

RESEARCH ARTICLE

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Developing and Validating an *Integrated Sinara* Application as a Database for Cervical Cancer Risk in Indonesia

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Abstract

Objective: The high incidence of cervical cancer, despite still-low screening coverage, presents a significant challenge especially for developing countries like Indonesia. Detecting cervical cancer risk can be one approach to increasing screening coverage. This study aims to develop and test the validity, reliability, and usability of the *Integrated Sinara* application as a database for identifying women at risk of cervical cancer. **Methods:** This study employed a Research and Development (R&D) design, utilizing the PDCA (Plan, Do, Check, Act) model. A total of 100 respondents in Maluku, Indonesia, participated in the application testing, selected through a purposive sampling technique. The *Integrated Sinara* application was developed as a mobile application connected to a web-based system for database storage. **Results:** The *Integrated Sinara* application demonstrated validity, with an r-count value exceeding the r-table value ($r > 0.195$), and a reliability coefficient of 0.891. The usability test result of 87.6% indicates that the *Integrated Sinara* application is highly feasible for use. **Conclusion:** The *Integrated Sinara* application can be used as a database for identifying women at risk of cervical cancer, making it easier for health workers to reach this at-risk group. Further research is needed to develop an iOS version of the application, evaluate the impact of the system, and assess its scalability in more diverse settings.

Keywords: Cancer prevention- early detection of cancer- mobile application- risk assessment

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Introduction

The incidence of cervical cancer worldwide is increasing every year, including in Indonesia. Globally, in 2022, about 661,021 new cases were recorded, along with 348,189 deaths [1]. This figure increased from 604,127 cases and 341,831 deaths in 2020 [2]. In Indonesia, there were 408,661 new cases and 242,988 deaths in 2022 [3], an increase from 396,914 new cases and 234,511 deaths in 2020 [4]. Cervical cancer can be fatal if not treated promptly, so early detection is crucial [5, 6]. Ironically, women's awareness of cervical cancer screening is still very low, even though the government has provided facilities [7].

About 14.6% of the target population had undergone cervical cancer screening using the visual inspection with acetic acid (VIA) method based on reports from 2021-2023. The results showed a positive VIA of 31,236 (1%) and suspected cervical cancer of 324 (0.01%) [8]. Since 2021, the coverage of cervical cancer screening in Indonesia has increased by only around 7% from the target of 70% [9]. The number of VIA examinations in Maluku in 2023 was 2.57% of women, an increase of only 1% from 2022, which was 1.66%. The results showed that 63

women were positive for VIA, five women were suspected of having cancer, and 39 women were referred [10, 11]. Ironically, while cases of cervical cancer are increasing, women's awareness of screening is still very low.

One effort to increase women's awareness of screening is through the role of health workers, who educate the public on the risks and symptoms of cancer [12-14]. The current problem is that many women are still not involved in cervical cancer screening, despite being educated by health workers. The most common reasons are embarrassment and fear of being screened, fear of knowing the results, not knowing their cancer risks, or even not feeling like they have any symptoms [15-17]. However, significant symptoms of cervical cancer usually appear when it is already at an advanced stage, and the majority of sufferers cannot be helped, so early detection is crucial [18]. In contrast, health workers only provide education and wait for women to come to the community health centre for screening. Healthcare workers should be more proactive in identifying cancer-risk groups within the community [13].

Previously, a mobile-based cervical cancer screening instrument using VIA test results was developed in Indonesia [19, 20]. However, the current problem is that

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many women have not yet participated in VIA testing. Our previous research developed the Sinara instrument for self-detecting cervical cancer risk by Indonesian women, using an assessment form, and it is still being used manually [21–23]. The urgency of this research is to develop an application to identify cervical cancer risk integrated with health workers at community health centres as a primary health care service, thereby reaching women at risk. Another problem is the geographical location of the islands in Maluku, which results in under-monitored screening [24]. Furthermore, the recording and reporting system remains manual and fragmented, which complicates program evaluation [25]. Therefore, this study aims to develop the Integrated Sinara application model as a database provider for women at risk of cervical cancer in Maluku.

