

Evaluation of Usability and User Experience of Oncodoc 's M-Health Application for Early Detection of Cancer

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Abstract

Objective: Cancer is a non-communicable disease that accounts for 71% of deaths globally. The prevalence of people living with cancer in Indonesia increased from 1.4/1000 population (2013) to 1.8/1,000 population (2018). This study aims to evaluate usability, user experience, and user feedback on the use of the Oncodoc m-health application. **Methods:** The research method uses mixed methods with a cross-sectional approach and online survey sampling techniques (677 respondents), in December 2021-January 2022 in Indonesia. The instruments used are the System Usability Scale and User Experience Questionnaire. The variables measured include the characteristics of respondents, usability, user experience, and responses to using applications qualitatively. Quantitative data were analysed descriptively and the User Experience Questionnaire's analysis tool. Qualitative data were analysed thematically. **Results:** Evaluation of the usability of Oncodoc's m-health application is in the "acceptable" category (70.88), and the adjective rating is in the "Good" category. Evaluations of the relative quality of user experience are in the "good" and "very good" types. The average user experience scale is (mean; SD): attractiveness (1.80; 0.99), perspicuity (1.82; 1.05), efficiency (1.78; 1.09), dependability (1.56; 1.01), stimulation (1.81; 1.06), and novelty (1.32; 1.10). The findings of this study are 1) the ability to accommodate user needs, 2) usage barriers, and 3) user expectations for the Oncodoc application. **Conclusion:** Overall, the Oncodoc m-health application is acceptable to users. We recommend developing a cancer early detection application with an approach that refers to user needs for further research.

Keywords: Mobile applications- telemedicine- usability- user experience

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Introduction

Cancer is the second leading cause of death from non-communicable diseases (9.3 million annually) after cardiovascular disease (World Health Organization, 2021). Prevalence of people living with cancer in Indonesia based on Basic Health Research data enhancement from 1.4/1,000 population (2013) to 1.8/1,000 population (2018) (Kementerian Kesehatan, 2018). Globocan reported the total cases of new cancer disease in 2020 in Indonesia reached 396,914 cases mortality rates amounted to 234,511 cases. The highest number of total cases is breast cancer (65,858 cases), cervical cancer (36,633 cases) and lung cancer (34,783 cases).

Early cancer detection is a prevention effort to detect malignancy early before patients feel symptoms (Loud et al., 2017). Early detection reduces the proportion

of diagnosed cancer patients at an advanced stage. It significantly increases recovery success for patients (World Health Organization, 2021). Early detection also proves to decrease mortality number for cancer patients (Tyne et al., 2009). Along with technology enhancement, efforts in early cancer detection are not only done by a conventional method but with the use of mobile-based (m-health) applications to increase participation effort in early cancer detection (Ruco et al., 2021).

The Association of Hematology and Medical Oncology (Perhompedin) with Universitas Dian Nuswantoro developed the Oncodoc application as a form to prevent cancer. Oncology specialists at Karyadi Hospital in Semarang who is a member of Perhompedin is responsible for content development. Meanwhile, Information Technology experts from Universitas Dian Nuswantoro is responsible for developing the Oncodoc

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application. The mobile app is available on the Google Play Store and can be installed on Android 5.0 OS. Oncodoc application was launched in October 2021 and was installed by 1000+ users by February 2022. This application provides several free features, such as:

a. Cancer detection: can detect cancer quickly in a matter of minutes. The available cancer detections are lung cancer, breast cancer, cervical cancer, colon cancer, prostate cancer and lymph cancer. There are several questions related to risk factors, symptoms, and signs in each early detection option. In the end, provisional results will be found based on the answers stating that the user has a high risk/no risk and features available for an advanced screening.

b. Information: providing promotive articles about cancer prevention.

c. Consultation: providing private consultation with specialist doctors.

d. Discussion: can be used to share user experiences with the community and provide or discuss comments with each other.

