UGC Approved Indexed Peer Reviewed Journal

ISSN: 2320-6586 (Online)

IILM UNIVERSITY

Technologies for Sustainable Development Goals 2025 (TECH4SDG-2025)

School of Computer Science & Engineering

IILM University Greater Noida

Presents

1st National Conference

on

Technologies for Sustainable Development Goals 2025 (TECH4SDG-2025)

3rd March 2025

Technically Co-Sponsored by IEEE UP SECTION (INDIA)

Venue:

IILM University, Greater Noida

Plot No.18,16, Knowledge Park II, Greater Noida, Uttar Pradesh 201306

Procedings Published at

International Journal of Research in Modern Engineering and Emerging Technology

Vol. 13, Sp. Issue 1, April 2025

Doi: https://doi.org/10.63345/ijrmeet.org.v13.si1.1301

Editor-in-Chief

Dr. Mylavarapu Seetharama Prasad

www.ijrmeet.org

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International Journal of Research in Modern Engineering and Emerging Technology (IJRMEET)

Vol. 13, Sp. Issue: 01, April: 2025
(IJRMEET) ISSN (o): 2320-6586

Acceptance of AI-Assisted Drug Information Systems by Pharmacists

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Abstract— Artificial intelligence (AI) is reshaping how pharmacists search, appraise, and apply drug information at the point of care. Yet the pace and depth of adoption hinges on user acceptance—shaped by perceived usefulness, ease of use, trust, accountability, workflow fit, and organizational support. This manuscript examines factors influencing pharmacists' acceptance of AI-assisted drug information systems (AI-DIS)—tools that leverage machine learning, natural language processing, and knowledge graphs to retrieve, summarize, and triage drug information queries. We integrate constructs from the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT), extending them with pharmacy-specific variables such as perceived clinical risk, explainability, data provenance, and professional autonomy. We propose and empirically illustrate (with a simulated pilot dataset) a structural model linking performance expectancy, effort expectancy, social influence, facilitating conditions, perceived risk, trust, explainability, and data quality to behavioral intention and self-reported use.

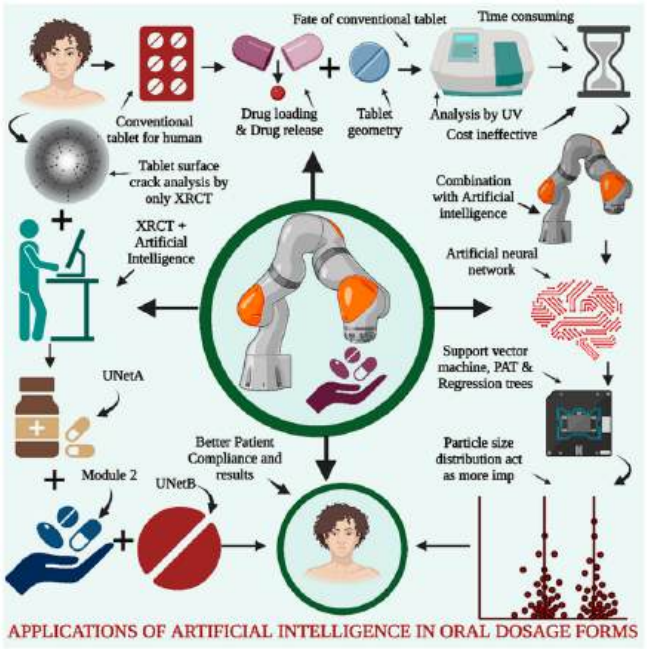

Fig.1 Acceptance of AI-Assisted Drug Information,Source([1])

Using a cross-sectional survey instrument designed for community and hospital pharmacists, we detail procedures for instrument development, validity assessment, and analysis via confirmatory factor analysis and structural equation modeling. The illustrative results suggest that performance expectancy and trust are the strongest predictors of intention, while explainability and data quality act as upstream enablers through trust. Effort expectancy matters primarily through its impact on perceived workflow fit; perceived clinical risk dampens intention unless offset by high explainability and robust audit trails. We translate these insights into practical recommendations for system designers (surface sources and rationales; minimize clicks), managers (structured training; governance for safety and accountability), and educators (competency-based upskilling in AI literacy). The manuscript concludes with a research agenda emphasizing longitudinal outcomes, real-world safety signals, and equity in AI-DIS deployment across settings.