Materials and Methods

This research develops an application for self-screening or detecting cervical cancer risk in fertile women. Screening results will be recorded in a database accessible to healthcare workers and program managers at local community health centres and regional health offices. Women, as users, use the mobile application for screening, while healthcare workers can access the data on the website. Women who download the application have agreed, through informed consent, that their data will be stored in the database and used in an appropriate manner.

Study Design

This study employed a Research and Development (R&D) design with the PDCA (Plan, Do, Check, Act) model (Jagusiak-Kocik, 2017). 1) The Plan stage involved identifying and formulating the cervical cancer screening problem in Maluku Province, conducting a literature review of research permits and ethics requirements, and analyzing user needs. 2) The Do stage involved analyzing functional and non-functional requirements, designing an application based on the needs analysis, developing the application according to the design plan, implementing the application on the Android platform, and conducting alpha testing using the black-box method. 3) The Check stage involved evaluating the alpha test results and conducting beta testing, including user trials. 4) The Action stage involved analyzing the alpha test results, revising the application based on the test results, and publishing the Integrated Sinara application on the Google Play Store.

Population and Study Setting

We collected data from 100 women of childbearing

age with the assumption that the number of respondents must exceed the number of items, specifically ranging from 2 to 20 respondents per item, with a minimum of 100 respondents [26]. The study was conducted in Maluku, Indonesia, from July to September 2025. Purposive sampling was used as the sampling technique. The inclusion criteria for respondents were married women aged 20-55 years, owning an Android smartphone, and domiciled in Maluku.

Instrument

The USE questionnaire by Lund was used to determine user responses regarding the effectiveness and efficiency of the Integrated Sinara application developed [27]. The instrument consisted of thirty questions covering four aspects: usability, ease of use, ease of learning, and satisfaction. Respondents had five response options, ranging from “strongly disagree” to “strongly agree.”

Development of the Integrated Sinara Application for Detecting Cervical Cancer Risk

The Integrated Sinara application was developed by designing an internet-based synchronisation system that connects the website and the mobile application. The design flowchart/general architecture of the application is shown in Figure 1.

Development of the Mobile Application

This mobile application is designed for Android Operating System (OS)-based devices, because the majority of mobile phone users in Indonesia use the Android OS [28]. The application was developed using MySQL phpMyAdmin with the following features:

1) Registration Page

The registration feature ensures each user has a unique account and is recorded in the system. Users register by providing their full name, telephone number, address, age, email address, password, and the name of the nearest health facility, ensuring secure application access and facilitating the tracking of individual screening histories. User identities are stored in the User Profile feature, which can be edited based on user needs (Figure 2).

2) Articles

This feature provides users with information about cervical cancer, including the definition, risk factors and early symptoms, the dangers of cervical cancer, cervical cancer screening, and the benefits of early detection with VIA and Pap smears. Articles can be updated regularly by the admin via a PHP-based web dashboard.

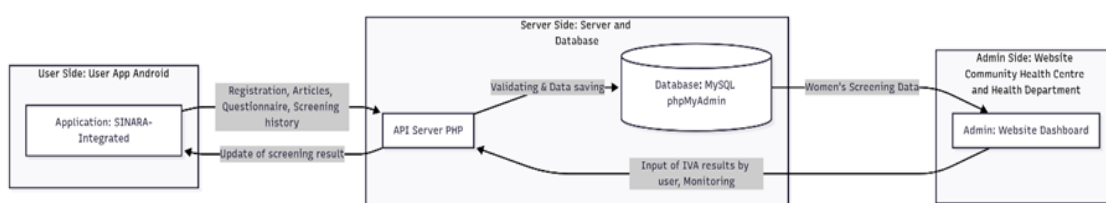


Figure 1. General Architecture of the SINARA-Integrated Application



Figure 2. Registration Page and User Profile

3) Cervical Cancer Risk Screening Questionnaire

The questionnaire serves as a self-screening tool to assess the risk of cervical cancer and consists of twenty-one items. Users answer questions related to risk factors (personal hygiene, sexual activity, lifestyle, economic situation, obstetric and family planning history, medical history, and screening history). The system processes the answers using a risk scoring algorithm. Screening results are displayed in Low Risk and Medium-High Risk categories (Figure 3).

