

Development of a web-based poedji rochjati score information system for early detection of high-risk pregnancy

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ABSTRACT

Maternal mortality remains a critical public health issue that can be reduced through effective early detection of high-risk pregnancies. In Indonesia, the Poedji Rochjati Score Card (KSPR) is widely used as a screening tool; however, its implementation is predominantly manual, leading to inefficiencies in data management, risk classification, and continuity of antenatal care. This study aims to develop a web-based Poedji Rochjati Score to support early detection of high-risk pregnancies at the primary healthcare level. This research employed an applied research and development design using the Rapid Application Development (RAD) method. The results indicate that the developed system successfully automates KSPR scoring and pregnancy risk classification based on standardized criteria. The system improves the accuracy and consistency of risk assessment, enhances maternal health data management, and supports longitudinal monitoring of pregnancy risk status. Implementation findings show that the system facilitates more efficient antenatal care services and provides structured risk reports to support clinical and referral decision-making. This study contributes to applied health informatics by demonstrating how standardized maternal risk screening can be effectively digitalized at the primary healthcare level. In conclusion, the web-based Poedji Rochjati Score information system offers an effective and innovative solution for strengthening early detection of high-risk pregnancies. The integration of a standardized screening tool with digital technology enhances screening accuracy, service efficiency, and data continuity in antenatal care. This study provides a practical foundation for further development and wider implementation of digital maternal health screening systems to support improved maternal healthcare quality.

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INTRODUCTION

Maternal mortality remains a major public health concern and is widely used as an indicator of the quality of maternal health services. Globally, maternal deaths are largely preventable through early detection of pregnancy risks, adequate antenatal care, and timely management of obstetric complications (Organization, 2019b)(Organization, 2021). In Indonesia, maternal mortality is still associated with delays in identifying high-risk pregnancies, fragmented maternal health records, and limited utilization of digital health systems at the primary healthcare level (Indonesia, 2020). Chronic Energy Deficiency is a risk factor that can be identified during the preconception period. Chronic energy deficiency increases the risk of pregnancy and childbirth complications, including anemia, fetal growth restriction, preterm birth, low birth weight (LBW), as well as increased maternal and neonatal morbidity and mortality (Aryani et al., 2024). Early detection of this condition serves as a crucial foundation for strengthening early screening systems as a strategic approach to reducing the risk of pregnancy complications and improving maternal health outcomes.

Compliance with antenatal care (ANC) visits among pregnant women plays a vital role in the early detection of pregnancy-related complications. This is because early identification of high-risk pregnancies is a key component of antenatal care services (Ayu Ditya Rancakasari, Klanting Kasiati, Astuti Setiyani, 2024). Integrated ANC services not only focus on routine pregnancy examinations but also incorporate early screening for medical, nutritional, psychosocial, and environmental risk factors, enabling potential complications to be identified and managed at an early stage. Early detection of high-risk pregnancy is a critical component of antenatal care services. One of the screening tools widely used in Indonesia is the Poedji Rochjati Score Card (Kartu Skor Poedji Rochjati/KSPR), which is designed to classify pregnancy risk levels based on maternal characteristics, obstetric history, and current pregnancy conditions (Rochjati, 2011). The use of KSPR enables midwives to identify potential complications early, determine appropriate interventions, and initiate timely referrals, thereby reducing the risk of adverse maternal outcomes. The use of the Poedji Rochjati Score Card (KSPR) has been proven to be beneficial in categorizing pregnancy risk levels in a practical and rapid manner (Tan et al., 2025).

Despite its clinical relevance, the implementation of KSPR in many primary healthcare facilities is still conducted manually using paper-based forms. Manual documentation systems are prone to data duplication, incomplete records, and difficulties in monitoring pregnancy risk status over time. These limitations can reduce service efficiency and hinder timely clinical decision-making, particularly in community health centers with high patient loads (Indonesia, 2020). Consequently, the effectiveness of KSPR as an early detection instrument is not yet fully optimized.

Advances in information and communication technology offer significant opportunities to improve maternal health services through digital health information systems. Previous studies have demonstrated that digital health systems can improve data accuracy, enhance information accessibility, and support continuity of care in maternal and child health services (Organization, 2020). Digital-based screening systems enable faster data processing, structured risk classification, and more efficient management of maternal health information compared to conventional manual methods. However, the adoption of digital systems specifically designed to support KSPR implementation in primary healthcare settings remains limited.

