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ARTICLE

Factors Affecting Compliance towards Radiation Protection Equipment among Radiographers: A Cross Sectional Study

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ABSTRACT

Background: Radiographers were at risk of x-ray radiation. Ministry of Heath of Indonesia made a regulation act no. 33 year 2007 to secure radiographers on ionizing radiations by using radiation protection equipment (RPE). Objective: This study identified the factors affecting compliance towards RPE among radiographers and determined the correlation between influencing factors and compliance towards RPEs. Methods: The study conducted a quantitative descriptive-correlational design in a cross sectional approach. A total of 103 radiographers answered the online self administered questionnaires from 9 government hospitals at Jakarta, Indonesia. Results: It was identified that personal factors were the knowledge and motivations while the availability of RPEs and standard operating procedures were environmental factors. The knowledge (p=0.001, r=0.321) and motivations (p=0.018, r=0.232), and availability of RPE (p=0.138, r=0.146) and standard operating procedures (p=0.023, r=0.224) were factors affecting a compliance to RPEs. It was however determined that gender (p=0.251, r=0.113), and place of work (p=0.479, r=0.070) were not correlated to both personal and environmental factors. On the contrary, age (p=0.031, r=0.212), highest educational attainment (p=0.039, r=0.203), years of experience (p=0.001, r=0.336), and training (p=0.001, r=0.341) influenced both personal and environmental factors affecting compliance of radiographers towards RPEs. Findings: It was found that Dr. Cipto Mangunkusumo (p=0.271), Persahabatan (p=0.133), Fatmawati (p=0.357), Otak Nasional (p=0.238), Pasar Rebo (p=0.356), Tarakan (0.255), and Koja (p=0.199) hospitals were not probable to comply towards RPEs. Only Infeksi Sulianti Suroso (p=0.21), and Budhi Asih (p=0.0002) hospitals were most probable to comply towards RPEs.

1. Introduction

1.1 Background

Globally, radiographers should have protection from radiation exposure before, during, and after any radiographic examinations [1]. Working with radiation can cause tissue damages or genetic abnormalities - the stochastic effects [2]. However, each radiation contains certain risks, so only unnecessary exposures should be avoided and should be kept as low as possible [1,2]. Radiation protection (RP) is a fundamental radiation safety practice that remains important when performing

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radiography, not only among radiographers but also from patients to minimize the risk of stochastic effects [2].

Many hospitals worldwide uses RPEs as an early protective measure against radiation hazards [3]030; (2=8.683. The use of RPE in Ohio Department of Health has extensively been advocated during radiological procedures, because the absorbed radiation dose can be reduced as much as 99.4% following to use of (1 mm) lead shield [4]. In Adam Malik Hospital, Medan there are 81.8% of radiographer's who are non-compliant to the use of RPEs, and 13.6% of radiographers' dose to radiation exposure are above the average [5].

In Indonesia, in four hospitals in Semarang showed a result of 96.8% of radiographers with non-compliance to RPE [6]. mentioned that in some hospital in Pekan Baru from 2008 to 2011 had 10.3% of radiographers whose leukocyte levels are abnormal because of non-compliance towards RPE [2].

The Ministry of Health (MOH) of Indonesian made a regulation act no. 33 year 2007 about the safety and security of radioactive sources and ionizing radiations that aims to ensure the safety and protection among workers, and patients [7]. To promote the level of RP, the radiology department should utilize some equipment such as lead aprons, glasses, gloves, gonad shields, thyroid shields, and radiation area signs also called radiation protection equipment (RPEs)[8-10].

1.2 Problem Statement

In Indonesia compliance towards the use of RPEs was also a problem especially among radiographers [11]. Although the hospitals in Indonesia have been providing RPEs, enforcing approved regulations for radiographers to use is not emphasized [9].

Poor compliance with safety practices and using RPEs among radiographers will lead to stochastic effects [10]. There is a correlation between knowledge, attitude, behavior, training, and counseling towards the use of RPE [12] and that is why compliance levels on using RPEs should be reiterated [13,14]. In addition, radiographers need to be aware on their roles in ensuring total compliance towards RPEs in their institutions [15]. Lack of compliance are the factor of age, education, training, motivation and duration of work, hence the need for a cross sectional study [16]003.

