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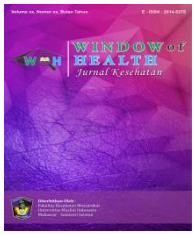

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SINARA Application to Detect Cervical Cancer Risk: Development and Validity

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ABSTRACT

The coverage of cervical cancer screening in Indonesia is 6.83% and in Maluku is 7.02% which is still low, even though affordable IVA examinations are available at health centers. Not knowing the risk of cervical cancer is one of the obstacles to low awareness of cervical cancer screening. Previous research has developed a valid and reliable SINARA instrument to detect cervical cancer risk. This study aims to develop and test the validity of the SINARA application, a smartphone application for detecting cervical cancer risk. This quantitative study uses the PDCA (Plan, Do, Check, Action) approach. The study was conducted from July to September. The research sample was 30 women of childbearing age in Ambon City, with a purposive sampling technique. Data collection was carried out offline using questionnaires and online using Google Forms. This study produced the SINARA application with validity test results> 0.361 and a Cronbach alpha value of 0.935, and good quality through usability test results of 82.82%. A high-quality SINARA application is expected to help increase the participation of women in carrying out cervical cancer screening at health facilities. It is recommended to integrate this with the health office to identify women at risk of cervical cancer.

Keywords: Cervical cancer risk detection; cervical cancer screening; sinara application

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INTRODUCTION

Cervical cancer is still one of the most common cancers experienced by women in the world, including in Indonesia. Global data shows that there were 604.127 (3.1%) cases of cervical cancer in 2020, with 341.831 (3.3%) deaths. This figure has increased from 2018, when around 569.847 new cases were diagnosed and 311.365 deaths occurred due to cervical cancer.[1] In Indonesia, in 2020, there were 36.633 (17.2%) new cases, so cervical cancer still ranks 2nd in women after breast cancer. This figure has also increased from 2018, with around 32.469 new cases diagnosed.[2]

Cervical cancer can be prevented, one of which is through secondary prevention through early detection or screening.[3] In fact, many women of childbearing age (WUS) are not aware of the importance of early detection of cervical cancer. Until 2021, in Indonesia, there were 2.827.177 women aged 30-50 years or only 6.83% of the target, who had undergone early detection of cervical cancer using the visual inspection method of acetic acid (IVA). The results showed that positive IVA had the highest number of 27.837 cases.[4] In 2023, cervical cancer screening coverage in Indonesia only reached 7.02% of the target of 70%.

In Maluku, the coverage of cervical cancer screening through IVA examination in 2023 was 2.57%, representing a decrease of less than 1% compared to 2022, which was 1.66%. The results found that 63 women had positive IVA, five women were suspected of having cancer, and 39 women were referred.[5,6] This fact is quite concerning, as the number of cervical cancer cases continues to increase. However, coverage of screening is still very low.

The government has attempted low-cost cervical cancer screening, namely screening with the IVA method at Community Health Centers. However, the participation of women of childbearing age is still low.[7] Various factors underlie the low participation of women in cervical cancer screening, including low levels of knowledge, shame, fear of the examination and its results, discomfort with the procedure, lack of social support (family, husband, health workers), distance to health facilities, time, cost, belief, and lack of awareness of the risk of cervical cancer.[8–12]

One of the causes of the lack of awareness of cervical cancer screening is that women do not know their risk of cancer, so they have not decided to be screened.[13] Women will be involved in screening activities if they have high awareness.[14] Following the decision-making theory of The Precaution Adoption Process Model, which is relevant in the Indonesian context to understand and influence individual behavior towards non-communicable diseases, such as cervical cancer.[15] Individuals will be at a stage where they decide to take preventive measures if they feel vulnerable and afraid of getting the disease.[16] This research is critical because women need to know the extent of their risk of cervical cancer so that it can influence the decision to be screened for cervical cancer.