The key to using mobile-based applications is the usability factor, where application users can experience problems in using them (Anderson et al., 2016). Usability is significant to determine whether an application has a value that is acceptable to users (Santoso et al., 2014). Evaluation of the System Usability Scale (SUS) was widely used in previous m-health studies (Maramba et al., 2018). This is because it is easy and practical to assess the usability of applications, websites, etc (Bangor et al., 2009).

Application user impression towards an application can be different (Santoso et al., 2016). Therefore, evaluation to measure the user experience of the application needs to be done. The User Experience Questionnaire (UEQ) is a tool to measure the user experience of interactive products in a simple, fast, direct way to find a comprehensive impression of the things they like. These measurements include attractiveness, perspicuity, stimulation dependability and efficiency (Laugwitz et al., 2008). The aim of this study is to determine the response to the use of the Oncodoc m-health application by evaluating its usability and user experience as a basis for developing the next Oncodoc application.

Materials and Methods

Method and Sampling Technique

The research uses mixed methods, which integrate quantitative data and qualitative data. Mixed methods produce complementary data and can be used to confirm findings on both qualitative and quantitative data. This research uses a convergent design approach where quantitative and qualitative data collection is carried out and analysed simultaneously (Fetters et al., 2013). The research design uses cross-sectional online supervision. Sampling technique with the practice-evaluation method. In this study, the respondents had at least run the Oncodoc application once. Before filling out the questionnaire, respondents were asked to download the Oncodoc application via Google Playstore and then

proceed to use the application. Filling in the evaluation data is done by answering questions through a Google Form. Dissemination of Google Forms via social media WhatsApp application.

Population and Sample

The minimum sample calculation using the Isaac & Michael Table (standard error of 5%) is 349. The questionnaires returned within the specified time limit are 719. Finally, the number of questionnaires that are fully filled and meet the inclusion criteria is 677. We assume that 677 respondents have describes the user of the oncodoc application.

Time and place

The research was conducted in Indonesia from December 2021-January 2022.

Instruments and Variables

Firstly, the SUS (System Usability Scale) questionnaire was used to determine user responses subjectively regarding the more accessible use of the Onkodoc application (Brooke, 2013). The System Usefulness Scale consists of ten questions with five choices of respondent responses ranging from “strongly disagree” to “strongly agree”. The results of calculating the SUS score using Bangor guidelines; the variables measured included the usefulness of the acceptance range, grade scale and adjectives rank (Bangor et al., 2009).

Secondly, UEQ (User Experience Questionnaire) is used to find out the impression of using the Oncodoc application in a fast and straightforward way (Laugwitz et al., 2008). The UEQ questionnaire consists of 26 questions and seven answer choice scales translated into Indonesian. There are six scales on the UEQ, namely: Attraction, Perspicuity, Efficiency, Dependability, Stimulation and Novelty (Santoso et al., 2016). This study is equipped with questions to validate that the respondents have run the Oncodoc application before answering questions about application evaluation.

At the end of the questionnaire, we asked for a qualitative response in writing regarding the perception of using the Oncodoc application. This allows respondents to give a positive or negative response found in quantitative data collection.

Data Analysis

Quantitative Data

The SUS questionnaire's usability analysis consists of ten questions with one to five Likert answer choices (strongly disagree-strongly agree). The data analysis on odd-numbered questions is done by deducting the Likert scale answered by the respondent of each question (xi) by one. For example, if the respondent answered question number one with a scale of four, the respondent's score is $4-1=3$. Meanwhile, the data analysis on even-numbered questions is done with the formula of $5-xi$, when xi is the Likert scale answered by the respondent. For example, if the respondent answered question number two with a scale of four, the respondent's score is $5-4=1$. All respondents' answers are added and multiplied by 2.5, then referred to

as the SUS score.

