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Maternal and Child Health Services Mobile Application Prototype: A Case Study of Puskesmas Sungai Duren Muara Enim Regency

Rasmila[1]*, Rahayu Amalia[2], M. Rizqi Hidayah Adryansyah[3], Kanero Juniar[4]

[1,4] Informatics Engineering, Universitas Bina Darma, Palembang, Indonesia
[2,3]Information System, Universitas Bina Darma, Palembang, Indonesia
Email: [1]rasmila@binadarma.ac.id, [2]rahayu_amalia@binadarma.ac.id,
[3]adryansyahrizqi@binadarma.ac.id, [4]kanero.095@gmail.com

Abstract

The Sungai Duren Community Health Center (Puskesmas), located in Muara Enim Regency, provides essential maternal and child health services. Currently, patient registration and data management are conducted manually using patient data books, leading to inefficiencies, errors, and data loss. This research aims to develop a UI/UX mobile application that enhances maternal and child health services at the health center. The study employs the Design Sprint 2.0 methodology, a rapid, iterative, and user-centered design approach consisting of five stages: Understand, Define, Decide, Prototype, and Test. The design of the application was created using Figma, and its effectiveness was evaluated through usability testing, using the System Usability Scale (SUS) and Net Promoter Score (NPS). The results of the study show that the application improves operational efficiency, enhances user satisfaction, and provides better access to health data, demonstrating the potential for scalable and replicable solutions in rural and underserved healthcare settings.

Keywords: Design Sprint 2.0, Puskesmas, Figma, SUS, mobile health application

1. INTRODUCTION

The Sungai Duren Community Health Center, located in Muara Enim Regency, frequently provides maternal and child health services, leading to a significant patient load. However, the center has been using a manual registration and patient history recording system with patient data books, which has become a source of inefficiency and error. The manual process has caused long patient registration times, misaligned patient queues, and the loss or damage of vital patient information, thus leading to gaps in service delivery. Additionally, the outdated method makes it challenging to track and access essential health data, thereby impacting the center's ability to provide effective care. These challenges reflect a broader issue in rural healthcare facilities, where inefficient data management hinders optimal patient care and resource allocation. Muara Enim Regency, being

a developing region, faces even greater challenges in improving healthcare infrastructure and services. Given this, it is crucial to integrate technology into the health sector to enhance service quality and patient outcomes [1], [2], [3], [4].

The existing gaps in the health service process at Sungai Duren Community Health Center pointed to a clear need for digital transformation. The traditional approach of managing patient data through physical records has caused significant delays in service delivery and has contributed to errors in the documentation of patient health histories. With a growing demand for maternal and child health services in the region, the ability to digitize patient information is no longer a luxury but a necessity. Therefore, the goal of this research was to design and develop a mobile-based healthcare application specifically tailored to the operational environment of the health center. The application was envisioned to not only address the inefficiencies of manual data entry but also to improve the accessibility and management of health data, making it more reliable, efficient, and secure for healthcare workers and patients alike [5].

The study introduced an innovative solution by applying a relatively underutilized method in the digitization of primary healthcare services, especially in rural areas of Indonesia. This research utilized the Design Sprint 2.0 methodology, an agile, rapid, and user-centered design approach. Design Sprint 2.0, as opposed to traditional software development methods like Waterfall, involves iterative cycles of understanding, ideation, prototyping, and testing, making it particularly well-suited to rapidly evolving healthcare environments. This method focuses on solving complex challenges through collaboration and quick validation of design concepts. The application of this framework allowed the team to create a user-friendly, intuitive UI/UX prototype that meets the specific needs of the healthcare workers and patients at Sungai Duren, while minimizing errors and enhancing the overall user experience [6], [7], [8].

