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EFFICACY OF EDUCATIONAL PROGRAM ON MEDICAL PRACTITIONER'S PERCEPTION ON RADIOLOGICAL EXAMINATION

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ABSTRACT

To measure the efficacy of educational programs and compare the perception among intervention and control group. The research design comprises a quasi-experimental design. Initial data collection was undertaken at the baseline (Pretest) prior to interventions, and then again following that intervention (Post-test).The study employs demonstrated equivalent populations prescribing the radiology examination at the two hospitals (experimental and control). The result clearly highlights the lack of participants' perception on essential biological facts of radiation and radiology equipment's after intervention in both intervention and control groups. The items included both the domains of the tool of ionizing and non-ionizing imaging modality used in the medical imaging with respect to the radiation dose involved in the imaging procedure. It also highlights the perception of biological radiosensitive tissues, the Intensity of biological effects of radiation and the dose range involved in the examination. The medical practitioner's shows increase perception in the intervention group on the radiological examination as compared to the control group.

KEY WORDS: Medical Practitioner , perception, Radiological Examination

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INTRODUCTION

In recent days the use of radiation in medical imaging procedure involving computed tomography interpretation procedure has been increased drastically making possible more accurate diagnosis of diseases and injuries. However the high radiation dose associated with the imaging procedure associated with potentially harmful biological effects specifically, high radiation doses tend to kill cells, while low doses tend to damage or alter the DNA of irradiated cells[1,2] which has been reflected in resent studies[3,4,5,6,7]. Therefore, imaging staff and patient are being exposed to higher doses of radiation than ever, putting them at increased risk of stochastic and deterministic has adverse consequences. In addition, medical imaging staffs are at higher risk, as their radiation exposure is cumulative over the years of their practice[8,9] ,and children who are undergoing the imaging procedure are at higher risk because of their higher tissue radio sensitivity[9]. Minimizing exposure is therefore a constant goal in the medical imaging procedure in particular pediatric imaging procedure. Training for medical practitioner and medical imaging staff in radiation protection has been shown to be the most effective method of reducing radiation risk[10]. It was identified that the radiological courses do increase awareness about radiation dose. There is a need to educate clinicians about ionizing radiation relevant to radiology examination and their clinical role to provide accurate information to their patients[11].Most of the Africa universities have medical college and schools which offers the training and give a degree in medicine. However, there are only few which give radiology course for their students during their undergraduate studies. This is striking, since, after graduation, these medical practitioners will be the only health professionals having the authority to request medical imaging procedure for the patients. In addition, there is a lack of studies in India about the hazards of unnecessary use of radiological examinations. There is only one study among medical doctors on the knowledge and awareness of radiation exposure during common radiological procedures; the result was poor[12]. Therefore, the aim of this study is to determine the efficacy of medical practitioner education program to increase the radiation awareness.

Methodology

The present study was conducted in two phase:-

Phase 1

a.To develop the Anxiety inventory and standardize the questionnaire

Extensive literature review and qualitative research was done and culturally appropriate items were generated. 55 items were generated initially and was subjected for content validity. The tool was given to 10 subject matter experts from the area radiology and tool development export for content validity and based on the content validity 4 items were eliminated. The remaining 51 item scale was subjected for item analysis on a sample size of n = 535. Items with corrected item-total correlation below 0.4 were deleted and 10 items were eliminated during item analysis, and thus the Medical practitioner's perception towards the radiological examinations with 41 items was finalized. The scoring criteria for the scale was formed to represent the perception of the medical practitioner on radiology examination on a 5-point scale ranging from 0 to 4, where 0 is no strongly disagree and 4 is 100% or strongly agree. The scores for any individual would fall between 0 and 164. If the score happens to be above 83, it shows favorable opinion to the given point of view (good), a score of below 82 would mean unfavorable opinion (bad).

b.To Develop Education program for medical practitioner

The Education program manual was prepared by considering the conceptual framework, validated instrument developed for the medical practitioner. According to previous studies, it was found that prior educational program or information helped increase in the radiation awareness among the medical practitioners[11,12,13].

