User Satisfaction with Digital Pharmacy Information Systems among Healthcare Professionals: A Systematic Review

Annisaul Karimah Syarifuddin[1], Susi Ari Kristina[2*], and Trung Quang Vo[3]

[1] Master Program in Pharmacy Management, Faculty of Pharmacy, Universitas Gadjah Mada, Yogyakarta, Indonesia
[2] Department of Pharmaceutics, Faculty of Pharmacy, Universitas Gadjah Mada, Yogyakarta, Indonesia
[3] Social and Administrative Pharmacy Division, Pham Ngoc Thach University of Medicine, Ho Chi Minh City, Vietnam
susiari_k@ugm.ac.id

Abstract. The usability evaluation of digital pharmacy information systems is crucial for their successful adoption and sustained use in healthcare settings. Although previous systematic reviews have addressed this topic, gaps remain in understanding the influence of recent developments, including e-prescribing and telepharmacy, on user satisfaction and system effectiveness. This systematic review synthesizes 10 studies published between 2014 and 2025 and focuses on recent digital pharmacy systems used by healthcare professionals. It examines user experience, satisfaction, and system effectiveness in supporting interaction and decision-making. The included studies were grouped into quantitative assessments using mean scores and standard deviations, statistical analyses using significance testing, and heuristic evaluations using severity scoring. The studies were conducted in Sudan, Algeria, India, Austria, France, the Netherlands, the United States, Turkey, and the United Kingdom and employed cross-sectional, retrospective, qualitative, mixed-method, and expert consensus designs. Sample sizes ranged from 15 to 1,391 participants. A sensitivity analysis was conducted to assess the potential influence of sample-size variation on the findings. Overall, the studies reported favorable usability, particularly in satisfaction, efficiency, and effectiveness. Reported Cronbach's alpha values ranged from 0.70 to 0.92, indicating acceptable to strong internal consistency.

Keywords: Usability, Heuristic Evaluation, E-Prescribing, Telepharmacy, System Usability Scale.

1 Introduction

Digital pharmacy information systems (DPIS) support medication management, electronic prescribing, telepharmacy, clinical decision support, dispensing workflows, and access to pharmaceutical care. Their successful implementation depends not only on

© The Author(s) 2026
V. D. S. Handayani et al. (eds.), *Proceedings of the 6th International Conference on Bioinformatics, Biotechnology, and Biomedical Engineering (BIOMIC 2025)*, Advances in Health Sciences Research 94,
https://doi.org/10.2991/978-94-6239-762-0_28

technical performance but also on whether healthcare professionals perceive the systems as useful, easy to use, reliable, and compatible with daily practice.

Previous systematic reviews have examined usability and satisfaction in DPIS; however, several gaps remain. Earlier reviews often focused on older e-prescribing technologies, addressed a limited range of digital pharmacy systems, or did not apply standardized usability frameworks. Recent advances in telepharmacy, decision support, and integrated pharmacy information systems have created new user-experience challenges that require updated synthesis.

This review addresses these gaps by synthesizing studies published from 2014 to 2025. The review focuses on contemporary digital pharmacy systems and considers evaluation frameworks such as the System Usability Scale (SUS), the Technology Acceptance Model (TAM), the Unified Theory of Acceptance and Use of Technology (UTAUT), Task-Technology Fit (TTF), and heuristic evaluation approaches.

In addition to system usability, this review recognizes that interoperability, digital literacy, workflow integration, and institutional readiness remain important barriers to the optimal use of DPIS. Understanding these factors is essential for designing user-centered systems that can improve medication safety, service efficiency, and satisfaction across diverse healthcare settings.

2 Methods

2.1 Article Selection

The selection of articles was conducted through a structured and transparent screening process in accordance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) approach. Literature searches were carried out in PubMed, Scopus, and ScienceDirect for publications from January 2014 to April 2025. This period was selected because digital health technologies, including e-prescribing and telepharmacy systems, expanded substantially during this period and shaped modern pharmacy information systems.