Moreover, the study highlights the dual benefits of the digital solution: not only improving the quality of healthcare delivery but also reducing the administrative burden on healthcare workers. With the automated system in place, healthcare workers can spend less time managing paper-based records and more time focusing on patient care. This shift significantly enhances the operational efficiency of the health center. By streamlining data entry, patient monitoring, and communication, the mobile application provides an effective solution for rural healthcare settings that often lack the necessary infrastructure. This aligns with Indonesia's national agenda to promote digitization in the health sector and offers a replicable model for other healthcare facilities in similar contexts to adopt digital systems for better service delivery [9-13].

The research contributes to the digital health discourse by addressing the specific challenges faced by rural healthcare facilities in Indonesia. Unlike previous studies

that have applied traditional design models to other sectors, this research bridges a gap by introducing an agile, sprint-based design methodology into the healthcare infrastructure of underserved areas. The findings offer practical insights into how iterative design methods can be adapted and applied to healthcare services, especially in rural settings with limited resources. The success of the mobile application prototype in improving service delivery, user satisfaction, and operational efficiency presents a significant advancement in digital health systems development, demonstrating the value of context-specific and user-centered design approaches [14], [15], [16].

2. METHODS

This research employs a contextual adaptation of the Design Sprint 2.0 methodology—a rapid, iterative design framework originally crafted for digital product innovation—to develop a mobile-based UI/UX prototype tailored to the needs of primary healthcare in rural Indonesia [17]. This study contributes to a novel application of Design Sprint 2.0 in the maternal and child healthcare domain, focusing on user-centered design and promoting innovative problem-solving through structured, dynamic phases: Understand, Diverge, Decide, Prototype, and Test [7]. The flexibility of Design Sprint 2.0 is essential for navigating the complexities of rural healthcare settings, where infrastructure and resources are often limited.

2.1. Empathize and Understand in the Healthcare Context

The first phase of the Design Sprint 2.0 process, "Empathize and Understand," emphasizes immersion within the specific healthcare setting. Researchers conducted in-depth interviews and observational studies at the Puskesmas Sungai Duren, focusing on identifying workflow inefficiencies and service delivery gaps. This stage was unique in that it didn't merely seek to identify system flaws from a technical perspective but also incorporated the principles of design empathy, specifically considering digital readiness and user accessibility in a low-resource context. The aim was to identify critical unmet needs, both in terms of operational functionality and the ability of healthcare workers and patients to engage with the technology. By adopting an empathetic approach, this research laid the foundation for developing a solution that directly addressed real-world challenges rather than theoretical ones, ensuring that the final product was rooted in the actual experiences of the users [18]. Figure 1 visually captures this phase, illustrating the understanding of pain points and user needs that informed the design process.

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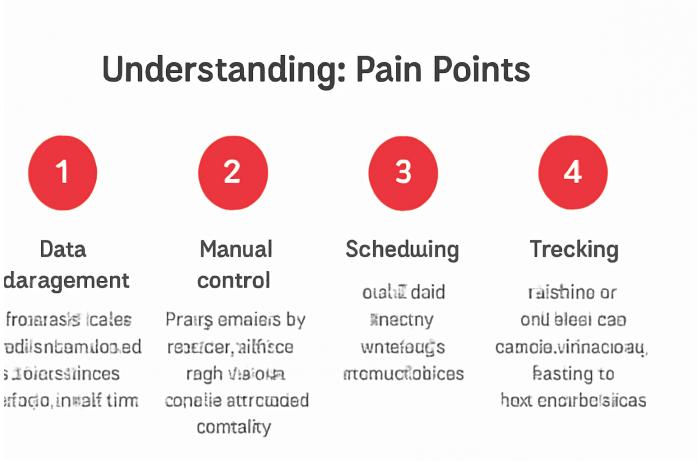

Figure 1. Understanding Pain Points

2.2. Synthesis and Ideation: Translating Insights into Actionable Ideas

Following the data collection phase, the research team synthesized the findings through Affinity Diagramming, a technique that enabled the clustering of user concerns into actionable insights. This process effectively translated qualitative data from fieldwork into tangible design elements. The novelty of this stage was in its integration of ideation tools, such as Crazy 8s sketching, commonly used in commercial design contexts, to a public healthcare setting. By introducing these tools, the research allowed a wide variety of low-fidelity ideas to be explored rapidly, which could then be tested against the unique workflows and operational constraints of local healthcare facilities. This approach broke away from the traditional, slow-paced design processes typically seen in public sector projects, allowing for quick generation and evaluation of ideas. The brainstorming sessions led to creative, yet practical, solutions for the healthcare system's most pressing problems, encouraging innovation without compromising feasibility.

