

AI-Enabled Mobile Health Applications as Physician Substitutes: Self-Medication Risks and Governance Solutions

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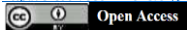
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ABSTRACT

Artificial intelligence (AI)-enabled mobile health applications can improve access to health information and guide users toward appropriate care, but they are increasingly treated as substitutes for professional medical assessment. This article evaluates the clinical, social, ethical, and legal risks that arise when symptom checkers, self-triage systems, or conversational AI tools influence self-diagnosis and self-medication. A focused narrative review and policy analysis was conducted using peer-reviewed evidence on diagnostic and triage performance, cyberchondria, antibiotic self-medication, privacy, algorithmic bias, and digital health equity, together with guidance from the World Health Organization, the United States Food and Drug Administration, the European Union, and the legislation of Uzbekistan. Evidence shows wide variation in performance: a 2022 systematic review reported primary diagnostic accuracy of 19.0%-37.9% and triage accuracy of 48.8%-90.1%, while a 2025 review found similarly broad variation in self-triage accuracy and substantial methodological limitations. The principal risks are false reassurance and delayed care, unnecessary escalation, health anxiety, inappropriate medicine use, antimicrobial resistance, non-transparent data sharing, unequal performance across population groups, and fragmented accountability. The article proposes a lifecycle governance model based on risk classification, independent clinical validation, human oversight, safe communication, medication safeguards, privacy by design, subgroup testing, post-market monitoring, and digital health literacy. AI should function as a carefully governed gateway to professional care rather than an autonomous replacement for physicians.

1. Introduction

Mobile health (mHealth) has moved health information from clinics and reference books into devices that people carry throughout the day. Symptom checkers, medication applications, wearable-device dashboards, and conversational AI systems can collect user-reported symptoms and other data, generate possible explanations, and recommend whether the user should seek emergency, urgent, routine, or self-care services. These functions may reduce informational and geographical barriers, support patient engagement, and help users prepare for a clinical consultation. They may be particularly valuable where medical personnel are limited or where a user needs rapid guidance outside normal service hours. The broader promise of AI in medicine is therefore not merely automation; it is the possibility of making high-quality knowledge more accessible while allowing clinicians to focus on tasks that require examination, judgment, and empathy (Topol, 2019; World Health Organization [WHO], 2021).

However, a user-facing health application is not equivalent to a physician. Some products use machine learning, some use fixed decision trees, and others use hybrid knowledge bases, yet all may be marketed or perceived as intelligent. A physician can clarify an incomplete history, observe non-verbal signs, conduct a physical examination, order tests, interpret results in context, and assume a professional duty of care. An application generally receives only the data that the user recognizes and chooses to enter. It may not know about pregnancy, allergies, comorbidities, drug interactions, social circumstances, or subtle warning signs. The central risk is therefore not that software always fails, but that a probabilistic output can be mistaken for a definitive diagnosis.

The phrase 'physician substitute' in this article refers to this behavioral and functional substitution: a person may use the application instead of contacting a qualified professional, even when the developer describes the product only as an informational aid. That substitution can create two opposite forms of harm. Under-triage may falsely reassure a user and delay necessary treatment, while over-triage may increase anxiety and unnecessary demand for emergency or specialist services. When an application also presents disease labels or treatment information, the user may attempt to treat the presumed condition without appropriate diagnosis or prescription. WHO guidance consequently emphasizes human autonomy, safety, transparency, accountability, inclusiveness, and continuous assessment throughout the AI lifecycle (WHO, 2021, 2023).

This article has three objectives: to synthesize evidence on the reliability and safety limitations of patient-facing symptom assessment technologies; to examine the social pathways through which these tools may contribute to cyberchondria, self-medication, privacy loss, and inequity; and to propose a practical governance framework with specific implications for Uzbekistan. The analysis adopts a balanced position. It does not treat all health applications as dangerous, nor does it assume that digital advice is inherently inferior to unaided decision-making. Instead, it asks which function is being performed, for which users, under what conditions, with what evidence, and with which safeguards.

2. Materials and Methods

A focused narrative review and policy analysis was undertaken. Peer-reviewed studies and systematic reviews published primarily between 2012 and 2025 were identified through PubMed-indexed literature and publisher databases using combinations of the terms 'symptom checker,' 'self-triage,' 'diagnostic accuracy,' 'mobile health,' 'cyberchondria,' 'self-medication,' 'antibiotic resistance,' 'health app privacy,' 'algorithmic bias,' and 'digital health equity.' Official policy and legal documents were drawn from WHO, the U.S. Food and Drug Administration (FDA), the European Union, and the national legal database of Uzbekistan. Sources were selected when they directly addressed patient-facing digital health tools, measurable safety or social outcomes, or governance requirements relevant to these tools. Vendor marketing claims without independent evidence were not treated as proof of effectiveness.

