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Recent Trends and Innovations in Pharmacy Practice: An Evidence-Based Narrative Review

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Abstract: Recent years have seen a significant shift in pharmacy practice due to a number of factors, including changing patient expectations, workforce shortages, digital innovations, and growing healthcare demands. Through new roles and creative service models, pharmacists are becoming more involved in clinical care, public health campaigns, and health system optimisation. The evidence from about thirty peer-reviewed studies, policy reports, and professional guidelines mostly published between 2015 and 2026 is compiled in this narrative review. Targeted searches of important databases, such as PubMed and Scopus, along with pertinent organisational reports, were used to find the literature. The review looks at important areas of innovation, such as telepharmacy and digital health, increased clinical roles and prescribing, point-of-care testing, automation, artificial intelligence, pharmacogenomics, and speciality pharmacy services. Research shows that chemist prescribing and test-and-treat models are linked to high patient satisfaction and safe clinical outcomes when supported by suitable governance frameworks, while digital transformation has improved access to pharmaceutical care, especially in underserved settings. Although there is still little empirical data, automation and artificial intelligence have the potential to improve operational effectiveness and medication safety. Speciality pharmacy and pharmacogenomics are two new fields with promising clinical potential, but they have issues with workforce preparedness, infrastructure, and reimbursement. Inconsistencies in outcome measurement, a dearth of implementation-focused research, and a lack of focus on equity continue to be major obstacles in all domains. In general, pharmacy practice is moving toward more patient-centered, technology-enabled, and integrated care models; however, the most important factor in determining success is not innovation per se, but rather the capacity to.

Key Words: Pharmacy Practice Transformation, Clinical Pharmacy Services, Patient-Centered Care, Healthcare Innovation, Digital Health in Pharmacy

INTRODUCTION

Over the past ten years, pharmacy practice has experienced tremendous change. After 2020, these changes became more rapid as a result of growing pressures on the healthcare system, rapid digitalisation, a lack of workers, and changing patient expectations. With their expanded roles in medication optimisation, chronic disease management, public health services, and healthcare system efficiency, pharmacists are now widely acknowledged as crucial contributors to clinical care [1,2,3].

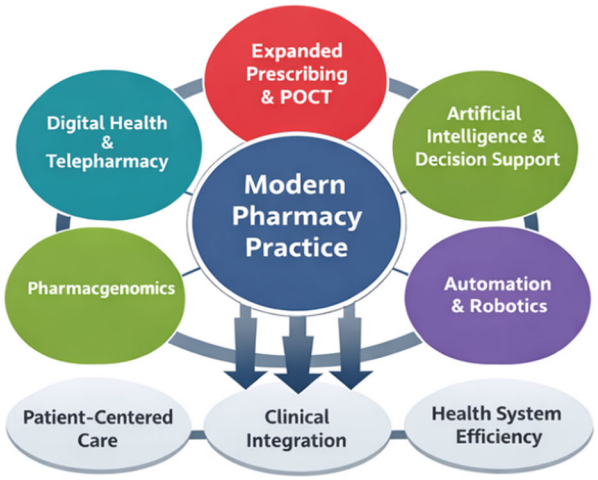

Figure 1: Key Innovation Domains Shaping Modern Pharmacy Practice and Their Impact on Patient Care, Clinical Integration, and Health System Efficiency

Digital health technology integration, telepharmacy services, increased prescribing authority, point-of-care testing (POCT), artificial intelligence (AI), automation, pharmacogenomics, and the expansion of speciality pharmacy services are some recent advancements in pharmacy practice [1,4,5,6]. These developments are part of a larger shift toward care models that are more clinically integrated, technology-enabled, and patient-centered.

The majority of reviews that have already been written tend to concentrate on individual innovations or particular practice settings, despite the fact that a growing body of literature has looked at these developments. For instance, earlier research has examined point-of-care testing services [7], pharmacist prescribing [8,9], and telepharmacy models [10,11] separately. Integrated evidence that examines the application of various innovation domains in real-world contexts and synthesises them is still lacking. Furthermore, the literature frequently fails to adequately address key issues like equity implications, sustainability of services, and variability in outcome measurement [3,4].