2.3. User-Centered Decision-Making: Prioritizing Needs

One of the most critical aspects of this research was its departure from conventional top-down decision-making processes in system design. Instead, the research embraced participatory decision-making, directly involving healthcare workers in selecting interface solutions. By involving the people who would use the system daily, the design became inherently more user-friendly and effective. The prioritization process was based on three core criteria: usability potential, feasibility within infrastructure limitations, and expected impact on patient care. These metrics were specifically adapted for low-resource environments, ensuring that the solutions would work within the context of Puskesmas Sungai Duren's current capabilities, without the need for costly technological upgrades. The

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collaborative decision-making process ensured that the final interface design not only met the needs of healthcare workers but also had the potential for high user adoption, as it directly reflected their input and experience. Figure 2 provides a visual overview of the decision-making process, showcasing the way in which various interface solutions were evaluated and prioritized.

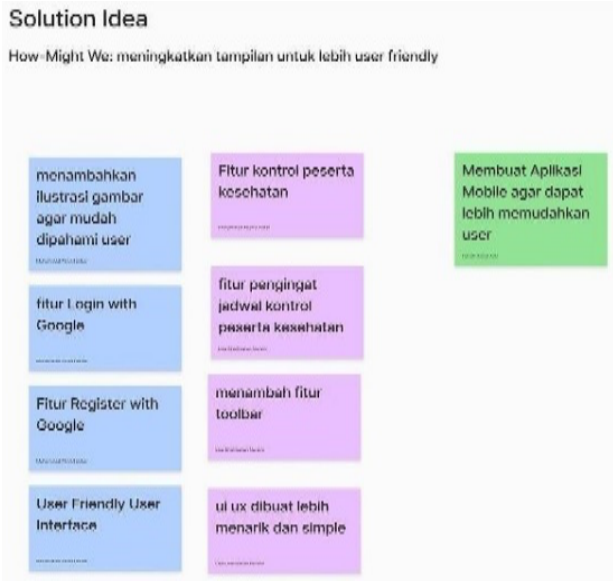

Figure 2. Idea Determination Decide Stage

2.4. Rapid Prototyping: Bringing the Health System to Life

In the next phase, Rapid Prototyping, the research team used Figma, a leading design tool, to create a high-fidelity prototype. The prototype simulated real-time patient registration, health monitoring features, and direct communication between patients and healthcare providers. This stage was particularly impactful because it embodied digital co-creation: non-technical users, such as healthcare workers and even patients, played an active role in shaping the structure and flow of the application. This collaboration between designers and end-users ensured that the prototype aligned closely with the needs and expectations of the actual users, providing them with a seamless, intuitive interface. The interactive prototype was tested in real-world scenarios, allowing the design team to identify any immediate flaws and iteratively improve the product. This iterative process was essential for refining the application and ensuring that it was functional and effective for its intended use in a resource-constrained healthcare setting.

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2.5. User-Centric Validation: Measuring Success with Dual Metric Testing

The final phase of the Design Sprint 2.0 process, User-Centric Validation, involved usability testing with target users using two key metrics: the System Usability Scale (SUS) and the Net Promoter Score (NPS). These metrics, which are commonly applied in product development, were uniquely used in this study to assess the effectiveness of the application in a government health service context—particularly in underserved rural populations. The SUS provided valuable insights into the application's overall usability, while the NPS helped gauge user satisfaction and their likelihood of recommending the application to others. This dual-metric testing strategy offered a comprehensive evaluation of the application's usability and acceptance, going beyond simple functionality and focusing on how well it served its users. The results of these tests were instrumental in understanding the interface's success and areas for improvement, demonstrating how digital health readiness can be evaluated using standard product development tools in an unconventional setting.