Several existing maternal health information systems primarily focus on administrative reporting rather than integrated risk screening processes that support routine clinical practice. In addition, limited studies have explored the development of KSPR-based information systems tailored to midwives' workflows and local service contexts. This condition indicates a research gap in the digital integration of standardized maternal risk screening tools within primary healthcare services (van der Giesen et al., 2020). The existing research gap relates to the limited integration of the Poedji Rochjati Score into digital information systems that support continuous pregnancy risk screening and monitoring, as well as the insufficient utilization of such systems as part of electronic

medical records, with potential development as a metadata foundation for maternal and child health.

To address this gap, this study aims to develop a web-based Poedji Rochjati Score information system to support early detection of high-risk pregnancies in primary healthcare facilities using the Rapid Application Development (RAD) method (Organization, 2015). The use of RAD ensures flexibility, active user involvement, and efficient system development. This research is expected to contribute to maternal health service innovation by integrating KSPR into a digital information system that enhances screening accuracy, improves data management, and supports evidence-based clinical decision-making by midwives.

RESEARCH METHOD

This study employed an applied research design with a system development approach to develop a web-based Poedji Rochjati Score information system for the early detection of high-risk pregnancy. The study was conducted in a primary healthcare setting in Indonesia and involved midwives who provide routine antenatal care services, with a focus on improving the effectiveness of antenatal risk screening through the integration of digital technology. The research process was carried out chronologically to ensure methodological clarity, scientific rigor, and reproducibility, as recommended in applied health informatics research (Cronje, 2020).



Figure 2. Research procedure based on the rapid application development (RAD) model

Research Design

The research design used in this study was Research and Development (R&D) with the Rapid Application Development (RAD) model. RAD was selected because it emphasizes short development cycles, active user involvement, and iterative system refinement, making it suitable for healthcare information system development in dynamic service environments. This approach allows continuous feedback from end users, particularly midwives, to ensure that the developed system aligns with real-world clinical workflows (Fryer & Dinsmore, 2020).

Research Procedure

The research procedure followed the main stages of the RAD model, which include requirements planning, system design, application development, and implementation. To clearly describe the research flow, the procedure can be outlined algorithmically as follows:

- a. Requirements Planning, data were collected through observation and interviews with midwives to identify problems in the manual implementation of the Poedji Rochjati Score Card. Functional and non-functional system requirements were defined based on user needs and existing antenatal care procedures.
- b. System Design, the system architecture, database structure, and user interface design were developed based on the identified requirements. This stage focused on designing input forms for KSPR data, automated scoring mechanisms, and risk classification outputs to support clinical decision-making.
- c. Application Development, the web-based application was developed iteratively, allowing continuous refinement based on user feedback. Each module, including data input, risk scoring, and reporting features, was tested internally to ensure functional accuracy and system stability.
- d. Implementation and Evaluation, the developed system was implemented in the research setting and used by midwives during antenatal care services. User feedback was collected to evaluate system usability, functionality, and relevance to daily clinical practice.

This step-by-step procedure ensures that the research process is systematic, transparent, and scientifically acceptable (Cronje, 2020).

Data Acquisition

Data acquisition in this study consisted of both primary and secondary data. Primary data were obtained through direct observation, interviews with midwives, and system usage during antenatal care services. Secondary data included maternal health records, KSPR guidelines, and institutional documents related to antenatal care procedures. The combination of these data sources enabled comprehensive system requirement analysis and validation of the developed application.

System Testing

System testing was conducted to ensure that the developed application functioned according to the specified requirements. Functional testing was performed to verify the accuracy of KSPR scoring calculations, data input processes, and output generation. Usability testing was also conducted by involving end users to assess ease of use, clarity of interface, and system responsiveness. This testing approach ensured that the system met both technical and user-centered quality criteria (Fryer & Dinsmore, 2020).

RESULTS AND DISCUSSIONS

Results of System Development and Implementation

The development of the web-based Poedji Rochjati Score information system resulted in a functional digital platform designed to support early detection of high-risk pregnancies at the primary healthcare level. The system was successfully implemented and utilized by midwives during routine antenatal care services. This implementation demonstrates that the manual KSPR screening process can be effectively transformed into a structured and automated digital workflow, supporting more consistent and accurate pregnancy risk assessment. The system enables direct input of maternal identity data, obstetric history, and current pregnancy conditions, which are then processed automatically to generate the Poedji Rochjati Score and corresponding risk classification. This automated scoring mechanism ensures that risk assessment follows standardized KSPR criteria consistently, reducing variability caused by manual calculations. Similar findings have been reported in previous studies, which indicate that automated clinical scoring systems improve accuracy and reliability in maternal risk screening (Grieshaber, 2020; Organization, 2019a).