The Education program manual included information about

- Justification and the framework
- How should justification be practiced and what knowledge is required for proper justification of a radiological procedure?
- Is the acquisition of patients' consent important?
- When is an investigation useful and what are the reasons that cause unnecessary use of radiation?
- What are the reasons for over-investigating
- Which procedures are responsible for the highest doses to the patient?
- Special conditions that a referring medical practitioner may encounter
- Can radiological procedures cause acute radiation injury?

Correction of the educational program for the medical practitioner was done by both the Investigator and the Guide, after which it was submitted for validation by ten experts from the Department of Radiology and medical practitioner.

CONTENT VALIDATION OF THE MANUAL

Aim : To determine the content validity of the education manual.

Sample: The expert panel consisted of health professions who were radiologist, medical practitioner who prescribe the radiology examination and Biostatistics. The experts were identified from Kasturba Medical College, Manipal. The experts were contacted individually and explained about the purpose of the study seeking consent to participate in this phase of content validation.

Sample size : 10

Procedure: All the experts identified were given an information letter explaining the purpose of the study

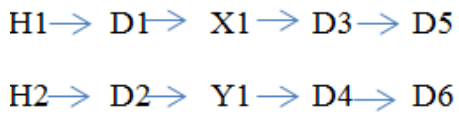
along with the consent form. After the experts gave their consent, an appointment date and time was obtained to meet them in person for the content validation. On the appointment date, the content validation form with the list items generated was given to the experts. The validation of the questionnaire was based on usefulness, appropriateness and relevance of the items in the different sections of the proforma. Percentage level of agreement between experts was used to evaluate the content validity of items. The criteria to include the items and domains were fixed at 80% i.e, the items will be included only if seven or more experts score it as relevant. The filled content validation forms were received from the experts and the data was compiled and analyzed. The items were accepted, modified or deleted based on the level of agreement between experts. Experts were also requested to provide comments or suggestions regarding the items. The comments were discussed and analyzed with the individual experts and clarifications were done. Further individual meetings with experts were also conducted to clarify the issues raised and collect necessary explanations. The consensus was obtained with all the experts regarding the fit of items under

***Data analysis**:* Descriptive statistics was used to summarize the demographic characteristics of experts and the percentage was used to report the agreement of experts for each item and domain in the scale.

Phase 2

The research design comprises a Pre-test / Post-test control group quasi-experimental design Initial data collection was undertaken at the baseline (Pretest) prior to interventions taking place, and then again following that intervention (Post-test).The study employs demonstrated equivalent populations prescribing the radiology examination at the two hospitals (experimental and control). The study conforms to fundamental experimental theory by allowing adequate control over major threats to internal and external validity. The research design for this study is shown in Figure 1.1. The diagram shows the various aspects of the research design, including the relationships between the groups and the timelines for each stage. This includes the preliminary investigation (Hospital 'A') and the control group (Hospital 'B'. The validated educational program was distributed among the medical practitioner as part of their education program in between the pre and post evaluation

Figure 1.1
The quasi-experimental research design



H1, preliminary investigation, Experimental Group Hospital 'A' Stage 1
H2, preliminary investigation, control Group Hospital 'B' Stage 1
D1, measurement Pre - Intervention Experimental Group Hospital 'A' Stage 2
D2, measurement Pre - Intervention, Hospital 'B' Stage 2
X1 intervention, Hospital 'A' Stages 2
Y1 control group Hospital 'B' Stages 2
D3, measurement Post - Intervention, Hospital 'A' Stage 3 After 7 Days
D4, measurement control Group Hospital 'B' Stage 3 After 7 Days
D5, measurement Post – post - Intervention, Hospital 'A' Stage 4 After 7 Days
D6, measurement post control Group Hospital 'B' Stage 4 After 7 Days
Sample Size: 30 medical practitioners in intervention and control group (sample size is calculated based on the pilot test)

Formula to calculation

$$n = \frac{(Z_\alpha + Z_\beta)^2 \times \sigma^2}{d^2}$$

z alpha = 1.96 for 95% CI
z beta = 0.84 for 80% power
n = 23.38

Study design: Quasi Experimental Study

Study Settings: The research work was done at Kasturba Hospital, Manipal. This is a 2500 bedded tertiary care teaching and referral hospital providing specialized healthcare services to all sections of people.