3. RESULTS AND DISCUSSION

By embedding the Design Sprint 2.0 methodology into the healthcare-specific development cycle, this study offers a replicable framework for rapid, needs-driven system design that balances technical innovation with the practical realities of service delivery in primary care. The approach is designed to be flexible, addressing the complexities and limitations of rural healthcare settings while ensuring that the system remains functional and effective.

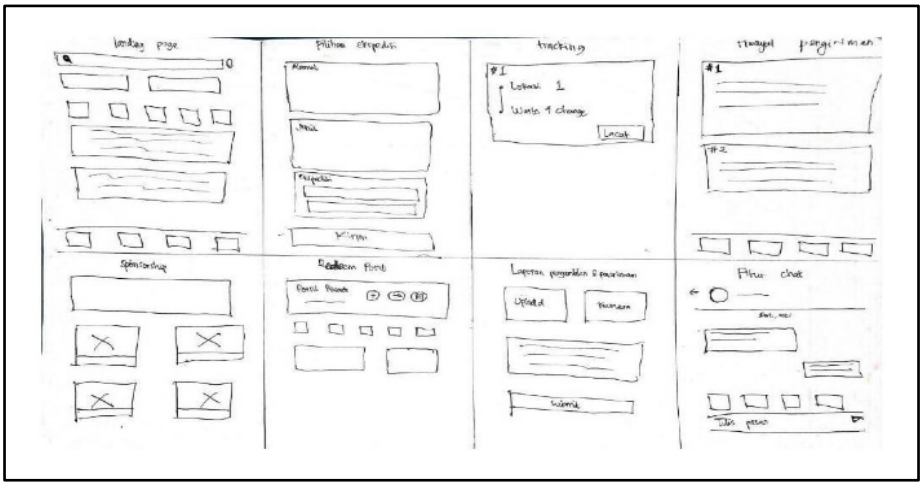

Figure 3. Crazy Eight

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The design process started with the Crazy 8s technique shown in Figure 3, a brainstorming method that facilitated rapid ideation of potential solutions. In this stage, the design team quickly sketched out several concepts to address the identified pain points in healthcare service delivery. The goal was to generate diverse ideas that could be iterated upon and tested in real-world scenarios. This technique helped explore creative solutions that directly addressed the inefficiencies observed at the Sungai Duren Community Health Center, such as manual data entry, patient registration delays, and difficulties in tracking patient health information.

3.1. Figma-based System Design

The resulting system design was created using Figma, which allowed the team to build a high-fidelity prototype customized for the needs of the healthcare center. By transitioning from manual record-keeping to a digital system, the design solved inherent inefficiencies like inaccurate data entries and delays in service delivery. Digitizing these tasks streamlined workflows, enhanced the speed of service delivery, and ensured that patient information was more accurate and accessible in real-time.