Given the speed at which innovations in pharmacy practice are being adopted—often surpassing thorough evaluation and policy alignment—this gap is especially crucial. AI-enabled tools and digital care models are examples of emerging technologies that are still developing more quickly than the empirical data demonstrating their efficacy and safety [3,12]. The major innovation domains shaping contemporary pharmacy practice are summarized in Figure 1, which illustrates how these developments collectively contribute to patient-centered care, clinical integration, and overall health system efficiency.

Thus, the purpose of this narrative review is to summarise current research on significant developments and trends in pharmacy practice, concentrating on three main issues:

- How are significant innovations in pharmacy practice being applied in various contexts
- What results have been documented in the literature
- What obstacles and deficiencies impact their equitable adoption and sustainability

By answering these queries, this review aims to offer a current and organised summary of pharmacy practice transformation while highlighting important topics for further study, policy creation, and practice enhancement.

METHODS

Study Design

This study was conducted as a structured narrative review aimed at synthesizing recent trends and innovations in pharmacy practice. A narrative approach was selected to allow the integration of heterogeneous evidence sources, including empirical studies, policy reports, and professional guidance. While this design does not follow a formal systematic review protocol, methodological steps were applied to enhance transparency, reproducibility, and analytical rigor.

Search Strategy

A targeted literature search was conducted in PubMed and Scopus between January 2025 and February 2026. The search covered studies published between January 2015 and February 2026 to capture recent developments in pharmacy practice.The search strategy combined keywords and Boolean operators as follows:

- (“pharmacy practice” OR “clinical pharmacy”) AND
- (“telepharmacy” OR “digital health”) AND
- (“pharmacist prescribing” OR “non-medical prescribing”) AND
- (“point-of-care testing” OR “POCT”) AND
- (“artificial intelligence” OR “automation”) AND
- (“pharmacogenomics” OR “precision medicine”) AND
- (“specialty pharmacy”)

In addition**,** grey literature was identified through manual searches of key organizational websites, including reports from international professional bodies and healthcare agencies.

Reference lists of included articles were also screened to identify additional relevant studies.

Study Selection and Source Inclusion

The search initially identified approximately 124 records. After removal of duplicates (n = 18), 106 records were screened based on title and abstract. Of these, 52 articles were assessed for full-text eligibility. A total of 34 sources were included in the final review.
Included sources comprised:

- Peer-reviewed studies (systematic reviews, observational studies, implementation studies)
- Policy reports and professional guidelines
- Selected expert commentaries relevant to emerging innovations

Inclusion Criteria

- Published between 2015 and 2026
- Focused on pharmacy practice innovations or service models
- Reported implementation, outcomes, or system-level implications
- Published in English

Exclusion Criteria

- Studies unrelated to pharmacy practice
- Opinion pieces without relevance to implementation or outcomes
- Duplicate or overlapping reports

Older foundational studies were included selectively to provide conceptual context.

Source Hierarchy and Evidence Weighting

To address variability in evidence quality, sources were categorized into three levels:

- **High-level evidence:** systematic reviews and controlled studies
- **Moderate evidence:** observational and implementation studies
- **Lower-level evidence:** policy reports, forecasts, and expert guidance

This classification informed the interpretation of findings and allowed differentiation between established evidence and emerging or limited data across domains.

Data Extraction and Organization

Data were extracted using a structured framework capturing:

- Innovation domain
- Study type and evidence level
- Practice setting
- Key interventions or services
- Reported outcomes
- Implementation challenges

Data extraction was conducted by multiple authors, followed by cross-review and discussion to ensure consistency and reduce subjectivity.

Data Synthesis

A thematic synthesis approach was used to organize findings into key innovation domains:

- Digital health and telepharmacy
- Pharmacist prescribing and expanded roles
- Point-of-care testing
- Artificial intelligence and automation
- Pharmacogenomics
- Specialty pharmacy services

Within each domain, findings were interpreted based on:

- Consistency across studies
- Strength of evidence
- Real-world implementation data

Where applicable, distinctions were made between:

- Established evidence
- Emerging evidence
- Areas with limited empirical data

Limitations of the Methodological Approach

Although structured steps were applied, this review remains a narrative synthesis and does not include formal quality appraisal or meta-analysis. The selection process, while systematic in approach, may still be subject to selection bias. In addition, the inclusion of heterogeneous source types introduces variability in evidence strength. Therefore, findings should be interpreted as an analytical overview of current trends rather than definitive evidence of effectiveness.

