



## Development of radiation dosage risk model for android-based radiology patients

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### ABSTRACT

Radiation for patients undergoing radiological examinations can have somatic and genetic effects. Somatic effects are effects that are directly felt by patients, while genetic effects arise due to damage to DNA molecules in the future as a long-term effect. Providing appropriate education is an effort to prevent the risk of radiation. Providing education orally only, the potential for misinformation is huge. The implication of this error causes the knowledge and attitudes of patients towards the risk of radiation to be lacking, so it is necessary to develop an educational model that can be attractive to patients who can ultimately improve the patient's knowledge and attitude. by giving treatment to the group being tested.

This type of research uses Research and Development (R&D). To prove the feasibility of the software, a quasy experiment pre-test control group design was used, with a total sample of 45 patients. Data collection tools are e-3Ramed applications, questionnaires and questionnaires. Univariate analysis uses frequency distribution, while bivariate analysis proves the effect of educational interventions on increasing patient's knowledge and attitudes about radiation risk by McNemar and Kruskal Wallis tests.

Based on statistical test results, it is known that the three educational models, oral, android, and android and oral combination are all effective in increasing the knowledge and attitudes of radiology patients about the risk of radiation dose with p-value <0.05. But the most effective educational model and has the highest ranking value is a combination of oral and android with a mean rank of 29.07.

An Android-based educational model has been developed, the e-3Ramed application which is effective in increasing the knowledge and attitudes of radiology patients about the risk of radiation doses.

**Keywords:** Education, Risk of Radiation Dose, e-3Ramed

### INTRODUCTION

Radiology is a medical support service unit that utilizes X-ray radiation for diagnosis purposes both diagnostic and interventional radiology [1]. In addition to providing benefits, X-ray radiation can

also be a potential health hazard. Some of the harmful effects to the human body due to exposure to X-ray radiation in the form of hair loss and skin damage. Other effects can cause organ tissue damage that can occur due to short exposure to

high radiation or long term exposure to low levels of radiation [2].

To prevent the risk of radiation doses, it is necessary to provide education. The success of the educational process is shown by better behavior changes involving changes in knowledge (cognitive), skills (psychomotor) and attitudes and behavior (affective). Besides delivering educational material is more effective when delivered in a pleasant atmosphere and with an interesting method [3]. At present, education on the risk of radiation doses is largely delivered orally by radiologists or radiographers. This method has deficiencies in the success of information delivery and requires more time [4]. If the educational model used utilizes the media as a tool, the educational process can explain part or all of the information that is difficult to explain verbally. One of the media that can be used as educational media is an android smartphone device [5]. On the one hand, providing education with a combination of android and verbal can further enhance the understanding of the material presented and is very effective because it can complement each other [6]. The impact of giving wrong education makes it difficult for patients to understand the risk of radiation, such as patients not knowing the examination procedures and the risk of radiation doses so that the possibility of repeated examinations is very large and in turn will risk more radiation doses to the patient.

Based on a preliminary study at the Mangusada Regional Hospital, the risk of radiation dose education is not optimal, only verbally delivered where the regulations and evidence of education implementation are not well documented. Data from the last 2 years shows that there are repeat tests every year because of the patient's ignorance of the procedure and the risk of radiation doses. Data for 2018 showed that the number of radiology patient visits was 22,061, x-ray radiology examination was 25,653 and 269 (1.3%) had repeat examinations [7]. While the 2019 data showed that the number of radiology patient visits was 21,196 people, x-ray radiology examination was 24,118 actions and as many as 88 actions (0.3%) had repeat examinations [8].

Starting from this, if the application of risk education for radiation doses of patients is not optimal, the risk of errors in delivering information is huge. In addition to its harmful effects on patients, it can also lead to errors / repetition of

examinations so that the impact on the establishment of an incorrect diagnosis [9]. The purpose of this study is to produce an Android-based application model as an educational medium to improve the knowledge and attitudes of radiology patients about the risk of radiation doses.

## **METHOD**

### **Type and Design of Research**

The type of research used is Research and Development (R&D), while to test the effectiveness of the product with a quasi-experimental method with a pre-test control group design research design [10, 11].

