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Study on Physicians Request for Computed Tomography Examinations for Patients With Head Injury in Hospital's Emergency Departments In East Java, Indonesia

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ABSTRACT:-
Background and objectives: There is a lot controversy about the use of Computed tomography (CT) for patients with minor head injury. We aimed to determine the practice of guiding rules for the safety of radiation and increasing awareness of physicians about risks of ionizing radiation and find out the reasons of emergency doctors for sending head injury patients to CT scan exams.
Materials and Methods: A descriptive questionnaire in the Emergency Department (ED) based study was performed to assess physicians' knowledge of radiation doses received from radiological treatments and knowledge about Clinic Decision Support rules (CDS). The questionnaire consisted of 26 questions distributed to physicians working in the emergency department in six hospitals in East Java. Finally, the data collected have been analyzed by some tests using SPSS version 15 and Smart PLS.
Results: In this study 44 participants had taken part. The percentage of general knowledge and awareness that shows the response of people who work in the emergency departments was total 44 respondents, by percent 6.8% of the respondents had passably knowledge, awareness and 84.1% they were having a good knowledge and awareness and 9.1% the respondents had very good knowledge and awareness. That means almost of respondents have good knowledge and awareness. To find out if an indicator is forming a construct (latent variables) testing the convergent validity of the measurement model with a reflexive indicator assessed based on the correlation between the item score to construct scores were calculated with the help of software Smart PLS. Size reflexive considered valid if the individual has a correlation (loading) to construct (latent variables) to be measured ≥ 0.5 or the value of t-statistics should ≥ 1.96 (test two tailed) at a significance level of $\alpha = 0.05$. If one of the indicators has a leading value <0.5, or the value of the t-statistic <1.96, then the indicator should be discarded (dropped) because it indicates that the indicators are not good enough to measure the construct in right. The positive influence between general knowledge and awareness against to knowledge about radiation doses can be interpreted that the better general knowledge and awareness, then it will be followed by an increase in their knowledge about radiation doses. And vice versa, the worse general knowledge and awareness, then this will decrease their knowledge about radiation doses too.
Conclusion: The present study has illustrated that the level of awareness and knowledge physicians who deal with ionizing radiation in CT scan units are adequate overall. There is a good influence between the diligence in applying the principles of guidance and rules stipulated by the nuclear energy in Indonesia by physicians to adjust the use of CT in the emergency department, the majority of participants who have a good awareness & knowledge, there are some of them do not have enough knowledge.
Keywords: - Awareness & knowledge, Radiation doses, Radiation side effects, CT scan procedures, Physicians in the emergency departments.

I. INTRODUCTION

Radiological examinations are an essential tool for the evaluation of many disorders in daily practice. Most of them, especially computed tomography (CT), use ionizing radiation, which has adverse biological effects [1]. Radiation is energy in the form of waves of particles. There are two forms of radiation non-ionizing and ionizing radiation. It is well known that ionizing radiation has biological damaging effects, either affecting the cell directly or indirectly via the production of free radicals. Both lead to *DNA* damage, including single or double-strand breaks, and or *DNA*, protein cross-links [2]. Figure (1) explain to Biological effect of ionizing radiation in the page.

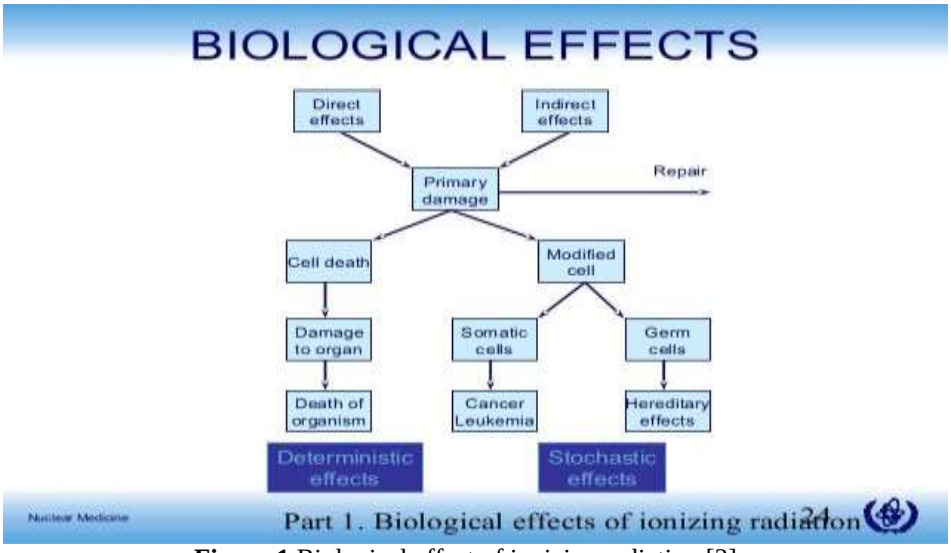

Figure 1 Biological effect of ionizing radiation [3]