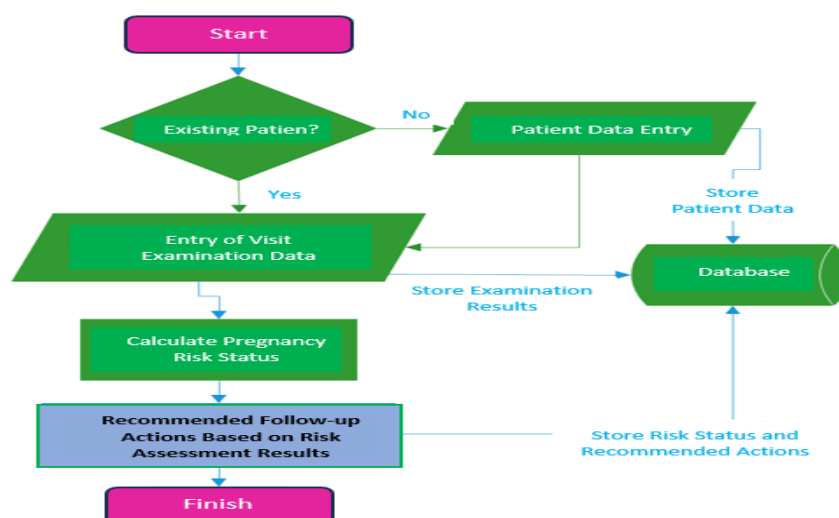


Figure 3. Workflow of the web-based poedji rochjati score information system

The implementation results also show improvements in maternal data management. Pregnancy risk data are stored in a structured database, allowing midwives to retrieve and review patient information efficiently. This digital data storage supports longitudinal monitoring of maternal risk status across antenatal visits, which is difficult to achieve using paper-based records. Digital record systems have been widely recognized as effective tools for improving continuity of care and reducing information loss in maternal health services (Fryer & Dinsmore, 2020; Indonesia, 2020).

System testing confirmed that the application functioned according to predefined requirements. Functional testing showed that data input processes, risk score calculations, and output displays operated correctly and consistently. The scoring results generated by the system corresponded with established KSPR guidelines, indicating that the digital implementation accurately reflects the manual scoring method. Usability testing further indicated that the system interface was understandable and compatible with midwives’ daily workflows, supporting findings from previous research on the importance of usability in healthcare information systems (Cronje, 2020; Grieshaber, 2020). This finding is consistent with previous studies, which emphasize that perceived usefulness and ease of use are key determinants of user acceptance in healthcare information systems (Davis, 1989; Holden & Karsh, 2010). The successful implementation of the system reflects key dimensions of information system success, including system quality, information quality, and user satisfaction, as described in established information system evaluation models (DeLone & McLean, 2003). These findings are consistent with the DeLone and McLean information systems success model, which emphasizes the central role of system quality and information quality in determining the success of information system implementation (Hamdoon & Naqbi, 2024).