The population in this study were patients who performed x-ray radiological examinations at Mangusada Regional Hospital in Badung Regency, Bali Province. By applying the time and sample saturation method, the samples used are all patients who undergo x-ray radiological examinations at the specified time (total sampling). The sampling technique used was purposive sampling with time saturation, where each patient at the time of the study was sampled in the study provided it met the inclusion and exclusion criteria [12]. The total sample in this study were 45 people

Univariate analysis to describe the characteristics of each study respondent uses a frequency distribution with a measure of percentage and proportion. Bivariate analysis was conducted to examine the effect of educational interventions with the android application method and other methods to increase respondents' knowledge and attitudes about the risk of radiation doses. The test used to test the pre-test and post-test scores on knowledge and attitudes in the three groups of respondents was the McNemar test and the Kruskal Wallis test using SPSS version 22.0. McNemar is used to determine the effect of two data sets (pre-test and post-test) which are in pairs. Kruskal Wallis is used to compare which methods are most influential or effective in increasing respondents' knowledge and attitudes about the risk of radiation doses.

**RESULTS**

**Development of an android-based radiation risk education model**

This research includes 5 (five) stages, namely, information gathering, product / model design, expert validation and revision, product / model trials and product / model results. The information gathering stage begins with the results of observation and communication with hospital management, service personnel and IT experts. As a result, the educational model needed is an Android-based application based on the consideration of cost, time, benefits for the radiographer and paper less. The design phase / design, consider that the model can be accepted by all parties by creating a flowchart, storyboard, and preparing the material as shown below.

The validation test phase, this android-based application has gone through a study process to analyze the target's needs and has gone through the feasibility test or validation stage by material experts, media experts, and information technology experts as media improvement materials. Validation test results, this application is very

feasible to be developed. The product / model trial phase is carried out at the Mangusada RSD Radiology Installation to determine the patient's response to the Android-based educational media developed. As a result, all patient responses stated that this application was feasible to be developed. The product / model results phase, this study produced a product that is the "e-3Ramed" android application which has the philosophy that this application is electronic which contains information messages about Ray (X-rays), Risk (risk of radiation dose), Radiology (examination procedure) , Modality (radiology equipment) and Education (educational evidence) to patients at the Mangusada Regional Hospital Radiology Installation.

**Effects of educational interventions on radiology patients**

**Educational interventions with oral methods**

To find out the effect of interventions with oral methods on increasing the knowledge and attitudes of respondents about the risk of radiation doses can be seen in the following table.

**Table 1. Effects of Educational Interventions with Oral Methods on Increasing Respondents' Knowledge and Attitudes**

Variable	N	Df	p-value*
Knowledge	15	2	0,002
Attitude	15	2	0,002

\*Mc Nemar

From the results of statistical tests using the McNemar test showed that the knowledge p-value was 0.002 and the attitude p-value was 0.002. Because the p-value <0.05, the hypothesis is accepted means that there is an influence between the value of knowledge and attitudes of respondents before and after educational interventions, so it can be concluded that the oral method as an educational medium is effective in increasing the value of

knowledge and attitudes to respondents about the risk of radiation dose.

**Educational intervention with the android application methods**

To find out the effect of intervention with the android application method to increase respondents' knowledge and attitudes about the risk of radiation doses can be seen in the following table.

**Table 2. Effects of Educational Interventions with Android Application Methods on Respondents' Knowledge and Attitude Improvement**

Variable	N	Df	p-value*
Knowledge	15	2	0,004
Attitude	15	2	0,018

\*Mc Nemar

From the results of statistical tests show that the knowledge p-value of 0.004 and the attitude p-value of 0.018. Because the p value <0.05, the hypothesis is accepted, which means that there is an influence between the value of knowledge and attitudes of respondents before and after educational interventions, so it can be concluded that the android application method as an educational medium is effective in increasing the value of respondents' knowledge about the risk of radiation doses.

### Educational intervention with a combination of the android application method and the oral method

To find out the effect of interventions with the android and oral application methods on increasing the knowledge and attitudes of respondents about the risk of radiation doses can be seen in the following table.