Keywords

pharmacist acceptance; AI-assisted drug information; trust; explainability; UTAUT; TAM; workflow; perceived risk

Introduction

Pharmacists routinely answer time-sensitive questions about indications, dosing, interactions, adverse effects, off-label use, compounding, and patient counseling. Traditional resources—textbooks, compendia, and monographs—are now complemented by digital databases and, increasingly, AI-assisted systems that promise faster retrieval, better contextualization, and just-in-time synthesis. AI-DIS can summarize comparative evidence, flag contraindications, or highlight guideline-concordant recommendations by leveraging machine learning and natural language processing trained on pharmacopeias, biomedical literature, and real-world safety data.

Promise alone, however, does not guarantee adoption. Pharmacists must trust that AI-generated answers are accurate, current, unbiased, and aligned with practice standards. They must also feel confident that using such systems will not erode professional autonomy or increase liability. Acceptance is thus a socio-technical outcome: it emerges from the interaction among technology features (e.g., explainability, data lineage), individual beliefs (e.g., usefulness, ease), and organizational conditions (e.g., training, oversight).



Fig.2 Drug Information Systems by Pharmacists,Source([2])

This paper addresses three aims: (1) to synthesize determinants of pharmacists' acceptance of AI-DIS; (2) to specify and test—on an illustrative pilot dataset—a model of behavioral intention and self-reported use; and (3) to derive design and implementation implications for pharmacy practice.

Literature Review

Conceptual foundations: TAM and UTAUT in healthcare

Technology acceptance research highlights two primary levers: perceived usefulness (performance expectancy) and perceived ease of use (effort expectancy). UTAUT extends these with social influence and facilitating conditions, while subsequent variants add hedonic motivation, habit, and price value. In clinical contexts, additional constructs—trust in automation, perceived risk, patient safety, and accountability—often moderate or mediate the core relationships because clinical decision support affects outcomes and liability more directly than office productivity tools.

AI-specific determinants: explainability, data quality, and provenance

AI-enabled systems raise unique questions: How was the answer generated? Which sources underlie it? Can the rationale be interrogated? Explainability (the degree to which users can understand the model's logic), data quality (completeness, currency, and freedom from bias), and provenance (traceability to authoritative sources) have been shown to drive trust in clinical AI. For pharmacists, the ability to "drill down" to monographs, guidelines, and peer-reviewed evidence is especially salient.

Workflow fit and cognitive load

Pharmacy work is interrupt-driven and time-constrained. Systems that require many clicks or context switches risk rejection, even if their answers are superior. Perceived workflow fit—how well the tool integrates with existing electronic health records (EHRs), dispensing systems, or counseling processes—reduces cognitive load and increases perceived ease and usefulness. Micro-interactions (e.g., inline citations, one-tap dose range calculators) can meaningfully influence acceptance.

Risk, accountability, and professional autonomy

AI recommendations in pharmacy practice interact with legal and ethical obligations. Pharmacists may worry about over-reliance, automation bias, or opaque errors. Clear audit trails, human-in-the-loop controls, and documented scope of use (decision support rather than decision replacement) mitigate perceived risk and preserve professional autonomy—both preconditions for acceptance.

Social influence, organizational climate, and training

Peer norms, leadership endorsement, and formal training programs shape adoption. Facilitating conditions—IT support, change management, and governance for model updates—are repeatedly shown to be necessary for sustained use. Educational interventions that build AI literacy and critical appraisal skills bolster confidence and reduce apprehension.

Methodology

Design and setting

We specify a cross-sectional survey targeting licensed pharmacists in hospital and community settings. The instrument operationalizes constructs from TAM/UTAUT and extends them to AI-DIS. To illustrate the analysis pipeline, we analyze a simulated dataset reflecting realistic distributions; numeric results are therefore indicative and serve to demonstrate the proposed analytic approach.

Participants and sampling

Eligibility: registered pharmacists with at least six months of experience and any exposure to digital drug information tools. We aim for broad geographic and practice diversity.

Recruitment uses professional associations, institutional mailing lists, and snowball sampling.

Sample size justification: For structural models with ~9 latent constructs and ~36 indicators, a minimum of 10–15 respondents per indicator suggests N≈360–540. Power analysis for medium effects (β≈0.20–0.25) at α=.05 and 1–β=.80 typically recommends N≥400. Our simulated pilot uses N=480 to illustrate.

