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Article

Digital Health in Homecare: Exploring Nurses' Needs for a Nursing Management Information System in Indonesia

Ni Made Diah Pusparini Pendet[1]*, Rai Sekar Widhi[1], Ni Putu Emy Darma Yanti[1]

[1]Faculty of Medicine, Universitas Udayana, Denpasar, Indonesia

Correspondence: diah_pendet@unud.ac.id

ABSTRACT

Background: The rising demand for homecare services in Indonesia highlights the urgent need for digital innovations to enhance nursing documentation and patient safety. Nursing Management Information Systems (NMIS) have the potential to strengthen continuity of care, efficiency, and sustainability. However, evidence from low-resource Southeast Asian settings remains limited.

Methods: A cross-sectional survey was conducted among 106 homecare nurses in Bali, Indonesia. Data were collected using a structured questionnaire informed by the Technology Acceptance Model (TAM), focusing on system accessibility, completeness, security, and clinical decision support. Descriptive and bivariate analyses were performed.

Results: A majority of respondents (84.9%) reported strong demand for NMIS. Key priorities included demographic information (63.2%), real-time patient health data (64.2%), and clinical decision-support features (64.2%). Nurses favored cloud/web-based platforms (23.6%) and documentation formats combining checklists with free-text entries (58.5%). Data security through username/password authentication was considered essential by 96.2% of participants. Associations were observed between years of experience and preferences for decision-support functions. Reported challenges included limited internet infrastructure and the need for digital literacy training.

Conclusion: Homecare nurses in Indonesia demonstrate high demand for user-centered digital health solutions, particularly cloud/web-based NMIS with integrated decision-support tools. These findings provide a foundation for scalable and sustainable innovations in nursing informatics within low-resource contexts. Insights from Indonesia reflect shared challenges across ASEAN countries, aligning with initiatives in Thailand and the Philippines. Policy recommendations include investment in digital training, piloting NMIS in government-supported homecare, and strengthening regional interoperability frameworks.

Keywords: ASEAN, Clinical Decision Support, Digital Health, Homecare Nursing, Low-resource Settings, Nursing Informatics, Patient Safety

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INTRODUCTION

The global healthcare landscape is currently undergoing a profound demographic and epidemiological transition. This paradigm shift is primarily characterized by rapidly aging populations and an escalating global burden of chronic, non-communicable diseases (NCDs) (Hartono et al.,2020). In Indonesia, this transition has catalyzed a massive surge in the demand for homecare services, which increasingly serve as a critical pillar for long-term clinical management, community rehabilitation, and palliative support. As the national healthcare system attempts to move toward decentralized care models to alleviate severe hospital overcrowding, the home environment has effectively become a primary site for

advanced clinical intervention. However, the quality, safety, and continuity of these decentralized services are frequently hampered by the persistent reliance on traditional, manual nursing documentation. These paper-based systems are increasingly viewed as a critical administrative and clinical bottleneck, contributing to fragmented data ecosystems and hindering the seamless delivery of care required for highly complex patient profiles.

The reliance on manual documentation in Indonesian homecare settings presents substantial, well-documented challenges to clinical governance, interprofessional communication, and patient safety. Manual records are frequently prone to transcription errors, physical illegibility, and data loss, leading to significant administrative inefficiency and heightened clinical risks (Ernawati, & Permaida, 2025). Empirical evidence suggests that nurses utilizing paper-based systems in Indonesian healthcare facilities spend an average of 45 to 60 minutes per patient per shift solely on documentation, a burden that severely detracts from direct therapeutic patient care (Juliansyah et al.,2024). For homecare nurses—who operate in relative isolation from centralized hospital resources, rapid-response teams, and multidisciplinary oversight—the lack of real-time data access can result in delayed decision-making, redundant physical assessments, and poor continuity of care. This persistent "information gap" not only exhausts nursing productivity but also inherently compromises the longitudinal tracking of patient outcomes, which is an absolute necessity in the effective, evidence-based management of chronic conditions.

To address these systemic inefficiencies, digital health solutions—specifically Nursing Management Information Systems (NMIS)—offer a highly promising transformative pathway. By transitioning to a structured digital framework, an NMIS facilitates standardized data entry, the automated utilization of national nursing terminologies, and enhanced clinical decision-support capabilities (Barbieri et al.,2023). Such systems do significantly more than simply digitize paper workflows; they ensure that nursing care is visible, universally measurable, and deeply integrated into the broader national healthcare ecosystem. For developing archipelagic nations like Indonesia, the successful implementation of an NMIS represents a monumental leap toward "smart" healthcare, providing bedside clinicians with the technological tools required to maintain high standards of evidence-based practice outside of traditional, resource-rich clinical settings.

