

# Streaming Data Approaches for Prescription Path Tracking: Design Principles, Measurement Frameworks, and Therapeutic Access Implications

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## ABSTRACT

The increasing complexity of advanced therapeutics and distributed care delivery makes prescription path coordination a central determinant of timely medication access and clinical outcomes. Prior authorization and coverage verification introduce substantial friction; recent physician surveys report that 94 percent of clinicians see these processes delaying necessary care and that 78 percent observe patients abandoning treatment when they encounter administrative barriers. Across specialty and community pharmacy networks, stakeholders typically lack consolidated, real-time visibility into prescription status as cases move between prescribers, payers, patient support programs, and dispensing sites. Streaming prescription path hubs address this visibility gap by continuously capturing clinically and administratively meaningful events and propagating status changes with low latency to connected platforms and care teams. Treating the prescription path as a longitudinal patient journey rather than a collection of isolated transactions enables organizations to compute metrics such as time to therapy initiation, phase-specific delays, and rework rates. This article synthesizes streaming platform patterns and health information system principles to propose design concepts, implementation strategies, and evaluation approaches for prescription path hubs. The resulting blueprint is aimed at healthcare technology architects who must design platforms that simultaneously support operational coordination and measurement of therapeutic access, enabling systematic monitoring, optimization, and computational analysis. Moreover, these hubs create unified information bases supporting cross-channel communication centers and mechanized workflow synchronization spanning prescription and coverage procedures, holding significance for persistence enhancement, bureaucratic load diminishment, and health fairness progression.

**Keywords:** Streaming Data Architecture, Prescription Path Coordination, Therapeutic Access, Authorization Workflows, Medication Persistence

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## 1. Background and Current Landscape

### 1.1 Prescription Path Coordination Complexities in Contemporary Healthcare

Medical service provision currently encompasses remarkable intricacy when directing prescription sequences across specialized therapeutic classifications and dispersed care structures. Pharmacies attending both specialty and mainstream populations synchronize undertakings spanning prescriber locations, coverage organizations, patient support initiatives, and delivery vendors, though foundational technological frameworks persist as disconnected and concentrated upon singular

dealings. Standard pharmacy platforms and coverage administration systems materialized to process discrete undertakings such as claim filing, eligibility affirmation, and approval solicitations rather than backing uninterrupted patient encounters throughout medication procurement. These design restrictions yield considerable awareness shortfalls, blocking participants from resolving fundamental inquiries concerning prescription results such as what share of digitally conveyed prescriptions never achieve initial dispensing within suitable clinical periods or which particular procedural phase encounters maximum patient withdrawal frequency. Ramifications stemming from these awareness shortfalls extend past operational ineffectiveness toward direct patient wellness consequences, given that medication procurement postponements and procedural discontinuities can compromise therapeutic potency while permitting illness advancement.

### 1.2 Authorization Prerequisites and Treatment Withdrawal Patterns

Approval stipulations preceding medication procurement have accumulated into a substantial healthcare system encumbrance, producing resistance that defers crucial treatments and propels patients away from ordered therapies. Practitioner surveys conducted through the American Medical Association record that 94% of physicians witness approval procedures always, often, or sometimes deferring patient procurement of necessary care, with these deferrals appearing regularly throughout essentially all practice contexts and therapeutic classifications [1]. Bureaucratic requirements accompanying approval sequences have enlarged until clinicians report completing an average of 39 prior authorizations per physician per week, with physicians and their staff spending 13 hours each week finishing approval documentation, diverting clinical hours and personnel assets from direct patient encounters. Additionally, 89% of physicians report that prior authorization somewhat or significantly increases physician burnout, while 40% of physicians have staff who work exclusively on prior authorization activities. Past bureaucratic burden factors, patient result consequences warrant specific consideration, given survey discoveries demonstrate that 78% of physicians report patients often or sometimes cease pursuing ordered treatments when meeting approval hindrances [2]. These withdrawal tendencies constitute critical medication procurement path breakdowns, as patients who terminate seeking ordered therapies owing to bureaucratic impediments may undergo preventable illness advancement, medical difficulties, or reduced life caliber. More than one in four physicians (29%) report that prior authorization has led to a serious adverse event for a patient in their care, with 23% reporting hospitalizations, 18% reporting life-threatening events requiring intervention to prevent permanent impairment, and 8% reporting disability, permanent bodily damage, or death. Furthermore, 88% of physicians report that prior authorization leads to higher overall utilization of health care resources, with 77% reporting ineffective initial treatment due to step therapy requirements, 73% reporting additional office visits, 47% reporting immediate care or emergency department visits, and 33% reporting hospitalizations. Amplifying consequences emerging from approval deferrals merged with patient withdrawal accentuate pressing demands for design methodologies furnishing clarity, resistance diminishment, and anticipatory intervention capacity when procurement hindrances surface.