4) Health Facility Locations of Cervical Cancer Screening

This feature provides information on the location of the nearest health facility that provides VIA services. The goal is to help users quickly and easily locate the nearest health facility. VIA screening facilities are currently available only at community health centres in the Maluku region (Figure 4).

5) Cervical Cancer Screening History

This feature allows users to record their VIA screening results. The app user inputs VIA test results at the

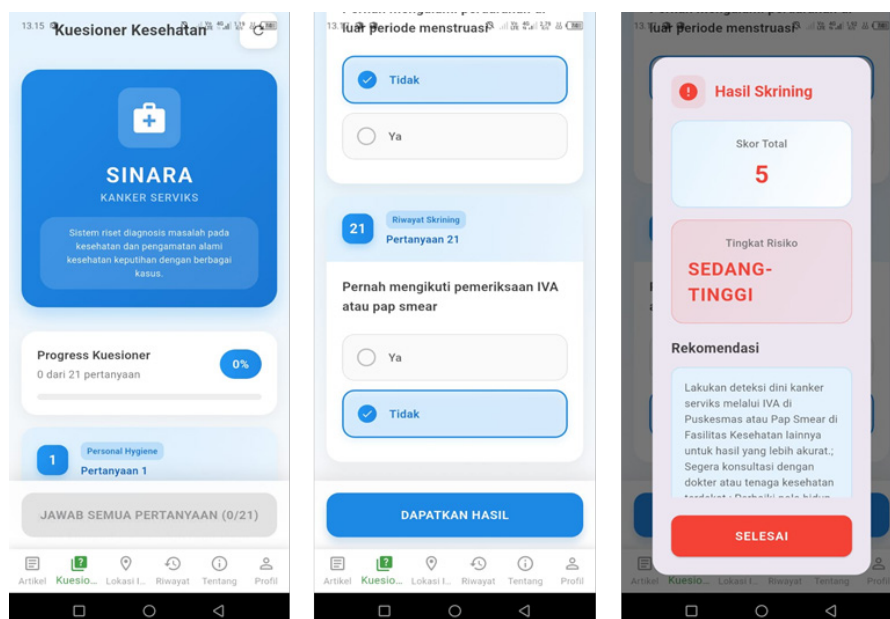


Figure 3. Cervical Cancer Risk Screening Questionnaire



Figure 4. Location of Cervical Cancer Screening

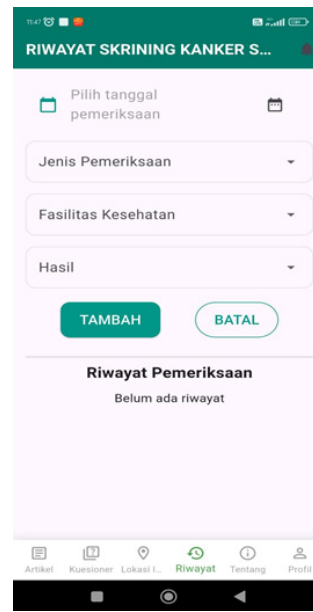


Figure 5. Cervical Cancer Screening History

Community Health Centre. The data is automatically saved in the database (phpMyAdmin) and synchronised to the website for healthcare workers to view. This feature enables users to easily track their screening history, facilitating healthcare workers' monitoring of the continuity of the cervical cancer early detection program. This section provides reminders for women at low to high risk of cervical cancer who have not yet been screened through a VIA or Pap smear at a healthcare facility. The reminder disappears once the cervical cancer screening results have been entered (Figure 5).

6) About the Application

The About application feature provides information about the application, its purpose, policies, privacy, and its developer. The purpose of this feature is to provide transparency and increase user trust.

7) User Data Security

This application utilises user credentials, firewalls, and security policies to protect participant data, which can only be accessed by healthcare workers at community health centres and health offices, as well as the developer's administrative account.

8) Language

Currently, the language used in the development of the Integrated Sinara application is Indonesian, aligning with the development goal of detecting cervical cancer risk in Indonesian women.

