation of 100 mSv or less[1,2]. However, according to reports by Sodickson et al., 22-year tracking of 31,462 patients at one hospital showed that 33% of the patients received CT scans at least five times, of which 15% received an effective dose of at least 100 mSv. It was predicted that 0.7% of them might develop cancer[3]. Children are more likely to develop cancer than adults are because their life expectancy is higher[3-7]. Medical radiation plays an important role in diagnosis and treatment of various diseases owing to the development of medical radiation equipment and the rising number of exams every year. The problem accompanied by the increase in these exams is the increased exposure to medical radiation[8,9]. According to UNSCEAR's report regarding the medical radiation exposure for 10 years from 1997 until 2007, the number of radiation diagnoses rose from 2.46 billion to 3.66 billion times, whereas the total amount of radiation also rose from 2.3 billion man-Sv to 4.0 billion man-Sv[10]. Thus, to reach the optimal standard of "as low as is reasonably

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achievable" (ALARA) of medical exposure, it is necessary to obtain the best image quality or results required for diagnosis with minimum exposure[11,12]. The US Food and Drug Administration attempts to reduce medical radiation exposure by making it mandatory to label the amount of radiation exposure and image record when a patient receives radiography. The state of California regulates radiation exposure by patients through state laws[13]. Therefore, in 2009, California began implementing the smart card project as a means of managing patient exposure to radiation; each country is using an exposure notebook with a similar concept as a means of management. In Korea, the amount of radiation exposure studied by the ministry of food and drug safety from 2007 to 2009 in 125 hospitals nationwide demonstrated significant differences in the amount of radiation exposure depending on medical institutions and equipment. Therefore, the dosage of radiation exposure should be maintained as low as possible in Korea through the adoption of smart card or other optimization plans[14].

Conversely, the danger posed by science and technology has always existed throughout human history but its significance is recently becoming more pronounced with growing concerns of the general public. Generally, it is better if the risk is as low as possible, but it would be impossible to make a choice that was completely risk-free. The legal principle in England designed for risk management, which clearly shows awareness of the problem is "as low as reasonably practicable" (ALARP). Ever since England has adopted the concept of "best practice" in 1842, it has maintained the principle that regulations must be as flexible as possible[15]. Despite this, in Korea, recent news reports about the Fukushima nuclear power plant have caused the Korean people to grow concerned about nuclear power generation as well as medical radiation exposure. It is not right to underestimate the dangers of radiation, but excessive concern over it is also problematic[16]. When the harmfulness of radiation is underscored, without accurate knowledge about exposure to diagnostic medical radiation, it can prevent adequate diagnosis and treatment when patients refuse exposure to radiation even when it is medically necessary[17].

Education or publicity regarding the dangers of radiation exposure is important for the general public and patients alike. However, improper publicity about the dangers of radiation for the general public and patients could give rise to exaggerated fear and prevent them from receiving radiographic inspections that are essential for them. Developing a common communication tool that can facilitate the understanding of radiation exposure dosage and explaining the level of risk by using appropriate analogies is also an important aspect of proper understanding by doctors, patients, and the general public regarding radiograph[14]. Irrespective of science or technology, the understanding and acceptance by the people are matters that should be deemed important along with the development and fostering of science and technology[18]. However, fear about medical radiation among the general public is on the rise, because in Korea, such attempts are not proactively undertaken. Since it is predicted that unnecessary social costs will rise due to social confusion about medical radiation, measures should be taken to allow proper value judgment through prior intervention. Accordingly, by providing objective information regarding medical radiation for elementary, middle, and high school students, who are expected to have a high ripple effect in education, and by analyzing behavioral changes in the selection of medical radiation, this study aimed to deduce the basis for educational intervention.