The problem is that there is no independent cervical cancer risk detection instrument in community health centers (Puskesmas). Health workers fill out the instrument during the women's screening at the Puskesmas. Previously, we explored cancer risk assessment instruments in women and developed the valid and reliable SINARA instrument to independently detect cervical cancer risk in

women based on culture and geography in Indonesia.[14,17] Independent risk detection instruments have indeed been shown to influence individual decisions to undertake preventive efforts.[18,19] However, along with technological developments, innovative cervical cancer risk detection instruments that can be accessed via smartphones are indeed urgently needed because smartphone use among all groups is increasing and will continue to increase annually.[20] The prevalence of smartphone use from 2021 to 2023, namely 65.7% to 67.29%.[21] This study aims to develop and test the validity of the SINARA application in detecting cervical cancer risk in Maluku women.

METHOD

This quantitative study uses the PDCA (Plan, Do, Check, Action) Kaizen 18 philosophy approach: (1) Plan, collect initial data and design applications. (2) Do, create and implement applications on the Android platform. (3) Check is conducting application trials. (4) Action, analyzing and revising the application based on the analysis results.[22] The research was conducted from July to September in Ambon City. The research population was women of childbearing age in Maluku. The total sample of 30 women of childbearing age in Ambon City was tested using a purposive sampling technique for testing the application on users (user interface).

Data were collected both offline and online to distribute application evaluation questionnaires to respondents, and online using Google Forms. The usability and credibility instruments for testing the application on users have been tested for validity. This research has received ethical approval from the Health Research Ethics Committee of the Faculty of Public Health, Airlangga University, with number 175/EA/KEPK/2024.

RESULTS

The development of the SINARA application follows the PDCA (Plan, Do, Check, Action) stages as follows.

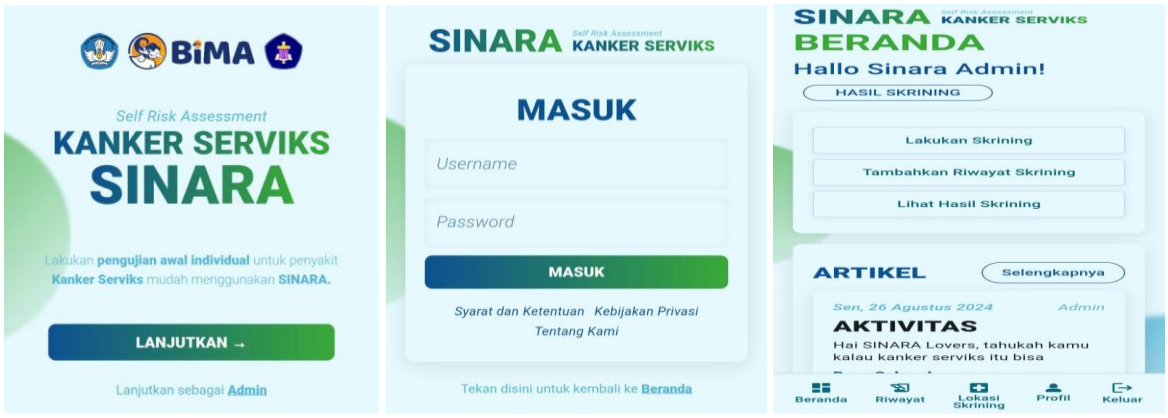
Plan Stage

At the planning stage, the application design is carried out, which produces a prototype of the SINARA application (Figure 1). The prototype was prepared twice, which resulted in more than 12 display pages and seven overlays. The application prototype was designed based on the initial review process of the needs analysis.

Figure 1. SINARA application prototype

Do Stage

The do stage is creating the application and implementation on the smartphone with the following results.