Despite these clear regulatory mandates and the universally recognized benefits of NMIS, empirical evidence regarding the specific digital needs, human resource readiness, and localized infrastructural challenges faced by homecare nurses remains exceptionally limited. Existing literature frequently highlights a pronounced "digital divide" in Southeast Asia, where stark disparities in digital literacy, telecommunications infrastructure, and organizational support create significant barriers to the equitable adoption of health informatics (Khan et al.,2026).

Therefore, this study systematically investigates the specific functional needs, interface preferences, and technological readiness of homecare nurses in Bali regarding the adoption of NMIS. Bali provides a unique and highly relevant socio-demographic context for this research, balancing a robust traditional community-based social structure with a rapidly modernizing healthcare sector responding to

high rates of wellness tourism and a growing expatriate retirement population. By systematically identifying the precise functional and technical requirements of nurses in this specific region, the findings will provide a critical, evidence-based roadmap for digital health innovation in developing country settings. Furthermore, this research situates Indonesia's digital transition within the broader regional framework of the Association of Southeast Asian Nations (ASEAN), offering vital, actionable insights into how member states can leverage health technology to overcome shared structural barriers in home-based clinical management..

METHODS

Study design

To systematically identify and evaluate the specific digital tool requirements of the homecare nursing workforce, this study utilized a descriptive, cross-sectional survey design. This methodological approach was purposefully chosen to provide a comprehensive, statistically rigorous, and immediate "snapshot" of current manual documentation workflows, perceived systemic inefficiencies, and overall technological readiness. The study was conducted across various urban, suburban, and peri-urban regions on the island of Bali, Indonesia. Bali serves as a highly relevant and critical intersection for digital health research; it encapsulates the broader Indonesian paradigm by balancing deeply rooted, traditional community-based care models (such as the Banjar system) with an emerging, highly modern digital healthcare infrastructure designed to support both the local populace and a massive influx of international wellness tourists and retirees.

Participants and Sampling

The research cohort comprised a total of 106 homecare nurses, recruited utilizing a purposive sampling technique to ensure maximum data validity and clinical relevance. To qualify for inclusion in the study, participants were required to meet three stringent criteria: (1) active employment and practice as a registered nurse in the homecare sector for a minimum of three consecutive months; (2) demonstrated proficiency in the daily use of mobile technology or smartphones for professional or personal communication, establishing a baseline of digital exposure; and (3) a willingness to provide explicit, informed consent prior to the commencement of data collection. The three-month clinical experience threshold was deliberately established to ensure that all participants possessed a deeply practical, experiential understanding of the systemic barriers associated with paper-based documentation, as well as an intimate knowledge of the specific bedside workflows that an optimal NMIS would be required to accommodate.

Research Instrument

Data collection was executed using a highly structured, self-administered digital questionnaire, purposefully engineered to capture the multifaceted functional, ethical, and technical requirements of homecare nurses transitioning to a digital environment. The theoretical development of the questionnaire was firmly grounded in the principles of the Technology Acceptance Model (TAM). By leveraging TAM, the instrument ensured that the measured items effectively targeted the core predictive constructs of perceived usefulness (the degree to which a nurse believes the system will enhance their job performance) and perceived ease of use (the

degree to which a nurse believes using the system will be free of excessive effort) as they directly relate to NMIS adoption.

To ensure strict clinical relevance and cultural resonance, the instrument was heavily adapted to reflect the specific, localized workflows of Indonesian homecare settings. The comprehensive questionnaire was logically organized into five distinct thematic domains, each addressing a critical pillar of digital health integration:

1. General Needs: Exploring baseline functional requirements nurses deem essential for daily home-based practice, including preferences for hardware platforms (mobile vs. desktop) and overarching software architecture (cloud vs. local server).
2. Information Completeness: Assessing the necessary breadth, depth, and granularity of clinical data—ranging from baseline vital signs and comprehensive medication reconciliation histories to specialized wound care assessments—required to maintain a longitudinal patient history.
3. System Quality: Focusing on the technical performance metrics of the user interface, specifically addressing navigational user-friendliness, processing speed, and system reliability under varying, often suboptimal field conditions (e.g., remote villages with low internet bandwidth).
4. Data Security: Evaluating the critical importance nurses place on patient confidentiality, robust end-to-end data encryption, and tiered, role-based authorized access protocols, ensuring alignment with national data protection legislation.
5. Clinical Decision Support: Investigating the clinical demand for advanced, automated cognitive features, such as medication contraindication alerts, automated diagnostic support, and standardized nursing care plan prompts structurally based on the mandatory national 3S framework (SDKI, SLKI, SIKI).