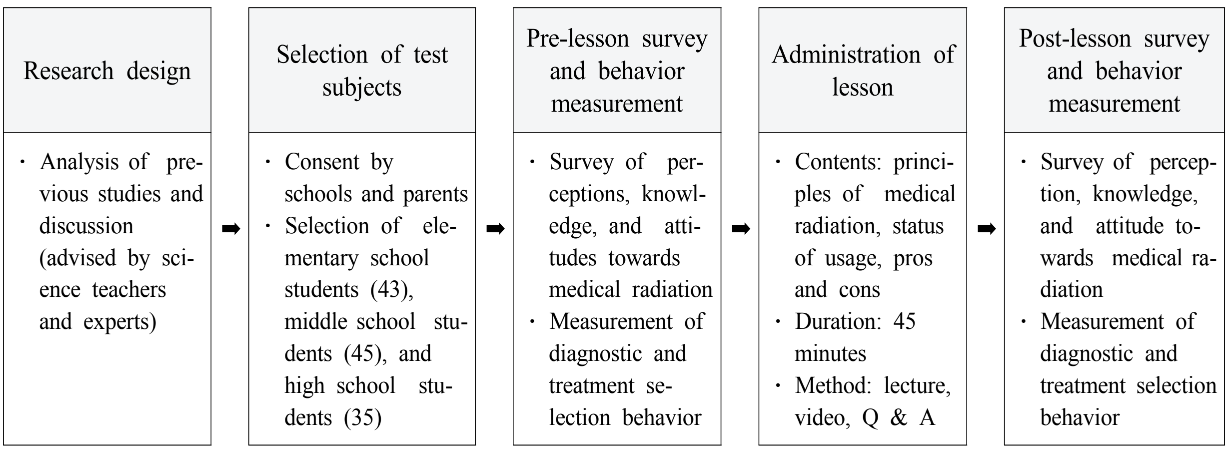

Fig. 1. Research procedure.

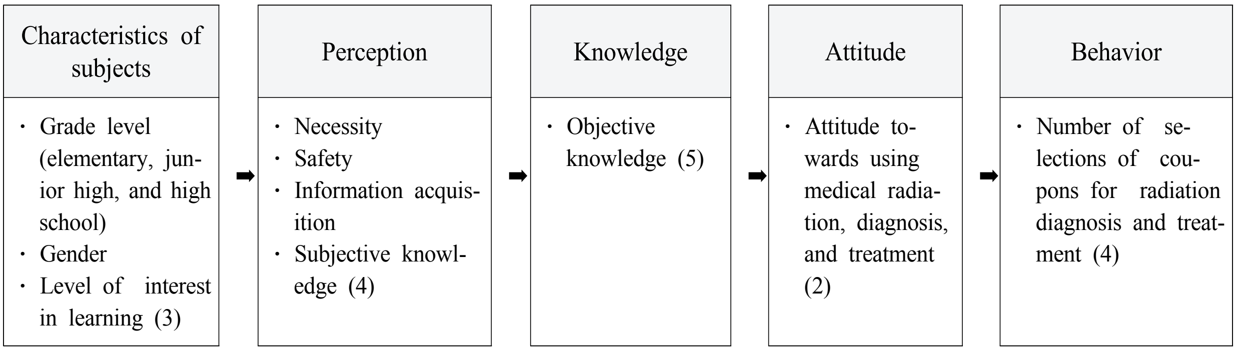

Fig. 2. Composition of questionnaire. The numbers inside the parentheses represent the number of questions.

2. METHODS

2.1 Procedure

By providing correct information about medical radiation and simulation, the basis for educational intervention (perception, knowledge, attitude, and behavior) was derived. The study was conducted in the five steps shown in Fig. 1. including, 1) research design, 2) transmission of official letters to target schools and the selection of test subjects, 3) pre-lesson survey, 4) lesson implementation, and 5) post-lesson survey and behavior measurement. In the research design step, the lesson target, lesson method, lesson content, and duration were determined.

2.2 Research subjects

The research subjects were elementary, junior high, and high school students in Korea, who would be conducive to the delivery of information about medical radiation. There were 123 students from three schools in the metropolitan area from whom parental consents were obtained. Gender distribution was 82 male students (66.7%) and 41 female students (33.3%); by grade level, there were 43 elementary students (35.0%), 45 middle school students (36.6%) and 35 high school students (28.5%).