Study period 6 months

Sources of data Medical practitioner prescribing the radiology examination

Ethical considerationApproved by institutional ethics committee (IEC), Kasturba Hospital, Manipal.

Sampling Criteria

a. Intervention and control group criteria

Inclusion criteria: Medical practitioner prescribing the radiology examination with MBBS, MD or DM qualification

Exclusion criteria: Medical practitioner who is not prescribing the radiology examination

Tools Used In the Study

Scale: Medical practitioner's perception towards the radiological examinations According to Polgar and Thomas (1997), there are several threats to internal validity in quantitative research. These include population selection, history, maturation changes, practice effects, instrument error, and attrition. In terms of the current investigation, the use of the quasi-experimental design and the accompanying method of implementation contributed greatly to reduce the threat to internal validity. The use of hospitals within the same area health service allowed for the inclusion of populations with similar demographic and cultural profile and characteristics. Hospitals were able to be chosen that demonstrated similar levels of activity and service delivery, and under the same central area health administration.

Statistical Analysis

- SPSS 15.0 was used for data analyses .Descriptive and inferential statistics were used for data analysis
- Descriptive statistics (frequency and percentage representation of the score of individual groups.)

RESULTS

Interventional study

After grouping content in the education program, manual was subjected to content validation by the experts in the field of health professions who were radiologist, radiation safety officer and medical practitioner who prescribe the radiology examination. The field of experts, their age and experience are given in the following table 1.1.

Figure 1.1

Details of experts involved in content validation

S.No	Expert field	Age in years	Experience in years
1.	Radiation field expert	33	8
2.	Radiologist	35	7
3.	Radiation field expert	27	5
4.	Tool development expert	39	8
5.	Radiologist	39	7
6.	Radiation field expert	29	3
7.	Tool development expert	46	25
8.	Radiation field expert	27	3
9.	Tool development expert	38	12
10.	Radiologist	44	10
11.	Radiologist	35	7
12.	Radiation field expert /RSO,KH	38	9
13.	Medical practitioners	34	8
14.	Medical practitioners	35	9
15.	Medical practitioners	32	5

The mean age of the expert group was 35.4 years and the mean experience was 8.4 years.
The level of agreement between experts for each item were in the following tables 1.2

Table 1.2

Items and percentage level of agreement between experts for medical practitioner's tool

Items	Level of agreement (%)
Justification and the framework	93
How should justification be practiced and what knowledge is required for proper justification of a radiological procedure?	86
Is the acquisition of patients' consent important?	80
When is an investigation useful and what are the reasons that cause unnecessary use of radiation?	100
What are the reasons for over-investigating	93
Which procedures are responsible for the highest doses to the patient?	100
Special conditions that a referring medical practitioner may encounter	100
Can radiological procedures cause acute radiation injury?	80

The above table shows that three items had 100% agreement, two items had 93% agreement and three items had 80% agreement and above between experts. Hence 8 items which had 80% or more agreement were considered relevant and included. These suggestions were considered while drafting the education program. In

our study out of 35 medical practitioners only 33 were participated till the end with the respond rate of 94.42%. The average experience of the practitioners in the interventional and the control groups are 2.43 and 2.18 respectively. Descriptive statistics were used to analysis the frequency and percentage control and interventional groups. The percentage of the participants who's perception was good and bad are shown in the Table 1.3 and table 1.4. In our study anything which falls below the score of 82 was considered as bad perception and the score falls above 83 was considered as good perception about the radiation. In the intervention group the data were collected in the three different points of time that is pre intervention, post intervention in the time duration of 7 days and post-post intervention after 7 days from the time of post intervention data collected. The percentage of good perception in the pre intervention group has drastically increases for 18.2 %(n=6) in pre intervention to the 48.5 %(n=16) in post intervention in the intervention period of 7 days and there were slight decrease in the good perception from 48.5%(n=16) to 45.5%(n=15) form the post intervention as show in table 1.3. In the control group the data were collected in the three different point of time that is pre control, post control in the time duration of 7 days and post-post control group after 7 days from the time of post control data collected. There was no significant change in the three groups as show in table 1.4

