

MediMinder: A Mobile Application for Medication Reminder and Expiration Monitoring

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Abstract

Medication non-adherence and the use of expired drugs are persistent health challenges in the Philippines, particularly among elderly patients and individuals managing chronic conditions such as hypertension and diabetes. Limited digital tools tailored to the local healthcare context and the absence of integrated caregiver coordination mechanisms contribute to these risks, underscoring the need for a localized, accessible, and secure mHealth solution.

This study aims to design and develop MediMinder, an mHealth application that enables patients and caregivers to manage medication schedules, monitor drug expiration dates, and coordinate care securely. The platform features automated alerts, expiration monitoring, inventory tracking, and QR code-based caregiver pairing. It also integrates MedCompanion AI, a Google Gemini-powered assistant, for real-time health guidance. The system was developed using the Agile Model across five iterative sprints. Evaluation was conducted with 105 users or caregivers, 7 IT experts, and 4 medical professionals from four barangays in San Fernando, Pampanga, using structured questionnaires based on the ISO/IEC 25010 software quality framework and a 4-point Likert scale.

Evaluation results yielded high ratings across all quality dimensions, with notable mean scores in functional suitability (3.44–3.45), safety features (3.40–3.45), and performance efficiency (3.33). Users, IT experts, and medical professionals consistently rated MediMinder highly for reminder accuracy, safety warnings for expired medications, and overall system reliability.

The findings suggest that MediMinder is an effective and reliable tool for improving medication adherence and patient safety in the Philippine digital health landscape. The application supports UN Sustainable Development Goals SDG 3 (Good Health and Well-Being) and SDG 9 (Industry, Innovation, and Infrastructure), offering a scalable model for community-based digital health intervention.

Keywords: MediMinder, mHealth, Medication Reminder, Expiration Monitoring, Inventory Tracking, Automated Alerts, AI Health Assistant

Introduction

The rapid advancement of mobile health (mHealth) technology has transformed healthcare by enabling systems that automate medication tracking, monitor drug safety, and support patient-caregiver

coordination. Modern digital tools now incorporate features such as automated reminders, inventory tracking, and intelligent health assistants that respond to the specific needs of patients with chronic conditions (Cao et al., 2024). These innovations aim to improve treatment adherence and patient safety by making medication routines more responsive and data-driven (Osterberg & Blaschke, 2005). As the Philippines faces rising rates of chronic illnesses like hypertension and diabetes, evaluating the usability and effectiveness of these digital interventions has become essential (DOH Philippines, 2020; Commission on Population and Development, 2022).

While mHealth technologies hold strong potential to improve health outcomes, their impact largely depends on user acceptance and system reliability. Users, particularly the elderly, may experience challenges such as limited digital literacy, difficulty navigating complex interfaces, or a lack of trust in automated alerts (Delin et al., 2023; Benitez et al., 2024). Following established software quality frameworks such as the ISO/IEC 25010 (ISO, 2011), factors like functional suitability, usability, and reliability significantly influence whether patients and caregivers adopt new health technologies. Assessing these variables provides valuable insights into how users respond to automated systems in home-based care environments.

Recent studies emphasize that the integration of technology in healthcare requires not only technical efficiency but also user-centered design (WHO, 2003). Patients tend to adopt systems when they perceive them as helpful, intuitive, and capable of preventing safety risks like the intake of expired medications. However, barriers such as unstable internet connectivity and the need for secure data sharing between patients and caregivers must be addressed to ensure full acceptance (Delin et al., 2023). Understanding these perceptions is crucial as healthcare moves toward digital infrastructure to support personalized care.

This article reports on the development and evaluation of MediMinder, a mobile application designed to address medication non-adherence and expired drug risks in a localized Philippine healthcare setting, with the aim of improving patient safety and supporting caregivers in managing daily medication routines.

Materials and Methods

This study aims to design and develop MediMinder, a mobile application that facilitates automated medication scheduling, expiration monitoring, and secure caregiver coordination, focusing on its core features, usability, and functionality tailored for patients, caregivers, and healthcare professionals in selected barangays of San Fernando, Pampanga.