SUS score, which indicates the application's level of usability and acceptability, has a range of 0-100. It is interpreted according to the SUS scale, namely, not acceptable (0-50.9), marginal (51-70.9), and acceptable (71-100) (Bangor et al., 2009). Figure 2 shows the relationship between adjective ratings, grading scale, and acceptability range.

User experience analysis of the Oncodoc app users using the UEQ analysis tool is obtained from the official website www.ueq-online.org. The analysis is performed by inputting data into the UEQ analysis tool, which will generate descriptive UEQ. The results of the UEQ analysis present the main components, presented in graphical form based on six measurement scales (attractiveness, perspicuity, efficiency, dependability, stimulation, and novelty) (Laugwitz et al., 2008). Interpretation of the average value of the scale on the UEQ based on the guidelines, namely, if the average value of -0.8 indicates a negative evaluation, between -0 and to +8 indicates a neutral evaluation, and the average value is more than +0.8 indicates a positive evaluation. Values between one and two show an excellent evaluation. The user's interest in the application is determined by its pragmatic and hedonic qualities. Pragmatic qualities are goal-oriented (Perspicuity, Efficiency, Dependability). Meanwhile, hedonic quality is not goal-oriented (Stimulation and Originality) (Hassenzahl, 2001).

Qualitative Data

Thematic analysis was used to analyze the data on perceptions of the respondents' use of the Oncodoc application. The analysis process is carried out by reading the transcript, and meaning units, coding using inductive

and deductive approaches, categorizing the coding based on the same pattern, and connecting between categories to get the central theme. Subtraction is done to sharpen, remove unnecessary, select, attention seeking, attention, abstract and organize data to get verified final results (Miles et al., 2014).

Results

Respondent's Characteristics

There were 726 respondents who filled out the questionnaire. Forty-nine of them were less than 17 years old, so the total analyzed data consisted of 677 respondents. The analysis results showed that the respondents consisted of 507 women (74.89%) and

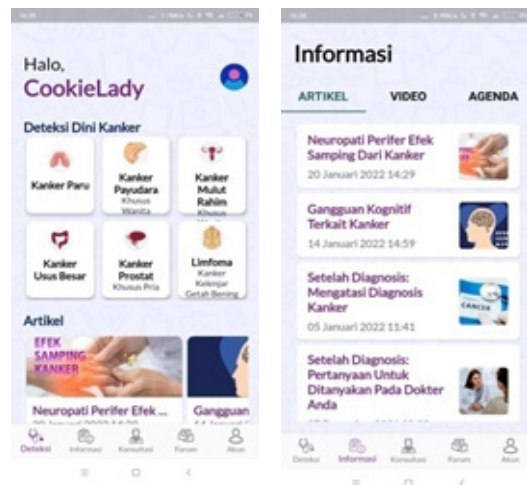


Figure 1. Display between Advance Application Oncodoc

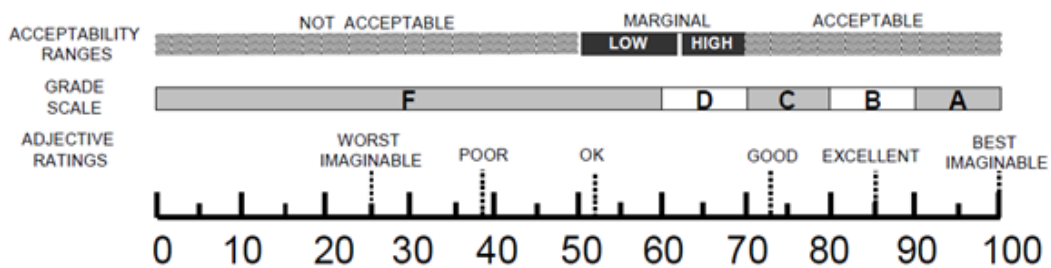


Figure 2. System Usability Scale (SUS) Score (Bangor A et al., 2009)

Table 1. Usability of the Oncodoc Application (n=677)