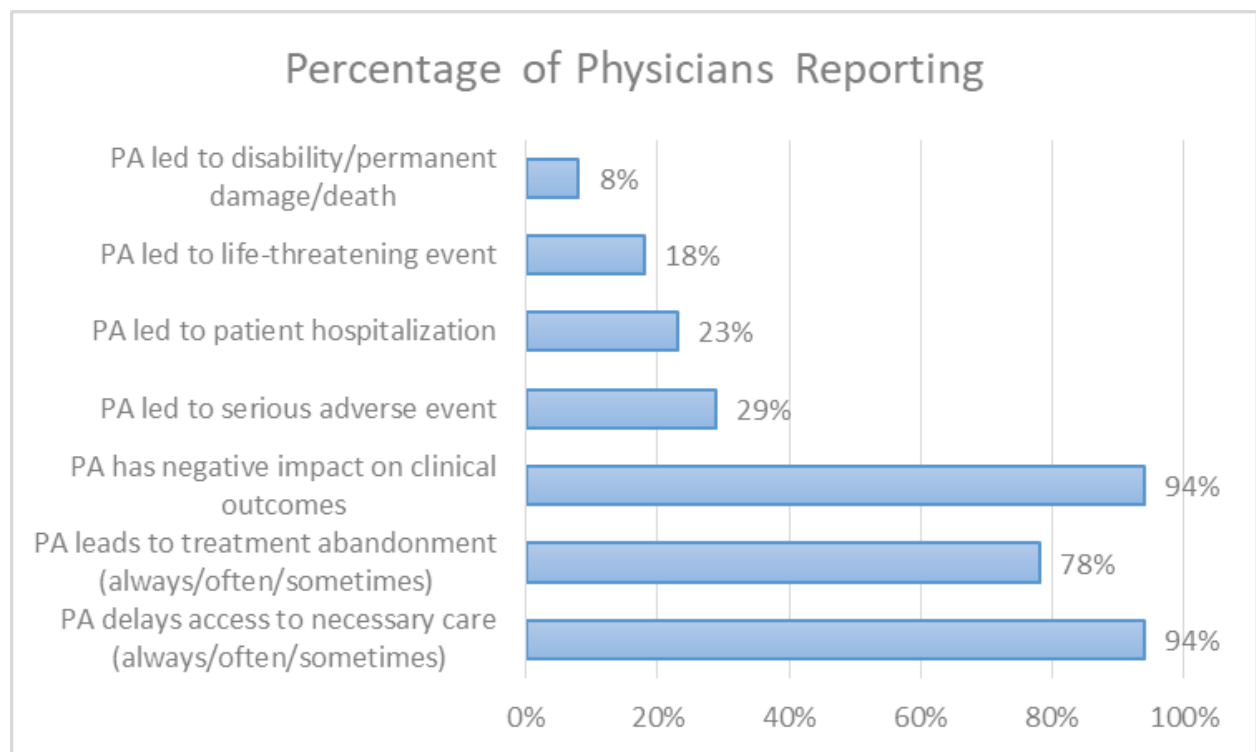


Fig. 1: Prior Authorization Impact on Patient Care Outcomes [1, 2]

