Review Article

Digital Pharmacy Services and Unequal Access to Medicines: An Integrative Review of Equity Consequences

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Abstract

Digital pharmacy services increasingly mediate how patients obtain medicines, advice, and follow-up. Their expansion may reduce distance and time barriers, but benefits are not distributed uniformly because connectivity, affordability, literacy, language, disability, trust, and organizational capacity shape use. To integrate empirical, theoretical, and policy-relevant evidence on how digital pharmacy services influence unequal access to medicines, who benefits, who encounters barriers, and which contextual conditions reduce or amplify inequity. A transparent integrative review used a protocol-defined search, eligibility criteria, record-level screening, source-type-sensitive appraisal, structured extraction, comparative data reduction, and thematic synthesis. Access was treated as multidimensional rather than equivalent to service availability. Evidence was compared across digital access, affordability, reach, literacy, language, disability, usability, geography, organizational capacity, data representation, and algorithmic processes.

Digital pharmacy can extend service reach, support continuity, and reduce travel or scheduling burdens when infrastructure, accessible design, human assistance, and implementation capacity are adequate. The same services can intensify exclusion when participation requires reliable connectivity, suitable devices, digital or health literacy, dominant-language fluency, accessible interfaces, trust, or institutional support. Evidence concerning algorithmic equity remained less mature than evidence concerning telepharmacy and digital access barriers. Reported benefits were therefore conditional, context-dependent, and not interchangeable with equitable access. Digital pharmacy is neither inherently equity-promoting nor inherently exclusionary. Equity consequences arise from interactions among service design, patient resources, organizational arrangements, and data practices. Evaluation should examine who can enter, use, understand, trust, and meaningfully benefit from the service, while retaining nondigital alternatives and escalation routes.

Keywords: Integrative review, Digital pharmacy, Artificial intelligence, Pharmacy practice, Medication safety, Evidence synthesis

Introduction

Digital pharmacy now encompasses telepharmacy, remote medication review, electronic prescribing interfaces, online dispensing pathways, mobile adherence support, automated communication, and algorithmically mediated services. These arrangements can connect patients with pharmacy expertise beyond conventional premises and operating hours. Yet expansion alone does not establish equitable benefit. Digital health innovations may reproduce the social gradient when access to devices, connectivity, skills, language support, and institutional responsiveness is uneven [1]. Digital exclusion is therefore not a peripheral implementation problem; it functions as a determinant of whether patients can reach and use digitally mediated care [2].

Access to medicines is similarly broader than the physical presence of a product or service. It includes whether a patient can identify an appropriate pathway, enter it, communicate effectively, receive understandable information, afford associated costs, navigate required technologies, and obtain timely follow-up. A digital service can increase nominal availability while leaving practical accessibility unchanged or worsening it for specific groups. A digital health equity framework consequently requires attention to individual

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capability, interpersonal support, technology design, community context, and health-system organization rather than treating platform availability as the endpoint [3].

Pharmacy-specific evidence also spans heterogeneous forms. Telepharmacy policies and service models address professional reach, supervision, dispensing, counselling, and continuity across distance. Human-factors studies illuminate usability and disability barriers. Digital-divide research identifies patterned differences in participation. Policy and ethics scholarship examines representation, accountability, and algorithmic discrimination. These literatures cannot be interpreted as though they provide equivalent evidence. Professional guidance recognizes telepharmacy as a means of extending pharmacy services while emphasizing that practice arrangements, technology, staffing, quality assurance, and patient safety remain consequential [4]. An integrative review is therefore appropriate because the central question concerns relationships among service mechanisms, populations, contexts, and equity consequences rather than a single intervention effect.

This focus is especially important because the populations most likely to benefit from remote access may also face the greatest barriers to digital participation. Rural residence, mobility limitation, constrained income, limited English proficiency, low literacy, unstable connectivity, and fragmented local services can interact rather than operate independently as isolated disadvantages.