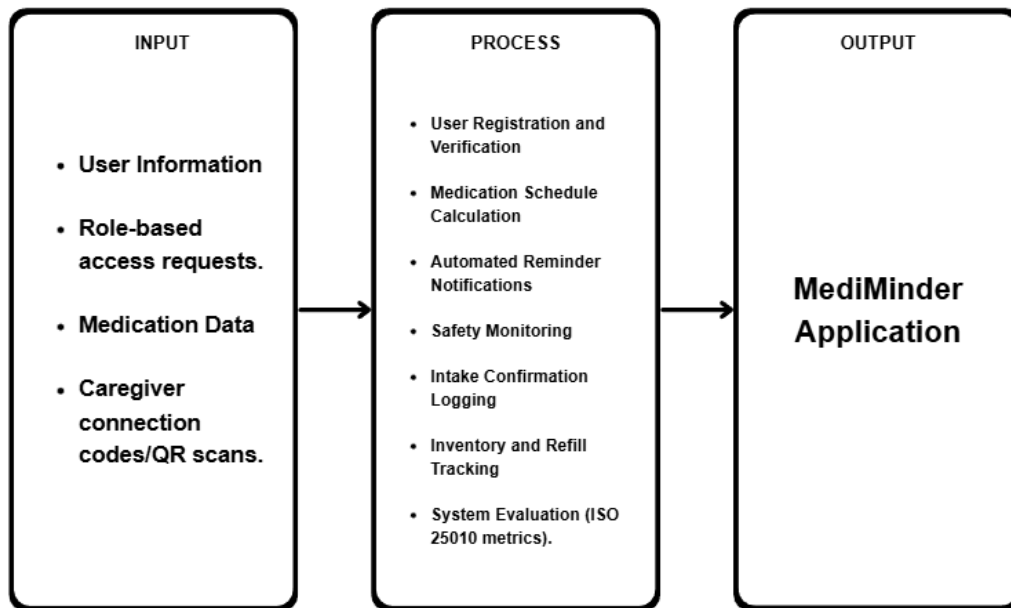


Figure 1. Conceptual Framework (IPO Model) of MediMinder

MediMinder follows the Input-Process-Output (IPO) model, where inputs such as user information, medication data, and secure caregiver connection codes required for account creation are gathered to support system functions. These inputs undergo processes including schedule calculations, automated notification delivery, expiration tracking, and safety monitoring, as well as evaluation using ISO/IEC 25010 quality metrics. The outputs represent the fully evaluated MediMinder Application, functioning as a tangible tool to improve medication adherence metrics, reduce expired drug risks, and enhance caregiver coordination, with user feedback guiding continuous improvement.

Methods

This study employed a quantitative descriptive research design to guide the development, pilot testing, and evaluation of MediMinder. The quantitative component utilized structured evaluation instruments based on the ISO/IEC 25010 software quality framework, administered to patients, caregivers, IT experts, and medical professionals who evaluated the application after use. These instruments quantitatively measured functional suitability, performance efficiency, reliability, security, interaction capability, and maintainability of the platform. This approach ensured that MediMinder was both contextually relevant and rigorously evaluated for usability, reliability, and adoption potential.

System Development Methodology

The MediMinder platform was developed using the Agile Model within the System Development Life Cycle (SDLC) for its iterative and flexible approach, enabling continuous feedback and improvements. Development began with requirement gathering from patients, caregivers, and IT experts to identify core features such as medication scheduling, expiration monitoring, inventory tracking, and the AI-based MedCompanion assistant. Requirements were refined and implemented in short iterative cycles over an 8-week timeline, with prototypes reviewed and improved based on stakeholder feedback. Each of the five sprints focused on specific components, from core authentication and scheduling logic to safety integration

and caregiver connection systems, with testing integrated into every iteration to ensure functionality, usability, and reliability.

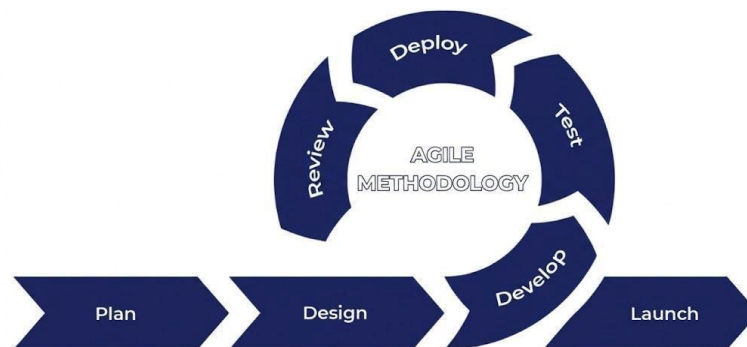


Figure 2. System Development Methodology

Participants

Participants were drawn from four selected barangays in San Fernando, Pampanga: San Juan, San Jose, Dolores, and Maimpis, based on their relevance as communities with accessible healthcare and high population density. The study involved 105 users or caregivers, 7 IT experts, and 4 medical professionals. Purposive sampling was used for the technical and medical experts, while convenience sampling was applied for the user cohort. This sampling approach captured firsthand experiences in medication management and caregiver coordination, representing diverse patient profiles, digital familiarity levels, and healthcare needs, allowing for a comprehensive assessment of the platform's usability, practicality, and relevance.