The evidence was synthesized into six themes: diagnostic and triage reliability; delayed or unnecessary care; mental health and cyberchondria; self-medication and antimicrobial resistance; privacy, cybersecurity, and equity; and legal accountability. Because the included studies used different applications, clinical cases, accuracy definitions, and reference standards, no new pooled effect estimate was calculated. Numerical findings are presented as study-specific or review-level results rather than as universal performance rates for all current products. The method is therefore a critical narrative synthesis, not a new systematic review or meta-analysis.

3. Results and Thematic Analysis

3.1. Diagnostic and Triage Reliability

The strongest evidence concerns symptom checkers that produce a ranked list of possible conditions and a recommendation about care urgency. In an early audit of 23 symptom checkers using standardized clinical vignettes, the correct diagnosis was listed first in 34% of evaluations and within the top 20 suggestions in 58%; appropriate triage advice was provided in 57% of evaluations (Semigran et al., 2015). These findings demonstrated two important distinctions. First, listing a possible diagnosis somewhere in a long differential is not the same as identifying it as the most likely condition. Second, diagnostic accuracy and triage safety are separate outcomes: a tool can misidentify the disease but still direct the user to an appropriate level of care, or it can name the disease while giving unsafe urgency advice.

Subsequent reviews found that the evidence remained heterogeneous. Chambers et al. (2019) concluded that diagnostic accuracy was generally low and variable and that evidence on effects on health service use was limited. Wallace et al. (2022) included ten studies and reported primary diagnostic accuracy ranging from 19.0% to 37.9%, while triage accuracy ranged from 48.8% to 90.1%. Performance varied not only between applications but also by disease, urgency, and study design. The wide range means that a single headline percentage is misleading: product-specific validation and intended use matter more than the broad label 'AI symptom checker.'

A more recent systematic review broadened the comparison to symptom-assessment applications, large language models, and medical laypeople. Across 19 included studies, self-triage accuracy ranged

from 11.5% to 90.0% for applications, 57.8% to 76.0% for large language models, and 47.3% to 62.4% for laypeople; 89% of included studies had at least one domain with high or unclear risk of bias (Kopka et al., 2025). The authors therefore did not recommend universal acceptance or rejection of these tools. Their utility must be evaluated for a defined use case and population. This point is crucial: even an imperfect tool may improve a poor unaided decision in one setting, while the same tool may create harm when it displaces timely professional care in another.

Vignette studies also have limits. Clear textbook cases entered by trained researchers do not reproduce the ambiguity, language variation, spelling errors, incomplete histories, or evolving symptoms found in real use. Applications are updated frequently, which can make an evaluation obsolete, and commercial systems may disclose little about their training data or decision logic. Safety evaluation should therefore prioritize clinically important failure modes - especially under-triage of emergencies - and should include real users, local languages, multimorbidity, pregnancy, children, older adults, and people with disabilities.

3.2. Delayed Care, Over-Triage, and the Illusion of Certainty

False reassurance is the most serious immediate danger. A benign label can cause a user to wait while a time-sensitive condition progresses. Because many severe diseases begin with non-specific symptoms, an application cannot safely treat the absence of a classic symptom pattern as proof that urgent illness is absent. The risk is amplified when users have limited health literacy, when symptoms are entered in a second language, or when the application does not ask about relevant medicines and comorbidities. A disclaimer placed on the first screen does not fully correct this problem if the subsequent interface presents a confident disease label or a reassuring visual score.

Over-triage creates a different burden. Risk-averse systems may recommend emergency care for conditions that could be managed through primary care or observation. This may increase cost, waiting times, and anxiety, particularly when the application is used repeatedly. The appropriate aim is not maximum sensitivity at any cost or maximum specificity at any cost, but a transparent safety threshold appropriate to the application's function. Emergency red flags should trigger clear escalation, while lower-risk outputs should communicate uncertainty and provide specific follow-up criteria rather than a definitive diagnosis.

3.3. Cyberchondria and Changes in Health-Seeking Behavior

Cyberchondria describes excessive or repeated online health searching that increases distress or health anxiety. It is not caused by every digital search, and seeking information can be beneficial. The problem emerges when uncertainty leads to repeated checking, increasingly severe interpretations, and further anxiety. In a systematic review and meta-analysis of 20 studies with 7,373 participants, health anxiety was positively associated with online health information seeking ($r = 0.34$) and more strongly associated with cyberchondria ($r = 0.62$) (McMullan et al., 2019). Earlier research likewise found that people with higher health anxiety searched more frequently, searched longer, and experienced more distress during and after searching (Muse et al., 2012).

