

Automating Authorization or Automating Exclusion? FHIR-Driven Prior Authorization, Provider Liquidity, and Healthcare Access in the United States

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ABSTRACT: The United States faces a critical policy question: Does digital prior authorization reduce administrative burden, or does it amplify existing mechanisms of coverage denial and exclusion? This study combines a newly compiled pre-implementation dataset of 32 payer-program disclosures for the year 2025 with a prespecified causal framework for evaluating Fast Healthcare Interoperability Resources (FHIR)-based prior authorization following verified production implementation. The year 2025 baseline includes 4,963,129 standard requests and 757,804 expedited requests among observations with disclosed denominators. The unweighted mean standard denial rate was 13.68%, whereas the request-weighted rate was 3.71%, demonstrating substantial concentration in large, low-denial contracts. Mean standard decision time was positively associated with denial rate (Pearson $r = .63$, $p < .001$). In a heteroskedasticity-adjusted exploratory model controlling for broad program type, each additional reported day of standard decision time was associated with a 4.86-percentage-point higher denial rate (95% CI [2.38, 7.34]). These cross-sectional associations are noncausal and do not estimate the effects of FHIR adoption. The proposed 2024–2030 payer-provider panel distinguishes the January 2026 process and transparency requirements from the principal January 2027 API implementation requirements. It incorporates verified production go-live dates, electronic transaction shares, and contemporary staggered difference-in-differences and event-study estimators. Outcomes include authorization speed, information requests, denials, appeals, authorization-related claim denials, accounts-receivable duration, cash conversion, treatment delays, abandonment, and equity. The study establishes a reproducible pre-implementation benchmark and a rigorous framework for determining whether interoperability reduces transaction costs and improves access or instead accelerates exclusion.

KEYWORDS: prior authorization, FHIR, interoperability, provider liquidity, health care access, algorithmic governance, difference-in-differences

INTRODUCTION

Prior authorization is simultaneously a utilization-management mechanism, an information-exchange problem, and a financial governance process. It determines whether a proposed service may proceed, how much administrative work is required before treatment, how quickly a provider can convert clinical activity into a billable claim, and whether patients remain on their intended care trajectories. Traditionally, prior authorization distributes clinical documentation across electronic health records (EHRs), payer portals, telephone systems, fax, proprietary rules, and payer-specific forms. Consequently, prior authorization is not merely an administrative transaction. It distributes time, uncertainty, and financial risk among insurers, providers, and patients (Arrow, 1963; Williamson, 1979).

The 2024 Centers for Medicare & Medicaid Services (CMS) Interoperability and Prior Authorization Final Rule provide an unusually important empirical setting for evaluating whether interoperability changes these relationships. The rule applies to Medicare Advantage organizations, state Medicaid and Children's Health Insurance Program (CHIP) fee-for-service programs, Medicaid and CHIP managed-care plans, and qualified health plans offered through federally facilitated exchanges. Beginning January 1, 2026, affected payers generally must provide expedited determinations within 72 hours and standard determinations within seven calendar days, provide specific reasons for denials, and publicly report prior-authorization metrics. The principal FHIR API requirements begin January 1, 2027 and include Patient Access, Provider Access, Payer-to-Payer, and Prior Authorization APIs (Centers for Medicare & Medicaid Services [CMS], 2024a, 2024b, 2026a).

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The technical architecture is based on FHIR Release 4 and the Da Vinci implementation guides. Coverage Requirements Discovery (CRD) identifies whether authorization is required and which requirements apply. Documentation Templates and Rules (DTR) organize the evidence needed to satisfy those requirements. Prior Authorization Support (PAS) facilitates submission, tracking, updating, and resolution of authorization requests. The Health Data, Technology, and Interoperability (HTI)-4 rule introduced certification requirements related to these capabilities, while the Standards Version Advancement Process (SVAP) provides a pathway for adopting updated versions of implementation guides (Assistant Secretary for Technology Policy/Office of the National Coordinator for Health Information Technology [ASTP/ONC], 2025, 2026a; Health Level Seven International [HL7], 2026).