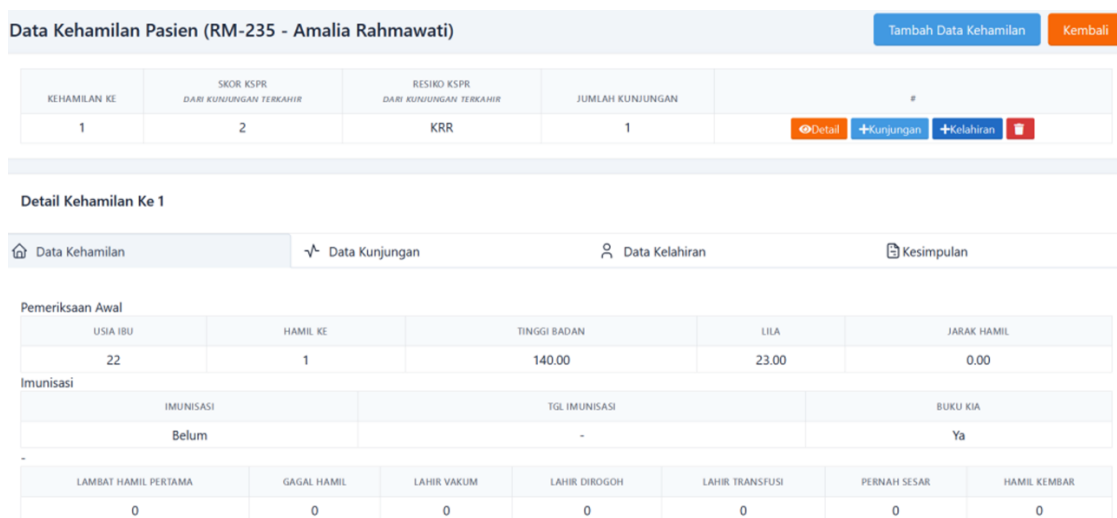


Figure 4. Example of pregnancy risk classification generated by the system

Discussion on the Effectiveness of Digital KSPR Implementation

The findings of this implementation shows that the digitalization of the Poedji Rochjati Score provides significant benefits for early detection of high-risk pregnancies. Automated risk scoring reduces dependence on manual calculations and minimizes the risk of human error, which has been identified as a common limitation in conventional screening practices. Consistent risk classification is essential for ensuring timely referrals and appropriate clinical interventions, both of which are critical factors in preventing maternal complications (Organization, 2019b).

The use of a web-based system also enhances the efficiency of antenatal care services. By simplifying documentation and scoring processes, the system allows midwives to allocate more time to clinical assessment and patient counseling. This efficiency gain is particularly relevant in primary healthcare facilities with limited human resources and high service demand. Previous studies have highlighted that digital health applications can improve service efficiency and support healthcare providers in managing increasing workloads (Cranford, 2020; Fryer & Dinsmore, 2020).

From a data management perspective, the transition from paper-based records to a digital database strengthens maternal health surveillance. The availability of structured and retrievable data supports evidence-based decision-making and facilitates internal monitoring of pregnancy risk (Organization, 2014). Digital health information systems have been shown to improve data quality and accessibility, contributing to better health system performance (Indonesia, 2020; Organization, 2019a)

The findings also support the suitability of the Rapid Application Development (RAD) method for healthcare system development. The iterative development process and active involvement of end users enabled the system to be tailored to real service needs. This user-centered approach is consistent with previous research emphasizing that healthcare information systems are more effective when developed through participatory and iterative methods (Cronje, 2020; Fryer & Dinsmore, 2020). The RAD approach allowed continuous refinement of system features, resulting in improved usability and functional relevance.

Contribution to Maternal Health Services and Research

This study contributes to maternal health services by providing an applied digital solution that integrates a standardized pregnancy risk screening tool with information technology. Unlike systems that focus primarily on administrative reporting, the developed application directly supports clinical decision-making in antenatal care (Stewart, 2021). This distinction represents an important contribution to digital maternal health innovation, as emphasized in recent literature on health information system development (Grieshaber, 2020; van der Giesen et al., 2020).

In terms of research contribution, this study strengthens existing evidence on the role of digital systems in maternal risk screening by demonstrating practical implementation at the primary healthcare level. The findings support previous studies that highlight the potential of digital health interventions to improve maternal health service quality, while also addressing usability and workflow integration challenges (Cranford, 2020; Fryer & Dinsmore, 2020). By focusing on KSPR-based screening, this research adds contextual relevance to the Indonesian maternal health setting (Indonesia, 2018). The use of information systems in health services has been shown to improve performance, including the completeness of reports, timeliness of report submission, data accuracy, and the utilization of data for evidence-based decision-making (Study et al., 2024). In addition, the implementation of information systems in health services facilitates faster identification of service-related problems, enhances accountability of health facilities, and supports rapid evidence-based decision-making (Damayanti et al., 2019).

One strategic partner for the implementation of such systems is the Independent Midwifery Practice (Tempat Praktik Mandiri Bidan/TPMB). As a primary-level health care facility that interacts directly and most closely with pregnant women, TPMB holds significant potential for implementing integrated health information systems. However, to date, relatively few TPMBs in Indonesia have optimally adopted and operated health information systems. This condition is largely attributed to limitations in technological infrastructure, financial support, and human resource readiness, as well as the absence of well-established mechanisms for system integration and reporting standardization (Indonesia, 2025). Therefore, the digitalization of medical records through the implementation of information systems in Independent Midwifery Practices is not merely a matter of regulatory compliance, but rather an urgent necessity.