A. Digital Health and Telepharmacy

Among the most well-established areas of innovation in pharmacy practice are telepharmacy and digital health. Access to pharmaceutical care has improved, especially in underserved and rural areas, according to observational studies and implementation reports [4,10]. These advantages can be regarded as reasonably well supported across various healthcare systems, particularly in relation to decreased delays in medication review and increased service coverage.

The quality of the evidence is still inconsistent, though. With few controlled comparisons evaluating clinical outcomes like medication safety or patient health improvement, the majority of studies are descriptive or service evaluations. Additionally, results differ between nations based on health system integration and regulatory frameworks. For instance, nations with centralised health systems have more developed telepharmacy models, while those with fragmented systems report more difficulties with implementation.

Regulation, interoperability, and cybersecurity barriers are commonly recognised but not sufficiently explored in empirical research [2,13]. Specifically, it is still unknown how these obstacles will affect long-term sustainability and scalability. Overall, evidence about clinical efficacy and system-level outcomes is still scarce and context-dependent, whereas access-related benefits are strongly supported.

Prescribing and Expanded Clinical Roles

One of the most well-established and scientifically validated developments in pharmacy practice is the growth of pharmacist prescribing. Non-medical prescribing is generally safe and linked to high patient

satisfaction, especially when it comes to the treatment of minor illnesses and chronic conditions, according to systematic reviews and controlled studies [8,14]. These results support prescribing as a mature area of practice development because they are generally consistent across a variety of settings.

Despite this, there are significant differences between nations in terms of reimbursement models, regulatory frameworks, and scope [14]. Research indicates that loosely implemented services are less successful than structured models, which are distinguished by well-defined referral pathways, access to patient records, and clear protocols. Nevertheless, a lot of research is carried out in pilot or controlled settings, which restricts understanding of routine practice performance. Prescribing is frequently portrayed in policy reports as a crucial remedy for the strains on the healthcare system, but these viewpoints aren't always backed by long-term outcome data. Integration with larger care systems, liability issues, and workforce preparedness continue to be major obstacles. As a result, even though there is a lot of evidence to support prescribing, its efficacy greatly depends on the implementation context.

Point-of-Care Testing

The body of evidence supporting pharmacy-based point-of-care testing (POCT) is expanding but still evolving. Particularly for infectious diseases and minor acute conditions, observational studies and pilot programs indicate that POCT services can enhance access to prompt diagnosis and support appropriate treatment decisions [15,16].

However, there is inconsistent and frequently context-specific evidence regarding clinical outcomes, such as improvements in patient health or decreases in inappropriate antibiotic use. Rather than robust clinical endpoints, many studies report patient satisfaction and feasibility. Furthermore, POCT's efficacy is strongly associated with its incorporation into organised care pathways, which include standardised procedures and cooperation with other medical professionals [9,16].

Regional differences in legal scope of practice and service quality have an impact on both implementation and results. Other commonly mentioned obstacles include the uncertainty surrounding reimbursement and the burden of documentation. All things considered, POCT is a field of new research with encouraging but still conflicting clinical impact data.

Artificial Intelligence and Automation

Automation and artificial intelligence are often referred to as transformative technologies in pharmacy practice, but there is still little data to support this claim. There are comparatively few large-scale, real-world evaluations that show quantifiable clinical or operational impact, and the majority of the literature consists of narrative reviews, pilot studies, and expert advice [7,17,18]. Stronger empirical evidence supports automation technologies like barcode verification and dispensing systems, especially when it comes to lowering dispensing errors and increasing workflow efficiency [19,20]. On the other hand, most AI applications, like clinical decision support and predictive analytics, are still in their infancy.