2.3 Research materials and methodology

The tools used in the study were a questionnaire, including questions about perception, knowledge, attitude, and behavior toward medical radiation; video and Power-point materials for the lesson; simulated radiation diagnosis selection form; and radiation treatment selection form to find out about behavior. The simulated radiation selection form consisted of three coupons that provided an osteoporosis exam, a general x-ray exam, and an ultrasonic exam, free of charge. The simulated radiation treatment form was a coupon that provides free radiation treatment in the case of cancer. Ultrasonic is not related to radiation exposure, but it was included in the study in order to study its effect on the students' behavioral change because the general public perceives it as a part of a radiation exam.

The lesson consisted of watching a video that included principles of medical radiation diagnosis and treatment, and the status of usage (10 minutes), a lecture (25 minutes), and explanation of program (10 minutes). In order to minimize the errors arising from the lecturer, one expert in the field of radiation delivered the lectures to all of the students in each grade level. The lesson lasted from December 11 to December 20, 2013.

The survey consisted of questions on knowledge, attitude, and behavior based on traditional learning models as shown in Fig. 2. Perception consisted of four aspects including the necessity, safety (danger level), information acquisition (familiarity), and subjective knowledge about medical radiation. Each category was measured on a five-point scale (1="Strongly disagree" to 5="Strongly agree"). In terms of measurement of objective knowledge, there were a total of five questions regarding the purpose of using medical radiation, status of medical radiation usage in Korea and overseas, concept and level of medical radiation exposure, and the effect of medical radiation on the human body. More correct answers showed higher objective knowledge. More coupons selected for radiographic inspection and treatment showed higher levels of behavioral change.

2.4 Analysis methodology

For statistical analysis, SPSS/WIN 15.0 was used for frequency and percentages, averages, and standard deviations, Pearson's correlation analysis, t-tests and one-way ANOVA, while the Scheffe method was used for post-lesson verification.

Table 1. General Characteristics of Subjects.

Items	Category	Pre-lesson n(%)	Post-lesson n(%)
Level of interest in lesson	Low	5(4.1)	3(2.4)
	Medium	18(14.6)	11(8.9)
	High	100(81.3)	109(88.6)
	Total	123(100.0)	123(100.0)
Radiation diagnosis experience	No/I don't know	61(50.4)	-
	Yes.	60(49.6)	-
	Total	121(100.0)	-
Radiation treatment experience	No/I don't know	112(92.6)	-
	Yes	9(7.4)	-
	Total	121(100.0)	-
Diagnosis behavior*,†	Osteoporosis exam	73(34.0)	60(33.0)
	General x-ray	78(36.3)	69(37.9)
	Ultrasound	64(29.8)	53(29.1)
	Total	215(100.0)	182(100.0)
Treatment behavior*	Agree	73(59.8)	70(58.8)
	Disagree	49(40.2)	49(41.2)
	Total	122(100.0)	119(100.0)

*The frequency of selecting medical radiation after the lesson was lower than before the lesson. This appears to be caused by the fact that there were differences between the information the subjects knew about medical radiation exposure and the information they acquired, which made their decision-making criteria ambiguous.
†The diagnostic behavior is the result of multiple responses.

3. RESULTS

3.1 Subject characteristics before and after the lesson

There was high interest (81.3%, 100 students) in medical radiation before the lesson and even higher interest (88.6%, 109 students) after the lesson. The frequency of selection behavior of choosing the osteoporosis exam and the general x-ray exam was lower after the lesson compared to before the lesson shown in Table 1.

3.2 Changes in perception, knowledge, attitude, and behavior before and after the lesson for each grade level

The level of interest in medical radiation education was shown to be significantly higher before the lesson than after the lesson in elementary school students ($p<0.033$) and middle school students ($p<0.004$). In the level of perception, including necessity, safety, information acquisition, and subjective knowledge about medical radiation, middle school students showed significantly high results in necessity ($p<0.002$) and safety ($p<0.005$), while all elementary, middle, and high school students showed significantly higher results ($p<0.000$) in information acquisition and subjective knowledge after the lesson compared to before the lesson.