Variable	Category					
Acceptance rating	Acceptable		Marginal		Not acceptable	
n	374		263		40	
%	55.24		38.85		5.91	
Grade	A	B	C	D	F	
n	103	114	157	124	179	
%	15.21	16.84	23.19	18.32	26.44	
Adjective rating	Best	Excellent	Good	OK	Poor	Worst
n	168	127	295	85	2	0
%	24.82	18.76	43.57	12.56	0.3	0

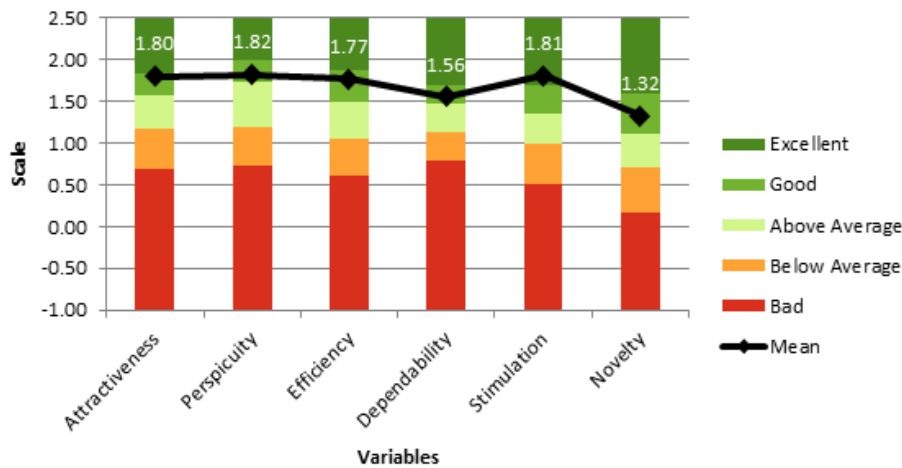


Figure 3. Benchmark Diagram of UEQ Variables on the Oncodoc Application (Output from Application the Official Website www.ueq-online.org)

Table 2. Pragmatic and Hedonic Qualities of the Oncodoc Application (n=677)

Item	Mean	Standard Deviation
Attractiveness	1.8	0.99
Perspicuity	1.82	1.05
Efficiency	1.77	1.09
Dependability	1.56	1.01
Stimulation	1.81	1.06
Novelty	1.32	1.1

Table 3. Qualitative Data from Using the Oncodoc Aplikasi Application

Variable	Category	Subcategories	Code
Experience During Using Oncodoc	(a) Positive Response	Interesting	Comfortable
			Good
		Motivating	Interesting
			Informative
		Efficient	Beneficial
			Appropriate
		Reliable	Fast
			Inexpensive
			Organized
		(b) Negative Response	Not interesting user interface
	Could be Trusted		
	Not clear		Guaranteed the truth
			Beneficial
	(c) Expectation		Future development
		Easy range	
Easy used			
Maintenance application	Novelty	Innovative	
		Unpleasant user interface	
	Not interesting user interface	Not interesting user interface	
		Complicated medical terms	
Future development	Future development	Non-detailed information	
		Less familiar language	
		New feature for help centers and FAQs	
Future development	Future development	New feature for health facility information	
		New feature for more early detection of cancer types	
Maintenance application	Maintenance application	To be available on IOS.	
		Update information	

170 men (25.11%). Respondent’s majority age is 17-25 year (78.88%). Most of the respondents were students (67.80%), private employees (13.15%), unemployed (7.53%), entrepreneurs (7.24%), civil servants/ Indonesian National Army (3.69%) and the rest are retirees. Most of the respondents have no income (70.75%), income above the district regional minimum wage (15.51%) and income below the district regional minimum wage (13.74%).