F. Development of the Website for the System Database

The Integrated Sinara application is synchronised with the website to store the application user database. The website can be accessed by cervical cancer program administrators at community health centres, health offices, and developer administrators. Some of the website's features are as follows:

1) Registration Webpage

Healthcare workers will register on this page by entering their email address and password. Through registration, health workers can access the information provided by the user and take further action based on that information (Figure 6).

2) Dashboard

In this section, healthcare workers can view information about all the features of the mobile application. Healthcare workers can view detailed user identity information on the website. Healthcare workers can also view screening results with details of the user's risk factors. Users is a feature that displays the number of website users registered by the developer to access the website (Figure 7).

Results

The Integrated Sinara application has been developed and tested in two stages: alpha testing (blackbox testing) and beta testing (user interface testing). Alpha testing

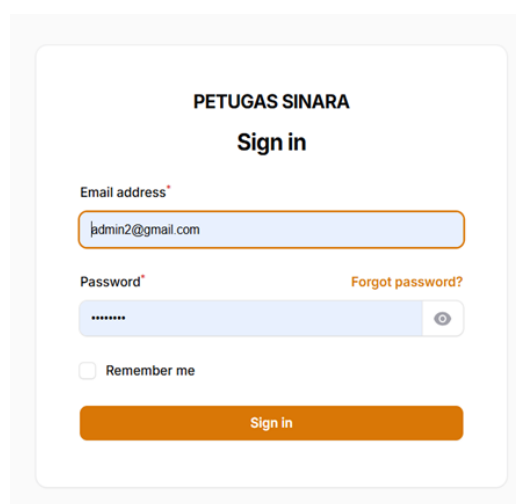


Figure 6. Registration Webpage

Table 1. Results of the Integrated Sinara Application Validity Test

Aspect	r-count*	Description
Visibility of System Status (U1)	0.569	Valid
Match between system and the real world (U2)	0.634	Valid
User Control and Freedom (U3)	0.694	Valid
Consistency and Standard (U4)	0.77	Valid
Error Prevention (U5)	0.62	Valid
Recognition rather than recall (U6)	0.53	Valid
Flexibility and Efficiency of use (U7)	0.774	Valid
Aesthetic and minimalist design (U8)	0.847	Valid
Help User recognize, diagnose, and recover from errors (U9)	0.838	Valid
Help and Documentation (U10)	0.731	Valid
Interoperability (U11)	0.6	Valid
Support User Skills (U12)	0.645	Valid
Respectfull Interaction (U13)	0.732	Valid

*r-table 0.195

was conducted to ensure that the application meets the objectives and needs initially determined. Beta testing was then conducted on 100 respondents at the Community Health Centre in Maluku, Indonesia. The application validity and reliability test values were generated based on the results of testing the application with respondents (Table 1).

Table 1 illustrates that the application is valid, as evidenced by the results of the validity test, where the r-count exceeds the r-table value ($r > 0.195$). Reliability testing, using Cronbach's alpha, yielded a result of 0.891 (greater than 0.60), indicating reliability. Next, researchers utilised the International Standards Organisation (ISO) 9126 software testing standard to evaluate the quality of the system/application being developed. Researchers tested the functionality and usability aspects to ensure

that feature improvements were made based on the test results before publishing the app on the Play Store. Evaluation of the functionality aspect aimed to determine the suitability of the software's functions to user needs (Table 2). The developed application features eight components: Application List, Login, Articles, Screening Questionnaire, Screening Location, Screening History, About the Application, and User Profile.

A usability evaluation was conducted to measure the application's effectiveness and efficiency using the USE Questionnaire. This measurement was performed by calculating the observed scores against the expected scores. The calculated percentages were then compared to the test feasibility standards in Table 3.

In addition, this study also evaluated the quality of the application using the International Standard Organization (ISO) 9126 software testing standard, a measurement standard for assessing the quality of software that meets user needs. One of these is usability testing, which encompasses four key aspects: usefulness, ease of use, ease of learning, and overall satisfaction. The Integrated Sinara application usability test results are 87.6% (Table 4). Based on feasibility testing standards, the usability test results indicate that the Integrated Sinara application falls into the "Very Feasible" category.