Although concerns about algorithmic bias, safety, and accountability are becoming more widely acknowledged, there are still few empirical studies looking at these problems in pharmacy settings [18,3]. The necessity of validation, transparency, and human oversight is emphasised in policy and professional guidance; however, these suggestions are not yet consistently backed by empirical data.

In general, there is moderate evidence to support automation, whereas artificial intelligence (AI) is still a relatively new and unproven field.

Pharmacogenomics

A promising, albeit still in its infancy, field of pharmacy practice innovation is pharmacogenomics. Instead of large-scale outcome evaluations, the majority of the evidence currently available comes from feasibility studies, pilot implementations, and expert recommendations [5,12]. Although pharmacogenomics-guided therapy has well-established theoretical advantages, its practical application is still scarce. Research indicates that pharmacists can play a significant role in patient counselling and test facilitation; however, infrastructure constraints, a lack of clinical decision support, and inadequate reimbursement models limit their integration into routine care. There is especially little data on clinical impact in community pharmacy settings. Therefore, pharmacogenomics should be viewed as a developing field with a lot of promise but little real-world validation at the moment.

Specialty Pharmacy (Expanded and Strengthened)

The increasing use of complex therapies, such as biologics and advanced treatments, makes speciality pharmacy services more crucial. Speciality pharmacists help with better medication management, patient education, and adherence support, according to observational studies and practice reports [21,22]. However, the evidence base for speciality pharmacy is still less standardised than that of other domains. Rather than consistent outcome measurement, a large portion of the literature concentrates on operational models and service descriptions. Furthermore, implementation varies amongst healthcare systems due to the high resource requirements and need for specialised knowledge. Although it is often recognised as a critical success factor, integration with multidisciplinary care teams is not always accomplished in practice. All things considered, speciality pharmacy is a moderately developed field with increasing significance but little comparative data on the best service models.

Figure 2 summarizes a generalized implementation pathway for pharmacy practice innovations, highlighting key stages from policy and infrastructure through service delivery, outcome evaluation, and equity considerations.

Table 1: Summary of Key Trends, Practice Settings, Evidence Strength, and Implementation Challenges in Pharmacy Practice Innovations

Innovation Domain	Primary Practice Settings	Key Services and Applications	Reported Outcomes (with Evidence Strength)	Key Implementation Challenges
Digital health and telepharmacy	Hospital pharmacies; health systems; rural and underserved settings	Telepharmacy services; remote medication review; electronic prescribing; integration with electronic health records	Improved access to pharmaceutical care and reduced delays in medication review (moderate evidence from observational studies); improved continuity of care (supported by policy and service evaluations) [1,2,10,13]	Regulatory variation; data interoperability limitations; cybersecurity risks; workflow integration challenges
Expanded clinical roles and pharmacist prescribing	Community pharmacies; primary care settings	Independent prescribing for minor ailments and chronic disease management; preventive care services	Safe clinical outcomes and high patient satisfaction (strong evidence from systematic reviews); increased access to care (consistent across settings) [14,8,9]	Workforce readiness; liability concerns; variability in reimbursement; limited access to patient health records
Point-of-care testing and test-and-treat models	Community pharmacies	POCT for infectious diseases and acute conditions; test-and-treat services	Feasibility and high patient acceptance (moderate evidence); potential reduction in inappropriate medication use (variable evidence across studies) [7,15,16]	Reimbursement uncertainty; documentation burden; limited interoperability with health information systems; variation in legal scope
Artificial intelligence and clinical decision support	Hospital and community pharmacy settings	Drug–drug interaction detection; adverse event prediction; adherence monitoring; workflow optimization	Potential improvements in medication safety and efficiency (limited real-world evidence; largely based on pilot studies and guidance) [7,17,18,4]	Limited real-world validation; accountability concerns; need for ethical governance; integration into clinical workflows
Automation and robotics	Hospital pharmacies; health-system pharmacies	Automated dispensing cabinets; unit-dose systems; inventory robotics; barcode verification	Reduction in dispensing errors and improved operational efficiency (moderate evidence from implementation studies); increased pharmacist time for clinical roles [19,20]	Context-dependent effectiveness; staff training requirements; system design limitations; organizational readiness
Pharmacogenomics and precision pharmacy	Community pharmacies; collaborative care settings	Pharmacogenomic testing facilitation; interpretation of results; patient counselling	Potential for individualized therapy (emerging evidence; limited real-world implementation data) [5,6,12]	Reimbursement limitations; infrastructure gaps; lack of decision support tools; need for pharmacist training
Specialty pharmacy services	Specialty pharmacies; integrated care settings	Management of biologics and advanced therapies; patient education; adherence monitoring; outcomes tracking	Improved medication management and care coordination for complex therapies (moderate but heterogeneous evidence) [21,22,23]	High resource requirements; need for specialized expertise; integration with multidisciplinary teams; variability in service models