Table1.3
Frequency and Percentage representation of the score of intervention group, post intervention group and post – post intervention group

INTERVENTION GROUPS		
Pre Intervention		
	FREQUENCY	**PERCENT**
Bad	27	81.8%
Good	6	18.2%
Total	33	100.0%
Post Intervention(After 7 Days)		
Bad	17	51.5%
Good	16	48.5%
Total	33	100.0%
Post-Post Intervention(After 7 Days After Post Intervention)		
Bad	18	54.5%
Good	15	45.5%
Total	33	100.0%

Table 1.4
Frequency and Percentage representation of the score of control group, post control group and post – post control group with intervention.

CONTROL GROUPS		
Pre Control		
	Frequency	Percent
Bad	25	75.8%
Good	8	24.2%
Total	33	100.0%
Post Control (After 7 Days)		
Bad	25	75.8%
Good	8	24.2%
Total	33	100.0
Post Control With Intervention (After 7 Days After Post Control)		
Bad	23	69.69%
Good	10	30.30%
Total	33	100.0%

In our study the pre and post intervention and control groups domains scores were also compared to identify the responsiveness of the domains of the scale. The mean pre and post scores of intervention and control groups were shown in the following figure 1.2 and figure 1.3.

Figure 1.2
Mean score of pre and post and post-post intervention domain of the scale (n =33)