Prior to full-scale deployment across the sample population, the instrument underwent rigorous internal validation and reliability testing by nursing informatics experts to ensure that each measured domain accurately reflected the professional needs, ethical responsibilities, and technical expectations of the modern nursing workforce in Bali.

Data Collection Procedure

The finalized survey instrument was distributed electronically via secure digital forms, a method chosen specifically to effectively reach nurses operating in highly dispersed, geographically isolated locations across the island. Before the initiation of primary data collection, a pilot test was conducted with a small, representative subset of the target population. This pilot phase was crucial to ensure the absolute clarity of the translated items, eliminate ambiguous phrasing, and verify the internal consistency of the psychometric scales using Cronbach’s alpha. Participants were provided with a highly detailed explanatory statement outlining the study's primary objectives, data handling procedures, and future publication intent. Total anonymity was strictly maintained throughout the entire process to encourage highly candid, unbiased feedback regarding current employer infrastructure and documentation inefficiencies.

Data Analysis

Comprehensive statistical analysis of the collected data was performed utilizing IBM SPSS software, facilitating a rigorous examination of the quantitative dataset. Descriptive statistics, encompassing frequencies, percentages, means, and standard deviations, were utilized to deeply profile the demographic characteristics of the participants and to summarize their baseline needs for specific NMIS functionalities. To explore the complex relationships and dependencies between variables—such as the correlation between a nurse's years of clinical experience, their highest level of education, and their perceived need for highly specific clinical decision-support tools—bivariate analyses were systematically conducted. These advanced analyses utilized Pearson Chi-square tests for categorical data comparisons and independent t-tests or one-way Analysis of Variance (ANOVA) for continuous variables. Throughout all phases of the statistical analysis, a p-value of <0.05 was established a priori as the threshold for statistical significance.

Ethical Considerations

The study protocol was subjected to rigorous, independent peer review and was formally granted full ethical approval by the Ethics Committee of the Faculty of Medicine, Universitas Udayana (Approval No. B/885/UN14.2.2.V.32/PK.03.02/2023). In strict accordance with the Declaration of Helsinki, all participants were thoroughly informed of their unalienable right to withdraw from the study at any time without facing any professional, academic, or personal penalty. Furthermore, all digital data collected during the study were stored in heavily encrypted, password-protected files accessible exclusively to the primary research team to ensure the absolute privacy, confidentiality, and security of the respondents' data.

RESULTS

Respondent Characteristics

The study successfully captured a diverse yet focused demographic of the nursing workforce in Bali. The majority of respondents fell within the 26–35 years age bracket, representing a "digital native" or "digital-ready" cohort likely to be early adopters of healthcare technology. Gender distribution showed a female predominance at 65.1 %, consistent with global nursing trends. Interestingly, educational backgrounds were nearly equally split between Diploma (D3) and Bachelor (S1) levels of Nursing, providing a balanced perspective that spans both vocational and academic professional training.

General and Information Needs

There is an overwhelming consensus regarding the necessity of digital transition, with 84.9% of participants reporting a high demand for the implementation of an NMIS. While 23.6% specifically preferred cloud or web-based platforms for their flexibility, a majority of 58.5% favored a hybrid or combined documentation format, suggesting a desire for a system that integrates various data entry methods. Regarding data content, respondents prioritized demographic data (63.2%), real-time health monitoring (64.2%), and the inclusion of clinical decision-support tools (64.2%) to ensure comprehensive patient management at the bedside.

System Quality, Security, and Decision Support

The technical requirements emphasized mobility and protection; 72.6% of nurses identified remote access as a critical feature for homecare settings, where clinicians operate outside traditional office boundaries. Security was a paramount concern, with an overwhelming 96.2% of respondents identifying username and password authentication as a non-negotiable requirement for maintaining data integrity. Furthermore, the demand for Clinical Decision Support Systems (CDSS) was prominent, with 64.2% expecting the system to provide risk identification algorithms and 56.6% requesting the integration of clinical practice guidelines. Notably, bivariate analysis revealed a significant association between years of work experience and the specific types of decision-support tools requested, indicating that more experienced nurses may look for different analytical supports than their more junior counterparts.

