



DESIGNING A CONTEXT-AWARE MATERNAL HEALTH INFORMATION SYSTEM FOR RURAL MIDWIVES: A NEEDS ASSESSMENT IN COASTAL COMMUNITIES OF GRESIK

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ABSTRACT	Keywords
Village midwives are at the forefront of maternal health services, yet they often face overwhelming administrative burdens due to manual recording and reporting systems. The transition to digital health applications is essential, but it must be tailored to the specific infrastructural and usability contexts of rural and coastal areas to ensure high adoption rates. This study aims to explore the context of use, identify operational bottlenecks in current manual practices, and define the functional requirements for a proposed maternal health application designed for midwives in coastal and rural settings. A descriptive quantitative approach was utilized. Data were collected via a structured questionnaire from 8 frontline healthcare workers, predominantly village midwives (87.5%), operating within the working area of Ujungpangkah Public Health Center, Gresik, Indonesia. The survey assessed current data management practices, infrastructural constraints, and digital feature preferences. The findings reveal a 100% reliance on physical register books for initial data entry, with 75% of respondents utilizing manual, paper-based reporting. The most significant bottlenecks identified were the redundancy of manual data re-entry (75%) and the universal difficulty in monitoring high-risk pregnancies (100%). Furthermore, 50% of the respondents experience unstable internet connectivity. Consequently, users strongly demanded automated monthly reporting (100%), robust data search capabilities (100%), and an offline-first architecture (75%). Previous digital solutions were criticized for overly complex interfaces (62.5%). To effectively support maternal health monitoring and reduce administrative fatigue, digital interventions for rural midwives must prioritize offline capabilities, automated data recapitulation, and a highly simplified, intuitive user interface tailored to regional infrastructural realities.	Maternal Health; Midwifery Informatics; mHealth; Needs Assessment; Coastal Communities

INTRODUCTION

Reducing maternal mortality remains a critical priority in global public health, requiring accurate and timely surveillance (World Health Organization, 2023; Royston & Armstrong, 2021). In Indonesia, village midwives are the primary healthcare providers responsible for monitoring pregnancies, identifying high-risk conditions, and ensuring safe deliveries at the community level (Kementerian Kesehatan Republik Indonesia, 2024; Puspitasari et al., 2022). To perform these duties effectively, midwives must meticulously record and report maternal health data. However, the prevailing reliance on manual, paper-based systems creates a significant administrative burden that often detracts from direct patient care and clinical observation (Sondaal et al., 2022; Rahayu et al., 2023).

The integration of health informatics, specifically mobile health (mHealth) applications, offers a strategic solution to streamline data management (Agarwal et al., 2021; Alotaibi & Federico, 2023). Digital platforms can facilitate real-time monitoring, automate report generation, and improve the accuracy of health records (Ganjali et al., 2023; Mechael et al., 2022). Despite these advantages, the implementation of mHealth solutions in rural and coastal areas frequently encounters substantial barriers (Feroz et al., 2021). These include inadequate technological infrastructure, such as unstable internet connectivity, and a mismatch between application design and the digital literacy of the end-users (Wahyuni & Santoso, 2023; Kruse et al., 2022; Jamil et al., 2021).

Furthermore, applications that fail to consider the specific "context of use" often experience low adoption and high abandonment rates, leading to fragmented data and wasted resources (Ahmadi et al., 2022; Haluza & Jungwirth, 2023). The cognitive load required to navigate complex user interfaces can be overwhelming for healthcare workers who are already fatigued by clinical duties (Yuliana et al., 2023; Mahmood et al., 2022). Therefore, before

developing a digital solution, a thorough needs assessment is imperative (Chib et al., 2021). This study explores the operational realities of frontline midwives in the coastal region of Gresik Regency to identify the precise functional and non-functional requirements necessary for developing a user-centered, highly adoptable maternal health information system (Bervell & Al-Samarraie, 2022).

METHOD

This study employed a descriptive quantitative research design utilizing a survey approach, a method widely validated for conducting needs assessments in health informatics (O'Connor et al., 2021; Novillo-Ortiz et al., 2022). The research was conducted in the working area of Ujungpangkah Public Health Center, located in Gresik Regency, East Java. Ujungpangkah is predominantly a coastal sub-district, which provides a highly relevant setting for assessing infrastructural and geographical challenges in rural healthcare delivery (Zurovac et al., 2023).

The target population comprised frontline maternal healthcare providers. A purposive sampling technique was employed to ensure that the respondents had direct, daily involvement with maternal health data management in remote settings (Londa et al., 2022). A sample of 8 respondents was selected, consisting of 7 village midwives and 1 primary healthcare staff member.

Data collection was conducted using a structured questionnaire, "Eksplorasi Context of Use Aplikasi Kesehatan Maternal." The development of the questionnaire was guided by standard User Experience (UX) and systems engineering frameworks to capture specific usability metrics (Nielsen, 2021; Istepanian & Al-Safir, 2022). The domains assessed included current recording workflows, perceived obstacles, hardware limitations, and specific functional requirements for future applications. The data were tabulated and analyzed using descriptive statistics to map the frequency and distribution of responses

(Santoso & Setiawan, 2024; Londa et al., 2022).