Wilhelm Roentgen first discovered ionizing radiation in the form of *x*-rays in *1895*, while performing experiments with cathode rays. In the *1970s*, *CT* was introduced as an innovative *x*-ray imaging tool. This technology was invented by electrical engineer Godfrey N. Hounsfield of Central Research Laboratories (London) in *1972*, along with physicist Allan M. Also in *1972*, the first CT head scanner was developed, and the first commercial unit of this prototype was installed in the *USA*, in *1973*. Between *1974* and *1976*, *CT* scanners began to be installed and used in medical institutions [4].

Computed tomography (*CT*) use in the evaluation of emergency department (*ED*) patients increased significantly during the last decade [5]. This trend has contributed to increasing health care costs and growing patient exposure to ionizing radiation [6]. However, it is unclear whether the increase in *CT* radiation is due to an increase of inappropriate use of *CT* scans. It has been suggested that commitment to evidence based Clinical Decision Support (*CDS*) can lead to more judicious use of *CT* scans in *EDs* [7].

The Canadian and New Orleans head *CT* rules are two of the most widely validated CDS for *mTBI*. The derivation and verification cohorts for these two *CDS* were composed of patients with blunt head trauma who either had loss of consciousness *(LOC)*, amnesia or disorientation. The deficiency in the knowledge of a medical doctor might alter the expected benefits compared to the risk involved, and can affect medical decisions[8].

As a result of the increased visibility of cases of cancer and other side effects as a result of large doses that are exposed during *CT* imaging, the Physicians need to have a clear understanding of the radiation risks associated with specific imaging examinations [9]. The physicians act as gatekeepers, referring their patients for imaging procedures and having open access to all imaging examinations including *CT*. Finally, the reason for choosing this problem is how we can minimize[10] the increasing exposure and unjustified to ionizing radiation in the *CT* examination, when it is ordered using computed tomography in emergency department with minor brain injury and the best ways followed by the physician for estimating dose to the patient per year before the *CT* examination in the emergency department.

The main problems underline in this research can be made such the following questions: How to evaluation on request computed tomography the head for patients with minor head injury in the emergency department in six hospitals in East Java?

Moreover, the Benefits of the Research were,

- Reduce the risks of radiation resulting CT scans.
- Improve awareness and knowledge of physician in the emergency department.
- Curbing exceeds clinic design support.

Finally Research Limitations

- The study was carried out in the Emergency Department that employ CT scan.
- The survey was targeting the physicians of Emergency Department who works in the emergency department.
- The study has covered six general hospitals in East Java.

II. MATERIALS AND METHODS

This study would try to evaluation on request for computed tomography for patients with minor head injury in the emergency department and determines the practice of guiding rules for the safety of radiation and increasing awareness of physicians about risks of ionizing radiation. In particular Ionizing radiation has long-term risks, including cancer. That the research focused on Improve awareness and knowledge of physicians in the emergency department. The study has been done in the Emergency Departments in the six hospitals in East Java in Indonesia that can mention as; Then, the data (RKZ Panti Waluya hospital, RSUD Ngudi Waluyo Wlingi hospital, RSUD dr Soedono Madiun hospital, RS Abdoer Rahim Situbondo hospital, Persada hospital, RSUD Lawang hospital). Then, the data have collected in almost three months from September to November 2016 and the data were analyzed by using software called Statistical Package for the Social Sciences "SPSS" and Partial Least Squares (PLS) method. By studying the relationship between awareness and knowledge, including the other variables (through knowledge about radiation doses and knowledge about side effects) to get a CT scan procedure proper treatment so note the relationship between awareness and knowledge between knowledge about radiation doses and side effects that affect the adjust the using computed tomography. Figure (2) will show the relationship among awareness & knowledge, knowledge about radiation doses, knowledge about side effects and to get a CT scan procedure proper treatment.