A total of 72 records were initially retrieved using controlled keywords and Boolean operators related to usability, digital pharmacy systems, e-prescribing, telepharmacy, System Usability Scale, technology acceptance, and user satisfaction. After one duplicate was removed, 71 unique records remained for title and abstract screening. Records were excluded if they were not original research, did not focus on healthcare professionals, or did not evaluate usability-related outcomes. Twenty full-text articles were assessed for eligibility, and 10 studies fulfilled all eligibility criteria and were included in the final synthesis.

The selected studies covered telepharmacy systems, electronic prescribing platforms, clinical decision support tools, and general pharmacy information systems. The included studies used cross-sectional surveys, mixed-method approaches, observational methods, retrospective audits, qualitative interviews, and expert consensus methods. Article selection and data extraction were performed independently by two reviewers. Discrepancies were resolved through discussion and, when necessary, consultation with a third reviewer.

2.2 Search Strategy

A comprehensive search strategy was used to identify relevant literature. Boolean operators AND and OR were applied to optimize the breadth and precision of the search. Filters were applied to include peer-reviewed articles published in English, and results were sorted by relevance.

The initial search retrieved 72 records: 31 from PubMed, 26 from Scopus, and 15 from ScienceDirect. After duplicate removal, 71 unique records were screened. During screening, 39 articles were excluded because they were not directly relevant to digital pharmacy system evaluation, eight were excluded because they were reviews, editorials, or tool-validation articles only, and four were excluded because they were not conducted in formal healthcare institutions. This process resulted in 20 full-text articles for eligibility assessment and 10 included studies.
The database-specific search terms are presented in Table 1.

Table 1. Search terms used in each database.

Database	Search terms	MeSH or related terms	Search date
PubMed	"Digital Pharmacy Information Systems" OR "Pharmacy Information System" OR e-prescribing OR telepharmacy AND "User Satisfaction" OR usability OR "Technology Acceptance" AND healthcare professionals AND English language AND 2014-2025	Electronic Prescribing; Pharmacy Services; User Satisfaction	April 29, 2025
Scopus	"Pharmacy Information System" OR "e-Pharmacy" OR "Digital Pharmacy System" AND "User Compliance" OR "Technology Adoption" OR "Healthcare Professionals"	Pharmacy Services; User Satisfaction	April 29, 2025
ScienceDirect	"Pharmacy Information System" OR "e-Pharmacy" OR "Digital Pharmacy System" AND "User Compliance" OR "Technology Adoption" OR "Healthcare Professionals"	Pharmacy Information Systems; User Satisfaction	April 29, 2025

2.3 Eligibility Criteria

Eligible studies were peer-reviewed articles written in English that evaluated usability, user satisfaction, user experience, technology acceptance, or adoption of digital pharmacy systems. The systems included e-prescribing platforms, telepharmacy services, clinical decision support systems, and pharmacy information systems.

Only studies involving healthcare professionals, such as pharmacists, physicians, or nurses, as primary users or respondents were included. Quantitative, qualitative, and mixed-method studies were eligible if they assessed usability dimensions, user experience, or satisfaction-related outcomes. Reviews, conference abstracts, editorials, opinion pieces, system-development papers without end-user evaluation, and studies without sufficient usability or satisfaction outcomes were excluded.

2.4 Data Extraction

Data extraction was conducted using a structured and pre-tested extraction form. Extracted information included bibliographic details, study objectives, research questions, study design, methodology, sample size, sampling technique, target population, type of digital pharmacy system, usability outcomes, satisfaction outcomes, and indicators of technology acceptance or adoption.

Data were synthesized descriptively and thematically to identify cross-study patterns, methodological trends, and key findings. This synthesis informed the construction of summary tables and supported the narrative integration of the review findings.