RESULTS

Demographic Profile and Current Workflows

The respondents represent a highly experienced cohort, with 87.5% possessing over 6 years of professional experience. Geographically, 75% of the respondents provide services in coastal villages. These topographies are historically associated with higher logistical challenges in health data transmission (Jamil et al., 2021). In terms of data management, there is a universal reliance (100%) on manual register books (e.g., standard cohort registers) for the primary recording of maternal data. When reporting to coordinating midwives, 75% of respondents use paper-based methods, while 25% utilize messaging platforms like WhatsApp, reflecting a fragmented transition to digital communication (Susanto et al., 2023).

Operational Bottlenecks and Challenges

The manual data management system presents severe operational inefficiencies. Consistent with literature on manual health surveillance (Rahayu et al., 2023), 62.5% of respondents pointed to the meticulous checking of data completeness as the most time-consuming task. The necessity to manually re-enter data for monthly reports was identified as a primary obstacle by 75% of the users. Most critically, 100% of the respondents reported that effectively monitoring high-risk pregnancies is exceedingly difficult under the current manual paradigm.

Infrastructural Limitations and Functional Requirements

Unstable internet signals were reported by 50% of the respondents. Additionally, constraints such as slow application performance and insufficient storage memory were frequently cited. When reflecting on their previous experiences with existing health applications, 62.5% of respondents noted that the tools were overly complex with too many menus, a common usability flaw in

early mHealth interventions (Mahmood et al., 2022).

The essential functional requirements identified include:

1. **Automation:** 100% need automated monthly report recapitulation.
2. **Data Retrieval:** 100% demand efficient data search features.
3. **Offline Capability:** 75% mandate an offline-first architecture due to network instability (Kurniawan, 2024), and 62.5% require visual data synchronization statuses.
4. **User Interface (UI):** Preference for a minimalist design, larger typography, and formal Indonesian combined with standard medical terminology.

DISCUSSION

The findings of this study highlight a critical intersection between midwifery practice and health informatics in coastal environments. The universal reliance on physical register books and the unanimous difficulty in tracking high-risk pregnancies underscore the urgent need for digital transformation in maternal health monitoring within the Ujungpangkah Public Health Center area. The administrative fatigue caused by manual data re-entry directly impacts the time available for clinical care, corroborating previous studies on the limitations of manual surveillance in developing regions (Sondaal et al., 2022; Ahmadi et al., 2022).

However, the data clearly indicates that simply introducing a digital application is insufficient. The feedback regarding previous applications—specifically their complexity and slow performance—serves as a crucial lesson in user interface (UI) and user experience (UX) design. For senior midwives working in resource-constrained environments, cognitive load must be minimized (Nielsen, 2021; Lestari et al., 2022; Yuliana et al., 2023). Systems that require excessive navigation or feature redundancy will likely face user resistance (Alotaibi & Federico, 2023; Chib et al., 2021).

From an informatics perspective, the most salient finding is the absolute necessity for an "offline-first" system architecture (Istepanian & Al-Safir, 2022). With 50% of the coastal areas in Ujungpangkah experiencing unstable connectivity, an application relying on continuous synchronous connections will inevitably fail (Zurovac et al., 2023). By enabling local data storage (e.g., via SQLite) with automatic background synchronization upon network detection, the system ensures uninterrupted data entry (Kurniawan, 2024; Bervell & Al-Samarraie, 2022).

Furthermore, automating the recapitulation of monthly reports directly addresses the primary operational bottleneck identified by 75% of the users. Automation in health information systems has been proven to significantly enhance the efficiency and accuracy of maternal health surveillance, thereby empowering midwives to focus on clinical interventions for high-risk patients (Agarwal et al., 2021; Ganjali et al., 2023). Future development phases must prioritize iterative prototyping alongside the midwives to ensure these theoretical requirements translate into practical utility (Mechael et al., 2022; Wahyuni & Santoso, 2023).

CONCLUSIONS

This study concludes that the reliance on manual, paper-based reporting in the coastal area of Ujungpangkah imposes a severe administrative burden on village midwives, significantly hindering the efficient monitoring of high-risk pregnancies. To successfully transition to a digital health ecosystem, the development of a maternal health information system must be strictly aligned with local infrastructural realities. Specifically, the proposed application must prioritize an offline-first architecture to mitigate prevalent internet instability, automate monthly report recapitulations to eliminate redundant data entry, and feature a highly simplified, intuitive user interface to minimize cognitive load. Implementing these context-aware functionalities will improve data accuracy and empower midwives to allocate

more time to direct clinical care. Moving forward, future research and software development should employ iterative prototyping directly with these frontline workers, followed by longitudinal evaluations to measure the system's concrete impact on time management and the early detection of maternal risks in resource-constrained environments.

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