Figure 2: Implementation Pathway for Pharmacy Practice Innovations

DISCUSSION

This review highlights a clear shift in pharmacy practice toward more clinically integrated, technology-enabled, and patient-centered care models. However, a key finding across all innovation domains is that implementation success remains uneven and highly context-dependent. While some innovations—such as pharmacist prescribing and telepharmacy—have progressed into routine practice in several healthcare systems, others, including artificial intelligence and pharmacogenomics, remain in earlier stages of adoption with limited real-world validation [1,4,514].

A critical pattern emerging from this synthesis is that technological capability alone does not determine successful implementation. Innovations that have scaled effectively are typically supported by three core elements: clear regulatory frameworks, integration within established care pathways, and sustainable reimbursement mechanisms. For example, pharmacist prescribing models supported by structured governance and access to patient health records demonstrate more consistent outcomes and safety profiles across settings [8,14]. In contrast, emerging technologies such as artificial intelligence continue to face barriers related to validation, accountability, and clinical integration despite strong theoretical potential [3,4,17].

Across domains, several cross-cutting barriers persist. Reimbursement remains a primary constraint, particularly for services such as point-of-care testing and pharmacogenomics, where funding models are often unclear or inconsistently applied [12,15]. Similarly, limitations in digital infrastructure—especially interoperability challenges between health information systems—continue to restrict the effective implementation of telepharmacy and data-driven

services [1,2]. Workforce readiness is another critical determinant, as expanding pharmacist roles require new competencies in prescribing, digital health, and precision medicine, which are not yet uniformly embedded in training frameworks [2,14].

Importantly, this review identifies a consistent gap between policy ambition and empirical evidence. Many innovations are promoted in policy documents and professional guidance as solutions to healthcare system pressures; however, supporting evidence is often derived from pilot studies, observational designs, or expert consensus rather than large-scale, real-world evaluations [3,12]. This gap is particularly evident in AI-enabled applications, where rapid technological advancement has outpaced rigorous assessment of clinical effectiveness, safety, and cost-effectiveness [7,8,14-17,24].

Ethical considerations are increasingly relevant in the context of pharmacy practice innovation. AI-enabled systems raise concerns related to algorithmic bias, transparency, and accountability, particularly when applied to clinical decision-making processes [15,4]. In addition, digital health models introduce challenges related to patient privacy, cybersecurity, and unequal access to technology. Despite growing recognition of these issues in professional guidance, empirical research evaluating ethical and equity outcomes remains limited [1,4].

Equity considerations, more broadly, are insufficiently addressed across most innovation domains. Digital health and AI-driven models may unintentionally widen disparities due to differences in digital access, health literacy, and data representation. Current literature acknowledges these risks but provides limited empirical evidence on how such disparities can be mitigated in practice [1,7].

Overall, the findings suggest that the future of pharmacy practice will depend less on the availability of new technologies and more on the ability of healthcare systems to integrate, regulate, and sustain these innovations effectively. Strengthening implementation frameworks, improving interoperability, and ensuring equitable access will be essential to translating innovation into meaningful healthcare outcomes.

Implications for Practice

The findings of this review have several implications for healthcare providers, policymakers, and educators. For healthcare organizations, successful implementation of pharmacy innovations requires prioritizing integration within existing care pathways, rather than adopting isolated technologies. Establishing clear protocols, ensuring interoperability of digital systems, and aligning services with reimbursement models are essential for sustainability.