Discussion

Cervical cancer screening coverage remains low worldwide, necessitating strategies or programs to improve compliance with cervical cancer screening, such as e-health interventions [29, 30]. Globally, mobile device use has increased and become a promising tool for interventions related to non-communicable diseases in developing countries [31, 32]. Furthermore, Indonesia's archipelagic geography also necessitates strategies to enhance healthcare services through the use of smartphones [33].

Table 2. Evaluation of Functional and Usability Aspects of the Application

Item	Answer	
	Success	Failed
Suitability		
1	The "Register" feature allows users to create an account in the Integrated Sinara application.	√
2	The "Login" button allows users to access the Integrated Sinara application dashboard.	√
3	The "Article" function allows users to view related articles.	√
4	The "Screening Questionnaire" feature allows users to conduct health screenings on the Integrated Sinara platform.	√
5	The "Screening Location" feature enables users to view the locations of health facilities that provide screening services.	√
6	The "Screening History" feature allows users to enter screening results at health facilities.	√
7	The "About the Application" feature allows users to view the terms, policies, and conditions of the Integrated Sinara application.	√
8	The "User Profile" feature allows users to access the Integrated Sinara application.	√
Accuracy		
9	The Integrated Sinara can display the results users expect.	√
Compliance		
10	The Integrated Sinara has all the required features according to the design.	√

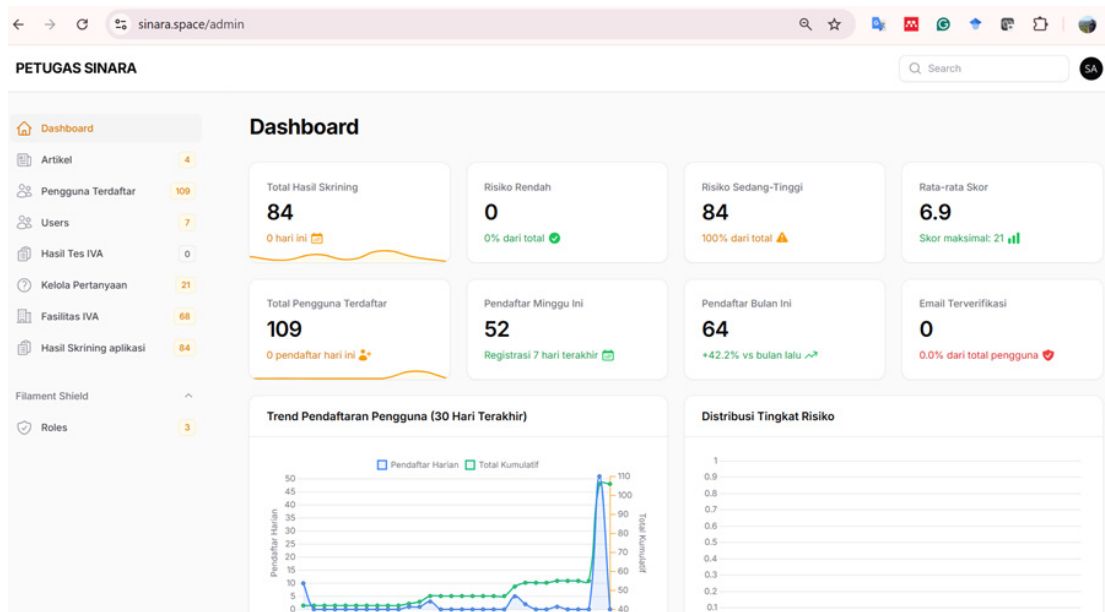


Figure 7. Dashboard of the Website

Table 3. Test Feasibility Standards

Values Rate (%)	Conclusion
< 21	Very unworthy
21 – 40	Unworthy
42 – 60	Quite
61 – 80	Worthy
81 – 100	Very Worthy

Our research developed an application model that provides a cervical cancer risk database to increase cervical cancer screening coverage. The results showed that the Integrated Sinara application achieved validity with a value of greater than 0.195 and a reliability value of 0.891. This application had a usability score of 87.6%, indicating positive feedback from respondents after trying the application. The usability test results indicated that respondents acknowledged the application’s usefulness, ease of use, ease of learning, and satisfaction.