In addition to functioning as a pregnancy risk screening tool, the web-based Poedji Rochjati Score information system developed in this study also offers an advantage as a digital medical record for pregnant women. All maternal identity data, obstetric history, current pregnancy conditions, and risk assessment results are systematically documented in a structured database. This enables continuous data storage and allows information to be easily retrieved and reviewed at each antenatal care visit. This finding supports the current government policy that mandates the implementation of electronic medical records in healthcare facilities, including Independent Midwifery Practices, to enhance service quality, ensure data security and confidentiality, and support the integration of digital health information systems (Peraturan Menteri Kesehatan Republik Indonesia Nomor 24 Tahun 2022 Tentang Rekam Medis, 2022).

This study makes a theoretical contribution by showing how the Poedji Rochjati Score was digitally transformed into a midwifery information system. This system supports continuous screening and monitoring of pregnancy risk while maintaining clinical validity and accuracy. The study also strengthens theoretical views on digital innovation in antenatal care. It does this by integrating a midwife-centered system design with electronic medical records. This integration helps ensure continuity of care and supports evidence-based decision-making in primary healthcare.

Despite these positive outcomes, this study has limitations. The system was implemented in a single healthcare facility, which may limit generalizability. In addition, the evaluation focused on system functionality and usability rather than long-term clinical outcomes. Future research may expand implementation across multiple facilities and assess the impact of digital KSPR systems on maternal morbidity and mortality indicators, as suggested in previous maternal health research (Organization, 2019b; van der Giesen et al., 2020).

Overall, the results and discussion demonstrate that the developed web-based Poedji Rochjati Score information system is a feasible, effective, and innovative tool for strengthening early detection of high-risk pregnancies. The integration of standardized screening criteria with digital technology enhances accuracy, efficiency, and data management in antenatal care services. These findings reinforce the importance of digital health innovations in improving maternal health outcomes and support further development and broader implementation of similar systems.

CONCLUSION

This study successfully achieved its objective of developing a web-based Poedji Rochjati Score information system to support early detection of high-risk pregnancies at the primary healthcare level. As outlined in the introduction, the main expectation of this research was to address limitations in manual KSPR implementation by providing a digital solution that enhances screening accuracy, efficiency, and maternal health data management. The results and discussion demonstrate that the developed system is capable of transforming conventional paper-based screening into an automated and structured digital process that aligns with midwives' clinical workflows.

The findings indicate that the digital implementation of the Poedji Rochjati Score supports more consistent risk classification and reduces potential errors associated with manual calculations. In addition, the system improves accessibility and continuity of maternal health records, enabling longitudinal monitoring of pregnancy risk status across antenatal visits. These outcomes confirm that the proposed digital approach effectively responds to the identified research problems and contributes to strengthening antenatal care services through evidence-based decision-making.

From a practical perspective, the developed system provides added value for maternal health services by improving service efficiency and supporting timely identification of high-risk pregnancies. The integration of automated scoring and reporting features facilitates clinical and referral decision-making, particularly in primary healthcare facilities with limited resources. This

contribution aligns with the broader objective of enhancing maternal health service quality through the application of information technology.

Despite these achievements, further development of the system remains possible. Future research may expand the implementation to multiple healthcare facilities to evaluate scalability and adaptability across different service contexts. Additional system enhancements, such as integration with existing health information systems, mobile-based access, and real-time referral tracking, may further strengthen its functionality and impact. Moreover, longitudinal studies examining the effect of digital KSPR implementation on maternal and neonatal health outcomes would provide stronger empirical evidence of its clinical effectiveness. Future studies should specifically examine the impact of digital KSPR implementation on maternal morbidity and mortality indicators, including the incidence of obstetric complications, timeliness of referrals, maternal near-miss events, and maternal mortality rates.

To ensure sustainable implementation, healthcare facilities should integrate the digital KSPR system into routine antenatal care through formal policies, standard operating procedures, and continuous training for midwives, supported by adequate infrastructure, system interoperability, and ongoing monitoring. Future research should evaluate system scalability across multiple healthcare facilities and assess its long-term impact on maternal and neonatal health outcomes. Overall, this study highlights the potential of digital maternal risk screening systems as a promising innovation for improving early detection and management of high-risk pregnancies, with sustainability strongly influenced by perceived usefulness and ease of use (Davis, 1989; Holden & Karsh, 2010).