## 2. Design Philosophies and Path Awareness

### 2.1 Evolving Beyond Dealing-Focused Platforms Toward Event-oriented Sequences

Moving from transaction-centric to event-oriented design represents a fundamental shift in how prescription path data are captured, organized, and used. Conventional platforms record individual claims, eligibility checks, and authorization decisions as independent transactions, with limited linkage to the broader patient journey. This fragmentation makes it difficult to derive path-level metrics and obscures systematic delay and abandonment patterns. The medication access journey framework provides a conceptual basis for structuring the path into nodes that patients traverse—perceived need, help seeking, clinical encounter, prescribing, adjudication, dispensing, and adherence—each with distinct barriers and enablers. Event-oriented prescription hubs operationalize this framework by defining an explicit event taxonomy and capturing timestamped events at each node, enabling longitudinal reconstruction of the path for both operational monitoring and analytic evaluation [3]. The framework identifies 7 nodes that patients encounter when attempting to access medication: perceived need, help seeking, encounter, prescribing, prescription adjudication, prescription dispensing, and adherence, while also identifying 18 barriers across these nodes, with patient health literacy, cost, insurance, and organizational health literacy representing predominant barriers across multiple nodes. Event-oriented prescription path hubs operationalize these structures via distinct happening capture at each node paired with swift transmission toward interested platforms and personnel, producing longitudinal documentation backing both operational synchronization and analytical revelation. Via coordination from prescribing platforms, registration tools, approval systems, and dispensing documentation under collective identification approaches, hub design allows participants to follow results throughout millions of prescriptions without requiring extensive hand-built reconciliation undertakings.

<b>Access Node</b>	<b>Top Barriers at Node</b>
Perceived Need	Health literacy, Patient attitudes and beliefs, Provider competencies and beliefs
Help Seeking	Cost, Health literacy, Transportation, Provider availability, Insurance
Encounter	Health literacy, Insurance, Language, Provider competencies and beliefs
Prescribing	Insurance, Medical conditions, Organizational health literacy
Prescription Adjudication	Organizational health literacy, Insurance, Health literacy
Prescription Dispensing	Cost, Transportation, Patient attitudes and beliefs, Organizational health literacy
Adherence	Health literacy, Cost, Patient attitudes and beliefs

Table 1: Medication Access Patient Journey Framework Nodes and Barriers [3]

## 2.2 Centralized Services and Procurement Quantification

Specialty pharmacy centralized functions have emerged as principal arranging frameworks for medication procurement programs, consolidating coverage examination, approval help, monetary support synchronization, and patient instruction inside unified service structures. Centralized service potency hinges critically upon processing duration oversight and lag reduction throughout each procurement procedure segment, though published examinations have recorded substantial obstacles blocking timely advancement via coverage affirmation and approval sequences [4]. Research indicates that before integration of specialty pharmacy services, patients often experienced bewilderment by the authorization process due to confusion, stress, or the high cost of obtaining medications, with providers frequently unaware that patients were unable to access prescribed therapy until follow-up appointments months later, during which time disease states could progress leading to increased downstream medical costs and poor patient outcomes. Event-oriented path hubs strengthen standard centralized service methods via high-detail signaling concerning when each segment starts and finishes, what conclusion materialized, and what length each changeover required. This refined awareness backs quantification structures distinguishing among lags traceable toward coverage entity conduct, paperwork shortfalls from prescriber locations, patient involvement challenges, or shipping logistics restrictions. Healthcare technology designers can embed quantification demands straight inside hub requirements via compulsory happening characteristic specifications and normalized conclusion coding throughout varying products, coverage entities, and care contexts, creating bases for thorough scorecards mirroring operational effectiveness together with patient encounter while situating hubs as foundations whereupon computational enhancement can experience secure evaluation and appraisal.

## 3. Prescription Path Segments and Breakdown Pattern Examination

### 3.1 Medication Procurement Nodes and Happening Classification

Transforming conceptual medication procurement structures toward tangible happening categorization demands meticulous consideration regarding clinical and administrative distinctions influencing patient conclusions and initiative execution. Each path node corresponds toward specific happening varieties, covering meeting finalization, prescription formation, coverage examination start, approval filing, paperwork request, claim resolution, and medication dispensing, bearing timestamps permitting exact length calculation and pattern sequence recognition. Released

investigations reviewing specialty pharmacy functions inside unified academic wellness system clinic arrangements have demonstrated that synchronized methods joining embedded clinical pharmacists alongside anticipatory approval backing accomplish a 78% decrease regarding medication approval duration (median of 67 days down to 15 days) and a 68% decrease regarding treatment commencement duration (median of 82 days down to 26 days) contrasted against conventional procedures [5]. The integrated model demonstrated a 34% decrease in pretreatment appointments (1.14 down to 0.75 clinic visits per day), an 80% decrease in on-treatment provider appointments (0.36 down to 0.1 clinic visits per day) since these were seen by the pharmacist, and a 38% increase in prescriptions for treatment generated from the clinic (0.8 up to 1.1 prescriptions generated per clinic day). These discoveries stress vocabulary construction significance for recording particular interventions and synchronization undertakings differentiating superior-performing procurement programs from those undergoing organized lags. Happening categorization ought additionally capture common breakdown patterns at each node, covering missing or incorrect coverage data throughout coverage examination, repeated rejections for similar clinical scenarios throughout approval, extended gaps preceding prescriber reaction toward paperwork requests, and intervals amid approval and initial dispensing potentially signaling patient involvement challenges or logistical hindrances.