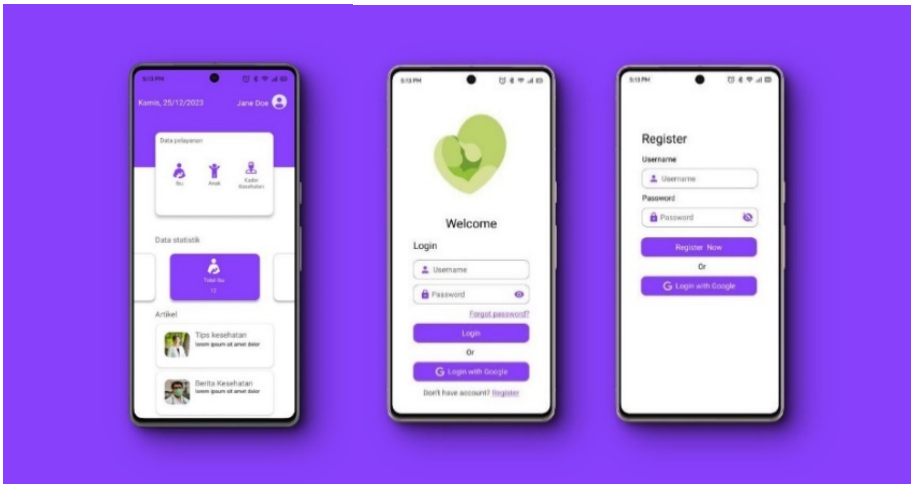

Figure 4. Home Page – User-Centered Design

Figure 4 shows the Home Page of the mobile application, which was designed to be simple and intuitive. The page integrates a real-time patient management interface that provides healthcare professionals with immediate access to patient data. One of the key innovations is the push alerts for health check-up reminders, which have been proven to increase patient attendance for routine care—especially vital in maternal and child health, where regular check-ups are crucial for monitoring the well-being of both mothers and children. By implementing

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automated reminders, the application enhances patient engagement, helping to ensure that individuals receive the care they need in a timely manner. This aligns with findings in existing literature, which suggests that digital health tools can positively influence patient behavior and increase adherence to healthcare protocols.