2.5 Data Analysis

Data analysis was conducted descriptively and thematically across the 10 selected studies to evaluate usability and user satisfaction in DPIS. The analysis focused on three areas: quantitative usability scores using mean values and standard deviations; statistical significance testing, mainly p-values, to examine relationships between system features and satisfaction; and heuristic evaluations using severity ratings to identify usability issues such as alert fatigue, system delays, and navigation difficulties.

The wide range of sample sizes, from 15 to 1,391 participants, was considered during synthesis. A sensitivity analysis was performed to assess how sample-size variation could influence the interpretation of findings. This approach helped identify potential bias from small samples while acknowledging that larger samples may increase reliability but reduce contextual detail.

The synthesis also identified recurring usability issues, including limited interoperability, lack of customization, insufficient error-recovery mechanisms, and inconsistent integration with routine pharmacy workflows. These concerns highlight the importance of context-aware and user-centered pharmacy systems that integrate technological advancement with organizational readiness.

3 Results

3.1 Characteristics of Reviewed Literature and Quality Assessment Results

A total of 10 studies were included in the final synthesis. These studies represented diverse healthcare settings, including hospital-based systems, community pharmacies, clinical trial settings, and national or expert consortium contexts. The included studies were conducted in Sudan, Algeria, India, Austria, France, the Netherlands, the United States, Turkey, and the United Kingdom.

The majority of studies used quantitative descriptive designs, particularly cross-sectional surveys and retrospective reviews. Several studies adopted mixed-method approaches by combining structured questionnaires with interviews or expert evaluation to deepen insights into user experience. Validated frameworks and conceptual models included UTAUT, TTF, P-TAM, and heuristic evaluation models.
The PRISMA screening process is shown in Fig. 1.

The quality assessment results for the included studies are summarized in Table 2.

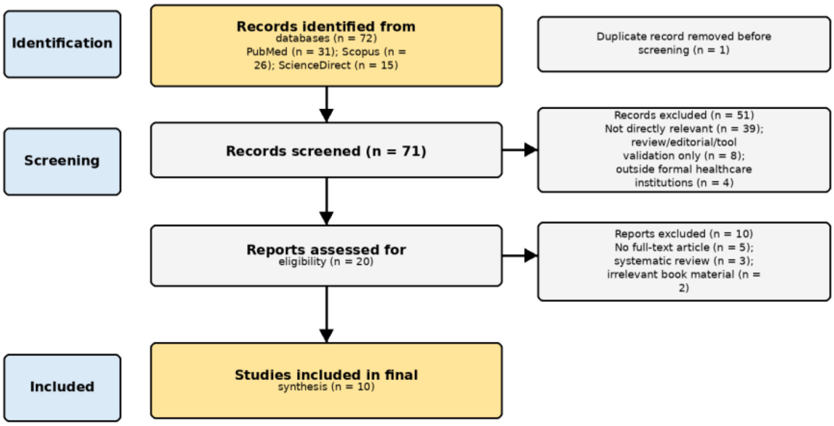

Fig. 1. PRISMA flow diagram.

Table 2. Quality assessment of the included studies.

Study	Design category	Quality assessment result	Interpretation
Abdelkhodir et al., 2025 [1]	Quantitative descriptive	Y, Y, Y, CT, Y	Mostly met; one item unclear
Ait Gacem et al., 2025 [2]	Quantitative descriptive	Y, Y, CT, Y, Y	Mostly met; one item unclear
Apte et al., 2022 [3]	Mixed methods	Y, Y, Y, CT, Y	Mostly met; one item unclear
Apte et al., 2024 [4]	Mixed methods	Y, Y, Y, Y, Y	All criteria met
Blagec et al., 2022 [5]	Mixed methods	Y, Y, Y, CT, Y	Mostly met; one item unclear
Bousquet et al., 2019 [6]	Quantitative descriptive	Y, Y, Y, Y, Y	All criteria met
Campmans et al., 2018 [7]	Quantitative descriptive	Y, Y, Y, CT, Y	Mostly met; one item unclear
Hillblom et al., 2014 [8]	Quantitative descriptive	Y, Y, Y, CT, Y	Mostly met; one item unclear
Sezgin et al., 2014 [9]	Qualitative	Y, Y, CT, CT, Y	Mostly met; two items unclear
Turnbull et al., 2024 [10]	Mixed methods	Y, Y, Y, Y, Y	All criteria met

Y = yes; CT = cannot tell.