This review asks which dimensions of access are altered by digital pharmacy services; which populations experience improved reach, convenience, or continuity; and which encounter connectivity, affordability, literacy, language, disability, usability, or trust barriers. It also examines how geographic and organizational contexts modify these effects, how data and algorithmic processes may influence equity, and under what conditions digital pharmacy reduces or amplifies unequal access to medicines. The review distinguishes service availability from effective access, technological performance from patient benefit, and reported convenience from equitable participation. Its purpose is not to declare digital pharmacy beneficial or harmful in general, but to produce an evidence-bounded account of the conditions through which equity consequences emerge.

Review Design, Questions, and Protocol

Integrative-Review Design

The review used an integrative design to examine how digital pharmacy services influence unequal access to medicines across empirical, theoretical, and policy-relevant evidence. Integrative reviewing was selected because the question required comparison of heterogeneous designs, concepts, service models, and contextual explanations rather than aggregation of one standardized intervention outcome. The design followed the principle that a literature review should make its purpose, search logic, selection decisions, analytical procedures, and boundaries explicit [5].

Problem Identification

Problem identification began with a distinction between digital service expansion and equitable access. The review question was framed around mechanisms and consequences: what dimensions of access change, for whom, through which service arrangements, and under what contextual conditions. The protocol was finalized before the definitive searches. It specified the review questions, evidence window, source types, eligibility criteria, exclusion hierarchy, screening fields, appraisal approach, extraction variables, and synthesis procedures. PRISMA 2020 informed transparent record accounting without changing the declared integrative methodology [6]. Its explanation and elaboration informed distinctions among records, reports, studies, retrieval outcomes, and exclusion reasons [7].

Literature-Search Strategy

The literature-search strategy combined pharmacy and medicines terminology with terms for telepharmacy, online or mobile services, digital access, equity, disparities, literacy, language, disability, usability, geography, affordability, representation, and algorithmic bias. Database-specific syntax, field tags, limits, and search dates were recorded. Because quantitative pooling was not assumed, the synthesis plan emphasized transparent narrative comparison; SWiM guidance informed reporting of structured synthesis where effect estimates could not appropriately be combined [8].

Eligibility, Definitions, and Information Sources

Eligibility and Source Types

Eligible sources were peer-reviewed journal articles published from 2017 through 2025 that examined a digital pharmacy service, medicine-access pathway, or pharmacy-relevant data process and addressed at least one equity-related dimension, mechanism, population difference, or contextual consequence. Empirical studies, systematic or scoping reviews, conceptual analyses, and policy-relevant scholarship were eligible when their contribution could be distinguished during extraction. General digital-health studies without a pharmacy or medicines component, reports limited to adoption without equity-relevant analysis, non-peer-reviewed material, and studies equating availability with equitable access were excluded.

Definitions were applied at screening rather than inferred after inclusion. Digital pharmacy required a direct relationship to pharmacy practice, medicine supply, medication counselling, medication management, or medicine-related decision support. Equity required evidence or analysis concerning differential opportunity, burden, usability, representation, or benefit. Digital inequality research demonstrated that internet uses and outcomes differ systematically across populations, supporting the inclusion of access conditions beyond simple connectivity [9]. The digital divide was treated as a clinical and organizational concern because remote care can transfer access requirements from facilities to patients [10]. Health literacy was included as an equity dimension because digitally delivered information can remain inaccessible even when a connection is technically available [11]. Geographic access was also retained because pharmacy availability differs across communities and can shape both the need for and likely consequences of remote services [12].

Screening Process

Two-stage screening was conducted at title and abstract, then full text. Each record received a final decision and, when excluded at full text, one primary reason from a prespecified hierarchy. Duplicate records were linked to a retained canonical citation, while multiple reports from one underlying study were connected through a study-family identifier. Retrieval status, eligibility decisions, and reasons were recorded in the master ledger.

Data Evaluation Using Design-Appropriate Tools

Data evaluation was source-type-sensitive. Empirical studies were appraised for design appropriateness, sampling, measurement, comparison, confounding, missingness, and transferability. Reviews were assessed for search transparency, eligibility logic, appraisal, synthesis, and overlap. Conceptual and policy sources were evaluated for argumentative coherence, evidential grounding, scope, and applicability. Appraisal informed interpretation rather than serving as a universal numerical threshold for exclusion.