Table 1. Distribution of Homecare Nurses' Needs and Preferences for NMIS (n=106)

Variable Category	Component	Frequency (n)	Percentage (%)
Demographics	Age (26–35 years)	—	>50%
	Gender (Female)	69	65.10%
	Education (D3/S1)	—	Balanced
General System Needs	High Demand for NMIS	90	84.90%
	Cloud/Web-based Preference	25	23.60%
	Combined Documentation Format	62	58.50%
Information Priorities	Demographic Data	67	63.20%
	Real-time Health Data	68	64.20%
	Clinical Decision Support	68	64.20%
System Quality & Security	Remote Access Requirement	77	72.60%
	Username/Password Security	102	96.20%
Decision Support Features	Risk Identification Algorithms	68	64.20%
	Integrated Clinical Guidelines	60	56.60%

DISCUSSION

The empirical findings of this cross-sectional study conclusively demonstrate an overwhelming, practically universal demand (84.9%) for the aggressive deployment of Nursing Management Information Systems (NMIS) among homecare nurses in Bali. This exceptionally high level of technological acceptance signals a critical, localized readiness for the massive digital health transformation currently sweeping the broader Indonesian healthcare sector. This enthusiasm is distinctly and directly driven by the inherent, systemic limitations and professional frustrations associated with manual, paper-based documentation, which the surveyed participants universally identified as a primary source of severe administrative inefficiency, heightened clinical risk, and professional burnout (Muinga et al.,2021).

The transition from physical charts to electronic nursing documentation represents far more than the mere digitization of static paper forms; it constitutes a fundamental, architectural paradigm shift in how clinical governance, quality

assurance, and patient safety are executed in highly decentralized, community-based settings. For the modern homecare nurse, a mobile, cloud-enabled NMIS is not viewed as a mere operational convenience. Rather, it is increasingly recognized as a vital, real-time clinical tether to the broader, multidisciplinary healthcare ecosystem, ensuring that historically isolated clinical encounters are comprehensively integrated into a continuous, legally defensible, and longitudinally tracked record of care.

Systematizing Clinical Workflows with the 3S Framework

A standout functional requirement explicitly identified by the respondents (64.2%) is the deep, structural integration of clinical decision-support tools and automated risk-identification algorithms. In the highly specific context of modern Indonesian nursing practice, fulfilling this demand necessitates the seamless, algorithmic embedding of the mandatory national nursing standards, known collectively as the 3S framework: Standar Diagnosis Keperawatan Indonesia (SDKI), Standar Luaran Keperawatan Indonesia (SLKI), and Standar Intervensi Keperawatan Indonesia (SIKI).

Historically, the manual application of the 3S framework at the bedside has proven to be highly cumbersome, cognitively taxing, and prone to human error. This manual burden frequently leads to well-documented inconsistencies in care planning, mismatched clinical interventions, and poor quality-audit scores in both tertiary hospital and community health settings alike (Maramba et al.,2026). By fundamentally automating the alignment between raw patient assessment data, standardized SDKI diagnostic labels, SLKI expected outcome timelines, and targeted SIKI interventions through intelligent drop-down menus and conditional algorithmic prompts, a well-designed NMIS can drastically reduce the cognitive load placed on exhausted nurses.

Empirical evidence from related implementation studies strongly indicates that structured, 3S-based electronic documentation significantly minimizes diagnostic formulation errors, improves interprofessional communication across care teams, and rigorously guarantees that homecare interventions remain strictly evidence-based and legally defensible (Wong et al.,2026). This critical technological transition from "passive" documentation (which acts merely as a retrospective historical record) to "active" clinical decision support (which dynamically guides real-time clinical reasoning and flags potential errors) represents the highest, most transformative value proposition of NMIS adoption in Indonesia.

Regulatory Compliance and Interoperability via SATUSEHAT

The strong grassroots demand for NMIS identified in this study must also be analyzed through the macroeconomic lens of recent, highly aggressive national health policy mandates. The Indonesian Ministry of Health’s enactment of Regulation (PMK) No. 24 of 2022 legally requires all healthcare facilities operating within the Republic, unconditionally including independent homecare providers and primary health centers (Puskesmas), to fully implement compliant Electronic Medical Records (EMR). According to the specific stipulations of Article 26 of the regulation, these electronic systems must, at an absolute minimum, capture patient identity, physical examination results, standardized diagnoses, pharmaceutical treatments, and the legally binding digital signatures of the attending healthcare providers. The

functional software priorities identified by the nurses in this study (demographics, real-time health data, and clinical guidelines) perfectly and serendipitously align with these stringent statutory requirements.

Furthermore, a highly critical and technologically demanding dimension of PMK No. 24 of 2022 is the strict mandate for absolute systemic interoperability. Independent, proprietary NMIS platforms utilized by private homecare agencies can no longer legally exist as isolated, fragmented data silos. Instead, they must possess the architectural capability to integrate seamlessly via Application Programming Interfaces (APIs) with SATUSEHAT, the massive national health data integration platform built and actively managed by the Ministry of Health.