3.2 Patterns and Predictors of Satisfaction across Studies

Table 3. Methodology of selected studies.

Study	Setting	Study design	Instrument	Sample size
Abdelkhodir et al., 2025 [1]	Sudan; clinical and academic settings	Cross-sectional	Validated questionnaire from the literature	401
Ait Gacem et al., 2025 [2]	Algeria; community pharmacists	Cross-sectional	UTAUT and TTF model-based instrument	187
Apte et al., 2022 [3]	India; various health settings	Mixed methods	Survey and interview	421
Apte et al., 2024 [4]	India; hospitals and primary care	Mixed methods	Validated questionnaire and interviews	332
Blagec et al., 2022 [5]	Austria; clinical trial setting	Mixed methods	CDS tool and expert user evaluation	23
Bousquet et al., 2019 [6]	France	Guideline implementation	Practice-based structured framework	15
Campmans et al., 2018 [7]	Netherlands; hospital system	Retrospective audit	Drug-confusion alert analysis	1,391
Hillblom et al., 2014 [8]	United States; expert consortium	Forum consensus	AMCP expert panel forum	26
Sezgin et al., 2014 [9]	Turkey; pharmacists	Qualitative	Interview and P-TAM model-based questionnaire	15
Turnbull et al., 2024 [10]	United Kingdom; hospital and community pharmacies	Multi-method	Survey and interview on digital health tool use	243

Overall, higher satisfaction was commonly associated with structured dispensing systems, consistent drug availability, clear communication from pharmacy staff, shorter waiting times, and adequate counseling. Studies using model-based instruments, such as UTAUT and P-TAM, suggested that satisfaction was closely related to perceived usefulness and system ease of use.

Heuristic evaluation studies emphasized the role of alert clarity, information relevance, and workflow compatibility in satisfaction with clinical decision support systems. These findings indicate that technological integration is important, but user satisfaction remains highly dependent on human interaction, system responsiveness, and adaptability to local context.

The methodological characteristics of the included studies are presented in Table 3.

3.3 Human Factors in Digital Pharmacy Systems: Communication and Empathy

Effective communication and empathetic interactions by pharmacists emerged as important determinants of user satisfaction across the reviewed studies. Users expressed higher satisfaction when pharmacists actively listened, provided clear explanations, and established collaborative dialogue. Trust in pharmacy services increased when pharmacists showed personal attention and responsiveness to user needs.

Conversely, dissatisfaction was identified when communication was rushed, minimal, or inconsistent. Such communication problems may lead to confusion, reduced confidence, and poor medication adherence. The implementation of digital systems alone did not improve user experience unless supported by strong interpersonal skills and human-centered service design.

3.4 Counseling and Information Delivery in Digital Pharmacy Systems

Effective communication of medication use, including dosage, risks, and administration instructions, is a cornerstone of pharmaceutical care. Several studies emphasized that inadequate counseling and poor information delivery remain persistent issues in outpatient pharmacy settings. Structured verbal counseling, when supplemented with written information or labeling, may improve user confidence and medication adherence.

Additional barriers included the absence of standardized communication protocols, inconsistent labeling practices, and limited access to private counseling spaces. These factors may reduce users' willingness to seek clarification and can contribute to medication misuse. In digital pharmacy systems, effective information delivery is not merely a technical feature but a human-centered service function that directly influences safety and satisfaction.