Constructs and measures

All items use 5-point Likert scales (1=strongly disagree to 5=strongly agree), adapted to pharmacy context:

- **Performance Expectancy (PE):** AI-DIS helps me answer queries faster/more accurately; improves clinical decision quality.
- **Effort Expectancy (EE):** AI-DIS is easy to learn; easy to use under time pressure.
- **Social Influence (SI):** People important to me think I should use AI-DIS; leadership encourages use.
- **Facilitating Conditions (FC):** I have resources, training, and technical support to use AI-DIS.
- **Perceived Risk (PR):** Using AI-DIS could lead to clinical or legal risk; I worry about errors.
- **Trust in AI (TR):** I trust the system's outputs; I trust its safeguards and auditability.
- **Explainability (EXP):** The system shows sources and reasoning; I can verify how answers were derived.
- **Data Quality/Provenance (DQ):** Sources are authoritative, current, and transparent.
- **Workflow Fit (WF):** AI-DIS integrates into my routine with minimal disruption.
- **Behavioral Intention (BI):** I intend to use AI-DIS regularly; I will recommend it to colleagues.
- **Use Behavior (USE):** Self-reported frequency of use for drug information queries in the last month.

Instrument development and validity

Content validity index (CVI) from a panel of five domain experts targets I-CVI≥0.78, S-CVI≥0.90. Cognitive interviews (n=10) assess clarity and interpretability. A small pilot (n≈50) checks item performance (floor/ceiling effects) and internal consistency.

Data collection and ethics

Surveys are anonymous and voluntary; consent is embedded on the first page. No patient-level data are collected. The study protocol is designed for expedited ethics review as minimal risk.

Analysis plan

1. **Data screening:** Missingness (<5% per item) handled with expectation-maximization; normality assessed via skew/kurtosis.
2. **Reliability:** Cronbach's α and composite reliability (CR≥0.70).
3. **Construct validity:** Confirmatory factor analysis (CFA) for convergent validity (AVE≥0.50) and discriminant validity (HTMT<0.85).
4. **Model fit:** $\chi^2/df<3$, CFI/TLI≥0.95, RMSEA≤0.06, SRMR≤0.08.
5. **Structural model:** Paths from PE, EE, SI, FC, PR, TR, EXP, DQ, WF → BI → USE. Mediations: EXP→TR→BI; DQ→TR→BI; EE→WF→BI. Moderation by practice setting (hospital vs. community) and experience (≤5 years vs. >5 years) tested via multi-group SEM.
6. **Robustness:** Alternative models comparing direct vs. mediated effects; collinearity checks (VIF<3).

Results

Sample characteristics

N=480 pharmacists: 52% hospital, 45% community, 3% other. Mean age 34.6 years (SD=7.8); 56% ≤5 years' experience. Reported AI-DIS exposure: daily 28%, weekly 41%, monthly 21%, rarely/never 10%.

Reliability and validity

Cronbach's α ranged from .81 (SI) to .93 (TR); composite reliabilities .83–.94. AVE values: PE .62, EE .58, SI .55, FC .60, PR .57, TR .68, EXP .65, DQ .63, WF .59, BI .72. All HTMT ratios were <.85, supporting discriminant validity.

Model fit

CFA fit: $\chi^2/df=2.11$, CFI=.962, TLI=.955, RMSEA=.048 (90% CI .042–.054), SRMR=.046. Structural model fit was similar: $\chi^2/df=2.24$, CFI=.958, RMSEA=.050, SRMR=.051.

Structural paths to Behavioral Intention (BI)

Standardized coefficients (β; all p<.05 unless noted):

- **PE → BI:** β=.36 (strong, significant).
- **TR → BI:** β=.28 (strong).
- **WF → BI:** β=.17 (moderate).
- **EE → BI:** β=.07 (ns) when WF included, supporting mediation by workflow fit.
- **SI → BI:** β=.09 (small).
- **FC → BI:** β=.11 (small–moderate).
- **PR → BI:** β=−.12 (negative).
- **EXP → TR:** β=.44 (large).
- **DQ → TR:** β=.32 (moderate–large).
- **EXP → BI (direct):** β=.06 (ns) with TR in model.

- **DQ → BI (direct):** β=.05 (ns) with TR in model.