Usability

The evaluation of the usefulness of the Oncodoc application on 10 question points showed that the total score of 677 respondents was 47,982.5 with an average of 70.88. Based on the SUS score (Figure 2), Oncodoc’s application acceptance rate (acceptance rating) with a value of 70.88 is in the acceptable category, the class scale is in the “C” category, and the adjective rating is in the “good” category. The percentage of respondents’ answers on the usefulness of the Oncodoc application in each category is shown in Table 1.

User Experience

Table 2 shows the interest of Oncodoc application users which are grouped by pragmatic quality (perspicuity, efficiency, dependability) and hedonic quality (stimulation and novelty). Stimulation has an average score of 1.81, while novelty has 1.32. This shows that the hedonic quality has the lowest average score of 1.57 compared to the pragmatic quality and attractiveness scale.

Figure 3 shows the UEQ benchmark diagram of the Oncodoc application in terms of quality compared

to other products (business software, web pages, web shops, and social networks). In total, the quality of the Oncodoc application is in the "good" category compared to 468 different products in the benchmark data set. The stimulation variable is included in the "excellent" category. In comparison, variables like attractiveness, perspicuity, efficiency, dependability, and novelty are in the "good" category.

Oncodoc's evaluation of the application of the UEQ scale showed that the most scores on the UEQ scale were > 1.5, except for the novelty scale (Figure 3). The average values of the UEQ scale on the Oncodoc application are respectively (mean (SD)): attractiveness 1.80 (0.99); perspicuity 1.82 (1.05); efficiency 1.77 (1.09); dependability 1.56 (1.01); stimulation 1.81(1.06), and novelty 1.32 (1.10).

Table 3 shows the results of the user experience responses of the Oncodoc application in the form of qualitative data. The themes obtained from the experience of using the Oncodoc application are:

1) The Oncodoc application is able to accommodate user needs. This is found in positive users, which are summarised as follows:

Attractiveness

"...convenient to look at and use..."

".. the app is very good.."

".. it interests me to use .."

Efficiency

"...Can provide precise info.."

"... Detect quickly "

"... People who can't afford it don't need to go to expensive doctors to detect..."

"... Well organised app performance."

"This is very practical to use anywhere, especially during the COVID-19 Pandemic..."

Dependability

"... this app is very reliable ..."

"The results are guaranteed to be true and safe."

"... Very helpful in detecting cancer."

Perspicuity

".. Simple login"

"... Application uses easy-to-reach words ..."

"... This app is easy to use for parents like me .."

Stimulation

"... The application is quite informative for detecting cancer disease."

"... "... useful, detection does not need to go to the hospital."

Novelty

"...This app is very innovative..."

2) Barriers to using the Oncodoc application, such as those found in negative user feedback, are as follows:

"The user interface is too simple and monotonous."

"The background colour of this background user interface is not attractive."

"The medical term is too complicated; most users like me don't understand what it means."

"There is no information about the causes of cancer and symptoms."

"I prefer the information feature to use Indonesian."

3) User expectations for successful use of the Oncodoc application are contained in the unit meaning as follows:

"Help centers needs to feature usage tutorials and FAQs..."

".. the features of doctors and hospitals are useful, making it easier for (us) to find health services .."

"... added early detection of other cancers to be more complete."

".. Have to update the information frequently to make it interesting and add more enthusiasm."

".. that the app should also be available on iOS, users don't have to search for Android to use".

Discussion

Usability is a term in human-computer interaction that means the capability system or application can be used effectively, easily, and satisfied with users (Hornbæk, 2006). Several methods exist for measuring usability. Heuristic evaluation, an expert-based approach, and user testing by actual users such as health consumers are among the most common (Georgsson et al., 2016). There are various tools were provided to measure usability such as The Post-Study System Usability Questionnaire (PSSUQ), The Computer System Usability Questionnaire (CSUQ), the Health Information Technology Usability Evaluation Scale (Health-ITUES), etc (Schnall et al., 2018; James, 1995). This study used The SUS questionnaire to explore the usability of Oncodoc application.