The policy theory is attractive. Integrating coverage discovery and documentation requirements into clinical workflows could reduce duplicate data entry, transmit structured clinical evidence, improve status transparency, and shorten the interval between ordering, authorization, treatment, claim submission, and payment. Yet digitization can improve the transport layer without changing the underlying decision criteria. A payer can issue a denial within seconds. A rules engine can apply restrictive criteria consistently and at scale. Structured data can increase transparency while simultaneously increasing surveillance and reducing the marginal cost of negative decisions. Thus, the central policy question is not whether prior authorization becomes electronic but whether electronic authorization changes the distribution of speed, errors, denials, appeals, payment, and access to care (Yeung, 2018).

Clinical evidence illustrates why these dimensions must be evaluated jointly. In a federal review of denied Medicare Advantage requests, the Office of Inspector General found that 13% of reviewed prior-authorization denials met Medicare coverage rules, while 18% of reviewed payment denials met both coverage and billing requirements. The report identified restrictive criteria, documentation problems, human errors, and system-processing errors as potential contributors (U.S. Department of Health and Human Services, Office of Inspector General [HHS OIG], 2022). Among patients receiving infusible rheumatology medications, initially denied authorization requests were associated with a median 50-day delay before infusion, and 82% of initially denied requests were subsequently approved (Wallace et al., 2020). In oncology, 69% of surveyed patients reported authorization-related delays, 22% reported not receiving recommended care because delays or denials altered their treatment plans, and 10% reported out-of-pocket payment (Chino et al., 2023).

Provider finance provides another important but understudied pathway. Prior authorization occurs before or around the time-of-service scheduling, whereas revenue-cycle analysis often begins with charge capture or claim submission. This separation can obscure a causal chain in which uncertain authorization delays treatment, incomplete authorization generates claim edits, unauthorized services become nonbillable or denied, appeals delay final payment, and payer-provider disputes age receivables or generate write-offs. Providers may incur clinical labor, medication, supply, and overhead costs while authorization disputes remain unresolved. Large integrated organizations may have sufficient reserves to absorb these costs, whereas independent, rural, safety-net, and specialty providers may have substantially less liquidity. Consequently, technically efficient authorization may produce financial effects before traditional quality measures become visible.

This article makes four contributions. First, it establishes a transparent baseline of payer-reported prior-authorization metrics for CY2025, before the principal API compliance deadline. Second, it demonstrates how national-looking averages can be substantially altered by weighting, market composition, reporting denominators, and disclosure quality. Third, it integrates transaction-cost economics, information asymmetry, and algorithmic governance into a testable theory of authorization technology, provider liquidity, and access. Fourth, it specifies a staggered difference-in-differences and event-study framework that distinguishes the 2026 process and transparency changes from actual FHIR implementation beginning in 2027.

Statement of the Problem

The central empirical problem is whether electronic prior authorization reduces the cost and time required to transmit requests without changing, increasing, or concealing the substantive criteria underlying coverage decisions. Existing studies have primarily examined clinician burden, patient experience, or individual workflow interventions. Comparatively little research connects authorization technology to provider cash flow and liquidity.

Moreover, it is difficult to isolate the effect of interoperable FHIR workflows from contemporaneous regulatory deadlines, public reporting requirements, benefit redesign, payer utilization-management policies, and secular improvements in electronic portals. Public metrics now exist, but they are fragmented, inconsistently defined, and frequently lack denominators. As of the July 25, 2026 evidence cutoff used in this study, post-2027 causal evidence was not available. A credible evaluation therefore cannot invent treatment effects, omit a reproducible prepolicy baseline, or define treatment solely by a statutory compliance date rather than verified production use.

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RESEARCH QUESTIONS AND HYPOTHESES

Research Questions

RQ1: Does implemented FHIR-based prior authorization reduce decision time, information-request cycles, initial rejections, authorization-related claim denials, and appeal overturns?

RQ2: Does FHIR adoption improve provider liquidity as measured by days in accounts receivable, the proportion of receivables older than 90 days, clean-claim rate, cash-conversion time, operating cash margin, and reliance on short-term borrowing?

RQ3: Does FHIR adoption reduce treatment delays, rescheduling, abandonment, substitution away from clinician-recommended services, and downstream acute-care utilization?