The objective knowledge regarding medical radiation was significantly higher ($p<0.000$) post-lesson in elementary, middle, and high school compared to pre-lesson, and attitude towards exams and treatments was higher in elementary and middle school students post-lesson compared to pre-lesson. However, medical radiation exam and treatment behavior was significantly lower ($p<0.000$) for high school students post-lesson compared to pre-lesson. This may be attributed to a perception regarding the usefulness of medical radiation pre-lesson, which changed into a behavior of not selecting unnecessary exams and treatments after receiving objective information about exposure shown in Table 2. The fact that objective knowledge of high school students increased, with no change in attitude, is the same as the study results regarding nuclear energy, which Dulsik (1992) conducted with students as subjects[19]. This appears to be a common result stemming from difficulties in problem solving based on mere provision of knowledge[20-22].

Table 2. Changes in Perception, Knowledge, Attitude, and Behavior for each Grade Level Pre- and Post- Lesson.

Items		Lesson	Elementary		Middle		High		Total	
			mean±sd	t(p)	mean±sd	t(p)	mean±sd	t(p)	mean±sd	t(p)
Level of interest in lesson		Before	4.35±0.72	-2.203 (.033)	4.44±0.78	-3.084 (.004)	3.69±1.11	-1.420 (.165)	4.20±0.92	-3.462 (.001)
		After	4.51±0.59		4.62±0.58		3.89±0.99		4.37±0.78	
Perception	Necessity	Before	4.26±0.73	-1.402 (.168)	4.58±0.58	-3.317 (.002)	4.34±0.59	.770 (.447)	4.40±0.65	-1.825 (.412)
		After	4.37±0.62		4.78±0.42		4.26±0.56		4.49±0.58	
	Safety	Before	4.02±0.77	-1.850 (.071)	4.33±0.93	-2.973 (.005)	3.71±0.96	-1.506 (.141)	4.05±0.91	-3.639 (.000)
		After	4.23±0.78		4.69±0.51		3.97±0.82		4.33±0.76	
	Information acquisition	Before	3.35±1.02	-4.219 (.000)	3.80±1.14	-5.641 (.000)	2.74±0.85	-8.234 (.000)	3.34±1.10	-9.888 (.000)
		After	4.09±0.78		4.71±0.51		4.14±0.73		4.33±0.73	
	Subjective knowledge	Before	3.09±0.92	-5.888 (.000)	3.64±1.25	-5.686 (.000)	2.79±0.95	-5.857 (.000)	3.21±1.11	-10.022 (.000)
		After	3.91±0.84		4.60±0.62		3.88±0.77		4.16±0.81	
Objective knowledge		Before	1.42±1.42	-3.849 (.000)	2.23±1.49	-5.490 (.000)	2.40±1.40	-4.999 (.000)	1.99±1.49	-8.215 (.000)
		After	2.09±1.34		3.64±1.10		3.74±1.34		3.12±1.46	
Attitude	Exam	Before	3.79±1.04	-2.789 (.008)	4.36±0.80	-2.976 (.005)	4.17±0.79	.818 (.419)	4.11±0.91	-2.583 (.011)
		After	4.19±0.76		4.67±0.56		4.03±0.98		4.32±0.81	
	Treatment	Before	3.74±0.93	-2.324 (.025)	4.38±0.75	-2.119 (.040)	4.11±0.83	1.214 (.233)	4.08±0.87	-1.548 (.124)
		After	4.07±0.86		4.60±0.65		3.89±1.05		4.21±0.90	
Behavior		Before	1.93±0.96	.274 (.785)	1.62±1.11	.496 (.623)	1.69±1.08	4.547 (.000)	1.75±1.05	3.501 (.001)
		After	1.91±1.09		1.58±1.18		0.83±1.15		1.48±1.21	

*The level of interest in the lesson about medical radiation, perception (necessity, safety, information acquisition, subjective knowledge), and attitude was measured on a five-point scale (1 being the lowest and 5 being the highest), and for objective knowledge, the best score was 5 and the lowest score was 0. As for behavior, the lowest was 0 and the highest was 3 as measured by the number of coupons selected for free medical radiation exam and treatment.