### 3.2 Measuring Congestion Points and Withdrawal Locations

Exact congestion point measurement and withdrawal site recognition constitute among the most considerable benefits of event-oriented path designs maintained compared against standard reporting techniques. Released specialty medication procurement reviews have recorded heightened lag and discontinuity frequencies throughout numerous therapeutic classifications, with clinical trials showing 50% discontinuation of therapy within the first 8 weeks for certain oral oncolytic medications, covering substantial attrition amid initial prescription and accomplished first dispensing. Event-oriented hubs allow refined monitoring concerning precise phases where patients withdraw, whether subsequent to initial rejection, preceding reaction toward paperwork requests, following cost conversations, or at additional particular path sites. Technology-supported intervention answers constructed for patient persistence enhancement have shown substantial involvement and continuation improvements, with one oncology adherence program demonstrating a 21% increase in patients who stayed on therapy past the first 8 weeks, while 70% of patients kept using the support application for at least 1 year compared to an industry average of 18%, and achieving 83-98% adherence rates across patient support programs when backed through thorough path standing awareness paired with prompt risk element recognition [6]. A streaming prescription path hub enables a standardized measurement framework that links path structure to operational and clinical outcomes. At minimum, implementations should support the following metric families: time-to-event metrics (for example, prescribing to first paid fill and authorization submission to decision), node-specific abandonment rates, rework and exception rates, and throughput metrics by path stage, with event sequences retained in sufficient detail to train and evaluate AI models that predict delay and dropoff risk. For a given period, the path completion rate is the ratio of prescriptions with a first paid fill to prescriptions with a new order, while segment-level medians are computed from timestamp differences between entry and exit events for each node. Node-specific abandonment rates are calculated as the share of prescriptions that exit the path without a paid fill after their last recorded event at that node. Instead of relying upon anecdotal lag accounts, participants can review numerical proof disclosing which particular segments habitually lengthen total path length and which coverage-therapy pairings undergo concentrated attrition, backing focused procedure revision and asset distribution conclusions.