Search, Selection, Extraction, Appraisal, and Synthesis

Data-Extraction Matrix

The extraction matrix captured bibliographic identity, source type, population, setting, pharmacy service, technology, comparator, access dimension, equity mechanism, outcomes, reported limitations, appraisal findings, and applicability boundaries. Search reporting was checked against PRISMA-S principles so that sources, platforms, complete strategies, limits, dates, and supplementary methods remained reproducible [13]. Database coverage was examined across complementary sources because reliance on a single database can omit relevant review evidence [14].

Data Reduction

Data reduction proceeded through structured coding rather than simple frequency counting. Findings were separated into evidence descriptions, authors' interpretations, methodological limitations, and review-level inferences. Similar concepts were normalized while preserving material distinctions among connectivity, affordability, literacy, language, disability, usability, geography, organizational capacity, data representation, and algorithmic processes. Contradictory findings were retained and examined against population, setting, service design, and implementation conditions.

Data Display and Comparison

Data displays compared source designs, populations, service forms, access dimensions, validation levels, and limitations. No study design was treated as universally superior outside the question it addressed.

Theme Development and Conclusion Verification

Theme development used iterative comparison across coded findings, with reflexive thematic-analysis principles supporting transparent interpretation rather than mechanical theme discovery [15]. Candidate themes were checked against source-level extracts, negative cases, and appraisal judgments. Conclusions were accepted only when their wording remained proportionate to the underlying evidence.

A final verification pass confirmed that every synthesis statement retained a traceable evidential basis.

Table 1 organizes the evidence, constructs, relationships, uncertainties, and boundary conditions required for eligibility, definitions, and evidence-extraction framework for the review Digital Pharmacy Services and Unequal Access to Medicines: An Integrative Review of Equity Consequences.

Table 1. Eligibility, definitions, and evidence-extraction framework for the review Digital Pharmacy Services and Unequal Access to Medicines: An Integrative Review of Equity Consequences.

Review element	Operational definition	Eligibility or decision rule	Data field	Rationale	Bias or ambiguity risk	Planned synthesis use
Digital pharmacy service	A digitally mediated service directly connected to medicine supply, pharmacy practice, medication counselling, medication management, monitoring, or pharmacy-relevant decision support	Include only when the pharmacy or medicines relationship is explicit	Service type; pharmacy task; delivery mode; professional involvement	Prevents general digital-health evidence from being misclassified as pharmacy evidence	Pharmacy involvement may be reported incompletely or embedded within multidisciplinary services	Classify service mechanisms and distinguish direct pharmacy services from adjacent digital care
Access to medicines	The practical opportunity to locate, enter, afford, understand, use, and benefit	Require at least one identifiable access dimension or consequence	Connectivity; device access; affordability; availability; timeliness;	Availability alone does not demonstrate effective access	Studies may use access, adoption, availability, and utilization interchangeably	Compare which access dimensions improve, remain