†Higher relevant scores represent higher levels of positivity in each area.

3.3 Pre- and post-lesson behavioral change by subject characteristics

In the simulated radiation diagnostics, the behavior level was measured higher if more of the three types of coupons provided for an osteoporosis exam, a general x-ray exam, and an ultrasonic exam were selected. Scores between 3 (the highest, when all three coupons were chosen) to 0 (the lowest, when none of the three coupons were chosen) were assigned. Before the lesson, female students had higher medical radiation selection behaviors than the male students ($p<0.039$), and no behavioral differences in other subject characteristics. Although the level of medical radiation selection behavior was higher for the female students than the male students even post-lesson ($p<0.002$), the selection behavior level decreased for both male and female students post-lesson. High school students showed lower medical radiation selection behavior levels compared to middle or elementary school students ($p<0.000$) shown in Table 3.

3.4 Correlation between pre- and post-lesson variables

The results of a correlation analysis of the level of interest in the lesson on medical radiation, perception (necessity, safety, information acquisition, and subjective knowledge), objective knowledge, exam and treatment attitude, and behavior showed that they all have correlations among the variables of perception. When one perceives that medical radiation is necessary, they also perceive it as safe. When the level of attitude toward receiving medical radiation for diagnosis is high, the level of attitude toward receiving it for treatment is also high. However, neither pre- nor post- lesson behavior demonstrated any statistically significant correlation among the level of interest in the lesson, perception, knowledge, and attitude. This appears to show that medical radiation use behaviors may be influenced by variables other than knowledge, perception, or attitude. In other words, education does not necessarily lead to behavioral changes in using medical radiation shown in Table 4.

Table 3. Pre- and Post-Lesson Behavioral Changes by Subject Characteristics.

Items		Category	Pre-lesson			Post-lesson	
			mean±sd	t/F(p)		mean±sd	t/F(p)
Gender		Male	1.61±1.06	-2.087 (.039)		1.24±1.19	-3.166 (.002)
		Female	2.02±0.99			1.95±1.12	
Grade level		Elementary	1.93±0.96	1.027 (.361)	b	1.91±1.09	8.917 (.000)
		Middle	1.62±1.11		b	1.58±1.18	
		High school	1.69±1.08		a	0.83±1.15	
Level of interest in lesson		Low	2.00±1.23	.808 (.448)		0.00±0.00	2.412 (.094)
		Medium	2.00±1.14			1.64±1.21	
		High	1.69±1.03			1.50±1.21	
Perception	Necessity	Low	-	1.134 (.259)		-	-0.904 (.368)
		Medium	2.09±0.70			1.00±1.41	
		High	1.71±1.08			1.50±1.20	
	Safety	Low	1.00±0.00	2.618 (.077)		0.00±0.00	1.533 (.220)
		Medium	2.06±0.86			1.50±1.32	
		High	1.66±1.11			1.50±1.19	
	Information acquisition	Low	1.70±1.02	.103 (.902)		-	.250 (.081)
		Medium	1.80±1.05			1.56±1.37	
		High	1.72±1.09			1.48±1.19	
	Subjective knowledge	Low	1.52±0.99	1.035 (.359)		-	-1.104 (.272)
		Medium	1.86±1.06			1.28±1.25	
		High	1.79±1.09			1.56±1.19	
Objective knowledge		Low	1.67±0.99	-.684 (.495)		1.51±1.16	.277 (.061)
		High	1.81±1.08			1.45±1.28	
Attitude	Exam	Low	1.00±1.00	1.100 (.337)		1.00±1.41	.349 (.706)
		Medium	1.63±0.77			1.42±0.90	
		High	1.81±1.13			1.50±1.24	
	Treatment	Low	1.50±0.71	.081 (.922)		1.40±1.52	.530 (.590)
		Medium	1.79±0.89			1.24±0.94	
		High	1.74±1.12			1.54±1.25	

*a, b, c indicate the same group in the post-analysis. Behavior is based on the full score of 3.