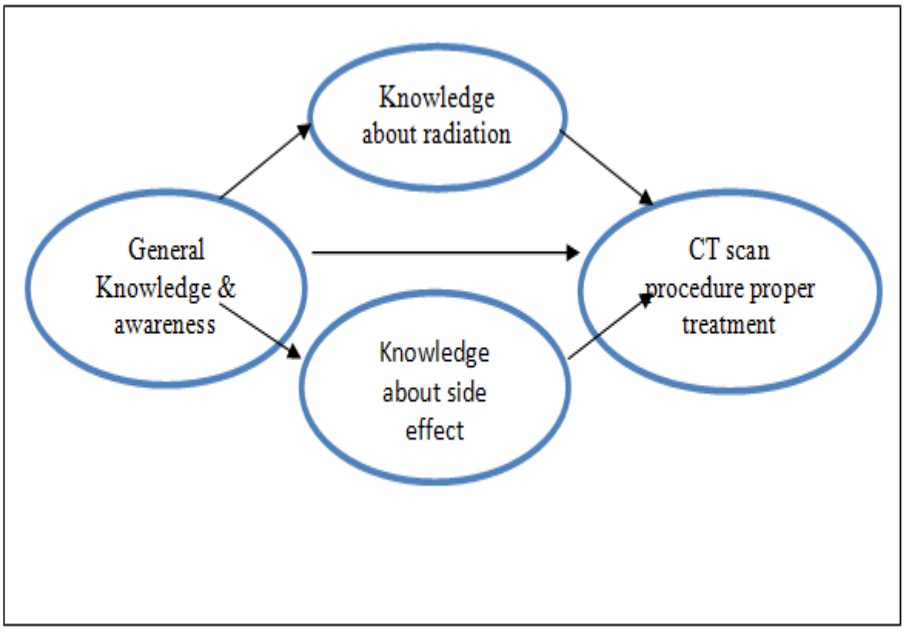

Figure 2 Conceptual Framework

The numbers of questions that has been written down for each variable were as follows: 13 questions about general awareness & knowledge, 4 questions about CT scan procedures, proper treatment, 6 questions about knowledge about side effects and 3 questions about radiation doses knowledge

Operational Definitions

- **Physicians in the emergency departments:** they are the people who work in the emergency department in the hospital. However, the study is going to focus on this sample.
- **Radiation doses:** it rather means absorbed dose which is a physical dose quantity representing the mean energy imparted to matter per unit mass by ionizing radiation. In the *SI* system of units, the unit of measure is joules per kilogram that named Gray (*Gy*) as has already mentioned.
- **Radiation side effects:** as a result of getting high doses of *X*-ray that let to get bad effects of the exposure. Moreover, these effects may lead to cause disease and cancer cells.
- **CT scan procedures:** A computed tomography (*CT*) scan uses *X*-rays to make detailed pictures of structures inside of the body. During the test, you will lie on a table that is attached to the *CT* scanner, which is a large doughnut-shaped machine. The *CT* scanner sends *X*-rays through the body area being studied.

III. RESULTS & DISCUSSION

The first survey has carried out in East Java, Indonesia with the aim of how to evaluation on request Computed Tomography (CT) scans of the head in patients with minor head injury in the Emergency Department and determines the practice of guiding rules for the safety of radiation and increasing awareness of physicians

about risks of ionizing radiation. In total, out of the 50 questionnaires had been distributed, 44 questionnaires were returned with completed answers. In the survey results, it shows the respondents, including gender, age, degree, the duration of experience and the person‟s career. For example:

1. Identity of Respondents by Gender

Table 1 The Gender participants from the analysis

	Frequency	Percent
Male	21	47.7%
Female	23	52.3%
Total	44	100%

Table 1 The Gender participants from the analysis that shows the response of people who work in the emergency departments was total 44 respondents, by percent *47.7%* of the respondents were male and *53.5%* were female. The reason that makes the percentage of women is higher because in Indonesia they have a higher population rate than men as shows figure (3) the percentage of gender.