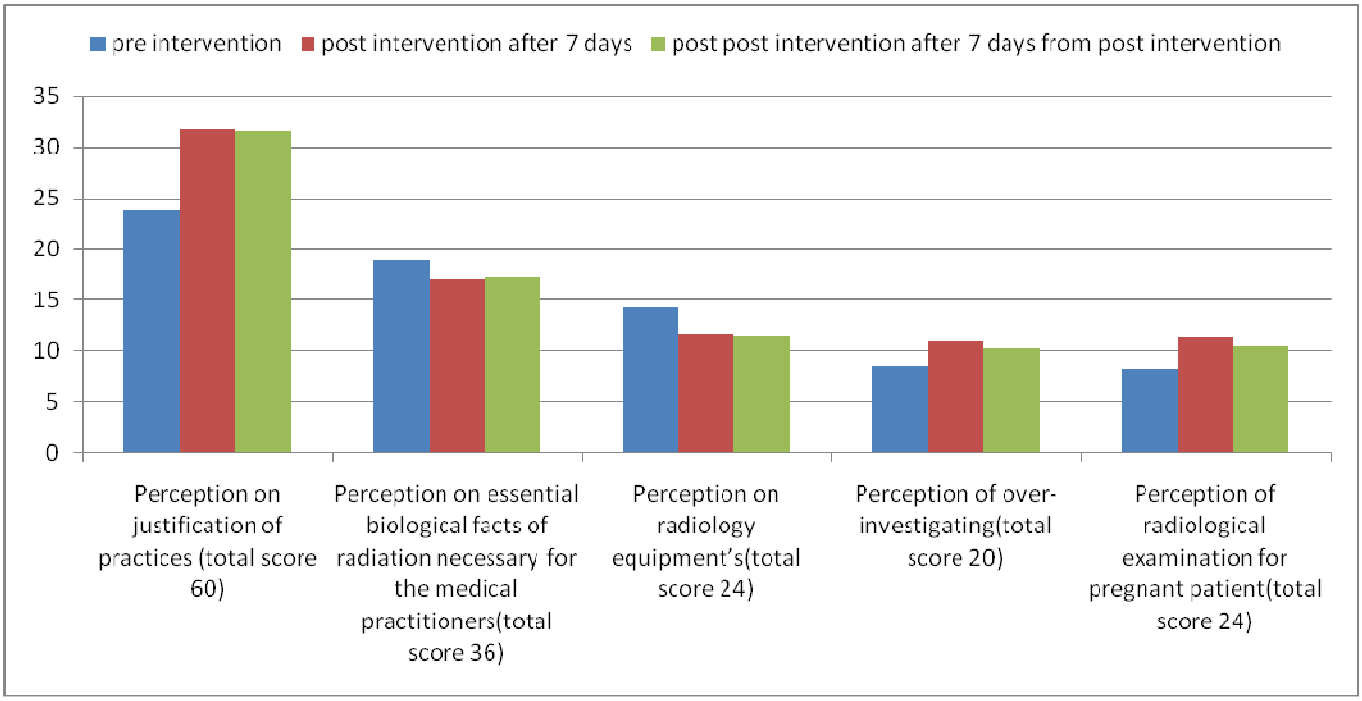
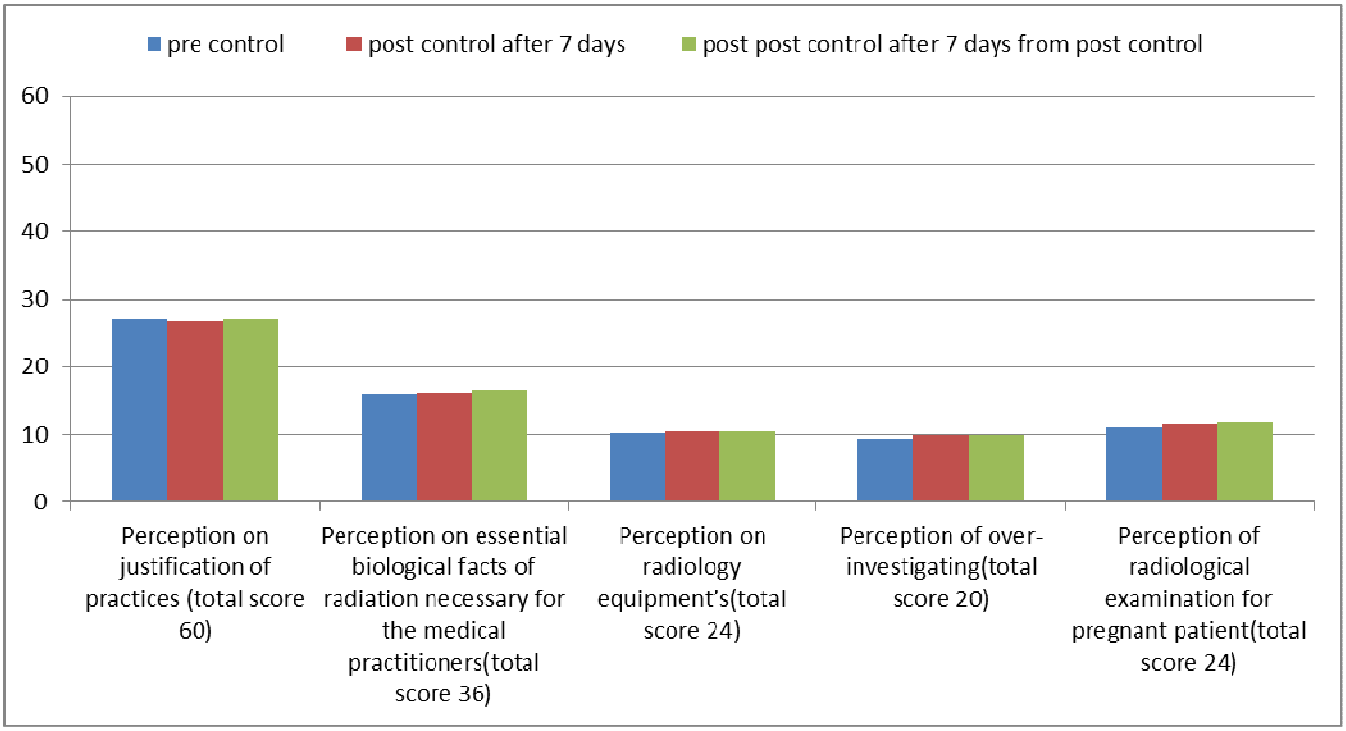