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References

- Aryani, A. A., Nafisah, L., Hapsari, P. W., & Mulyani, J. D. (2024). *Risk Factors for Maternal Mortality in Banyumas Regency in 2022*. 7(1), 24–30.
- Ayu Ditya Rancakasari, Klanting Kasiati, Astuti Setiyani, R. S. (2024). The Relationship between Antenatal Care (ANC) Compliance with Pregnancy Risk Detection. *JURNAL KEBIDANAN*, 15(1), 1–7.
- Cranford, J. A. (2020). *Writing and Publishing Research Articles in Health Sciences*. Springer.
- Cronje, J. C. (2020). *Teaching and Learning with Technology: A Guide for Educators*. Routledge.
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319–340. <https://doi.org/10.2307/249008>
- Damayanti, N. A., Setijanto, D., Hargono, A., & Wulandari, R. D. (2019). *Integrated Information System for Early Detection of Maternal Risk Factors Based on Continuum of Care Approach of Mother and Toddler Cohorts*. 25(3), 153–160.
- DeLone, W. H., & McLean, E. R. (2003). The DeLone and McLean model of information systems success: A ten-year update. *Journal of Management Information Systems*, 19(4), 9–30. <https://doi.org/10.1080/07421222.2003.11045748>
- Fryer, L. K., & Dinsmore, D. L. (2020). The promise and pitfalls of technology-supported learning in health

- education. *Medical Education*, 54(6), 503-509. <https://doi.org/10.1111/medu.14115>
- Grieshaber, S. (2020). Reporting research findings: Structuring results and discussion sections. *Journal of Research Writing*, 12(2), 45-56.
- Hamdoon, S., & Naqbi, A. (2024). A Mixed-Method Approach to Post-Implementation Success of Technology Performance in UAE Universities : Assessing DeLone and McLean IS Success Model. *June*, 1-23. <https://doi.org/10.1177/21582440241240827>
- Holden, R. J., & Karsh, B.-T. (2010). The technology acceptance model: Its past and its future in health care. *Journal of Biomedical Informatics*, 43(1), 159-172. <https://doi.org/10.1016/j.jbi.2009.07.00>
- Indonesia, K. K. R. (2018). *Profil Kesehatan Indonesia*. Kementerian Kesehatan RI.
- Indonesia, K. K. R. (2020). *Pedoman Pelayanan Antenatal Terpadu*. Kementerian Kesehatan RI.
- Indonesia, K. K. R. (2025). DIGITALISASI (REKAM MEDIS ELEKTRONIK) PELAYANAN KEBIDANAN DI PRAKTIK MANDIRI BIDAN (PMB) Angkatan 1. In *LMS Kemenkes RI*.
- Organization, W. H. (2014). *Trends in Maternal Mortality: 1990 to 2013*. WHO Press.
- Organization, W. H. (2015). *WHO Recommendations on Antenatal Care for a Positive Pregnancy Experience*. WHO Press.
- Organization, W. H. (2019a). *Digital Health Interventions: Classification of Digital Health Interventions v1.0*. WHO Press.
- Organization, W. H. (2019b). *Maternal Mortality*. WHO Press.
- Organization, W. H. (2020). *WHO Guideline: Recommendations on Digital Interventions for Health System Strengthening*. WHO Press.
- Organization, W. H. (2021). *Global Strategy for Women's, Children's and Adolescents' Health*. WHO Press.
- Peraturan Menteri Kesehatan Republik Indonesia Nomor 24 Tahun 2022 Tentang Rekam Medis, (2022).
- Rochjati, P. (2011). *Skrining Antenatal pada Kehamilan Risiko Tinggi*. Airlangga University Press.
- Study, A. Q., Worku, A. G., Midekssa, D., Tilahun, A., & Belay, T. (2024). *The Impact of Health Information System Interventions on Maternal and Child Health Service Utilizations in Ethiopia* : 1-14.
- Tan, H., Sitanggang, H., Amelia, T., Saragih, P., Tan, H., & Kebidanan, S. (2025). DETEKSI DINI KEHAMILAN BERISIKO DENGAN KARTU SKOR POEDJI ROCHJATI (KSPR) DI PUSKESMAS MEDAN DELI TAHUN 2024. 11(2), 116-122.
- van der Giesen, J., Slegers, P., & Endedijk, M. (2020). Developing innovation-oriented research in applied sciences. *Studies in Higher Education*, 45(11), 2314-2328. <https://doi.org/10.1080/03075079.2019.1602751>