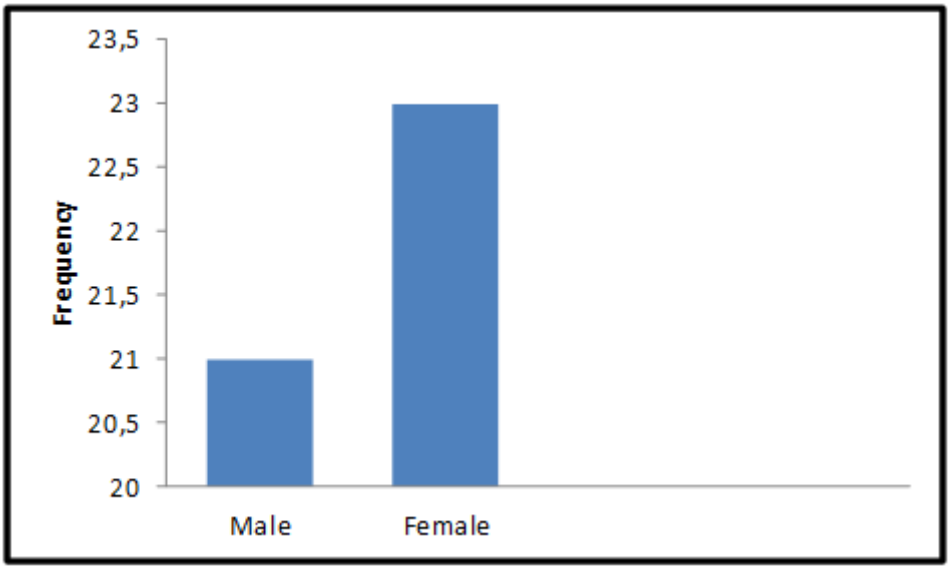

Figure 3 The percentage of gender

IV. INTERPRETATION OF THE RESULT

4.1Analysis using *PLS*

4.1.1Convergent Validity

Size reflexive considered valid if the individual has a correlation (loading) to construct (latent variables) to be measured ≥ *0.5* or the value of *t*-statistics should ≥*1.96* (test two tailed) at a significance level of *α= 0.05*. If one of the indicators has a leading value *<0.5*, or the value of the t-statistic *<1.96*, then the indicator should be discarded (dropped) because it indicates that the indicators are not good enough to measure the construct in right

4.1.2Construct Dependent Evaluation

Evaluation of the model using the *R*-square (R^2) to construct the dependent, *R*-square value reflects the overall predictive power of the model with a limit of *R*-square values greater than *0.10* or greater than *10* percent (or goodness-fit of the model) [10]. Figure (4) to explain Structural Equation With Partial Least Square Approach Using Software Smart *PLS* (Measurement Model Specification)

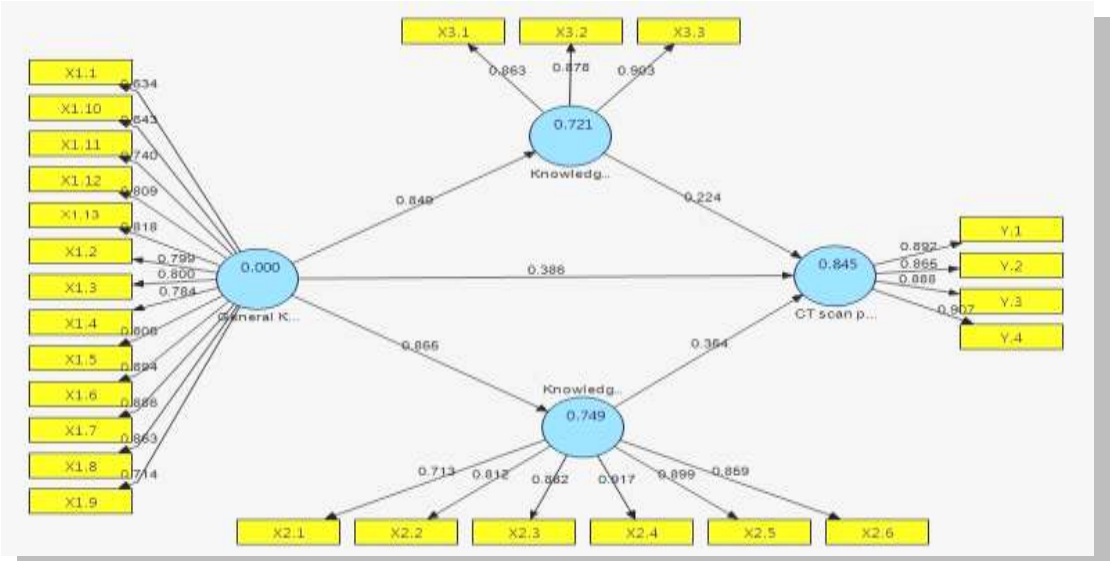

Figure 4 Structural Equation With Partial Least Square Approach Using Software Smart PLS (Measurement Model Specification)

V. CONCLUSION

Based on the current results of a survey on the awareness and knowledge of physicians about the benefit and risk of ionizing radiation in computer tomography (CT) units in the emergency department. The findings demonstrated that as follow:

1. The level of awareness and knowledge physicians who deal with ionizing radiation in CT scan units are adequate overall.
2. There is a good influence between the diligence in applying the principles of guidance and rules stipulated by the nuclear energy (BAPETEN) in Indonesia by physicians to adjust the use of CT in the emergency department.
3. Finally, from the research results it can be concluded that, besides to the majority of participants who have a good awareness & knowledge, there are some of them do not have enough knowledge.

On the other hand, in versus there a number of previous studies and reports are in disagreement with present study [11], [12], [13]. Recommendations Based on the findings of the study, it can provide the recommendations as follow:

1. The hospitals should provide some courses or workshops occasionally to enhance or keep the level of awareness of physicians about ionizing radiation.
2. Through this research I recommend that there be keen more on the application of clinical decision support rules by the physicians in the emergency department.
3. Hopefully it can be the existence of specialist medical physics in hospitals is important to avoid the unjustified use of radiation.
4. According to the responses, *CT* scan must be available in an Emergency Department in each hospital.

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