Figure 1.3
Mean score of pre and post and post-post control domain of the scale (n =33)



The figure 1 and figure 2 suggests that the mean scores of all domains have changed significantly in the intervention group as compare to the control group which indicating the effect of education program on all the domains. The domains two and three have not shown any significant changes in the mean score in the intervention group. The mean score percentage of intervention and control groups show in the table 1.5 and table 1.6. The outcome of the study domain Perception on essential biological facts of radiation necessary for the medical practitioners shows that the percentage of the mean domain score has decreased drastically to 48.23%

in post intervention as compare to 52.60% in pre intervention group. With respect to the domain Perception on radiology equipment's shows that the percentage of the mean domain score has decreased drastically to 48.10% in post intervention group as compare 59.59% in the pre intervention group. The result of our study clearly highlights the lack of participant perception on essential biological facts of radiation and radiology equipment's after intervention in both intervention and control groups.

Table 1.5
Percentage of pre and post and post-post intervention domain scores of the scale (n =33)

	Perception on justification of practices (total score 60)	Perception on essential biological facts of radiation necessary for the medical practitioners(total score 36)	Perception on radiology equipment's(total score 24)	Perception of over-investigating(total score 20)	Perception of radiological examination for pregnant patient(total score 24)
pre control	39.64646465	52.60942761	59.59596	42.87879	34.34343
post control after 7 days	52.92929293	47.39057239	48.9899	55.30303	47.9798
post control after 7 days from post control	52.72727273	48.23232322	48.10606	51.06061	43.93939

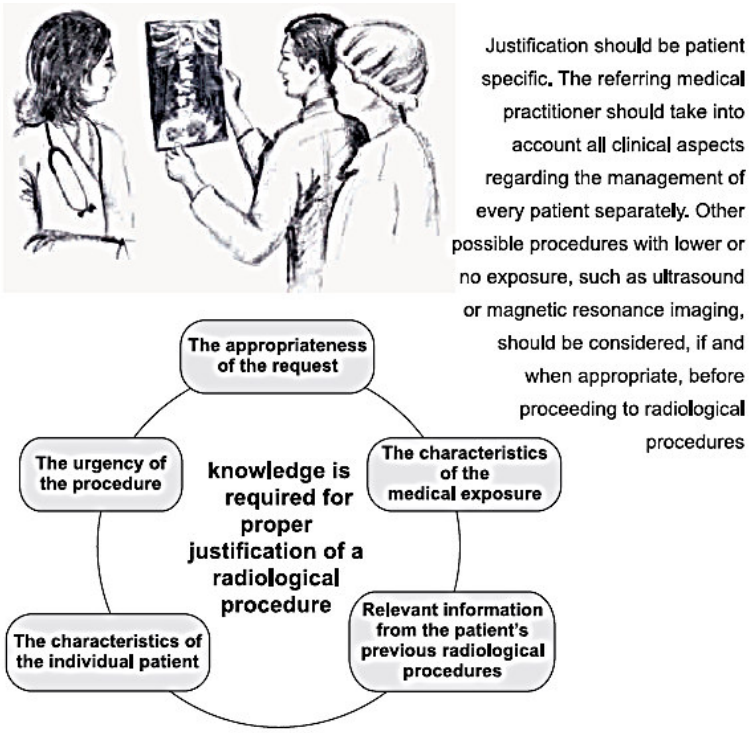
Table: 1.6
Percentage of pre and post and post-post control domain scores of the scale (n =33)