For policymakers, regulatory frameworks should move beyond pilot authorization toward standardized and scalable service models, particularly for pharmacist prescribing and POCT. In addition, reimbursement structures must be clarified to support emerging services such as pharmacogenomics and digital health interventions.

For pharmacy education and workforce development, there is a need to strengthen competencies in digital health, clinical decision-making, prescribing, and data interpretation. Structured training pathways and continuous professional development programs will be critical to support evolving roles.

Future Directions

Future research should prioritize implementation-focused studies that evaluate pharmacy practice innovations in real-world settings using standardized outcome measures. Key outcomes should include clinical effectiveness, patient safety, cost-effectiveness, and equity impact.

Further work is needed to develop and validate regulatory and reimbursement models that support sustainable service delivery. In particular, comparative studies examining different prescribing models, telepharmacy frameworks, and POCT integration strategies would provide valuable insights.

Additionally, research on artificial intelligence and pharmacogenomics should focus on large-scale validation, integration into clinical workflows, and assessment of ethical implications, including bias and data privacy. Finally, equity-focused research is needed to ensure that emerging innovations do not exacerbate existing healthcare disparities.

Limitations

This study has several limitations inherent to its narrative review design. First, the absence of a formal systematic search strategy and screening process may introduce selection bias and limit reproducibility. Second, the review does not include a formal quality appraisal of included sources, resulting in variability in the strength of evidence presented. Third, the inclusion of diverse source types—such as empirical studies, policy reports, and professional guidance—may affect consistency in evidence interpretation. Additionally, the lack of a defined study count and potential overrepresentation of certain authors or regions may influence the balance of the review. Therefore, the findings should be interpreted as a structured synthesis of current trends rather than a definitive assessment of intervention effectiveness.

CONCLUSION

Pharmacy practice is evolving toward more integrated, digitally supported, and clinically oriented models of care. While several innovations—particularly pharmacist prescribing and telepharmacy—are supported by relatively consistent evidence, others, including artificial intelligence and pharmacogenomics, remain at earlier stages of real-world implementation with limited empirical validation.

A key conclusion of this review is that the primary challenge is not the development of innovation, but its effective implementation within healthcare systems. Variability in regulatory frameworks, reimbursement models, infrastructure, and workforce readiness continues to determine whether new services can be sustained at scale.

Among the identified priorities, the most urgent area for action is the establishment of standardized outcome evaluation frameworks. Without consistent measures of clinical, operational, and equity outcomes, it remains difficult to assess the true value of pharmacy practice innovations or guide policy decisions.

Future progress will require coordinated efforts to align policy, practice, and research, with particular emphasis on implementation-focused studies and equity-centered design. Strengthening these areas will be essential to ensure that advances in pharmacy practice translate into meaningful and sustainable improvements in healthcare delivery.

Author Contributions

Anas Alhur conceptualized the study, designed the review framework, and led the overall manuscript development, including drafting, critical revision, and final approval.

Afrah Alhur contributed to literature screening, data organization, and manuscript drafting.

Salwa Al Malh contributed to literature review, data extraction, and drafting of clinical pharmacy–related sections.

Roaa Alkhaldi contributed to literature identification, data extraction, and drafting of thematic sections.

Maryam Alqarni and Waad Alotaibi contributed to literature review, data extraction, and preparation of initial drafts of key sections.

Fajr Omar and Fatimah Alshammari contributed to literature identification, synthesis of findings, and manuscript drafting.

Kholah Alzahrani and Rahaf Alshahrani contributed to data extraction, interpretation of findings, and drafting support.

Nesreen Al Malawi contributed to interpretation of results and critical revision of the manuscript.

Mohammed Qahl contributed to supervision support, critical revision, and validation of the final manuscript.

All authors reviewed and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

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Conflicts of Interest

The authors declare no conflicts of interest.

Ethical Considerations

Ethical approval was not required for this study as it is based exclusively on analysis of previously published literature and does not involve human participants, patient data, or identifiable personal information.

Data Availability Statement

Data sharing is not applicable to this article as no new data were generated or analyzed in this review.

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