3.5 Workflow Optimization in Outpatient Pharmacies

Operational efficiency is a key determinant of satisfaction in outpatient pharmacy services. Several studies reported that delays caused by disorganized workflows, such as bottlenecks in prescription validation, stock retrieval, or labeling, adversely affected user experience. Fragmented manual workflows and limited automation contributed to lower satisfaction in some settings.

Conversely, structured service models improved transparency and reduced turnaround time. Digital tools, including computerized physician order entry and clinical decision support, helped streamline dispensing processes and reduce redundant tasks. Overall, workflow redesign, effective digital integration, and adequate staffing are essential strategies for minimizing delays and enhancing satisfaction.

3.6 Waiting Time and Service Efficiency

Timely service delivery is another central element influencing satisfaction with digital pharmacy systems. Reduced waiting times and efficient service flows were associated with more favorable user perceptions. Organized layouts and streamlined processes were correlated with higher satisfaction scores in several studies.

In contrast, long waiting times and system inefficiencies, such as manual data entry or understaffing, contributed to dissatisfaction. Telepharmacy services improved efficiency and access to medications, particularly for users in remote areas, by reducing the need for in-person queues.

3.7 Pharmacy Environment, Trust, and Communication

The physical and virtual environments of pharmacy services play important roles in shaping perceptions, trust, and satisfaction. Beyond timely service, users value environments that offer comfort, cleanliness, confidentiality, and ease of communication. Pharmacies with organized layouts and private consultation areas received higher satisfaction ratings because they facilitated open dialogue between users and pharmacists.

Overcrowded or noisy environments, insufficient ventilation, and lack of privacy negatively affected user experience and reduced willingness to communicate. In digital and telepharmacy contexts, maintaining privacy standards presents additional challenges, particularly when services are accessed from public or shared locations. Redesigning pharmacy services to prioritize comfort, confidentiality, and engagement is therefore essential for improving satisfaction and clinical outcomes.

4 Discussion

This systematic review highlights that user satisfaction with DPIS is influenced by the interaction between technological features and human-centered service delivery. High satisfaction was consistently linked to structured workflows, medicine availability, reduced waiting time, effective communication, privacy assurance, and responsiveness to user needs. These patterns were observed across diverse healthcare settings with different levels of digital infrastructure and institutional readiness.

Technology adoption was evaluated using models such as UTAUT and P-TAM, with emphasis on perceived usefulness and ease of use. Heuristic evaluations identified usability concerns, including alert fatigue, complex interfaces, and limited platform responsiveness. However, methodological inconsistencies were noted across studies, particularly in the use of validated instruments. Some studies used standardized tools or Likert-type satisfaction scales, whereas others used customized questionnaires, limiting direct comparability.

The variability in sample sizes across studies, ranging from 15 to 1,391 participants, introduces challenges in interpreting the findings. Studies with smaller samples may have limited statistical power or reduced generalizability, whereas larger studies may obscure contextual nuances present in smaller subgroups. The sensitivity analysis supported a balanced interpretation of findings across study sizes and healthcare settings. A synthesis of satisfaction-related findings is summarized in Table 4.

This review also underscores the importance of interpersonal dynamics in shaping user experiences with DPIS. Pharmacist empathy, clear counseling, and privacy assurance were repeatedly identified as critical factors influencing user trust and satisfaction, particularly in telepharmacy and semi-automated environments. Optimizing DPIS therefore requires not only technical robustness but also a strong focus on human experience, interoperability, digital literacy, and institutional readiness.

Table 4. Satisfaction report.