† In the case of high school students, the reason that their medical radiation selection behavior dropped drastically after the lesson compared to the elementary and middle school students is because they responded more sensitively to value judgments on medical exposure.

4. CONCLUSION

This study was prompted by an interest in the optimization plans for medical radiation exposure as well as an interest in providing educational solutions that keep the general public's excessive concern over medical radiation exposure from becoming a social issue. As a result of a 45-minute lesson given to Korean elementary, middle, and high school students regarding the purpose of medical radiation use, the status of the use of medical radiation in Korea and overseas, the concept and level of exposure to medical radiation, and the effect of medical radiation on the human body, the objective of all of the subjects were enhanced. However, there was no statistically significant behavioral change. Rather, in the case of high school students, their level of medical radiation selection behavior became significantly lower after the lesson. In this study, the accumulation of objective knowledge caused the high school students to make rational judgment towards the selection for fewer exams due to more concerns over radiation exposure than the benefits of medical radiation exams. This results has demonstrated, through studies by Jang et al (2012), Lee (2012)[23, 24]. For students, their sense of responsibility and willingness towards behavior with respect to a problem is manifested differently depending on their understanding of the cause of social and ethical issues related to science[23]. The scientific literacy model explains that attitude related to science is expressed differently depending on the degree of knowledge, and rational decision-making becomes more possible with more accumulation of knowledge[24]. An ordinary person assesses danger based on his or her memory of past experience and imaginations about future events[25]. However, in the case of Korean people, their negative perception of radiation has increased since the Fukushima nuclear power plant accident, and negative behavioral intent has formed due to the reports

Table 4. Correlation among Level of Interest in Lesson, Perception, Knowledge, Attitude, and Behavior Pre- and Post-Lesson.

Category	Items		Level of interest in lesson	Perception: Necessity	Perception: Safety	Perception: Information acquisition	Perception: Subjective knowledge	Objective knowledge	Attitude: Diagnostic attitude	Attitude: Treatment attitude	Behavior
Pre-lesson	Level of interest in lesson		1								
	Perception	Necessity	.459**	1							
		Safety	.398**	.603**	1						
		Information acquisition	.387**	.439**	.538**	1					
		Subjective knowledge	.338**	.362**	.486**	.750**	1				
	Objective knowledge		-.107	.276**	.189*	.137	.235**	1			
	Attitude	Diagnostic attitude	.123	.456**	.367**	.239**	.376**	.410**	1		
		Treatment attitude	.184*	.529**	.396**	.220*	.314**	.332**	.821**	1	
	Behavior		-.076	-.056	.021	.068	.124	.062	.122	-.005	1
Post-lesson	Level of interest in lesson		1								
	Perception	Necessity	.536**	1							
		Safety	.481**	.809**	1						
		Information acquisition	.553**	.678**	.656**	1					
		Subjective knowledge	.477**	.643**	.661**	.756**	1				
	Objective knowledge		-.047	.182*	.038	.277**	.213*	1			
	Attitude	Diagnostic attitude	.186*	.418**	.374**	.400**	.348**	.112	1		
		Treatment attitude	.166	.384**	.365**	.366**	.349**	.080	.884**	1	
	Behavior		.155	.143	.158	.031	.133	-.057	.127	.140	1

* $p < 0.005$, ** $p < 0.001$

†There is high correlation among perception variables, while behavior had no correlation with all the variables.

‡There was no correlation between the level of interest in the lesson and objective knowledge about medical radiation. That is, it is easy to increase objective knowledge when the level of interest in learning is high but in the case of medical radiation, the knowledge about medical radiation could not be enhanced just because there is a high level of interest in its lesson.

by the press regarding medical radiation and excessive exposure. It can therefore be inferred that the behavioral change that can lead to rejection of medical radiation exams or treatment was also manifested in the high school students. Thus, it can be predicted that the negative perception regarding medical radiation exposure in grown-ups over the age of high school students will also be enhanced.