The SUS interpretation guidelines state that the product cannot be accepted if the mean score is less than 50; the product is marginally feasible if the average value is 50-70, and the product is acceptable if the average value is more than 70 (Dumas et al., 1999; Bangor et al., 2009). This study reaches 677 users to measure the usability even though a reference declares that small participants are sufficient for the usability study (Six et al., 2016). This judgment is based on the consideration that Oncodoc is an online application with a wide range of access to the user. The calculation result of the average SUS value in the Oncodoc application is 70.86, which could be declared that the Oncodoc application is deemed acceptable by users. This is shown in the respondents' opinions, who expressed positive acceptance after using the application. Previous studies found that usability factors, acceptance, and adoption in health applications related to age, education, and digital health literacy (Rachmani et al., 2019; Van der Vaart et al., 2019; Rachmani et al., 2021).

Usability is primarily concerned with the design features of interactive products in terms of how simple they are to use. However, user experience considers the individual's entire interaction with products, as well as the thoughts, feelings, and perceptions that result from that experience (Albert et al., 2013). The interest in the Oncodoc application users' experience is reciprocated from 3 aspects, namely attractiveness, pragmatic and hedonism. The attractiveness aspect is the central part related to system attractiveness' for the users. The pragmatic aspect is the system's goal-oriented aspect regarding perspicuity, efficiency, and dependability. The hedonic aspect relates to non-technical factors related to

user enjoyment in terms of system stimulation and novelty (Hassenzahl, 2001). Evaluation result (1.80), meaning that users like the Oncodoc application.

The advantage of this application is that Oncodoc is appealing to users; it is attractive and convenient to use. Application users or respondents are students between 17-25 years old. Some respondents interested in using this application stated that the younger generation tended to be more knowledgeable about cancer. Still, after using the Oncodoc application, they felt it was beneficial and exciting to use. On the other hand, a 40-year-old respondent stated that this application is interesting because it is straightforward to help quickly find out cancer symptoms. This shows that the application can be accepted by the target users of this application, ranging from young to middle age groups, to help detect cancer early. As stated in previous research, the acceptance of mobile health applications is determined by the ease and functionality of the application to facilitate self-care (Anderson et al., 2016).

The pragmatic aspects of the oncodoc application in terms of sharpness, efficiency, and dependability showed positive evaluation results (the average value was more than +0.8). This result is in accordance with the respondent's perception that the Oncodoc login method is simple, using words that are easy to understand. Based on previous research, the m-health application can be accepted if the content is easy to achieve, easy to operate and use (Iskandarsyah et al., 2022; Mendiola et al., 2015). The response related to efficiency stated that the application could provide accurate information, provide early detection results quickly, cheaply, and practically can be used anywhere at any time, especially during the COVID-19 pandemic. During the COVID-19 pandemic, it provides safe, comfortable health services without the anxiety that the community needs. This study adds to evidence that the use of the Oncodoc application in terms of effectiveness is a medical service provided by doctors to patients that is safe, comfortable, effective and provides a safe distance during the COVID-19 pandemic (Bokolo, 2021; Anthony Jnr, 2021). In addition, the application usage is more affordable as it is a public health services provided for free (Boudreaux et al., 2014). Respondents' responses related to dependence stated that the Oncodoc application is straightforward and trusted; it also provides guaranteed results and is very helpful in detecting cancer. Respondents felt helped by the education contained in the information feature of the Oncodoc application. It will increase knowledge about cancer and impact people's confidence to use the application. The results of this study are the same as previous studies, which reported that the application of m-health for early detection of cancer gave positive results, educating and increasing knowledge about breast cancer (Lee et al., 2017), cervical cancer (Quercia et al., 2018), prostate cancer (Zhang et al, 2017), and lung cancer (Szanto et al., 2017).