	Perception on justification of practices (total score 60)	Perception on essential biological facts of radiation necessary for the medical practitioners(total score 36)	Perception on radiology equipment's(total score 24)	Perception of over-investigating(total score 20)	Perception of radiological examination for pregnant patient(total score 24)
pre control	45.10101	44.61279	43.05556	47.12121	46.21212
post control after 7 days	44.34343	44.78114	43.93917	49.39394	47.85354
post control after 7 days from post control	45.20167	45.77778	43.8125	49.8	48.95833

DISCUSSION

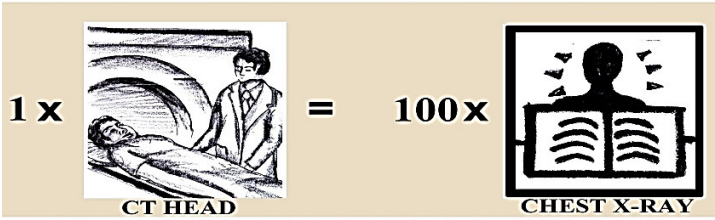
Human being living in this world is being exposed to the ionizing and non-ionizing radiation. The ionizing radiation used in the medical imaging producers such as Computed Tomography and interventional procured are consider being significant and it is believed that linear relationship exists between radiation exposure to the population undergoing such imaging procedure and development of cancer. Even though the individual absolute risk may be small, the repeated exposure of the individual patients may lead to a signification increase in cancer cases. Information published for the previous study show that there is one third of the radiology request prescribed by the medical practitioners are unnecessary[11,12].The use of alternative medical imaging techniques using less radiation should be considered when clinical decisions are being made. The result of our study clearly highlights the lack of participant's perception on essential biological facts of radiation and radiology equipment's after intervention in both intervention and control groups. The items included in both domains of the tool highlights the ionizing and non-ionizing imaging modality used in the medical imaging with dose involved in the imaging procedure. Also highlights the perception of biological highly radiosensitive tissues, Intensity of biological effects of radiation depends on the dose involved in the examination and biological effects of radiation in regard to the various dose range used for scanning the patient. Even though the items included in domains were explained in the Education program for medical practitioner, one of the possible reasons for the decrease in the percentage may be due to the imaging equipment which operates under the ionizing and non-ionizing radiation may be ambiguous as exampled in figure 1.4.

Figure 1.4
ionizing and non-ionizing radiation content included in the manual



The other possible reason may be due to the complexity in the understating and memorizing the radiation of dose of each imaging procedure with respect to the chest x ray as show in figure 1.5.

Figure 1.5
radiation of dose of CT hear procedure with respect to the chest x ray



1 CT HEAD EXAMINATION = 100 PA CHEST X-RAY

Access to Current Data and Recommendations

The education and training of the Radiologist and Nuclear medicine physician are specifically designed to provide expertise on the medical uses of radiation and specifically on radiation protection. The Accreditation Council of Graduate Medical Education oversees a cadre of experts who define the requirements for the training and education of the Physician. Their guidelines are called "The Essentials of Accredited Residencies," and specific recommendations for training are available for each specialty and subspecialty in organized medicine. In the essentials for diagnostic radiology are specific requirements that the training must include radiation biology, diagnostic radiologic physics, and radiation protection. In the essentials for nuclear medicine, the requirements for training in radiation biology and protection include knowledge of the biologic effects of ionizing radiation, means of reducing radiation exposure, calculation of the radiation dose, evaluation of radiation dose, evaluation of radiation overexposure, and medical management of persons overexposed to nuclear ionizing radiation. Such emphasis on the basic education and training requirements for the use of radiation in medicine accentuates a major difference between the radiologist or nuclear medicine physician and other specialist physicians who use radiologic studies in their practices. The medical profession has emphasized the importance of continuing medical education, perhaps more so than any other profession. The medical profession's dedication to continuing education allows the practitioners (Radiologist and Non-Radiologist) to keep current with the thoughts and knowledge concerning the effects of radiation and the means of radiation protection.

CONCLUSION

The medical practitioner's shows increase perception in the intervention group on the radiological examination as compare to the control group.

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