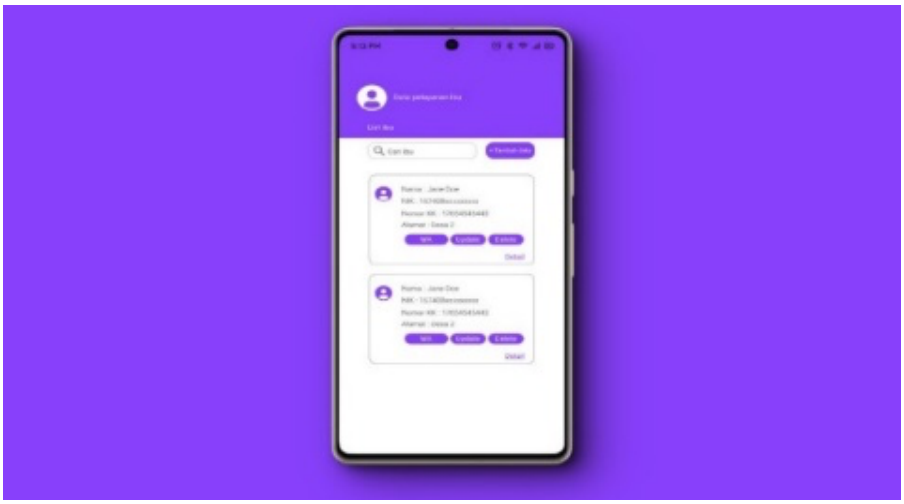

Figure 5. Service List Page

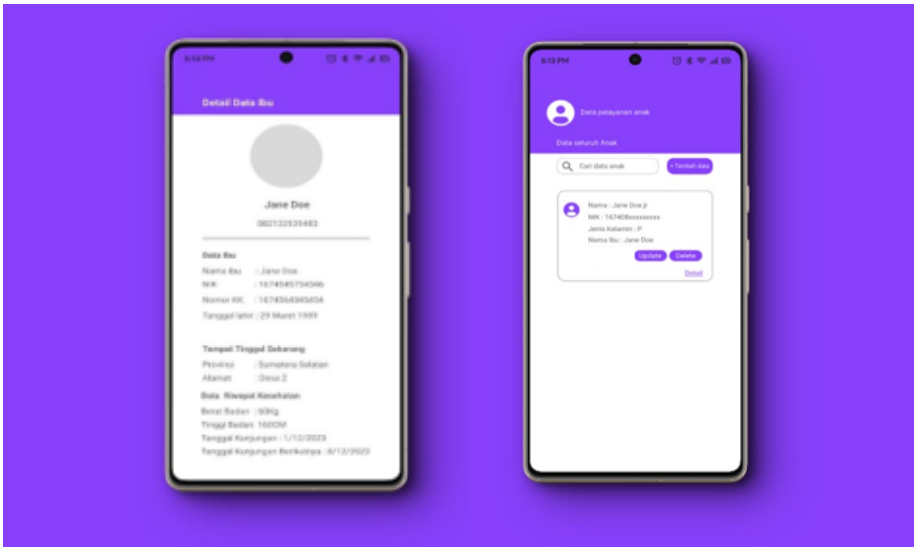

Figure 6. Participant Details Page

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In Figure 5 and Figure 6, we see the Participant Service List Page and the Maternal and Child Health Participant Details Page. These pages were designed to ensure ease of use for healthcare providers. The Participant Service List Page offers a streamlined way for healthcare workers to access a comprehensive list of patients, making it easier to manage a large volume of individuals in a day. On the Maternal and Child Health Participant Details Page, healthcare professionals can quickly review a patient's medical history, track progress, and input new information. The focus on user-centered design ensures that these pages are intuitive and user-friendly, reducing the cognitive load on healthcare providers. Feedback from pilot testing confirmed that this layout enabled staff to perform their duties more efficiently, reducing time spent navigating complex interfaces and focusing more on patient care.

3.2. Pilot Testing and Usability Evaluation

Pilot testing was a crucial part of the validation process for this digital solution. During this phase, System Usability Scale (SUS) and Net Promoter Score (NPS) metrics were used to assess the usability and satisfaction levels among users. The results from these usability tests are summarized in Table 1. The high SUS and NPS scores indicate that users found the application to be highly usable and would recommend it to others. These findings confirm the hypothesis that a well-structured UI/UX design can facilitate task efficiency, minimize administrative errors, and improve overall user engagement in healthcare settings, particularly those with limited resources.

Table 1. Usability Testing Results

Evaluation Criteria	Participant 1	Participant 2	Participant 3	Participant 4	Participant 5
Ease of Application Control Management Features	4	4	3	5	4
Ease of Viewing and Selecting the Patient Control Menu on the Home Page	5	5	4	4	5
Clarity of Information on the Service Page	5	5	5	4	5
Net Promoter Score (NPS)	5	5	4	5	5

Table 1 demonstrates a strong user satisfaction with the application. The SUS scores show that users found the system easy to navigate and efficient, while the NPS score indicates that users would recommend the system to others. These results validate the hypothesis that the design's simplicity and clarity contribute significantly to improving healthcare workers' productivity.

3.3. System Functionality: Real-Time Data Management & Offline Capability

The system's data management module enables healthcare personnel to manage and update patient records in real-time, reducing the time spent on administrative tasks and ensuring accurate, up-to-date information is always available. Additionally, the search and filter functionalities make it easy to locate specific patient records quickly. One of the system's key features is its offline capability, allowing it to function even in areas with unstable or intermittent internet access. This is particularly critical for rural healthcare centers, where reliable internet access is not always available. Delayed synchronization ensures that data is updated once the connection is restored, which improves the robustness of the system and makes it more adaptable to diverse healthcare environments.

Despite these promising results, challenges were noted during the testing and deployment phases. Issues such as limited digital infrastructure and varying levels of technological proficiency among healthcare workers posed significant barriers to the full adoption of the system. As a result, there is a pressing need for capacity-building initiatives to ensure that healthcare staff can maximize the potential of the system. Furthermore, the offline mode and delayed synchronization features must be continually optimized to ensure the system functions smoothly in diverse infrastructure environments. These findings underscore the importance of contextual adaptations in healthcare technology solutions. While the prototype proved to be functionally sound, future development should focus on scalability and ensuring that the system is resilient across different settings and technologies.

Table 2. Testing Assessment Results

Question	Average SUS and NPS Scores	Final Result
Ease of application control management features	4	Easy
Ease of viewing and selecting the patient control menu on the home page	4.6	Easy
Clarity of information on the service page	4.8	Easy
Net Promotion Score	4.8	Recommended

Table 2 presents an overview of the testing assessment, which highlights the high usability of the application. The average SUS score and NPS score indicate that users found the system easy to use and would recommend it. These results further support the notion that a well-designed application can improve healthcare delivery in low-resource settings by streamlining workflows and enhancing the quality of patient care.