AI interfaces can intensify this cycle when they generate long differential diagnoses without explaining base rates, when they respond differently to repeated prompts, or when conversational fluency is mistaken for clinical confidence. Conversely, a well-designed tool can reduce anxiety by distinguishing emergency warning signs from routine follow-up, limiting repetitive assessments, and connecting the user with a clinician. Psychological safety is therefore a design requirement, not merely a matter of user self-control. Applications should avoid sensational disease lists, use calibrated language, and provide a clear stopping point at which further digital checking is replaced by professional consultation.

3.4. Self-Medication, Medication Safety, and Antimicrobial Resistance

A symptom checker does not need to issue a formal prescription to influence medicine use. A provisional disease label may lead a user to reuse an old prescription, purchase an over-the-counter product, combine medicines, or obtain an antibiotic without adequate assessment. The pathway is indirect but plausible: digital self-diagnosis increases perceived certainty, while easy access to medicines reduces the practical barrier to treatment. The consequences include adverse drug reactions, interactions, masking of important symptoms, incorrect dosing, and delayed diagnosis.

Antibiotic self-medication is particularly important because individual misuse has population-level consequences. A systematic review and meta-analysis of community pharmacies in 24 countries found that the pooled proportion of non-prescription antibiotic supply was 62%, rising to 78% when antibiotics were directly requested by a patient (Auta et al., 2019). A scoping review in low- and middle-income countries identified prior experience, perceived illness severity, cost, access barriers, medicine availability, and limited knowledge as recurring drivers of antibiotic self-medication (Torres et al., 2019). These factors can interact with an application's apparently authoritative output.

The scale of antimicrobial resistance (AMR) makes even a modest digital contribution to inappropriate use relevant. A global analysis estimated that bacterial AMR was directly attributable to 1.27 million deaths and associated with 4.95 million deaths in 2019 (Antimicrobial Resistance Collaborators, 2022). Patient-facing applications should therefore not recommend antibiotics, controlled medicines, or individualized dosing without a lawful clinician-led pathway. Where medicine information is provided, it should emphasize contraindications, the need for diagnosis, and referral to a physician or pharmacist.

3.5. Privacy, Cybersecurity, and Commercial Use of Health Data

Symptom data can reveal pregnancy, mental health concerns, sexual health, chronic disease, medication use, and other highly sensitive information. The privacy risk extends beyond an obvious data breach. It includes secondary use for advertising, profiling, insurance or employment decisions, opaque cross-border transfer, and re-identification through combination with device identifiers or location data. In a study of 24 highly rated medicines-related applications, 19 (79%) shared user data with first or third parties, and the wider data-sharing network created opportunities for aggregation and re-identification (Grundy et al., 2019).

A larger cross-sectional analysis also identified inconsistent privacy practices: 28.1% of examined mHealth applications provided no privacy policy, and only 47.0% of observed data transmissions were consistent with the stated policy (Tangari et al., 2021). Consent cannot be considered meaningful when essential processing is hidden in lengthy text, when the user cannot refuse non-essential tracking, or when a health assessment is conditioned on advertising identifiers. Data minimization, encryption, access controls, retention limits, vendor oversight, and a prohibition on unrelated advertising use should be minimum requirements.

Uzbekistan already has a legal foundation through the Law 'On Personal Data' No. ZRU-547, which regulates processing, protection, consent, cross-border transfer, and anonymization, and the Law 'On Cybersecurity' No. ZRU-764, which establishes national cybersecurity principles (Republic of Uzbekistan, 2019, 2022). However, AI-enabled health applications raise additional questions about clinical purpose, automated inference, continuous model updates, and responsibility for third-party processors. Health-specific implementation rules should clarify how these general duties apply to symptom and diagnostic data.

3.6. Algorithmic Bias and Digital Health Equity

An application may perform well on average yet perform poorly for a subgroup that was underrepresented in its training or validation data. Bias can arise from language, age, sex, disability, skin tone, socioeconomic status, access to prior care, or the use of an inappropriate proxy. Obermeyer et al. (2019) showed how a widely used health management algorithm produced racial bias because it used healthcare cost as a proxy for health need; correcting the proxy would have raised the proportion of Black patients receiving additional support from 17.7% to 46.5%. Although this was not a symptom-checker study, it demonstrates a general lesson: seemingly neutral targets can reproduce inequalities already present in the health system.