(a) (b) (c)

(d) (e) (f) (g)

Figure 2. SINARA Application Display

The initial application display contains the Ministry of Education and Culture logo and BIMA as the funding source for this research, followed by the Indonesian Christian University of Maluku logo and the Continue button to register as a user or Continue as admin (a). Application users will register a username and password to run the SINARA application. User information will be stored in a database that can be accessed by the admin (b). Some features of the SINARA application are home, history, screening location, profile and exit (c). Users carry out cervical cancer risk screening by selecting answers according to their conditions (d); after that, they get the screening results, and users can consult via WhatsApp by selecting Make an Appointment (e). If the user decides to consult and screen for cervical cancer at the facility, a reminder feature will appear on the smartphone screen while the application is open (f). In addition, there is a feature for filling in information on the results of cervical cancer screening carried out by users at health facilities, consisting of the screening date, type of screening, screening location and cervical cancer screening results (g). This information is stored in the application database and can be accessed by the admin.

Check Stage

At this stage, alpha (black box testing) and beta (user interface) application testing are carried out. Alpha testing is a system application test, while beta testing is a test of application usage carried out on 30 respondents with the following results:

Table 1. Respondent Characteristics Based on Age, Education and Occupation

Characteristics	Parameter	n	%
Age	18-27	14	47
	28-37	7	23
	38-47	8	27
	>47	1	3
Education	Elementary School	0	0
	Junior High School	0	0
	High School	13	43

Occupation	College	17	57
	Housewife	15	50
	Private Employee	6	20
	Honorary	1	3
	Civil Servants	2	7
	Lecturer	6	20

Table 1 shows that the majority of respondents are in the 18-27 age group, as many as 14 people (47%), with the highest level of education in the College group, as many as 17 people (57%) and the most significant number of respondents in the Housewife group, as many as 15 people (50%).

Action Stage

The application validity and reliability test values were generated based on the results of testing the application with respondents (Table 2).

Table 2. Results of the SINARA Application Validity Test

Aspect	r-count	Description
Visibility of System Status (U1)	0.839	Valid
Match Between system and the real world (U2)	0.853	Valid
User Control and Freedom (U3)	0.743	Valid
Consistency and Standard (U4)	0.878	Valid
Error Prevention (U5)	0.874	Valid
Recognition rather than recall (U6)	0.848	Valid
Flexibility and Efficiency of use (U7)	0.944	Valid
Aesthetic and minimalist design (U8)	0.924	Valid
Help User recognize, diagnose, and recover from errors (U9)	0.878	Valid
Help and Documentation (U10)	0.795	Valid
Interoperability (U11)	0.733	Valid
Support User Skills (U12)	0.779	Valid
Respecfull Interaction (U13)	0.779	Valid

Table 2 illustrates that the application has been valid with the results of the validity test r-count > r-table (> 0.361). Reliability testing using Cronbach's alpha with a result of 0.953 (> 0.60) is reliable. In addition, this study also tested the quality of the application using the International Standard Organization (ISO) 9126 software testing standard, which is a measurement standard for good quality software according to user needs. One of them is usability testing, which includes four assessed aspects: usefulness, ease of use, ease of learning, and satisfaction. The SINARA application usability test results are 82.82% (Table 3).

Table 3. Application Usability Test Results

No.	Dimension	Number of valid questions	Number of valid questions	Number of valid questions	%
1	Usefulness	8	1200	1018	84.83333
2	Ease of use	11	1650	1376	83.39
3	Ease of learning	4	600	500	83.33
4	Satisfaction	7	1050	837	79.71
	Total	30	4500	3731	82.82

DISCUSSION

The development of the SINARA application has achieved good results, with a validity value of more than 0.70 and a reliability test score of 0.953, as well as satisfactory application usability. Positive feedback from users indicates that the application has features that are easy to understand and operate. This application is intended for women of childbearing age, with the main feature being cervical cancer risk screening. Women can be screened by answering 21 questions, the results of which can indicate their cervical cancer risk. Cervical cancer risk is categorized into low-risk and medium-to-high-risk categories. This risk is categorized based on previous research on the development of the SINARA instrument conducted by previous researchers, so that women can determine their cervical cancer risk.[14]

Other studies have also analyzed the risk of cervical cancer in women using the SINARA instrument, with the results that more than 80% of women have a risk of cervical cancer.[23] This proves that the SINARA instrument can be developed into an Android application to make it easier for women to screen for cervical cancer risk using smartphones. The SINARA instrument, previously developed by researchers, can only be used manually on paper. Meanwhile, the SINARA app can be used practically via smartphone.