Research Instrument

MediMinder was evaluated using a quantitative approach. Quantitative data from system testing and post-use surveys based on the ISO/IEC 25010 software quality model assessed functional suitability, performance efficiency, reliability, security, interaction capability, flexibility, and maintainability. Each item was measured using a 4-point Likert scale ranging from 1 (Strongly Disagree) to 4 (Strongly Agree). To ensure the accuracy of health-related content within the integrated Medical FAQ, the questionnaire was reviewed and validated by medical professionals prior to distribution. Data were analyzed using descriptive statistics, including mean and standard deviation, to provide measurable insights into the system's performance and user satisfaction.

Data Collection Procedure and Analysis

A formal request for institutional approval was secured prior to data collection, and ethical compliance was ensured through informed consent from all participants. Following the application's development and pilot testing phase, structured survey questionnaires based on the ISO/IEC 25010 framework were distributed via Google Forms to users, IT experts, and medical professionals to assess usability and performance. Survey data were analyzed using mean and standard deviation on a 4-point Likert scale, generating measurable insights into the system's performance and user satisfaction. This quantitative approach provided both statistical clarity and practical insights into MediMinder's effectiveness as an mHealth solution for medication management.

Result and Discussion

The MediMinder system is designed with a secure architecture and a suite of integrated features that collectively support efficient, transparent, and data-driven medication management and caregiver coordination. Its architecture combines modular components that work together seamlessly, ensuring reliability, data security, and ease of use for both patients and caregivers. Each feature—from automated medication scheduling and expiration monitoring to QR code-based caregiver pairing, inventory tracking, and AI-powered health guidance—addresses specific challenges commonly encountered in managing medication adherence and preventing expired drug intake. By presenting both the overall system framework and its key functionalities, this section highlights how MediMinder improves coordination, minimizes medication risks, and promotes safer health practices within the community.

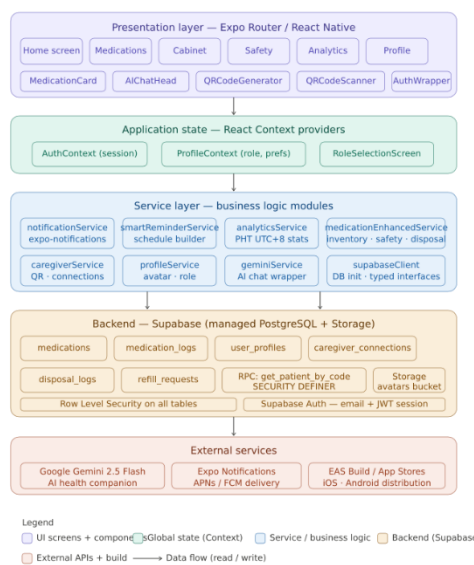


Figure 3. System Architecture of MediMinder

The System Architecture of MediMinder illustrates the interaction between system users, the mobile application, and the backend database. The system serves two primary user types: the Patient, who manages and logs their own medications, and the Caregiver, who monitors a connected patient's adherence in read-only mode. Both user types interact with the MediMinder mobile application, built on Expo and React Native and deployed on iOS and Android. The application handles authentication, medication management, dose logging, caregiver connectivity via QR code, analytics, safety monitoring, and push notifications. All data operations are securely stored in a Supabase-managed PostgreSQL database protected by Row Level Security policies, with SECURITY DEFINER RPC functions enabling cross-user lookups for the caregiver system. The AI Companion module queries the Google Gemini 2.5 Flash API, while push reminders are delivered through APNs and FCM. This architecture ensures efficient data flow, secure multi-role access, and scalable medication management across users.

System Evaluation Results

Table 1. Users' and IT/Medical Professionals' Evaluation on Functional Suitability and Safety of the MediMinder Application

Characteristics	Mean	SD	Verbal Interpretation
Users' Evaluation on Functional Suitability.	3.44	0.55	Very High
Users' Evaluation on Safety.	3.40	0.51	Very High
Users' Evaluation on Performance Efficiency.	3.33	0.56	Very High
IT/Medical Professionals' Evaluation on Functional Suitability.	3.45	0.50	Very High
IT/Medical Professionals' Evaluation on Safety.	3.45	0.51	Very High
Grand Mean:	3.41	0.53	Very High

The ISO/IEC 25010 evaluation of MediMinder yielded a grand mean of 3.41 (SD = 0.53), interpreted as "Very High." Users and IT/medical professionals consistently rated the system highly across functional suitability, safety features, and performance efficiency, confirming that MediMinder is a reliable, efficient, and well-designed platform for medication management and patient safety in the Philippine healthcare context.