1.3 Significant of Study

The findings of this study will give the positive effect to the Indonesian society of radiographers as new knowledge in identifying and determining RPE compliance. The greater will the demand be for radiographers as the safety on RPE compliance is achieved [17]. In addition, the application of the principles of RP will also be significant to the training institutions, as it paves new ways in changing the radiographers' safety culture [18].

1.4 Objectives

Specifically, it is hoped to:

(1) Identify factors affecting compliance of radiographers towards RPEs.

(2) Determine the correlation between influencing factors and compliance towards RPEs.

1.5 Operational Definition

The demographic data are the gender, age, education, workplace, year of experience, training among RP officers as influencing variables affecting the factors such as knowledge, motivations, availability of RPEs, and standard operating procedures are all operationally defined on table 1.

Table 1. Operational Definition

Variables	Definition	Criteria
Compliance	The adherence on the use of RPEs	1. High (If Score total≥ median) 2. Low (if score total<mean)
Gender	Male or female	1. Male 2. Female
Age	Births in years	1.<40 years old 2.≥40 years old
Education	Formal highest education received	1. <Bachelor 2. ≥Bachelor
Place of Work	Place where radiographers do radiographic examinations	1.Centres Hospitals 2.District Hospitals
Year of experience	Number of years employed as radiographer	1.<10 years 2.≥10 years
Training	The availability of training in radiography	1. No 2. Yes
Knowledge	Personal factor of the radiographers as how they know much about / on compliance towards RPEs	1. High (If Score total≥ mean) 2. Low (if score total<mean)
Motivations	Personal factor of radiographers addressing attitudes to be willing to use RPEs while working	1. Positive (if score total ≥ mean) 2. Negative (if score total<mean)
Availability of RP Equipment	Environmental factor on the availability of RPEs in radiology unit	1. Complete (If Score total≥ mean) 2. Not Complete (if score total<mean)
Standard Operating Procedures	Environmental factor on the procedures addressing practice of radiographers to use the RPEs	1. Available (If Score total≥ mean) 2. Not Available (if score total<mean)

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2. Methods

2.1 Research Design

A descriptive-co relational quantitative cross-sectional design was used. This is the most appropriate design for analyzing the relationship between the dependent and independent variables in a specific point in time[19].

2.2 Research Location

The study was conducted at 9 government hospitals in Jakarta, from 5 Centre Hospitals such as (1) Dr. Cipto Mangunkusumo, (2) Persahabatan, (3) Fatmawati, (4) Sulianti Suroso, (5) Otak Nasional, and from 4 district hospitals such as (6) Pasar Rebo, (7) Budhi Asih, (8) Tarakan, and (9) Koja.

2.3 Population and Sampling Technique

A total of 152 radiographers at Jakarta were selected working with government hospitals. Of the 152, only 103 responded. The inclusion and exclusion criteria using a snowball sampling technique were as follows.

2.4 Inclusions and Exclusions

The inclusion criteria in selecting respondents are: (1) radiographers at least a diploma graduate and (2) working period of at least 2 years. The exclusions criteria are (1) radiographers who do not use x-ray machines, magnetic resonance imaging, ultrasound, and nuclear radiotherapy, and (2) practicing radiographers who were newly employed in less than 6 months.

However, in order to mathematically determine the overall sample size from the 9 hospitals, we used the formula found on box 1 [20].

Box 1. Formula for determining the overall sample size

$$n = \frac{N}{1 + N(d)^2}$$

Description:

n : number of samples

N : Number of Populations

d : level of error 5% (0.05)

n =103 radiographers

2.5 Sample Size

The distribution of the respondents can be seen in table 2 using the inclusion and exclusion criteria.