Author and year	**Supporting satisfaction**	**Reducing satisfaction**	**Overall score**
Abdelkhodir et al., 2025 [1]	Medicine availability; timely service	Limited counseling; long waiting time	4.10 /5.0
Ait Gacem et al., 2025 [2]	Digital service efficiency; staff professionalism	System downtime; limited patient interaction	3.90 /5.0
Apte et al., 2022 [3]	Quick processing; privacy maintained	Inconsistent feedback; limited accessibility	4.00 /5.0
Apte et al., 2024 [4]	Staff courtesy; e-service convenience	Confusing interface; delayed updates	3.85 /5.0
Blagec et al., 2022 [5]	Ease of CDS use; staff confidence	Integration limitations	4.20 /5.0
Bousquet et al., 2019 [6]	Patient-centered guidance; clear structure	Need for contextual adaptation	3.80 /5.0
Campmans et al., 2018 [7]	Alert clarity; error reduction	Alert fatigue	3.95 /5.0
Hillblom et al., 2014 [8]	System-based transition safety	Data-sharing concerns	3.75 /5.0
Sezgin et al., 2014 [9]	Perceived usefulness; ease of use	Technical knowledge barriers	4.00 /5.0
Turnbull et al., 2024 [10]	Service speed; user training	Limited rural coverage	3.88 /5.0

5 Conclusion

This systematic review found that user satisfaction with DPIS is shaped by both technical factors, such as usability and automation, and human-centered elements, including pharmacist communication, counseling quality, privacy, and workflow efficiency. The included studies showed that varying levels of digital infrastructure and institutional readiness influence user experience across healthcare contexts.

The use of models such as UTAUT, TTF, P-TAM, and heuristic evaluation helped identify important usability factors; however, methodological inconsistencies highlight the need for more standardized evaluation tools. Interpersonal dynamics, including empathy and privacy assurance, remain crucial for developing trust and satisfaction in telepharmacy and semi-automated pharmacy services.

In conclusion, optimizing DPIS requires technological enhancement together with user-centered service design. Future research should standardize usability evaluation, address digital literacy and interoperability gaps, and examine organizational readiness to support equitable access to pharmacy services across different healthcare settings.

Acknowledgments. The authors would like to express their sincere gratitude to the Master Program in Pharmacy Management, Faculty of Pharmacy, Universitas Gadjah Mada, Yogyakarta, Indonesia, for the academic support provided throughout this study. The authors also acknowledge the contributions of all researchers and reviewers whose work and insights were essential to the completion of this systematic review.

Ethical Approval. Ethical approval was not required for this study because it was a systematic review based on previously published literature and did not involve human participants, animals, or identifiable personal data.

Disclosure of Interests. The authors declare no conflict of interest in relation to the design, execution, or publication of this systematic review. All stages of the research process were conducted independently without any financial or personal influence that could have affected the objectivity of the findings.

References

1. A. Abdelkhodir, R. Khajouei, M. Jebraeily, J. Med. Syst. 49, e115 (2025)
2. H. Ait Gacem, H. Alami, M. Khaleghi, et al., BMC Health Serv. Res. 25(1), 1-12 (2025)
3. S. Apte, N. Godbole, S. Jadhav, J. Innov. Health Inform. 29(3), 1-12 (2022)
4. S. Apte, N. Godbole, S. Jadhav, Indian J. Pharm. Pract. 17(1), 12-20 (2024)
5. K. Blagec, J.J. Swen, R. Koopmann, et al., PLoS One 17, e0268534 (2022)
6. C. Bousquet, E. Mouillet, et al., Health Inform. J. 25(4), 1234-1241 (2019)
7. Z. Campmans, P.M. van den Bemt, R.J. de Groot, et al., Pharmacoepidemiol. Drug Saf. 27(5), 512-516 (2018)
8. D. Hillblom, G.R. Jones, S.L. Anderson, et al., J. Manag. Care Spec. Pharm. 20(9), 905-913 (2014)
9. E. Sezgin, S.O. Yildirim, S. Yildirim, A.E. Yilmaz, Telemed. J. E Health 20(10), 912-918 (2014)
10. D. Turnbull, M. Varnfield, et al., Digit. Health 10, 1-10 (2024)

Open Access This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License (http://creativecommons.org/licenses/by-nc-nd/4.0/), which permits any noncommercial use, sharing, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if you modified the licensed material. You do not have permission under this license to share adapted material derived from this chapter or parts of it.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.