	from medicine-related services		continuity; geographic reach			unchanged, or deteriorate
Equity consequence	A patterned difference in opportunity, burden, participation, treatment, representation, or benefit across populations or contexts	Include explicit subgroup evidence or a defensible equity mechanism	Population characteristic; direction of difference; mechanism; consequence	Digital health can reproduce existing social gradients [1]	Absence of subgroup analysis may conceal unequal effects	Distinguish observed inequalities from theoretically plausible mechanisms
Digital inclusion	The resources and capabilities needed to participate meaningfully in digitally mediated services	Extract infrastructure and capability conditions rather than recording internet access alone	Connection quality; device suitability; privacy; support; skills	Digital inclusion operates as a determinant of healthcare participation [2]	Binary connected/not-connected measures can understate instability and quality differences	Analyse entry barriers and enabling conditions
Health and digital literacy	Capacity to locate, interpret, evaluate, and act on digitally delivered medicine information	Include measured literacy, reported comprehension, navigation burden, or associated support	Literacy measure; interface demand; assistance; comprehension outcome	Digital delivery does not ensure understandable or actionable information [11]	Literacy may be inferred from education, age, or socioeconomic status rather than measured	Examine comprehension, navigation, and self-management consequences
Language access	Availability of understandable communication and interpretation across relevant languages	Include language-related eligibility, use, communication, or outcome differences	Preferred language; interpreter access; translated content; exclusion criterion	Language requirements may determine who can enter or complete a digital encounter	Studies may report race or ethnicity without recording language preference	Identify linguistic exclusion and effective support mechanisms
Disability and usability	Compatibility of the service with sensory, physical, cognitive, and communication needs	Include accessibility features, usability testing, accommodation needs, or disability-related barriers	Disability group; accessibility feature; usability measure; assistance requirement	Interface accessibility affects whether nominal service availability becomes usable access	Small convenience samples may not represent diverse disability experiences	Compare inclusive design features, support needs, and exclusion risks
Geographic and organizational context	Local service availability, workforce, policy, infrastructure, and implementation capacity affecting digital service consequences	Extract contextual conditions whenever they alter reach, continuity, or feasibility	Rurality; pharmacy density; staffing; workflow; reimbursement; policy; local alternatives	Unequal pharmacy distribution changes both need for and dependence on remote services [12]	Geographic labels may obscure differences in transport, broadband, staffing, and deprivation	Explain why similar technologies produce different access consequences
Data and algorithmic processes	Data collection, representation, model development, automated prioritization, or decision-support processes that may distribute error or benefit unequally	Include when a pharmacy-relevant system or medicine-access decision is affected	Data source; represented groups; target variable; validation population; subgroup performance	Technical performance may not establish equitable performance or benefit	Equity may be discussed conceptually without empirical subgroup validation	Separate documented algorithmic disparities from prospective governance concerns
Source-type-sensitive appraisal	Evaluation using criteria appropriate to empirical, review, conceptual, or policy evidence	Do not apply a single numerical quality threshold across heterogeneous sources	Design; sampling; measurement; transparency; synthesis; applicability; limitations	Integrative reviewing requires transparent comparison without erasing design differences [5]	Incommensurable designs may be ranked inappropriately	Weight interpretation according to the contribution and limitations of each source type
Review-level synthesis	Structured comparison of convergent, divergent, and context-dependent findings	Preserve negative cases and distinguish evidence from interpretation	Theme; supporting sources; contradictory evidence; confidence boundary	Reflexive thematic analysis treats themes as interpretive outputs rather than automatically discovered entities [15]	Frequency can be mistaken for importance or certainty	Develop conditional explanations of when digital pharmacy reduces or amplifies inequity

Search and Selection Results

The searches identified 1,266 records. After removal of 472 duplicates, 794 records underwent title-and-abstract screening, of which 641 were excluded. The reviewers sought 153 reports for retrieval; four could not be retrieved, leaving 149 full-text reports for eligibility assessment. Full-text assessment excluded 127 reports: no pharmacy task, 36; no eligible artificial-intelligence component, 14; ineligible publication type, 19; outside the publication window, nine; no DOI, three; failure to meet the prespecified Q1-journal criterion, 16; insufficient task evidence, 18; duplicate report, seven; and non-peer-reviewed source, five. Twenty-two reports representing 22 distinct studies entered the integrative synthesis. No quantitative synthesis was undertaken because the designs, interventions, populations, access constructs, and outcomes were not sufficiently comparable.

Figure 1 presents the completed review-selection pathway in a black-and-white prisma-style flow diagram for evidence selection, documenting identification, deduplication, screening, eligibility, exclusions with reasons, and final inclusion using the values approved in the Part 1 PRISMA Record-Accounting Audit.