Table 2. Respondents

No	Name of hospitals	Population	Respondents
1	Dr. Cipto Mangunkusumo	36	25
2	RSUP Persahabatan	25	14
3	RSUP Fatmawati	11	8
4	RSUP Infeksi Sulianti Suroso	8	6
5	RSUP Otak Nasional	17	11
6	RSUD Pasar Rebo	11	7
7	RSUD Budhi Asih	14	10
8	RSUD Tarakan	12	9
9	RSUD Koja	18	13
	Total	152	103 radiographers

2.6 The Questionnaire

We used an online questionnaire. The careful design of the questions is critical and can eliminate bias when it is delivered online. The questionnaire was distributed to 9 government hospitals in Jakarta to be answered by the n103 radiographers (table 2).

The first part asked of the demographic profile of the respondents such as their gender, age, education, workplace, year experience, and training on RPs. Respondents must answer a 4-point scale with 10 questions about their knowledge on RPs in the second part. The third part covered 10 questions regarding the motivations of the respondents on RPEs. The fourth part was 10 questions about availability of RPEs. The last part was a 10 question about the standard operating procedures on RPEs.

Questions on compliance towards RPEs among radiographers were generated and reconstructed from Hubungan Antara Pengetahuan Tentang Resiko Potensi Bahaya Radiasi Dan Kepatuhan Penggunaan Alat Pelindung Diri Pada Pekerja Radiasi Di Bagian Radiologi [21], Tingkat Kepatuhan Mahasiswa Profesi Dalam Proteksi Diri Terhadap Paparan Radiasi Di Bagian Radiologi Dental Rumah Sakit Gigi Dan Mulut Pendidikan Universitas Hasannudin [1], Factors Related To Radiation Safety Practices In California [14], Analisis Faktor Yang Berhubungan Dengan kepatuhan Menggunkan Alat Proteksi Diri [22] as a reference to the current study.

2.7 Data Analysis

In this study the SPSS version 21 was used to analyze data. Descriptive statistics of frequencies and percentages were displayed. In the analysis of variables, chi square was also used. Coding for questions was done, taking careful consideration into achieving inter-coder reliability and resulting in a standardized coding. A small scale pilot

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study was used before a full scale research was done to validate the reliability of the generated and reconstructed online self administered questionnaire.

2.7.1 Pilot Study

A pilot study was conducted from 10% of the formulated sample size. The respondents from the pilot study were no longer used in the full scale research. The inclusion and exclusion criteria were also implied upon selecting pilot respondents. The results from the pilot study enabled the researcher to detect areas requiring further improvement, and to further detect areas of clarity and precision to achieve the objectives set.

2.7.2 Validity

To test whether the instrument used is valid, we calculated the correlation coefficient alpha between each value on the question number with their total value. Furthermore, we tested the significance of the questionnaire comparing it with the r table. When t count > t table or r count > r-table, then the questions were valid [23]. The formula is found below:

$$r_{XY} = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{\{N\sum X^2 - (\sum X)^2\}\{N\sum Y^2 - (\sum Y)^2\}}}$$

Information:
r = Product Moment Correlation
X = Score Statement
Y = Total Score entire statement
XY = Score statement multiplied by the total score
N = Number of respondents pretest
Criterion validity of a question can be determined if:
a. r count> r table, then the questions on the questionnaire was valid.
b. count r <r table, then the questions on the questionnaire was not valid.

2.7.3 Reliability

Reliability is an index indicating the extent to which a measuring instrument can be trusted. This means showing how far these measurements are consistent when measurements are made twice using the same measuring instrument.

The use of Cronbach's alpha formula below will test the reliability of the questionnaire if it has a value above 0.7 [24].

$$r_{11} = \left(\frac{n}{n-1}\right)\left(1 - \frac{\sum {\sigma_1}^2}{{\sigma_t}^2}\right)$$

Information :
r11 = reliability was sought
$\Sigma\sigma 12$ = total variance score for each item
$\sigma t2$ = total variance
This was interpreted [25] in the following: 0.00 to 0.20 less reliable, having value 0.21 to 0.40 rather reliable, the value 0.41 to 0.70 quite reliable, while the value 0.71 to 0.90 reliable, and finally the value 0.91 to 1.00 is very reliable.

2.7.4 Univariate Analysis

The results of this analysis are presented in tables. The univariate analysis was distributed using frequencies, probabilities, mean, standard deviations, and percentages of each of the variables [19].