Digital access itself is also a determinant of outcome. Device quality, internet cost, digital literacy, accessibility, trust, and the availability of follow-up services influence whether a tool helps or harms. The Framework for Digital Health Equity places these determinants at individual, interpersonal, community, and societal levels (Richardson et al., 2022). For Uzbekistan, validation in the languages and communication patterns actually used by patients is essential. A translated interface is not sufficient if the underlying model was never tested with local symptom descriptions, disease prevalence, medicine access, and referral pathways.

3.7. Legal and Ethical Accountability

Accountability is distributed across the developer, data provider, commercial operator, healthcare institution, clinician, app store, regulator, and user. A simple choice between 'the developer is responsible' and 'the user is responsible' is therefore inadequate. Responsibility should follow control: the organization that defines the intended use and updates the model should document safety and performance; the deploying institution should confirm local suitability and monitor incidents; clinicians should understand the limits of tools incorporated into care; and regulators should define when the software is a medical device and what evidence is required. A disclaimer may inform the user, but it should not erase responsibility for a foreseeable unsafe design.

International approaches increasingly apply risk-based oversight. FDA guidance distinguishes lower-risk software from device software functions for which failure could threaten patient safety and focuses oversight accordingly (U.S. Food and Drug Administration, 2022). The European Union's AI Act imposes additional requirements on high-risk AI systems, including certain systems linked to regulated medical devices, while WHO recommends transparency, documentation, external validation, cybersecurity, human intervention, and post-market monitoring (European Parliament & Council of the European Union, 2024; WHO, 2023). These frameworks are not identical, but they share a central principle: the greater the possible clinical harm, the stronger the evidence and oversight required.

Table 1

Principal risk pathways and recommended controls

Risk domain	Failure pathway	Potential consequence	Required control
Diagnostic safety	Under-triage or false reassurance	Delayed emergency or specialist care	External validation; red-flag override; clear escalation
Service use	Over-triage and repeated checking	Anxiety, cost, and avoidable demand	Calibrated urgency; uncertainty statements; follow-up criteria
Medication safety	Disease label prompts unsupervised treatment	Adverse reactions, interactions, AMR	No prescription-like advice; clinician or pharmacist referral
Mental health	Long disease lists and inconsistent answers	Cyberchondria and compulsive checking	Supportive wording; stop rules; rapid human contact
Privacy	Opaque collection or third-party sharing	Profiling, discrimination, or data breach	Data minimization; encryption; granular consent; vendor audit
Equity	Biased data, proxies, or language performance	Unequal errors across population groups	Local and subgroup validation; accessible multilingual design
Accountability	Unclear product status and responsibility	Weak redress and repeated unsafe failures	Risk classification; documentation; incident reporting; audit

4. Governance and Risk-Reduction Framework

Effective regulation should follow the product lifecycle rather than rely only on approval at the moment of launch. The following measures translate the evidence into a practical framework for developers, health institutions, and public authorities.

Risk classification before deployment. Every application should have a precise intended-use statement. General education, appointment support, self-triage, diagnosis, and treatment recommendation are different functions and should not share the same evidentiary threshold. If an output can reasonably change a user's decision about emergency care, diagnosis, or medication, the function should be treated as clinically consequential even if it is delivered through a consumer app store.

Independent clinical and local validation. Testing should use representative real-world cases in addition to vignettes and should report sensitivity for red flags, under-triage, over-triage, calibration, usability, and performance across relevant subgroups. Validation should be independent of the developer

where possible and repeated after material updates. Evidence from another country or language should not automatically be assumed to apply locally.

Human oversight and direct escalation. The application should be designed to connect users to professional care, not to create a closed digital pathway. Emergency indicators must produce an immediate, unambiguous instruction to contact emergency services. Uncertain or high-risk cases should offer rapid telemedicine, primary-care, dental, pharmacy, or specialist referral as appropriate.

Safe communication and medication boundaries. Warnings should be specific, visible, and repeated at the point of risk rather than hidden in terms of service. The interface should distinguish a possible condition from a diagnosis and a general medicine description from a personalized treatment recommendation. Antibiotics, controlled medicines, and individualized dosing should remain within a licensed professional pathway.

Privacy and cybersecurity by design. Only data necessary for the stated clinical function should be collected. Sensitive information should be encrypted in transit and at rest, access should be logged and restricted, retention should be time-limited, and non-essential tracking should be off by default. Contracts with analytics, cloud, and AI service providers must preserve the same health-data protections and provide a clear breach-response process.