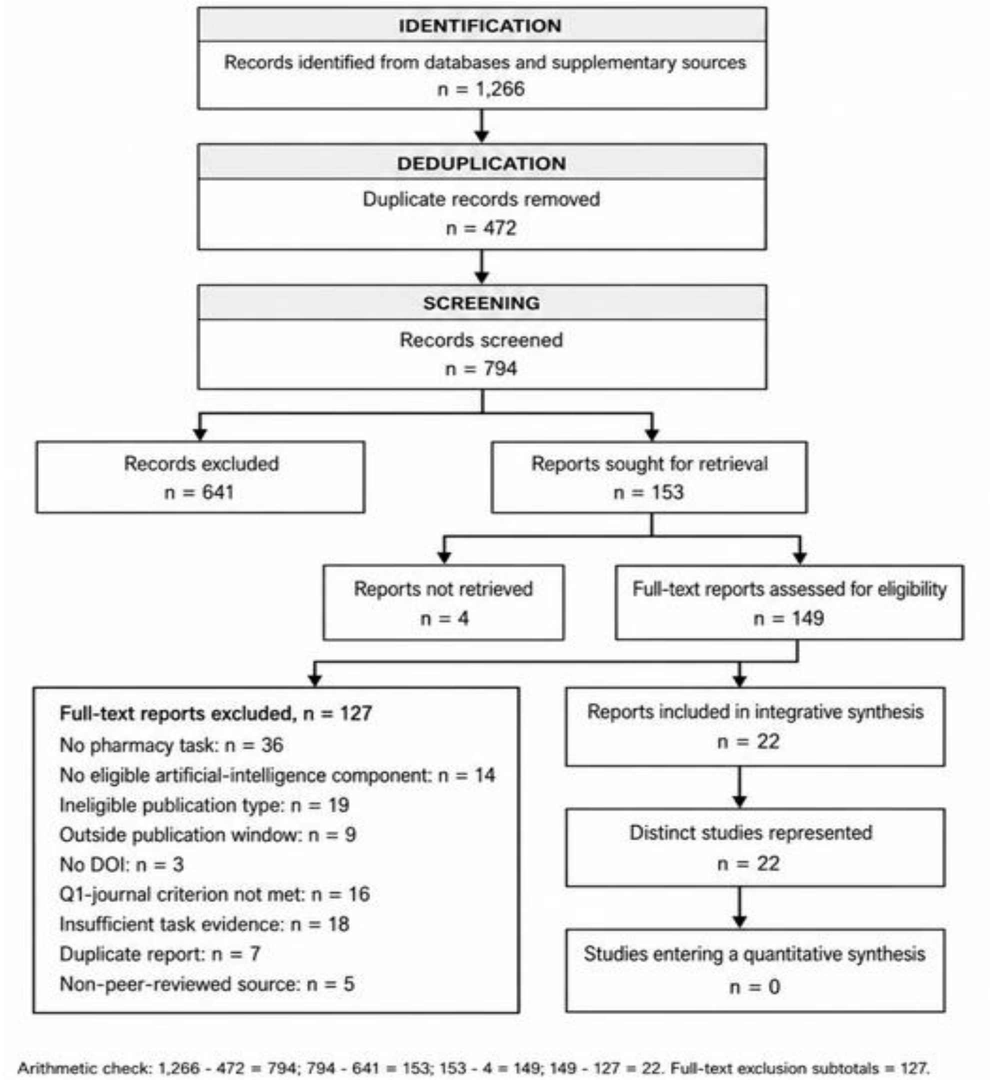

Figure 1. Black-and-White PRISMA-Style Flow Diagram for Evidence Selection

Included-Source Characteristics

The included evidence base spanned synchronous telepharmacy, virtual community-pharmacy care, remote clinical-pharmacist services, pharmacy-access studies, digital-inclusion research, usability investigations, and conceptual or policy analyses. The review did not treat these sources as interchangeable. A systematic review of synchronous telepharmacy identified multiple outpatient service configurations, but variation in setting, technology, staffing, outcomes, and study quality limited direct comparison across models [16]. A broader telepharmacy review likewise described benefits alongside operational, legal, technical, and contextual constraints, supporting a conditional rather than uniformly favorable interpretation [17]. Evidence concerning virtual care in community pharmacy showed expanding service possibilities, although the maturity, consistency, and external applicability of evaluations remained uneven [18].