**Table 3. Effects of Educational Interventions with Android and Oral Application Methods on Knowledge and Attitude Respondents' Improvement**

Variable	N	Df	p-value*
Knowledge	15	1	0,003
Attitude	15	1	0,001

\*Mc Nemar

From the results of statistical tests show that the knowledge p-value is worth 0.003 and the attitude p-value is 0.001. Because the value of p <0.05, the hypothesis is accepted, which means that there is an influence between the value of knowledge and attitudes of respondents before and after educational interventions, so it can be concluded that the android and oral application method as an educational medium is effective in increasing the value of respondents' knowledge about the risk of radiation dose.

## DISCUSSION

Utilization of other conventional methods such as the use of posters and leaflets as an educational model has also been widely used but has not produced results as expected and is considered less attractive so that ideas and ideas emerge that need to develop more interesting and creative educational models by utilizing technology in the form of android-based application methods [13]. Referring to this research, it is necessary to develop a model of risk education for radiation doses with an Android-based application method, which has referred to the R&D theory which consists of five stages.

According to the results of the study, it is known that there is a significant influence between the results of the measurement of knowledge and attitudes of radiology patients before and after the intervention of radiation dose risk education is

given by the oral method, which means that the oral method is still effective in increasing the knowledge and attitude of the radiology patient even though the value is the lowest effectiveness and the average intervention time per patient required is relatively long compared to other methods. This is influenced because the oral method can find out the communication skills of officers and patients, can explore the patient's reasoning for information received, the existence of direct interaction related to things that are not understood by patients to officers, easy to implement and can stimulate and increase the patient's curiosity so that it can foster attitudes to undergo a radiology examination.

Based on the results of the study, it is known that there is a significant influence between the results of the measurement of knowledge and attitudes of radiology patients before and after the intervention of radiation dose risk education is given by the Android-based application method, which means that the Android-based application method is effective in increasing the knowledge and attitude of the radiology patient and requires an average of the least average intervention time per patient. Several factors influence because the Android-based application method is able to clarify the presentation of the message so that it is not too verbal (written), overcome the limitations of space, time and sensory power, overcome the passivity of the recipient of the message, cause motivation to learn, allow direct interaction such as the truth,

allow the recipient independent learning information in accordance with their abilities and interests and the learning media used provide the same material standards to all recipients of information.

The results showed a significant influence between the results of the measurement of knowledge and attitudes of radiology patients before and after the radiation dose risk education intervention was given with the android and oral based application method, which means that the android and oral based application method as an educational media for radiation dose risk was effective in increasing knowledge and attitudes of radiology patients and have the highest value of effectiveness but the average time required for intervention is the most.

## CONCLUSION

Based on the description in the previous chapters can be concluded as follows:

- [1]. An android-based radiology patient education model has been developed about the risk of radiation doses called 'e-3Ramed'.
- [2]. The radiology risk education model of radiology patients with oral methods is effective in increasing the knowledge and attitudes of radiology patients about the risk of radiation doses with a p-value <0.05

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- [3]. The radiology risk radiation education model of patients with the android-based application method (e-3Ramed) is effective in increasing the knowledge and attitudes of patients about the risk of radiation doses with a p-value <0.05
- [4]. The radiological risk dose education model for radiology patients with a combination of the android (e-3Ramed) method and the oral method effectively increases the patient's knowledge and attitudes about the risk of radiation dose with a p-value <0.05
- [5]. The educational model that has the highest and most effective ranking is the combination of the Android (e-3Ramed) method and the oral method.

## RECOMMENDATION

1. To the management of RSD Mangusada, the e-3Ramed application can be used as a recommendation in improving the quality of service in the Radiology Installation so that in the future it will be necessary to regulate regulations so that this application can be implemented.
2. To the next researcher, in order to conduct further research by considering the technical calculation of the amount of radiation dose that can be lowered in the event of repeated checks and using more varied and varied research samples.

Participants In My Research Study? *An Bras Dermatol.* 91(3), 2016, 326-330. Doi:10.1590/Abd1806-4841.20165254

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