This research demonstrates that Design Sprint 2.0, when adapted to the healthcare context, can lead to the rapid development of effective, user-friendly digital health tools. The mobile-based application developed for the Sungai Duren Community Health Center provides an innovative solution to the challenges of manual data recording, slow service delivery, and fragmented patient information. The positive results from usability testing, the integration of real-time data management, and the offline capability all confirm that well-designed UI/UX solutions can improve healthcare outcomes and enhance the user experience.

Future work should focus on scalability, ensuring the system can be integrated with existing electronic health records (EHRs) and adapted for use in other healthcare settings. Moreover, testing across different geographic regions and with varying infrastructures will be crucial to determine the generalizability and adaptability of the system in other areas. This approach will lay the groundwork for the widespread adoption of digital health tools in rural and underserved healthcare environments, ultimately improving healthcare delivery and patient outcomes globally.

3.4. Discussion

The integration of Design Sprint 2.0 into the development of a digital health solution for Sungai Duren Community Health Center demonstrates the power of agile, user-centered design in solving critical healthcare challenges in rural settings. This study highlights the potential of rapid prototyping and iterative testing to create solutions that not only address immediate operational inefficiencies but also align with the real-world constraints of low-resource environments. The Design Sprint 2.0 methodology provided a structured yet flexible approach, enabling the research team to produce a scalable, usable, and contextually relevant mobile health application.

One of the most compelling aspects of this study is the use of Design Sprint 2.0 to rapidly test and iterate the application in real-world settings. This approach is especially crucial for healthcare solutions, where traditional, linear development models may struggle to address the complexity and dynamic needs of primary care systems in underserved areas. By using an agile design process, the team was able to validate hypotheses early, adapt the application according to user feedback, and

ensure that the final product closely matched the users' needs and working conditions. This iterative process allowed the team to prioritize essential features, such as real-time data management and push reminders, which directly addressed inefficiencies in patient registration, data tracking, and follow-up care. Rapid prototyping also ensured that the design remained flexible enough to accommodate unforeseen challenges and insights as the team tested the system with healthcare workers and patients.

User-centered design, as demonstrated in the development of this application, is critical in healthcare settings, particularly when dealing with low-resource environments and digital literacy barriers. The simplicity of the UI/UX design, with its intuitive interface and minimalistic approach, directly contributed to improved usability and user satisfaction. As evidenced by the high SUS and NPS scores (Table 1), the design succeeded in reducing the cognitive load on healthcare workers, allowing them to interact with the system efficiently without extensive training. This is particularly significant in rural healthcare settings, where workers may have limited exposure to complex digital systems. The success of the minimalist design in overcoming these barriers highlights the importance of creating solutions that are accessible and easy to use, even for those with limited technological proficiency. The system's real-time updates and search and filter functionalities further streamlined tasks, enabling healthcare workers to provide faster and more accurate care, thereby improving service delivery and patient satisfaction.

The implementation of push alerts for health check-up reminders serves as a prime example of how digital health tools can foster patient engagement. Regular reminders for routine care are particularly crucial in maternal and child health, where consistent monitoring is necessary to identify potential health risks early. The results of this research align with existing literature, which underscores the importance of timely interventions and consistent patient follow-ups in improving health outcomes. While the push alert feature has shown promise in improving attendance rates for health check-ups, it also reveals the potential for digital health tools to create continuous, automated communication channels between patients and healthcare providers. This can result in improved patient compliance and behavioral change, helping to bridge the gap between scheduled appointments and actual patient behavior. However, a deeper exploration of how to personalize these notifications could lead to even greater impacts on patient adherence, fostering a more tailored, responsive care model.