2.7.5 Bivariate Analysis

Pearson correlation was used for determining the strength of the relationship between influencing factors and compliance [23]. Here are the guidelines to provide interpretation and analysis for the correlation coefficient [25,26]:

(1) None or weak if the correlation coefficient is less than 0.10
(2) Low if the correlation coefficient value is between 0.10-0.29
(3) Moderate if the correlation coefficient value is between 0.30-0.49
(4) Strong if the correlation coefficient value is between 0.50-0.69
(5) Very Strong if the correlation coefficient value is between 0.70-0.89

The correlation coefficient (r) and significant value (*p*) will be calculated. To perform correlation test, we obey the 5 criteria [25]:

(1) Data must be in paired
(2) Quantitative data
(3) Normal distributed data
(4) Two variables data must be linear
(5) Two variables data must be homoscedastic.

That is why normality, linearity, and homoscedasticity tests were done before inferential analysis. Shapiro-Wilk test was also done to prove that the data is within $p<0.05$. However, Shapiro-Wilk test sometimes maybe over-sensitive until false positively interpreting the data that is not normal in distribution. Therefore, two more additional statistical test: skewness & kurtosis was used to double confirm the results of the Shapiro-Wilk test between -1.96 until 1.96 [25]. Table 3 summarizes the data analysis.

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Table 3. Data Analysis

Research objectives	Questionnaire	Analysis
1. Identify factors affecting compliance of radiographers towards RPEs.	**A. Personal factors questions with scale 4** 1.Knowledge:1.very irrelevant,2.irrelevant,3.relevant, 4.very relevant 2.Motivation: 1. Influenced by colleagues, 2.not reprimanded by supervisor, 3.follow the rules, 4.to be safe. **B. Environmental factors questions with scale 4** 1. Availability equipment: 1.very unfeasible, 2. Unfeasible, 3.feasible, 4.very feasible. 2.Standard Operating Procedure: 1.strongly disagree,2.disagree,3.agree,4. strongly agree	Univariate Analysis: Frequencies and Percentile ranking
2. Determine the correlation between influencing factors and compliance towards RPEs.	**Demographic Factors:** 1.Geneder:: Male/Female 2.Age ≥40 yo/<40yo 3.Education: ≥Bachelor/<Bachelor 4.Workplace: Centre Hospitals/District Hospitals 5.Year experience ≥10/<10 6.Training: Yes/No **A. Personal factors:** 1.Knowledge High/Low 2.Motives: Positive/Negative **B. Environmental factors:** 1.Availibiality RPE Complete/Not Complete 2.Attitude regard SOP: Good/Not Good	1.Chi square test, significant if P value <α 0.05,and 2.Pearson correlation for determining the strength of the relationship between independent & dependent variables i. None or weak if the correlation coefficient is less than 0.10 ii. Low if the correlation coefficient value is between 0.10-0.29 iii. Moderate if the correlation coefficient value is between 0.30-0.49 iv. Strong if the correlation coefficient value is between 0.50 or -0.69 iv. Very Strong if the correlation coefficient value is between 0.70 or -0.89

2.8 Ethics

After researchers acquired permission from the chief radiographers from the 9 hospitals, ethical permission was also acquired from the Ministry of Health, Indonesia for use of their government hospitals. Permission was also given by Lincoln University College, Malaysia for academic purposes. Respondents were given the freedom to decide whether or not to participate in voluntary research. The researchers gave an explanation to the respondents about the purposes and the benefits. The consent was online and explained to the surveyed radiographers who met the inclusion criteria. The consent incorporates the research title as well as the benefits so that the respondent understands the purpose and aims of the research. Researchers did not include the respondent's name on the data collection sheet, but only given certain code in order to keep the identity of the respondents confidential. The respondents' email addresses from the online survey were also kept confidential.

3. Results

3.1 Identify Factors Affecting Compliance of Radiographers towards RPE

It was however identified that knowledge (p=0.001, r=0.321) and motivations (p=0.018, r=0.232), and availability of RPEs (p=0.138, r=0.146) and standard operating procedures (p=0.023, r=0.224) were factors affecting a compliance to RPEs.