Table 2. Users' and IT/Medical Professionals' Evaluation on Reliability, Interaction Capability, and Maintainability of the MediMinder Application

Characteristics	Mean	SD	Verbal Interpretation
Users' Evaluation on Reliability.	3.35	0.55	Very High
Users' Evaluation on Interaction Capability (Usability).	3.44	0.54	Very High
Users' Evaluation on Maintainability.	3.41	0.54	Very High
IT/Medical Professionals' Evaluation on Reliability.	3.42	0.56	Very High
IT/Medical Professionals' Evaluation on Interaction Capability.	3.45	0.52	Very High
Grand Mean:	3.41	0.53	Very High

Table 2 presents the evaluation scores for Reliability, Interaction Capability (Usability), and Maintainability as assessed by users and IT/medical professionals. Both user groups consistently rated MediMinder as "Very High" across all dimensions, with grand means of 3.41 (SD = 0.53), confirming the platform's overall reliability, ease of use, and maintainability.

Limitations and Future Work

Despite its promising results, MediMinder has several limitations that should be acknowledged. First, the study was conducted with a relatively small and geographically constrained sample of 105 users or caregivers drawn from only four barangays in San Fernando, Pampanga, which may limit the

generalizability of findings to broader Philippine populations and other cultural contexts. Second, the cross-sectional evaluation design captures user perceptions at a single point in time, and no longitudinal data were collected to assess the sustained impact of MediMinder on actual medication adherence rates or health outcomes. Third, the application's full functionality depends on stable internet connectivity, which remains a significant barrier in some rural and underserved communities in the Philippines. Finally, the 4-point Likert scale, while appropriate for the study's scope, does not capture the full nuance of user experience, and qualitative data such as open-ended feedback could enrich the findings.

Future work should prioritize expanding the deployment of MediMinder to a wider geographic coverage, including rural barangays and other provinces, to validate the system's scalability and cross-cultural applicability. Longitudinal studies tracking medication adherence and clinical outcomes over six to twelve months would strengthen the evidence base for MediMinder's real-world effectiveness. Additionally, future development should explore offline functionality to address connectivity challenges, integration with electronic health records (EHR) systems in public health facilities, and multi-language support to serve diverse linguistic communities in the Philippines. The MedCompanion AI module could also be enhanced with larger, more specialized medical knowledge bases and validated clinical guidelines to improve the accuracy and reliability of AI-generated health advice.

Conclusion

This study successfully developed MediMinder, a mobile application for medication reminder and expiration monitoring, through a quantitative descriptive research approach and the Agile system development model. By integrating structured evaluations from IT professionals, medical practitioners, and end-users, the research ensured that the system was both contextually relevant and technically sound. Agile's iterative cycles enabled continuous stakeholder feedback, resulting in a platform that evolved responsively to user needs while maintaining usability, security, and reliability. The platform's core features—including automated medication scheduling, expiration alerts, inventory tracking, QR code-based secure caregiver coordination, and AI-driven health guidance through MedCompanion AI—illustrate the potential of digital technologies to address patient safety challenges in medication management.

Specifically, the MedCompanion AI module underscores the importance of accessible health guidance by providing users with real-time responses to medication-related queries, reinforcing MediMinder's dual role as a functional medication manager and an educational tool for patient safety. The findings affirm that digital innovations, when designed with both user-centered and research-driven approaches, can contribute meaningfully to medication adherence improvement and expired drug risk mitigation. While MediMinder does not fully resolve the systemic issues of medication non-adherence, it establishes a scalable and secure framework that integrates health accountability with caregiver engagement. Ultimately, the study contributes to the discourse on how mobile applications and artificial intelligence can support health system goals by transforming everyday medication routines into safer, more structured health practices, in alignment with UN SDG 3 and SDG 9.

Acknowledgement

The authors would like to express their sincere gratitude to the research adviser and the panel of Information Technology (IT) professionals and medical practitioners whose expert evaluations and technical guidance were essential in refining the MediMinder application.

The authors are also deeply grateful to the barangay officials and the community residents of San Juan, San Jose, Dolores, and Maimpis in the City of San Fernando, Pampanga, for their cooperation and time. Their participation provided the vital insights necessary to make this study possible. Finally, the authors thank their families and friends for their unwavering support and encouragement throughout the development of this project.

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