One of the most notable features of this application is its offline capability, which is a critical adaptation for rural healthcare settings with inconsistent internet access. By ensuring that the system can function without a stable connection and synchronize data once connectivity is restored, the application has enhanced its robustness and adaptability in environments with unreliable digital infrastructure.

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This delayed synchronization feature not only improves the system's resilience but also demonstrates an understanding of the unique challenges faced by rural healthcare facilities. Despite its promising implementation, the offline functionality still presents room for optimization. Future iterations of the system could benefit from refining this feature to ensure that data synchronization is as seamless as possible when connectivity is restored. Moreover, exploring the application's data security measures in offline modes could further ensure that sensitive patient information remains protected, even in environments with varying levels of digital security infrastructure.

While the system offers promising solutions, challenges remain in its full-scale adoption. One major barrier to implementation is the limited digital infrastructure in rural healthcare settings. The success of this mobile health application largely depends on the availability of consistent internet access and reliable devices. Furthermore, as highlighted in Table 2, the usability and adoption of the system are still constrained by technological proficiency among healthcare workers, emphasizing the need for capacity-building initiatives that focus on enhancing digital literacy. To address these challenges, future development should focus on training healthcare workers to use the system effectively and efficiently. Additionally, integrating user feedback loops into the system's evolution will allow for continual adjustments based on the changing needs and capabilities of healthcare providers. Strengthening the offline functionality will also be crucial in ensuring that the system remains accessible and useful even in areas where internet access is intermittent or unavailable.

The promising results of this research underscore the potential for Design Sprint 2.0 to transform healthcare service delivery in rural settings. However, the system's scalability remains a key area of focus. As the system is extended to other healthcare facilities, it will be essential to explore its integration with existing electronic health records (EHRs) to improve data sharing and interoperability. The ability to scale this solution while maintaining high levels of usability and efficiency will determine its success in broader healthcare contexts. Additionally, testing the application in diverse geographic regions with varying levels of digital infrastructure will be essential to assess its generalizability. This will ensure that the application can be adapted and applied in different healthcare settings, not just within the context of the Sungai Duren Community Health Center, but across other underserved areas in Indonesia and similar regions globally.

This research demonstrates the transformative potential of Design Sprint 2.0 in healthcare, particularly in rural and low-resource settings. By focusing on user-centered design, rapid prototyping, and iterative testing, this study developed a mobile health application that addresses critical inefficiencies in healthcare service delivery. The integration of real-time data management, automated reminders, and offline capabilities provides tangible solutions to operational challenges, while the

high usability and positive user feedback further validate the effectiveness of the design. As future work progresses, addressing challenges related to scalability, integration with EHR systems, and enhancing offline features will be essential to ensure that this solution can be widely adopted and adapted in various healthcare environments. This research provides a solid foundation for scalable, context-specific healthcare solutions that can improve the quality of care and patient outcomes in rural, underserved healthcare settings.

4. CONCLUSION

This research successfully developed a UI/UX prototype of a mobile-based health application tailored for the Sungai Duren Community Health Center (Puskesmas Sungai Duren), utilizing the Design Sprint 2.0 methodology to address the specific needs of both healthcare workers and patients. By involving users in the design process, the application was shaped to meet their real-world requirements, ensuring usability and improving overall service delivery. The user-centered approach of this research enabled the development of an application that enhances data management, streamlines patient registration, and ensures better tracking of maternal and child health services, leading to more structured and reliable patient data.

The digitalization of these processes significantly improves the efficiency and accuracy of health services, helping healthcare providers to manage patient information in real-time, and provides better access to crucial health data for informed decision-making. However, to ensure scalability and a broader impact across other healthcare settings, future developments should focus on integrating the system with existing electronic health records (EHRs) for improved interoperability, further enhancing offline functionality to make the system adaptable to areas with intermittent internet access, and implementing a framework for continuous user feedback and review to refine and adapt the application over time. By addressing these areas, this research lays a strong foundation for improving healthcare delivery and patient outcomes in rural and underserved healthcare environments.

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