Previous research has developed a mobile application to detect cancer risk in Indonesia [34]. In that study, users could screen for several cancer risks, including cervical cancer. Furthermore, mobile applications for cervical cancer detection using VIA test results already exist (19,20). However, these applications are intended for self-screening.

Our research is novel in developing a self-screening application for cervical cancer risk that is integrated with

community health centres and health offices. Women, as users of the application, will be screened for cervical cancer, and the data will be synchronized on a website accessible to program holders at community health centres and health offices. Data from women’s cervical cancer risk screening will serve as the basis for further interventions to increase cervical cancer screening coverage.

According to one of the roles of community health centres is to conduct preventive efforts through disease screening. Low cervical cancer screening coverage poses a challenge for health workers at community health centres, necessitating innovation in efforts to increase screening coverage. Health workers at community health centres play a crucial role in cervical cancer screening as a preventative measure [35]. Healthcare workers must be proactive in identifying at-risk groups within the community [13]. Therefore, the Integrated Sinara application is very helpful in achieving this goal.

This study has several limitations. First, the application has not been tested in areas with limited internet access, so its effectiveness cannot be generalized across the entire Maluku region. Second, the application was only developed for the Android operating system, so not all women have access to it.

The Integrated Sinara application has demonstrated good validity, reliability, and feasibility, making it a potential innovation for increasing cervical cancer screening coverage in Indonesia. We recommend involving health workers through devices provided by

Table 4. Application Usability Test Results

No.	Dimension	Number of valid questions	Number of valid questions	Number of valid questions	%
1	Usefulness	8	1,200	1,012	84.43
2	Ease of use	11	1,650	1,627	98.6
3	Ease of learning	4	600	512	85.33
4	Satisfaction	7	1,050	791	75.33
Total		30	4,500	3,942	87.6

community health centres or health offices to reach more women who do not have smartphones. Further studies should be conducted to evaluate the impact of the developed system and its scalability in more diverse settings. In addition, this application could be developed for iOS to expand its reach.

Author Contribution Statement

DM: Conception and design of the study, data collection, development and validation of the application, manuscript editing, procured the funding and approval of the final version. GVN: Designed prototype of application, analysed data result testing, manuscript drafting and editing. SRM: Data collection, application testing, manuscript drafting. JP: Data collection, application testing.

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General

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Funding Statement

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Approval

The Health Department of Maluku Province approved this study.

Ethical Consideration

This study was ethically approved by the Health Research Ethics Committee of the Faculty of Public Health, Airlangga University, under number 211/EA/KEPK/2025.

Conflict of Interest

There is no conflict of interest.