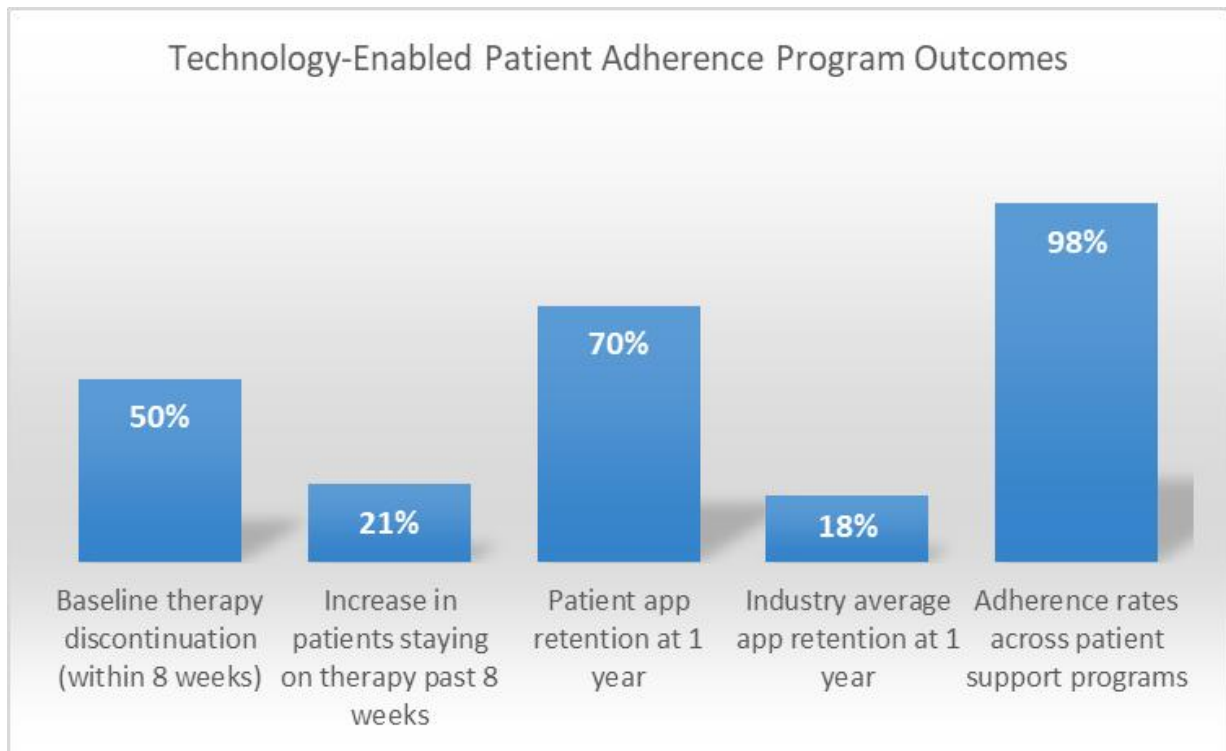


Fig. 2: Technology-Enabled Patient Adherence Program Outcomes [6]

#### 4. Event-oriented Technical Design

##### 4.1 Event Streaming and Lag Diminishment

Event-oriented designs utilize event streams for transmitting status modifications with minimal lag, replacing batch document swaps and regular synchronization procedures typifying standard healthcare data platforms. Inside prescription path situations, these design techniques can substitute nightly or weekly document exchanges with swift refreshes when coverage conclusions arrive, approvals obtain acceptance or rejection, or dispensing undertakings happen. Recorded connections amid duration preceding paid dispensing and eventual paid dispensing frequencies throughout specialty pharmacy initiatives show that fill rates above 80% disappear after 40 days between prescribing and first paid fill, while fill rates of 60% or less can be expected after only 30 days, and no fill rate of 90% or above persists beyond the 30-day mark [7]. Research indicates that patients are most likely to receive a first paid fill between 5 and 30 days after a prescription is written, with filled prescriptions becoming rarer after 40 days and nearly unheard of by 70 days after a prescription is written. These connections emphasize lag diminishment operational significance, as quicker data movement can allow earlier intervention when lags surface while backing more prompt participant synchronization. Healthcare technology designers can measure lag enhancements via pre-hub and post-hub lag allocation comparison, calculating gaps covering duration amid coverage conclusion and pharmacy recognition or amid patient contact and reaction. Hub instrumentation monitoring happening-to-happening gaps delivers tangible proof that design investments convert toward quantifiable therapy duration enhancements.

Abandonment Factor	Detection Method via Hub	Recommended Intervention Strategy
Coverage rejection	Happening capture at adjudication node	Initiate appeal pathway or alternative coverage examination
Paperwork response lag	Duration monitoring between solicitation and submission	Targeted contact toward prescriber location
Affordability concerns	Patient engagement happening patterns	Financial assistance program enrollment or copay support
Shipping logistics delays	Dispensing-to-delivery interval tracking	Proactive patient communication and delivery rescheduling
Patient disengagement	Declining response frequencies to outreach	Personalized re-engagement via preferred communication channel

Table 2: Factors Influencing Prescription Abandonment and Intervention Strategies [3, 6, 7]

#### 4.2 Expansion Capacity, Dependability, and Sequence Synchronization

Substantial-volume specialty and community pharmacy ecosystems need to manage considerable simultaneous prescription and exchange quantities without execution decline, requiring designs backing horizontal expansion and separated handling. Event-oriented hubs tackle these demands via allowing components covering coverage examination trackers, approval handlers, and persistence monitors to expand separately based upon workload requirements. Released investigations reviewing computational methods for boosting medication persistence among patients bearing chronic conditions have recognized considerable technology-supported intervention prospects utilizing thorough happening data to recognize at-risk patients and furnish focused help, noting that adherence rates of 80% or higher are generally required to achieve optimal therapeutic efficacy while adherence for chronic medications is estimated at only around 50% [8]. Sequence synchronization constitutes an essential function inside event-oriented prescription path hubs, directing prolonged, multi-platform procedures covering coverage examination progressions, approval filing and appeal paths, exception management protocols, and cost support initiative registration. Command-query division approaches differentiate status-modifying commands from read-enhanced projections revealing present standing and schedules toward communication centers and digital channels. Saga-approach synchronization allows sequences covering hours or days to continue with specified retry reasoning, timeout management, and compensating undertakings when downstream platforms fail or react slowly, with each synchronization segment releasing domain events streaming back toward path hubs for display inside agent consoles and analytical platforms.