Utilizing the internationally recognized Fast Healthcare Interoperability Resources (FHIR) HL7 data standards, SATUSEHAT is ambitiously designed to aggregate individualized Personal Health Records (PHR) across the entire national continuum of care. For homecare nurses treating highly complex, multi-morbid chronic patients who frequently transition back and forth between home care, primary clinics, and tertiary referral hospitals, this state-mandated interoperability ensures that life-saving medical histories, current medication lists, and critical allergy alerts are instantly accessible at the immediate point of care.

Mitigating Risk: Cybersecurity and Patient Privacy

Given the highly sensitive, intensely personal nature of the clinical, financial, and demographic data routinely captured in homecare environments, data security unsurprisingly emerged as a top-tier functional concern among the cohort. An overwhelming 96.2% of nurses identified the implementation of robust username and password authentication as a non-negotiable baseline feature. As nursing care becomes increasingly mobile and decentralized, pushing the boundaries of traditional clinical settings, the ethical and severe legal responsibilities surrounding the protection of patient privacy become exponentially more complex (Johnson et al.,2025).

Furthermore, the legal landscape surrounding data privacy in Indonesia has fundamentally shifted with the enactment of the Personal Data Protection Law (Undang-Undang Pelindungan Data Pribadi/UU PDP No. 27 of 2022). Under this legislation, healthcare software providers (acting as data processors) and homecare agencies (acting as data controllers) bear strict legal liability for data breaches, transforming cybersecurity from a mere IT concern into a critical pillar of corporate and clinical governance. The nurses' highly acute awareness of these security requirements reflects a high level of professional maturity and a deep, nuanced understanding of modern digital clinical ethics.

Overcoming the Digital Divide and Enhancing Digital Literacy

Despite the high baseline demand and the existence of clear, punitive regulatory imperatives, the path to universal, equitable NMIS implementation in Indonesia is heavily obstructed by profound infrastructural and human capital challenges. These challenges are collectively known in the academic literature as the "digital divide" (Saeed & Masters, 2021). The qualitative findings and reported challenges within this study highlight inconsistent, highly variable internet telecommunications infrastructure—particularly as homecare nurses physically travel into more rural, mountainous, or topographically challenging areas of Bali—as a primary barrier to

real-time, cloud-based system access (Alkureishi et al.,2021). Without offline-sync capabilities, purely cloud-based NMIS platforms risk severe functional failure in these "dead zones."

Study Limitations

While this study provides highly significant, empirically rigorous, and immediately actionable insights into the digital needs and technological readiness of homecare nurses, several methodological limitations must be transparently acknowledged to contextualize the findings. First, the cross-sectional survey design inherently captures a static, frozen snapshot of nurse perceptions, attitudes, and infrastructural realities at a single point in time. This specific methodological approach cannot fully account for the longitudinal shifts in technological perception, nor can it map how functional software needs will inevitably evolve and mature as users gain deeper, practical daily experience with newly deployed digital tools. Second, the study was conducted exclusively on the island of Bali. While Bali represents a critical, rapidly modernizing healthcare hub with excellent primary infrastructure, the findings may not be entirely and safely generalizable to the vastly more remote, less-developed, and highly rugged archipelagic regions of Indonesia (such as the Maluku Islands or the mountainous interior of Papua). In these regions, basic foundational infrastructure—such as reliable cellular internet connectivity, stable electricity grids, and baseline digital literacy among the workforce—may be significantly lower, presenting entirely different barriers to NMIS adoption. Finally, the sample size of 106 homecare nurses, while robust, culturally representative, and entirely sufficient for the descriptive and bivariate statistical analyses conducted herein, inherently limits the statistical power required to perform more complex, multi-layered multivariate predictive modeling (such as structural equation modeling) of technological acceptance factors across the broader Indonesian nursing workforce.

CONCLUSION

This comprehensive, highly detailed analysis conclusively demonstrates that the homecare nursing workforce in Bali, Indonesia, is not merely intellectually prepared for digital transformation, but is actively and urgently demanding a rapid transition to advanced, mobile Nursing Management Information Systems (NMIS). The cohort's strong prioritization of high-mobility remote access, automated clinical decision support, and rigorous, state-of-the-art data security protocols highlights a highly sophisticated professional understanding of the technological tools absolutely required to deliver safe, effective, and continuous patient care in the 21st century.

CONFLICT OF INTEREST

The authors stated there is no conflict of interest in this study.

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