Several previous studies in Indonesia have developed mobile-based cervical cancer early detection instruments. However, these studies used VIA test results to determine cervical cancer risk.[24,25] This means that the woman has been screened, while the most common problem is low participation in cervical cancer screening.[26] Low cervical cancer screening rates among women, including in Indonesia, are caused by various factors, including a lack of awareness of cervical cancer risk.[27,28] Other studies have shown that cervical cancer screening decisions are based on respondents' beliefs about their vulnerability and fear of cervical cancer based on information received.[15] Therefore, women's awareness of cervical cancer risk is expected to increase their involvement in cervical cancer screening. So, this study offers a novel contribution to previous research by developing an application to independently detect cervical cancer risk using a smartphone.

The SINARA app has several important features in addition to the cervical cancer risk screening described previously. First, the cervical cancer screening location feature in Maluku, along with the

availability of trained health workers, is a key feature. This information can make it easier for women to find cervical cancer screening locations at the nearest health facility. Information about the location of screening is important because one of the determinants of women undergoing cervical cancer screening is the availability of infrastructure and access to information.[29] Second, the cervical cancer screening history feature enables users to record cervical cancer screening results from health facilities. Screening data for women of childbearing age is stored in a database, which is expected to provide information to health services regarding cervical cancer screening coverage. Third, the cervical cancer screening reminder feature. The reminder feature can encourage individuals to follow their treatment or health examination.[30] This feature of this app provides recurring notifications when women have not entered their cervical cancer screening results at a health facility. The notification will disappear when the cervical cancer screening results are added to the app. This feature helps remind women to get screened if their risk screening results indicate a moderate-to-high risk.

The SINARA application is expected to help increase participation in cervical cancer screening for women of childbearing age, after women know how significant their risk of cervical cancer is. In line with the theory of The Precaution Adoption Process Model (PAPM), individuals will be at the stage where they decide to take preventive measures if they feel vulnerable and afraid of getting the disease, and make this decision regularly.[16] Women who know the risk of cervical cancer are more likely to undergo cervical cancer screening at health facilities, compared to those who do not know the risk. In addition, the morbidity rate of cervical cancer is relatively high, so women need to know the risk factors they experience, because women who have high-risk factors have a greater chance of getting cervical cancer.[31] Several risk factors of cervical cancer in Indonesian women are sexual activity at age <20 years, having >1 sexual partner, income, smoking habits, family members who have a history of cancer, and use of hormonal contraceptives. These risk factors have been included in the screening feature on the SINARA application.[32–34]

This study has several limitations. First, the screening location on the SINARA application is still limited to the Maluku area. Second, the SINARA application was developed exclusively for the Android operating system, as it is compatible with a wide range of mobile devices and accessible to a larger user base.

CONCLUSIONS AND RECOMMENDATIONS

This study resulted in a valid and reliable SINARA application, as evidenced by the usability test results. This application is expected to help increase the participation of women of childbearing age in carrying out cervical cancer screening at health facilities. The SINARA application features a cervical cancer risk screening tool, with results stored in a database. It is recommended to integrate this with the health office to identify women at risk of cervical cancer. Further research is recommended to expand the cervical cancer screening location feature in the SINARA application beyond the Maluku area, ensuring it is accessible to all regions in Indonesia. Also, the application can be developed for the iPhone operating system, enabling every woman to detect the risk of cervical cancer.

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