References

- Bray F, Laversanne M, Sung H, Ferlay J, Siegel RL, Soerjomataram I, et al. Global cancer statistics 2022: Globocan estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin.* 2024;74(3):229-63. <https://doi.org/10.3322/caac.21834>.
- Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, et al. Global cancer statistics 2020: Globocan estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin.* 2021;71(3):209-49. <https://doi.org/10.3322/caac.21660>.
- International agency for research on cancer. Incidence, mortality and prevalence by cancer site (indonesia) [internet]. 2022 [cited 2025 mar 16]. Available from: <https://gco.iarc.who.int/media/globocan/factsheets/populations/360-indonesia-fact-sheet.pdf>.
- International agency for research on cancer. Globocan 2020. Cervix uteri, cancer incidence and mortality statistics worldwide and by region (2020) [internet]. 2020. Available from: <https://gco.iarc.fr/today/data/factsheets/cancers/23-cervix-uteri-fact-sheet.pdf>.
- Durairaj M, Kunnathur Murugesan S, Nagendiran B, Immaculate HJ, Mariappan S. Chapter 15 - deadly cancer of cervix tackled with early diagnosis using machine learning. In: Meenu G, Hemanth DJ, editors. *Artificial intelligence and machine learning for women's health issues*. Academic Press; 2024. p. 219-34.
- Obol JH, Lin S, Obwolo MJ, Harrison R, Richmond R. Knowledge, attitudes, and practice of cervical cancer prevention among health workers in rural health centres of northern uganda. *BMC Cancer.* 2021;21(1):110. <https://doi.org/10.1186/s12885-021-07847-z>.
- Bellatika ss, afriani ld. Implementation of the early detection program for cervical cancer through iva examination. *Indonesian journal of midwifery* [internet]. 2024;7(2):189-99. Available from: [Http://jurnal.Unw.Ac.Id/index.Php/ijm](http://jurnal.Unw.Ac.Id/index.Php/ijm).
- Kementerian kesehatan ri. Profil kesehatan indonesia 2023 [indonesia health profile 2023] [internet]. Jakarta; 2024 [cited 2025 mar 29]. Available from: <https://kemkes.Go.Id/id/profil-kesehatan-indonesia-2023>.
- Kemenkes ri. Profil kesehatan indonesia 2021 [indonesia health profile 2021] [internet]. Jakarta; 2022 [cited 2025 mar 29]. Available from: <https://kemkes.Go.Id/id/profil-kesehatan-indonesia-2021>.
- Dinas Kesehatan Provinsi Maluku. Data Deteksi Dini Kanker Serviks dan Payudara [Early Detection Data for Cervical and Breast Cancer]. Ambon; 2023.
- Zulkarnaini ms, faradila a, angkotasan i. Maluku province health profile 2022. Ambon: Maluku provincial health office; 2022.
- Ogochukwu Juliet E, Samuel T, Ogochukwu Ruth A, Olajumoke Ope O, Manali D, Devesh M, et al. Impact of patient-physician communication on cervical cancer screening among women aged 25-65. *Journal of Medicine, Surgery, and Public Health.* 2025;5:100182. <https://doi.org/10.1016/j.glmedi.2025.100182>.
- Liebermann E, Segó R, Vieira D, Cheng Q, Xu B, Arome M, et al. Roles and activities of nurses in cancer prevention and early detection in low- and middle-income countries: A scoping review. *Asia Pac J Oncol Nurs.* 2023;10(7):100242. <https://doi.org/10.1016/j.apjon.2023.100242>.
- Solehati t, imansari b, madiuw d, kosasih ce, hermayanti y, mediani hs. Effect of cervical cancer education and provider recommendation for screening: A systematic review. *Jurnal aisyah : Jurnal ilmu kesehatan.* 2020;5(2):181-9. <https://doi.org/10.30604/jika.v5i2.363>.
- O'Donovan B, Mooney T, Rimmer B, Fitzpatrick P, Flannelly G, Doherty L, et al. Advancing understanding of influences on cervical screening (non)-participation among younger and older women: A qualitative study using the theoretical domains framework and the com-b model. *Health Expect.* 2021;24(6):2023-35. <https://doi.org/10.1111/hex.13346>.
- Shrestha AD, Andersen JG, Gyawali B, Shrestha A, Shrestha S, Neupane D, et al. Cervical cancer screening utilization, and associated factors, in nepal: A systematic review and meta-analysis. *Public Health.* 2022;210:16-25. <https://doi.org/10.1016/j.puhe.2022.06.007>.
- Origa M, Kayiira A, Ghebre R, Bollinger L, Kisakyé SI, Teoh D. Views on cervical cancer screening among female caregivers at the uganda cancer institute. *Gynecol Oncol Rep.* 2025;57:101654. <https://doi.org/10.1016/j>