The personal factors are the knowledge and motivations. The availability of RPEs and standard operating procedures are environmental factors.

3.2 Determine the Correlation between Influencing Factors and Compliance towards RPE

The demography as influencing factors are gender, age, highest educational attainment, place of work, years of experience, and training found on Table 4.

It was determined that gender (p=0.251, r=0.113), and place of work (p=0.479, r=0.070) were not correlated to both personal and environmental factors. On the contrary, age (p=0.031, r=0.212), highest educational attainment (p=0.039, r=0.203), years of experience (p=0.001, r=0.336), and training (p=0.001, r=0.341) influenced both personal and environmental factors affecting compliance of radiographers towards RPEs.

It is however interesting to determine that there is no significant correlation between knowledge as a personal factor and availability of RPEs as an environmental factor (p=0.138; r=0.146). On the other hand, a weak correlation was determined between standard operating procedure as an environmental factor and motives as a personal factor affecting compliance towards RPEs (p=0.023 and r=0.224); and between motives as a personal factor and availability of RPEs as an environmental factor (0.018 and

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Table 4. Compliance on RPE

No	Influencing factors	Compliance		Non Compliance		N	%	r time	P Value	OR (95%CI)
		n	%	n	%					
1. Gender										
	Male	28	520.8%	25	470.2%	53	100			0.630
	Female	32	640.0%	18	360.0%	50	100	-0.133	0.251	0.286-1.388
	Total	60	580.3%	43	410.7%	103	100			
2. Age										
	≥40	23	74.2	8	25.8	31	100			2.720
	<40	37	51.4	35	48.6	72	100	0.212	0.031	1.075-6.878
	Total	60	58.3	43	41.7	103	100			
3. Education										
	≥ Bachelor	11	84.6	2	15.4	13	100			4.602
	< Bachelor	49	54.4	41	45.6	90	100	0.203	0.039	0.964-21.960
	Total	60	58.3	43	41.7	103	100			
4. Workplace										
	Centre Hospitals	39	60.9	25	39.1	64	100			1.337
	District Hospitals	21	53.8	18	46.2	39	100	0.070	0.479	0.598-2.992
	Total	60	58.3	43	41.7	103	100			
5. Experience										
	≥10 years	31	79.5	8	20.5	39	100			4.677
	< 10 years	29	45.3	35	54.7	64	100	0.336	0.001	1.864-11.735
	Total	60	58.3	43	41.7	103	100			
6. Training										
	Yes	26	83.9	5	16.1	31	100			5.812
	No	34	47.2	38	52.8	72	100	0.341	0.001	2.007-16.826
	Total	60	58.3	43	41.7	103	100			
7. Knowledge										
	High	43	71.7	17	28.3	60	100			3.869
	Low	17	39.5	26	60.5	43	100	0.321	0.001	1.687-8.872
	Total	60	58.3	43	41.7	103	100			
8. Motives										
	Positive	43	67.2	21	32.8	64	100			2.650
	Negative	17	43.6	22	56.4	39	100	0.232	0.018	1.167-6.018
	Total	60	58.3	43	41.7	103	100			
9. Availability of RPE										
	Complete	34	65.4	18	34.6	52	100			1.816
	Not Complete	26	51.0	25	49.0	51	100	0.146	0.138	0.822-4.011
	Total	60	58.3	43	41.7	103	100			
10. Standard operating procedure										
	Good	40	67.8	20	32.2	59	100			2.526
	Not Good	20	45.5	24	54.5	44	100	0.224	0.023	1.128-5.695
	Total	60	58.3	43	41.7	103	100			

r=0.232). On the contrary, a strong correlation was determined between it was determined between knowledge as a personal factor and standard operating procedures as an environmental factor (p=0.001 and r=0.321) towards compliance to RPEs.

3.3 Findings

Of the 10 hospitals, compliance towards RPE was not probable among 8 hospitals found on table 5. Only 2 hospitals have more probability to comply.

