

AI-Powered Supply Chain and Telepharmacy

Optimizing Operations for Access and Equity

Laura Behm, Pharm.D., BCPS
December 2025

EXECUTIVE SUMMARY

The infrastructure of American pharmacy is fracturing. Between 2010 and 2021, nearly 29% of community pharmacies in the United States closed their doors, a trend that accelerated violently with over 2,200 additional closures in 2024 alone. These closures are not evenly distributed; they disproportionately impact rural and low-income urban communities, creating vast "pharmacy deserts" where medication access is determined by geography rather than need. Simultaneously, health system pharmacies face unprecedented margin compression, forcing leaders to do more with significantly less.

This white paper argues that Artificial Intelligence (AI) offers the only viable path to stabilize this crumbling infrastructure. By transitioning from manual, reactive logistics to AI-Powered Supply Chains and Telepharmacy, organizations can decouple operational capacity from physical footprint. Through the deployment of predictive inventory modeling, autonomous robotic dispensing, and remote clinical supervision, we can reduce waste, optimize labor, and extend the reach of the pharmacist into the homes of the most vulnerable patients. This is not merely an operational upgrade; it is an equity imperative.

1. THE OPERATIONAL CRISIS: DESERTS AND FRAGILITY

The traditional pharmacy business model—reliant on high-volume dispensing and physical foot traffic—is failing. The closure of thousands of pharmacies has left millions of Americans without easy access to essential medications, directly contributing to non-adherence and poor health outcomes. For hospitals, the crisis is internal: supply chains are fragile, prone to shortages, and heavily burdened by waste. Traditional "par level" inventory systems are reactive, leading to the twin failures of stockouts during critical demand

spikes and expensive expiration waste during lulls.

In this environment, manual inventory management is a liability. Pharmacy directors can no longer afford to tie up millions of dollars in working capital on "just in case" inventory, nor can they afford the labor costs of manual counting and verifying. The sector requires a shift to Autonomous Operations, where the movement of medication is governed by predictive algorithms rather than human heuristics.

2. THE AI SUPPLY CHAIN: FROM REACTIVE TO PREDICTIVE

Artificial Intelligence transforms the supply chain from a static ledger into a dynamic, learning system. By utilizing Deep Reinforcement Learning, modern inventory systems can analyze historical dispensing data, seasonal disease trends (e.g., local flu outbreaks), and even external supply shocks to forecast demand with superhuman accuracy. Recent studies demonstrate that AI-driven vendor-managed inventory (VMI) systems can reduce perishable inventory holding costs by nearly 30% and reduce total hospital stock levels to approximately 20% of historical norms without risking stockouts. This "Just-in-Time" precision frees up massive amounts of working capital.

CASE STUDY: Autonomous Dispensing

In the realm of dispensing, robotics have surpassed human capability. The UCSF Medical Center set the global standard with an autonomous robotic pharmacy that has prepared over 3.5 million sterile doses with zero errors. This level of reliability suggests that the future of dispensing is automated, allowing human pharmacists to exit the production role entirely.

Furthermore, platforms like Plenful are dismantling the "hidden factory" of administrative waste. By automating 340B auditing, rebate management, and

prior authorizations, these tools reduce manual administrative work by over 75%, effectively solving the workforce shortage by creating new capacity within the existing team.

3. TELEPHARMACY: DECOUPLING CARE FROM GEOGRAPHY

If robotics solves the logistics of dispensing, telepharmacy solves the access to expertise. Telepharmacy enables a single pharmacist to supervise multiple remote technicians and counsel patients via secure audiovisual links, making pharmacy services viable in low-volume rural or urban underserved areas where a traditional store would be unprofitable.

However, the adoption of telepharmacy is currently hindered by a fragmented regulatory landscape. As of 2025, only 28 states fully permit telepharmacy, and rules vary wildly. Michigan allows remote sites within 150 miles of a hub pharmacy, facilitating broad access. In contrast, Texas restricts telepharmacy to rural counties with fewer than 50,000 residents and, crucially, prohibits remote dispensing sites from dispensing Schedule II controlled substances, severely limiting care for pain and palliative patients.

IMPACT: Accelerated Therapy

Despite regulatory hurdles, innovation is accelerating. House Rx has integrated AI-driven specialty dispensing directly into physician clinics, slashing the “time-to-therapy” to just 3.5 days—an 80% improvement over the industry average. Globally, China’s Ping An Good Doctor has deployed unstaffed “One-Minute Clinics,” AI-powered booths that can diagnose and dispense medications to millions.

4. CONCLUSION: OPERATIONS AS A VEHICLE FOR EQUITY

The integration of AI into the pharmacy supply chain and the expansion of telepharmacy are not just efficiency measures; they are mechanisms of health equity. By using AI to drive down the cost of dispensing and logistics, we make it economically feasible to keep pharmacy services in rural and underserved communities.

For the pharmacy leader, the strategy is clear: automate the product to liberate the provider. We must aggressively adopt predictive inventory and robotic dispensing to survive financial pressures. Simultaneously, we must advocate for harmonized telepharmacy regulations that allow us to deploy these digital assets where they are needed most. In the future,

the quality of a patient’s pharmaceutical care should be determined by the severity of their condition, not the zip code of their home.

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