- gore.2024.101654.
18. Madiuw D, Hermayanti Y, Solehati T. Cancer risk assessment instruments in women: Literature review. *Journal of Maternity Care and Reproductive Health*. 2020;3. <https://doi.org/10.36780/jmcrh.v3i3.139>.
 19. Aprina A, Astuti T, Amatiria G. Early Warning System of Cervic Cancer (EWS Ca. CERVIC) In Women of Reliable Age Based on Mobile. *Jurnal Aisyah : Jurnal Ilmu Kesehatan*. 2022;7(4). <https://doi.org/10.30604/jika.v7i4.1378>
 20. Aprina a, astuti t, amatiria g. Enhancing early cervical cancer detection through the mobile-based dedikasi application. *Healthcare in low-resource settings*. 2024;12(1).
 21. Madiuw D, Hermayanti Y, Solehati T. Indonesian self-risk assessment for cervical cancer (sinara): Instrument development and validation. *Nurse Media Journal of Nursing*. 2021;11:219-32. <https://doi.org/10.14710/nmjn.v11i2.34199>.
 22. Madiuw d, leutualy v, sopacua dt, tomasoa vy, herwawan jh, tasijawa fa, et al. Cervical cancer risk detection with sinara [internet]. Nasrudin m, editor. Pekalongan, central java; 2022 [cited 2024 mar 22]. Available from: <https://www.Penerbitnem.Com/2022/11/deteksi-risiko-kanker-serviks-dengan.Html>.
 23. Silalahi V, Kurniawaty Y. Resiko Kanker Serviks pada Wanita dengan Menggunakan Instrument Sinara (Indonesian Self-Risk Assessment for Cervical Cancer). *Malahayati Health Student Journal*. 2023;3(3):752–60. <https://doi.org/10.33024/mahesa.v3i3.9968>
 24. Cahya R, Sulistiadi W, Tu NF, Haryo P. Dampak Hambatan Geografis dan Strategi Akses Pelayanan Kesehatan: Literature Review [The Impact of Geographic Barriers and Health Service Access Strategies: Literature Review]. *Media Publikasi Promosi Kesehatan Indonesia*. 2023;6(5):868–77. <https://doi.org/10.31934/mparki.v2i3>
 25. Lestari bc. Post-training evaluation of early detection of breast cancer and cervical cancer. *Journal of innovation research and knowledge [internet]*. 2021 nov [cited 2025 sep 16];(6):219–28. Available from: <https://bajangjournal.Com/index.Php/jirk/article/view/649/450>.
 26. Anthoine E, Moret L, Regnault A, Sbille V, Hardouin JB. Sample size used to validate a scale: a review of publications on newly-developed patient reported outcomes measures. *Health Qual Life Outcomes*. 2014;12:176. <https://doi.org/10.1186/s12955-014-0176-2>.
 27. Lund am. Measuring usability with the use questionnaire12. *Usability interface*. 2001 jan;8(2):3-6.
 28. Gayatri rw, katmawanti s, wardani he, yun lw. Android application-based interactive services for diabetes mellitus patients. In3rd international scientific meeting on public health and sports (ismophs 2021) 2022 jan 25 (pp. 156-162). Atlantis press.
 29. Soto M, Martinez-Gutierrez J, Momany M, Capurro D, Ciampi Spode F, Cea E, et al. Preferences of underserved chilean women on a mobile technology intervention for cervical cancer screening: Qualitative study. *JMIR Mhealth Uhealth*. 2018;6(11):e196. <https://doi.org/10.2196/mhealth.9494>.
 30. Liu X, Ning L, Fan W, Jia C, Ge L. Electronic health interventions and cervical cancer screening: Systematic review and meta-analysis. *J Med Internet Res*. 2024;26:e58066. <https://doi.org/10.2196/58066>.
 31. Mohan S, S HS. Usability and quality evaluation of the “e- midwife” mobile application for nurse-midwives in obstetric complications: A randomized controlled trial. *Int J Community Based Nurs Midwifery*. 2023;11(4):247-56. <https://doi.org/10.30476/ijcbnm.2023.98777.2264>.
 32. Wang L, Liu Y, Tan H, Huang S. Transtheoretical model-based mobile health application for pcos. *Reprod Health*. 2022;19(1):117. <https://doi.org/10.1186/s12978-022-01422-w>.
 33. Graham GN, Ostrowski M, Sabina AB. Population health-based approaches to utilizing digital technology: A strategy for equity. *J Public Health Policy*. 2016;37(Suppl 2):154-66. <https://doi.org/10.1057/s41271-016-0012-5>.
 34. Wulandari R, Pangarsa EA, Andono PN, Rachmani E, Sidiq M, Setyowati M, et al. Evaluation of usability and user experience of oncodoc ‘s m-health application for early detection of cancer. *Asian Pac J Cancer Prev*. 2022;23(12):4169-76. <https://doi.org/10.31557/apjcp.2022.23.12.4169>.
 35. Hartzler AL, Tuzzio L, Hsu C, Wagner EH. Roles and functions of community health workers in primary care. *Ann Fam Med*. 2018;16(3):240-5. <https://doi.org/10.1370/afm.2208>.



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