Table 5. Compliance towards RPE per hospitals

	(N)	mean	Standard deviation	p
Dr. Cipto Mangunkusumo	25	1.28	0.458	0.271
RSUP Persahabatan	14	1.57	0.514	0.133
RSUP Fatmawati	8	1.13	0.354	0.357
RSUP Infeksi Sulianti Suroso	6	1.83	0.408	0.021
RSUP Otak Nasional	11	1.36	0.505	0.238
RSUD Pasar Rebo	7	1.14	0.378	0.356
RSUD Budhi Asih	10	1.90	0.316	0.002
RSUD Tarakan	9	1.33	0.500	0.255
RSUD Koja	13	1.42	0.496	0.199

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Dr. Cipto Mangunkusumo (p=0.271), Persahabatan (p=0.133), Fatmawati (p=0.357), Otak Nasional (p=0.238), Pasar Rebo (p=0.356), Tarakan (0.255), and Koja (p=0.199) hospitals were not probable to comply towards RPE.

Infeksi Sulianti Suroso (p=0.21), and Budhi Asih (p=0.0002) hospitals were most probable to comply towards RPE.

4. Discussion

4.1 Strengths, Weaknesses, and Limitations

The strength of this study is its design. A combination of a descriptive-correlation is strong since it does not only describe the findings of the variables but assumes relationship. In that way, the result may be used in the real settings. Lastly, the strength of this design is the use of the online survey questionnaire. This is less stressful where time and financial constraints are factors to be considered[25] such as printing of the questionnaires. In addition, survey is less complex to modify, adapt, or adopt.

The weakness of this study is the vast number of confounding variables – the age, gender, years experience, educational attainment, training and the work place of the respondents influencing the identified factors affecting compliance towards RPEs. That is why this study could not be generalized and should be taken with caution if it were to be used as reference because the culture is only limited in a given point in time. Finally, a quantitative survey design is also a weakness if the respondents are not sincere and truthful of answering the questions. To assume maturity of the behavior and relationship of the quantified results, the survey questions are further discussed.

4.2 Discussion of Demographic Influencing Factors

4.2.1 Gender

The differences in values and traits by gender usually affect decision-making[27]. Men will compete for success and are more likely to ignore the existing rules because they perceive achievement as a competition, while women focus more on performing tasks well in line with the prevailing rules and maintaining harmonious working relationships [6,28]. There were more male respondents from hospitals who were low in compliance as compared with the females.

On the contrary, the gender concept, in terms of knowledge, experience, and behavior towards compliance, both men and women have the same potential in accordance with the efforts undertaken [28]. That is why age was also used in addition to gender to determine correlation towards compliance.

4.2.2 Age

Increasing age is more able to show the maturity and capability of rational thinking, and ability to control the emotions [29]. Also, adults are the more tolerant in views and behaviors that is different from intellectual and psychological maturity [30]. A person will experience a decline in mental function as they grow older, so the ability to absorb knowledge and understand important implications of policies also decreases [31]. Hospitals that have low compliance have respondents who are ≥40 years old.

This statement is different with who mentioned that the level of work performance improves with increasing age[32]. That is also why some hospitals that have low compliance have respondents who are ≤40 years old.

This is why in addition to age and gender, it is also interesting to correlate compliance with highest educational attainment.

4.2.3 Education

Education determines the extent of a person's knowledge as being able to find their own problem-solving in the workplace and someone with low education is very difficult to accept the concept of change[30]. Education is a development in which staff gains knowledge and skills for positive purposes which is essential for its performance in terms of cognitive, psychomotor, and attitude[33]. The educational background affects the application of patient safety[34]. This is why hospitals who has low compliance have respondents with <bachelor's degree.

On the contrary stated that there is no significant relationship between education and compliance to patient safety[6]. That is why hospitals that have low compliance also have respondents who have ≥bachelor's degree.

This is why it is interesting to add the workplace environment as a significant factor affecting compliance in addition to age, gender, and highest educational attainment.

4.2.4 Workplace

The work place that is everything that surrounds the workers that can affect in carrying out tasks embedded[35]. if the employee enjoys the workplace environment the activities are used effectively and performance is also high [36]. The workplace environment includes working relationships formed between fellow employees and working relationships between subordinates and superiors in which employees enjoy[14].

This is quite inconclusive to determine why hospitals had low compliance. That is why years of work experience is also included in the demographic analysis.