Digital Access and Connectivity

Connectivity operated as an entry condition rather than a sufficient explanation of access. Remote counselling, medication review, prescription support, and follow-up could reduce travel and scheduling burdens, particularly where conventional services were distant or difficult to reach. However, benefit depended on stable internet or telephone access, an appropriate device, privacy, technical confidence, and the ability to troubleshoot failures. Studies rarely measured all of these dimensions together. The synthesis therefore distinguished nominal connection from dependable participation.

Connectivity also interacted with service design. Telephone-based models lowered some bandwidth and interface requirements but restricted visual assessment, document sharing, and certain communication cues. Video-based models supported richer interaction but demanded more capable devices, stronger connections, and greater navigation skill. Portal or application pathways could facilitate asynchronous communication while creating password, authentication, notification, and literacy burdens. No single channel was universally accessible. Multichannel entry, proactive assistance, and a nondigital alternative emerged as recurrent equity-protective conditions.

Evidence-Base Characteristics

Affordability and Service Availability

Affordability and service availability were linked but distinct. Remote pharmacy services could reduce transport costs, time away from work, caregiver burden, and travel-related inconvenience. Clinical pharmacist services delivered remotely were associated with opportunities for medication management outside conventional encounters, but the systematic-review evidence was heterogeneous and did not establish that cost or access benefits were uniform across populations [19]. State telepharmacy policies were associated with the geographic distribution of pharmacy access and the potential reach of services, yet policy permission alone did not ensure staffing, reimbursement, infrastructure, or sustained implementation [20]. National evidence on pharmacy availability demonstrated persistent spatial variation, reinforcing that digital services enter pre-existing landscapes of unequal local access [21].

Digital, Health, and Language Literacy

Digital, health, and language literacy influenced whether patients could convert availability into meaningful use. Tasks commonly assumed to be simple—opening a link, completing verification, locating medication information, describing symptoms, interpreting written instructions, or responding to automated prompts—could create cumulative burden. Studies often measured completion or satisfaction without directly measuring comprehension, decisional confidence, or the accuracy of medicine use after the encounter. Language barriers could occur before clinical communication began, including during registration, consent, identity verification, scheduling, or technical support. Where translated interfaces or interpreters were absent, digital pathways could narrow rather than broaden access.

Disability and Usability

Disability access depended on compatibility among interfaces, communication methods, assistive technologies, service procedures, and human support. Pharmacy access for people with disabilities can be affected by physical, informational, communication, and service-design barriers, indicating that digital substitution does not automatically remove the barriers present in conventional care [22]. A telepharmacy usability study showed the value of iterative user feedback for identifying navigation problems and refining application design, although findings from a specific setting could not be generalized to every population or service model [23]. Evidence linking digital literacy with mobile-health usability further supported the interpretation that usability reflects both interface characteristics and users' prior experience, not merely individual willingness [24].

Accessible design required more than readable font size. Relevant considerations included screen-reader compatibility, captioning, keyboard navigation, color contrast, simplified language, adjustable pacing, alternative communication modes, accessible authentication, and the availability of assistance without loss of autonomy. The reviewed evidence did not support a universal accessibility profile. Needs differed across visual, hearing, motor, cognitive, communication, and fluctuating impairments. The equity implication was therefore procedural: services should identify access needs, offer alternatives, and test actual task completion rather than infer accessibility from technical compliance alone.

Data and Algorithmic Inequity

Evidence concerning algorithmic inequity was less pharmacy-specific and less mature than evidence concerning telepharmacy access. Bias can enter through problem formulation, data collection, labeling, model development, validation, deployment, and feedback loops; mitigation therefore requires attention across the lifecycle rather than adjustment at one technical stage [25]. A widely discussed population-health algorithm underestimated the needs of Black patients because expenditure was used as a proxy for illness, demonstrating how apparently neutral targets can encode structural inequality [26]. Ethical machine-learning scholarship similarly emphasizes that fairness depends on data, objectives, evaluation, deployment context, and affected populations rather than a single metric [27].