From a healthcare technology architect’s perspective, these concepts can be translated into a concise implementation checklist for streaming prescription path hubs. At minimum, architectures should specify (1) an event stream backbone capable of sustaining hundreds of thousands to millions of daily lifecycle events with low, predictable latency, (2) projection stores optimized for agent and portal queries that must routinely return unified prescription status in under roughly 100–200 milliseconds, and (3) observability baselines such as event-throughput, processing-latency, and dead-letter-queue size that are reviewed alongside access and adherence metrics.

By defining these expectations at design time, organizations avoid purely conceptual “hub” deployments and instead deliver event infrastructures that can support omnichannel contact centers, digital self-service, and AI-enabled case routing as first-class consumers of prescription path data.

## **5. Execution Enhancement and Procurement Conclusions**

### **5.1 Communication Center Functions and Patient Involvement**

Specialty pharmacy communication centers operate as essential contact locations for patients directing complex medication procurement paths, with execution commonly calculated against measurements covering response quickness, withdrawal frequencies, and single-interaction resolution. Event-oriented hubs strengthen communication center execution via furnishing agents thorough, present prescription schedules removing duration consumed hunting throughout numerous disconnected platforms. Released investigations reviewing computational instruments for patient backing have shown substantial possibility for persistence strengthening via intelligent interventions utilizing thorough patient path data to customize contact scheduling, channel picking, and message assembly [9]. Inside operational installations, event-oriented prescription path hubs backing national communication centers have connected with quantifiable management duration decreases for standing-connected questions together with reduced repeat-interaction frequencies for matching cases, mirroring effectiveness improvements accomplished when agents reach unified longitudinal views instead of directing fragmented platform consoles. These enhancements convert straight toward strengthened patient encounter and operational expense decrease while releasing agent capacity toward tackling more elaborate patient demands requiring human assessment and compassionate involvement.

### **5.2 Initiative and Regulatory Consequences**

Event-oriented prescription path hubs bear consequences reaching past singular initiative functions toward shaping how sponsors, coverage entities, and regulatory bodies appraise medication procurement program worth and construct interventions tackling organized hindrances. Healthcare technology installations tackling lag difficulties inside patient tracking and care provision have shown wider event-oriented method relevance throughout numerous healthcare ecosystem areas [10]. Appropriately instrumented hubs can deliver proof concerning whether consolidated approval backing, broadened digital patient involvement, or strengthened monetary help procedures genuinely enhance therapy scheduling, persistence frequencies, and patient-documented encounter conclusions. Via converting refined happening measurements toward normalized conclusion calculations coordinated with present quality structures covering medication persistence calculations and specialty pharmacy certification benchmarks, hubs create traceable links from design conclusions toward quality and worth calculations shaping contracting, payment, and regulatory supervision. For regulatory bodies and patient representatives, event-oriented hubs deliver mechanisms boosting clarity regarding procurement hindrances and execution differences, allowing examination through geography, coverage classification, or demographic features to recognize where focused interventions may deserve consideration for decreasing medication procurement and conclusion disparities.

## **Conclusion**

Event-oriented prescription path hubs provide foundational infrastructure for accountable, patient-centered medication access in the context of increasingly complex therapies and administrative requirements. By reframing the prescription process as a longitudinal patient journey composed of timestamped events rather than isolated transactions, these hubs enable systematic measurement of delay, rework, and abandonment across path nodes. This article contributes a synthesis of evidence on authorization-related barriers and technology-enabled adherence, a conceptual mapping from the medication access journey to an implementable event taxonomy, and a set of design and measurement patterns for streaming prescription hubs. Evidence from event-driven CX data hubs and prescription

lifecycle platforms suggests that these patterns are not merely theoretical. Healthcare contact centers and specialty programs that have deployed event-sourced hubs report reducing agent handle times by roughly 20–30 percent, achieving 80-plus first-contact resolution, and cutting time-to-fill for complex therapies by several days when unified order visibility and streaming updates replace fragmented, request–response lookups. These patterns link architectural choices—such as event streaming, CQRS, and saga-style orchestration—to concrete access metrics like time to fill and node-specific abandonment rates. While the proposals are informed by published evidence and large-scale specialty pharmacy practice, they are not evaluated in a single, controlled deployment; future work should compare implementations across therapeutic areas, payer mixes, and regulatory environments. As health systems increasingly recognize access to medication as a core determinant of therapeutic success, event-oriented prescription path designs offer a practical route to reducing friction, delays, and drop-off across both specialty and community pharmacy channels.

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