The objective knowledge and attitude regarding medical radiation use may be enhanced through education for the elementary and middle school students. However, there was no behavioral change. This can be understood in the vein that perception of danger does not always lead to behavior to defend against the danger[26]. The lower grade students for whom perception changes are easily formed must not only be provided the opportunity to understand and listen to various perspectives but also be encouraged to make ethical decisions based on value[27]. Education only enhanced their objective knowledge about medical radiation use without any changes to attitude or behavior for the high school students. From this, it can be inferred that unlike the younger elementary and middle school students, it would be difficult to bring about attitude or behavioral changes in grown-ups above high school age through education or publicity. Therefore, issues regarding risks such as radiation exposure must be treated as an issue of value judgment that takes into account multifaceted considerations[28].

The International Commission on Radiological Protection takes the position that if the clinical benefit from diagnosis and treatment of disease is greater than the risks from the increasing exposure to medical radiation, then medical radiation may be used (justification), and if used for the same purpose, it is desirable to reduce unnecessary exposure through optimization (ALARA). While there is no radiation dosage limit, there is a diagnostic reference level for medical radiation exposure, which allows the amount of exposure in each exam to be reduced[29]. The nation-wide information sharing, with respect to the fundamental defense principles of medical radiation, should be developed so that it can be treated as an underestimation of danger and value judgment on excessive risk. In such event, it has to be borne in mind that societal values take up an important position in risk perception[30]. Schlinger (1976) has demonstrated, through studies by McAllister (1995), Posch (1994) and McComas (2006) that the goal of social education does not stop at forming socially desirable attitudes, but rather, leads them to be put into practice; in fact, the emotional communication strategy in education for societal change is more effective for behavioral change rather than attitude change[31-34]. Therefore, it is necessary to provide emotional education that shows how medical radiation is a scientific technology that looks after not only one individual but also the health of his/her family, because the benefit one obtains from diagnosis and treatment is greater than the radiation exposure. In the studies by Arora (2000) and Berry (2004), when the benefit one obtains from medical exam and the loss that could arise without medical exams are presented, there were more behaviors of taking the medical exams when the loss was conveyed through the message[35, 36]. In addition, in the study by Meyerowitz et al. (1987), in self-diagnosis of breast cancer, it was more effective for behavior change when the loss was conveyed through the message by providing information[37]. In a study by Mcneil et al. (1982) regarding decision on cancer treatment using radiation, the behavioral change effect was manifested greater when loss in the case of not receiving radiation treatment was presented[38]. Before false information about medical radiation becomes generalized, each medical institution should take strict and expedient measures for optimization of patient exposure. In addition, for the general public, programs must be provided through which medical exposure may be approached as a value judgment issue. In doing so, rather than providing information for reducing medical radiation exposure, intervention has to take place by proposing specific and achievable ways that have high benefits from diagnosing and treating diseases. At the same time, physician-centered optimization education that is capable of achieving optimization of medical radiation must take place. Krille et al. reviewed previous studies on the level of physician's perception of radiation exposure, and as a result, they concluded that an extremely small number of physicians had proper knowledge about radiation exposure[39]. Therefore, in order to reduce the amount of radiation exposure from the constantly rising medical radiation exposure, the experts, including physicians, must achieve optimization. In addition, for the general public, there is a need for the intervention of a program for enhancing social perception. Even though the differences in perception that exist between the general public and experts are not merely due to a gap in knowledge; good quality information and education is still necessary[40]. All countries face social problems that must be resolved by the people or their government[41]. This study can serve as basic material for resolving social issues such as the people's excessive concerns over medical exposure that have recently become an issue. Before this issue turns into a bigger social problem in Korea where medical radiation needs to be used continuously, an intervention for raising the national perception has to take place in conjunction with the optimization of medical radiation exposure in terms of health promotion.

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