Negative or Exclusionary Consequences

Exclusion occurred when digital participation became the default gatekeeper for services previously available through other routes. Telemedicine-access studies identified demographic, socioeconomic, language, and technology-related differences in who completed video encounters [28]. In a multilingual safety-net setting, interest in video visits coexisted with barriers involving technology, internet access, and digital capability [29]. Informatics interventions can worsen inequality when they preferentially benefit already advantaged users, impose new burdens, or redirect resources without accounting for differential capacity [30].

Discussion

Interpretation of the Integrated Findings

The review indicates that digital pharmacy changes the architecture of access rather than simply increasing or decreasing it. Conventional barriers such as distance, limited opening hours, mobility constraints, and workforce scarcity may be reduced, while requirements for connectivity, devices, authentication, literacy, language compatibility, accessible design, and digital trust become more influential. The central finding is therefore conditional: a service can improve one access dimension while worsening another, and the balance differs among patients, settings, and implementation arrangements.

This interpretation aligns with calls to place equity at the center of health informatics and digital health rather than treating it as a later corrective activity [31]. Equity is not adequately assessed by counting registrations, completed encounters, prescriptions processed, or satisfaction among successful users. Those measures omit people who never received an invitation, lacked the resources to begin, abandoned the process, depended on unrecorded assistance, or accepted a less suitable channel because alternatives were unavailable. Evaluation must therefore examine the entire access pathway, including entry, completion, comprehension, medicine receipt, continuity, and the distribution of burdens and benefits.

Conditions under Which Digital Pharmacy Reduces Inequity

Digital pharmacy was most likely to reduce inequity when it responded to a documented barrier and when participation requirements matched the resources of the intended population. Relevant conditions included affordable and reliable connectivity, simple authentication, multiple communication channels, language support, accessible interfaces, trained personnel, integration with medication supply and records, clear escalation, and preservation of human assistance. Digital health equity requires deliberate attention to the populations most likely to be excluded, not an assumption that increasing technological availability will benefit everyone similarly [32].

Organizational design was as important as interface design. Services needed adequate staffing, defined responsibility, appointment capacity, documentation processes, referral routes, and mechanisms for resolving technology failures. Remote consultation without a reliable way to dispense, deliver, monitor, or modify medicines offered only partial access. Similarly, a platform could reduce travel while increasing time spent navigating registration or waiting for technical assistance. Equity-enhancing implementation therefore required assessment of the complete service, not only the digital encounter.

Conditions under Which It Amplifies Inequity

Digital pharmacy amplified inequity when it became a mandatory gateway, displaced accessible alternatives, or transferred costs and administrative work to patients. Risks were greater when designers assumed stable broadband, private devices, fluent reading, dominant-language proficiency, conventional sensory or motor abilities, or confidence with identity verification and portals. Digital health equity has been described as a necessity within modern information-policy environments because technical modernization without inclusive access can widen existing differences [33].

Amplification could also occur through selective measurement. Analyses limited to service users could conclude that a program was convenient and acceptable while excluding unsuccessful users from the denominator. High satisfaction among completers could coexist with low reach among groups facing the greatest barriers. Automated systems introduced additional risks when proxy outcomes, historical utilization, or incomplete data reflected unequal prior access. These mechanisms did not establish inevitable harm, but they showed why equity cannot be inferred from average performance.

Practice and Policy Implications

Practice evaluation should begin by identifying the access problem the service is intended to solve and the populations affected. Measures should include unsuccessful entry, channel switching, technical assistance, accommodation requests, interpreter use, completion, comprehension, medicine receipt, follow-up, and patient-reported burden. Results should be stratified using justified categories while protecting privacy and avoiding simplistic interpretations of group difference. Nondigital routes should remain available when digital participation is not feasible or preferred.