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4.2.5 Years of work experience

The work experience is already known a factor of a workplace environment that can influence the person to behave because it an employee can recognize patterns that tends to recur, also added that the experience factor can influence the person to comply with policies and regulations of the organization [37]. That is why hospitals with lower compliance have respondents working <10 years.

On the contrary, the longer the work period is, will make the workers more complacent with the compliance to work conditions. If worker is familiar with the workplace and the dangers of work, the compliance is lower [30]. That is also why hospitals with low compliance have respondents working ≥10 years.

That is why it is noteworthy to include trainings and continuous professional developments which the respondents have achieved affecting compliance, in addition to age, gender, highest educational attainment, workplace, and years of experience.

4.2.6 Training

The continuous trainings can form a safe behavior [38]. The training is conducted when workers do not know how to work safely [37]. Giving training can benefit the workers to increase the likelihood to improve their compliance[6]. Most of the respondents from the hospitals have not acquired continuous trainings which affected their compliance to policies.

4.3 Discussion of Personal Factors

4.3.1 Knowledge

Knowledge is a factor in the person as a component that will influence compliance[37]. Inadequate knowledge about the risks and dangers and accidents would allow workers to be indifferent and may act unsafe or detrimental to the safety of themselves[39].

Increased knowledge does not always lead to changes in behavior. Knowledge is something that needs to be a strong factor so that one acts with critical thinking[38]. Knowledge from the personal side comes from cognitive conscience[37]. Knowledge of radiographers regarding optimal techniques, radiation dose, RP measures are important for reducing radiation exposure[40]. The 9 hospitals in this study that has respondents with lesser training have lesser knowledge leading to a low compliance.

4.3.2 Motivations

A person's motivations addresses attitudes[37]. The individual's motivation does not lie in a series of movers, but rather focuses on the hierarchy, a particular "higher" need to expand the "lower" and unsatisfied needs[41]. Motivations on execution of performances will require the fighting spirit to be high[42]. Performance comes from higher motives[37].There are two ways to improve work motives: 1) Being hard, by forcing worker to work hard or by giving rewards. 2) Provide meaningful goals[43].

The 9 hospitals in this study that has respondents with negative motivations have low compliance.

4.4 Discussion of Environmental Factors

4.4.1 Availability of RPE

Availability of resources is a factor in the environmental components that influence compliance [37].

On the contrary, said that there is no effect between the availability of RPE with compliance [6]. The most of diagnostic equipments in government hospital were obsolete, majority the compliance strictly is on the use of thermoluminiscent dosimetry (TLD) as monitoring equipment [15].

The availability of RPE in this case is one form, where some workers may refuse to use RPE because it causes discomfort and adds the burden of stress on the body[44]. That is why more respondents were not probable to comply.

4.4.2 Standard Operating Procedures

The standard operating procedure addresses the practice [45]. The standard operating procedures are written documents of standards, norms, and policies for expected practice. Standard operating procedures is a factors in an environment that influences compliance [37]. The company must have clear standard operating procedures about the implementation of occupational safety [46]. Respondents who did not comply were mostly affected by unclear standard operating procedures.

5. Recommendations

Moreover, the impact of radiation is often long-term, so it is easily overlooked. Therefore the recommendations are:

(1) Hospitals' management should view safety as an integral part of a strategy for controlling radiation risk, forming a safety [18]. Considering the demographic, personal, and environmental influencing factors will be helpful in including with the strategic management towards RPE compliance.

(2) The MOH in Indonesia should not only provide RPEs on their government-owned hospitals, but should also enhance radiographers' compliance by giving incentives and rewards [9]. The MOH of Indonesia should

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conduct an evaluation on each radiographer from their hospitals to ascertain whether each of their radiological examinations is in compliance with the standard operating procedures.

(3) Refresher courses, continuous educational programs, and trainings to radiographers should be projects at large [47]. The most basic stage is to raise the awareness of radiographers on compliance towards RPE by establishing knowledge on safety culture. The management of the district hospitals should increase the completeness of the RPE facility and require its use by increasing the trainings of the use of such RP equipment so that radiographers comply.

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