Post-market surveillance and change control. Developers and deploying institutions should maintain version histories, monitor performance drift, record adverse events and near misses, and provide a simple mechanism for users and clinicians to report unsafe advice. A material change to the model, knowledge base, triage threshold, or data source should trigger reassessment rather than being treated as an ordinary software update.

Digital health literacy and professional engagement. Public education should teach users that fluency is not certainty, a ranked list is not a diagnosis, and emergency symptoms require professional assessment. Physicians, dentists, nurses, and pharmacists should routinely ask whether digital advice influenced a patient's decision and correct unsafe interpretations without dismissing the patient's effort to seek information.

5. Implications for Uzbekistan

Uzbekistan can gain from mHealth as smartphone access and digital public services expand, but imported applications should not become an unregulated substitute for local clinical pathways. The Ministry of Health, together with the authorities responsible for medical devices, personal data, and cybersecurity, should establish a public register of clinically consequential digital health functions. The register should identify the intended use, developer, current version, evidence base, supported languages, data location, responsible local entity, and route for reporting incidents. Approval should be proportionate: a general wellness tool requires less oversight than software that recommends urgency, predicts disease, or influences medication.

Local validation should include users communicating in Uzbek and Russian and should assess regional language needs, health literacy, disability access, disease prevalence, and the availability of referral services. Pilot deployment through supervised primary care and telemedicine would provide safer evidence than unrestricted stand-alone use. Universities and health institutions can support independent testing, while clinicians and pharmacists can contribute realistic cases and monitor whether digital advice changes self-medication or delays care.

Existing personal-data and cybersecurity laws provide a foundation, but implementing regulations should explicitly address sensitive health inferences, cross-border processing, use of third-party AI services, retention, model updates, and liability. Public campaigns should link digital health literacy with antimicrobial stewardship: users need to know both when an app cannot rule out a dangerous condition and why an apparent infection label does not justify taking an antibiotic. This combined approach would preserve the accessibility benefits of mHealth while strengthening patient safety and public trust.

6. Discussion

The evidence does not support describing current patient-facing applications as equivalent replacements for physicians. It also does not justify banning them as a class. Their value depends on a narrower and more realistic role: structuring symptom information, highlighting red flags, supporting self-triage, and guiding users toward appropriate professional care. The relevant comparison is not always an application versus an expert clinician. In some contexts it is an application-assisted decision

versus an unaided decision by a person who may otherwise do nothing. That potential benefit must nevertheless be weighed against the risk that the application's authority discourages consultation.

Three principles emerge across the clinical, social, and legal evidence. First, uncertainty must be visible. A fluent or numerically precise output should not conceal incomplete data or weak validation. Second, responsibility must be matched to control. Organizations that design, update, distribute, or integrate the system cannot transfer all foreseeable risk to the user through a disclaimer. Third, evaluation must continue after deployment because user behavior, disease patterns, data sources, and software versions change. These principles align with WHO's lifecycle approach and with risk-based regulation in the United States and European Union (WHO, 2023; U.S. Food and Drug Administration, 2022; European Parliament & Council of the European Union, 2024).

The physician's continuing role is not based only on superior recall of medical facts. It includes contextual judgment, physical examination, ethical duty, dialogue, and the ability to respond to uncertainty and suffering. AI may strengthen these functions when it is used as an assistive layer, but it weakens care when it converts probabilistic suggestions into unsupervised decisions. The safest design objective is therefore augmentation with a clear path to human care.

7. Limitations

This article is a focused narrative review rather than a systematic review. The included literature varies substantially in application type, clinical domain, reference standard, and study quality, and many accuracy studies use simulated vignettes rather than real users. Commercial products and large language models also change rapidly, so published results may not represent their current versions. Evidence directly linking symptom-checker use to self-medication remains less developed than evidence on accuracy, cyberchondria, or non-prescription antibiotic access; the proposed pathway should therefore be tested in prospective and locally grounded studies.

8. Conclusion

AI-enabled mobile health applications can expand access to information and improve navigation of health services, but their benefits are conditional on design, evidence, and governance. When users treat provisional outputs as diagnoses, the result may be delayed care, unnecessary escalation, cyberchondria, unsafe medication use, privacy loss, and unequal outcomes. These risks cannot be controlled by a generic disclaimer alone. A safe system requires risk classification, independent and local validation, human escalation, medication safeguards, privacy by design, subgroup testing, transparent accountability, and continuous monitoring. For Uzbekistan, these measures should build on existing personal-data and cybersecurity laws and be connected to local clinical and telemedicine pathways. AI should help people reach the right professional care at the right time; it should not encourage them to replace clinical assessment with an unverified digital conclusion

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