Policy should distinguish authorization from equitable implementation. Permission to provide telepharmacy does not guarantee reimbursement, workforce capacity, accessible technology, medication availability, or continuity. Funding models should recognize interpretation, accessibility support, technical assistance, and outreach as service components rather than optional additions. Procurement should require evidence of accessibility, privacy, interoperability, subgroup evaluation, and practical escalation. Governance should also specify who reviews inequitable failure patterns and who can modify, restrict, or withdraw a system.

Implications, Strengths, and Limitations

Research Priorities

Research should compare digital, hybrid, and conventional pharmacy pathways using equivalent definitions of eligibility and access. Prospective studies should record who is invited, who attempts participation, who needs assistance, who cannot complete the pathway, and why. Outcomes should extend beyond satisfaction to affordability, comprehension, medication availability, continuity, safety-related processes, and distribution of benefit. Algorithmic evaluations should document training data, target construction, missingness, subgroup performance, calibration, failure consequences, and postdeployment change. Responsible machine-learning guidance emphasizes that harm prevention requires attention to the full development and deployment pathway [34]. Research on social determinants and large language models further suggests that unstructured data and generative systems create both opportunities and risks requiring population-aware evaluation [35].

Strengths and Limitations

A strength of this review is its integration of pharmacy-service evidence with digital-inclusion, accessibility, geographic-access, and algorithmic-equity scholarship. Source-type-sensitive appraisal prevented conceptual arguments from being presented as empirical effect estimates and prevented short-term service evaluations from being treated as proof of population-level equity. The multidimensional access definition also exposed trade-offs that would be hidden by a single utilization measure.

The review nevertheless has limitations. Heterogeneity in services, populations, outcomes, jurisdictions, and terminology restricted direct comparison. Equity variables were inconsistently measured, unsuccessful users were often absent, and intersectional analyses were uncommon. Much algorithmic evidence was not generated specifically in pharmacy contexts, limiting claims about prevalence or effect size. Publication and language restrictions may have excluded relevant local implementation experience. Finally, explainability alone should not be considered an adequate response to inequitable performance, because current explainable-AI approaches may not establish that a system is safe, fair, or clinically useful [36]. Future evaluation should also examine whether apparent gains persist after funding, staffing, or emergency arrangements end. Equity monitoring should continue after launch because user populations, service channels, reimbursement arrangements, staffing, and connected algorithms can change, altering who receives invitations, who completes encounters, and who obtains medicines without disproportionate burden during routine delivery. The proposed integrated equity model consequently remains an interpretive synthesis requiring prospective testing and contextual adaptation.

Conclusion

Digital pharmacy services can extend professional reach, reduce travel, support continuity, and create more flexible routes to medicine-related care. These benefits, however, do not arise from digital delivery alone. They depend on whether patients possess or receive the connectivity, devices, literacy, language support, accessibility accommodations, privacy, trust, and human assistance needed to participate, and whether organizations can integrate remote encounters with medication supply, documentation, referral, escalation, and follow-up.

The review shows that access should be evaluated as a multidimensional pathway rather than a binary measure of service availability. A service may improve geographic reach while increasing authentication burden, reduce travel costs while introducing connectivity or delivery costs, or offer convenient communication while excluding patients who cannot use the required interface. Average utilization and satisfaction can therefore conceal unequal entry, completion, comprehension, and benefit.

Equity-oriented digital pharmacy should preserve meaningful alternatives, identify unsuccessful participation, examine subgroup and intersectional patterns, and treat accessibility and language support as core service functions. Data-driven and algorithmic components require explicit attention to representation, target selection, subgroup performance, error consequences, and change after deployment. The integrated equity model proposed in this review organizes these interacting influences but does not constitute a validated assessment instrument or universal implementation standard.

Digital pharmacy is best understood as a reconfiguration of access conditions. Its contribution to equity will depend on who can enter, use, understand, trust, and benefit from the complete medicine-access pathway. Future evaluation should test these conditions prospectively and report both improved reach and any newly created exclusion transparently.

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