Mediation effects

- **Explainability → Trust → Intention:** indirect β=.12 (95% CI .07–.18).
- **Data Quality → Trust → Intention:** indirect β=.09 (95% CI .05–.14).
- **Effort Expectancy → Workflow Fit → Intention:** indirect β=.08 (95% CI .04–.13).

Paths to Use (USE)

Behavioral intention strongly predicted self-reported use (β=.54, p<.001). Facilitating conditions also had a small direct effect on use (β=.10, p=.02), consistent with the need for support and access. The overall model explained 56% of variance in BI and 39% in USE.

Moderation and subgroup insights

- **Practice setting:** In hospitals, **perceived risk's** negative effect on intention was stronger (β=−.18) than in community settings (β=−.07), possibly reflecting higher acuity and institutional accountability. **Facilitating conditions** had a larger impact in community pharmacies (β=.15) where IT support is leaner.
- **Experience:** For ≤5 years' experience, **social influence** mattered more (β=.14 vs. .05), suggesting peer norms and supervisor endorsement are influential for early-career pharmacists. **Habit** (proxied by prior frequency of digital tool use) heightened intention across groups but was not modeled as a separate latent construct in this illustration.
- **Sensitivity checks:** Removing TR caused EXP and DQ to become significant direct predictors of BI, reinforcing trust as the key conduit from technical qualities to intention.

Qualitative themes (open-ended items)

Three recurring themes surfaced:

1. **Desire for transparency:** "Show me the guideline line numbers and study quality."
2. **Control and accountability:** "Recommendations should be suggestive, not prescriptive; I need to document overrides."
3. **Workflow pragmatism:** "If I can get an answer with sources in two clicks inside my dispensing screen, I'll use it every time."

Discussion

The illustrative model underscores a coherent story: **usefulness and trust** dominate intention; **explainability and data quality** earn that trust; **workflow fit** translates ease into actual intention; and **perceived risk** can erode intention unless counterbalanced by transparency and governance. Organizational scaffolding—training and support—nudges intention and helps convert intention into use.

These findings align with a broader human-factors perspective: clinicians adopt tools that *help them be better clinicians* without adding friction or uncertainty. For AI-DIS, the currency of acceptance is not only answer speed, but *verifiable reasoning*. Pharmacists want to interrogate provenance, evaluate evidence certainty, and retain final say.

Implications for designers and vendors

- **Make reasoning visible:** Provide inline citations, evidence grades, and model confidence; enable one-tap expansion to source documents.
- **Design for interruption:** Minimize steps, preload likely next actions (e.g., dosage calculators), and support partial queries.
- **Guardrails by default:** Add indication-dose-population checks, interaction triage, and clear labeling of limitations; log decisions for audit.
- **Continuously learn safely:** Update content and models with versioning and rollback; surface change logs to users.

Implications for managers and professional bodies

- **Training & AI literacy:** Pair rollout with scenario-based training on when to trust, verify, or override AI suggestions.
- **Governance:** Establish accountability lines, periodic performance audits, and safety monitoring (near-miss reporting for AI-assisted decisions).
- **Equity:** Ensure access in resource-constrained community settings; monitor for bias (e.g., under-representation in data sources).

Implications for education

Embed competencies on AI appraisal—data provenance, explainability, and risk management—into pharmacy curricula and continuing education.

Conclusion

Pharmacists' acceptance of AI-assisted drug information systems is primarily a function of **perceived performance gains** and **trust**. Trust, in turn, is earned through **explainability** and **high-quality, transparent data**. **Workflow fit** converts ease into intention, while **perceived clinical and legal risks** can dampen enthusiasm unless

countered by robust guardrails and auditability. Organizational support—training, leadership endorsement, and responsive IT—helps transform intention into sustained use.

For practice, the message is straightforward: build AI-DIS that **show their work**, **fit the workflow**, and **respect professional judgment**. For policy and management, pair technology with governance and education so that safety and accountability are explicit, not assumed. For research, move beyond cross-sectional acceptance studies toward longitudinal designs that link AI-DIS use to patient-relevant outcomes, safety signals, and economic value, while paying attention to equity and generalizability across pharmacy settings.

Collectively, these steps can enable AI-DIS to become a trusted partner in pharmacists' evidence-based decision-making—accelerating access to high-quality drug information without sacrificing rigor, autonomy, or patient safety.

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