The hedonic aspect includes the stimulation and novelty aspects, which show the lowest score (1.57) compared to the attractiveness and pragmatic aspects. However, it still offers a positive evaluation. Respondents' responses to the hedonic aspect showed that the Oncodoc

application is applicable, innovative, and useful because there is no need to go to the hospital for early cancer detection. The results of this study are similar to previous studies that state that the m-health application can perform an oral cancer screening remotely by uploading data on a cloud server via an android application (Birur et al., 2018). This study also adds to the scientific evidence that increasing similar cancer applications like these could also be preventive, promotive, and informative for early diagnostic efforts (Collado-Borrell et al., 2016).

Although only a small number of respondents stated that this matter needs attention. This study identifies barriers to using the Oncodoc application, among others: the user interface is not pleasant. The user suggests changing the background user interface with more attractive colour to make it seem lighter and more user-friendly. Medical terms in both the early detection feature and the available information make some users confused and unfamiliar (e.g., pap-smear, etc.). The use of information in English is not appropriate because the application is aimed at people from diverse educational backgrounds and social statuses. The respondents will have difficulty using the application if it is in English, as they use Indonesian for daily conversation. The finding of this study is similar to the results of previous studies, which stated that social status and language barriers are the inhibiting factors in the use of mobile breast cancer screening (Lee et al., 2018). Therefore, it is important to identify and reduce barriers, strengthen positive points that play an important role in development planning, and increase the use of cancer applications among users (Mohammadzadeh et al., 2013).

Respondents' suggestions include application development and maintenance. Application development includes additional help centre features for users who have difficulty using the application. The addition of FAQs (Frequently Asked and Questions) feature, and addition for more early detection features for other types of cancer screening. The users also stated to add more other important features, such as types of health facilities, including specialists that could be selected by users to carry out further examinations after conducting early detection. Some users also advised that the Oncodoc application should also be available in the Appstore so that users can use it on the iPhone.

Most respondents' biggest expectation of Oncodoc application is to have an up-to-date and maintained information. New and relevant information is considered important because medical information is constantly evolving, it could help to accommodate users' insight. The successful implementation of m-health for cancer care includes the provision of accurate and timely information with regards to security and privacy in its delivery (Mohammadzadeh et al., 2013).

Our study has limitation: This study only analyzes the assessment of the usability and user experience variables. There is no grouping of respondents' answers based on characteristic variables. The description of the respondent's characteristics (age, occupation, gender, occupation, education level, and area of residence) in descriptive form is used to identify users of the

Oncodoc application. Qualitative data analysis regarding respondents' responses to the use of the Oncodoc application was carried out from the respondents' written brief responses. There is no follow-up to conduct in-depth interviews, leading to no detailed information from the perceived responses. Future research is expected to use the focus group discussion method to primarily find out the weaknesses and shortcomings of the application to improve usage according to user needs.

Our findings highlight the Oncodoc application is acceptable to users: attractive, simple, easy-to-use, and innovative cancer early detection tool. Users benefit from this application because it is informative, practical, and provides fast, precise, and inexpensive results. Negative feedback for the monotonous user interface, clarifying medical terms and language improvements. Application development and maintenance is the hope of respondents to further increase the use of this cancer early detection application.

Author Contribution Statement

WR, PEA, SM came up with the concept and design of the study, analysis, and interpretation of the data, and drafting the manuscript. APN, SM conducted data collection. WR, WDE and RE analysis the data, interpretation of the data, and revising the manuscript. All authors approved manuscript preparation and the final version.

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Approval

This research is not the research of Universitas Dian Nuswantoro students, Semarang, Indonesia. All Author have read and approved the final manuscript.

Ethical Declaration

This study was approved by Health Research Ethics Committee Faculty of Health Universitas Dian Nuswantoro, Semarang, Indonesia, with approval number 137/EA/KEPK-Fkes-UDINUS/X/2021. All study participants provided informed consent prior to engaging in any study-related procedures.

Data Availability

The datasets used and/or analysed during the current study are available from the corresponding author on

reasonable request.

Conflict of Interest

The authors have no conflict of interest to declare.

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