RQ4: Are the benefits or harms of FHIR adoption disproportionately experienced by independent, rural, safety-net, low-liquidity, high-Medicaid, dual-eligible, disabled, or racially minoritized patient and provider populations?

Research Hypotheses

H1: Verified FHIR adoption and a greater proportion of electronic authorization transactions will reduce authorization turnaround time and administrative resubmission cycles.

H2: Holding payment policy constant, improved electronic authorization will reduce authorization-related claim errors and provider accounts-receivable duration.

H3: Faster administrative processing will not necessarily improve access if digitization automates restrictive criteria without reducing initial denials, inappropriate denials, appeal overturns, treatment delays, or abandonment.

H4: Providers with greater exposure to affected payers and to services requiring prior authorization will experience larger liquidity effects. They may also experience greater exclusionary effects when automated rules depend on incomplete or systematically biased clinical data.

LITERATURE REVIEW

Prior Authorization, Utilization Management, and Administrative Burden

Prior authorization can serve legitimate purposes by screening potentially low-value, unsafe, noncovered, or insufficiently supported services before expenditure occurs. In principle, ex ante review can address information asymmetry between clinicians who observe individual patient needs and payers responsible for managing pooled resources (Arrow, 1963). In practice, prior authorization has been associated with inconsistent requirements, duplicative documentation, nonclinical administrative work, and uncertainty regarding which criteria will govern a decision.

Surveys conducted by the American Medical Association (AMA) report physician concerns regarding delays, treatment interruption, and adverse consequences associated with prior authorization (AMA, 2024, 2026). These surveys provide important descriptive evidence but should not be interpreted as causal estimates. Similarly, the Council for Affordable Quality Healthcare (CAQH) reports lower estimated transaction costs for fully electronic authorization compared with manual processing, but such estimates represent potential administrative savings rather than demonstrated improvements in patient outcomes or provider financial performance (CAQH, 2024).

Three findings from the empirical literature are particularly relevant.

First, many initially denied services are ultimately approved. Wallace et al. (2020) found that 96% of infusion authorizations were eventually approved, including 82% of initially denied requests. Shin et al. (2024) likewise found that most initially denied radiation-oncology cases were ultimately approved after additional review. High overturn rates can represent appropriate iterative review, but they can also indicate poor first-pass decision quality. Distinguishing these possibilities requires reporting initial decisions, final dispositions, documentation requests, peer-to-peer review, and appeals using consistent denominators.

Second, delay can harm patients even when final authorization is granted. In oncology, some patients who ultimately received authorization nevertheless failed to receive recommended care because delays caused clinicians to modify treatment plans (Chino et al., 2023). Radiation-oncology denials may result in changes to treatment dose, technique, or site of care that have clinical implications (Shin et al., 2024). Final approval status therefore cannot serve as the sole measure of patient impact. Studies must also measure time to treatment, treatment substitution, and abandonment.

Third, administrative burden is distributed among multiple actors. Clinicians and staff determine requirements, collect documentation, complete payer-specific forms, communicate with payers, and conduct appeals. Patients may bridge communication gaps, pay out of pocket, delay treatment, or forgo care. A 2026 survey found that 59.1% of patients and 75.8% of caregivers with prior-authorization experience reported delays in care; direct involvement was also associated with worse self-reported outcomes, although the convenience-sample design precludes causal inference (Thom et al., 2026).

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Prior Authorization and Electronic Workflow Integration

Electronic prior authorization is not a single intervention. A web portal can replace fax transmission while preserving duplicate data entry. Robotic process automation can transfer data between systems without making coverage criteria transparent. A fully integrated FHIR workflow can identify authorization requirements during ordering, collect structured evidence, submit requests from within the EHR, retrieve responses, and track status.

Treating all electronic processes as a single exposure therefore creates substantial exposure misclassification. The relevant treatment is not simply "electronic prior authorization" but the degree to which an interoperable workflow is available, activated, and actually used.

Evidence from integrated workflow interventions is encouraging but not conclusive. Chen et al. (2025) evaluated 6,551 radiation-oncology cases, including 2,403 intervention cases and 4,148 historical controls. Denials declined from 7.6% to 2.6%, median authorization time decreased from 4.2 to 2.8 business days, and the 90th percentile decreased from 17.7 to 10.5 business days. These findings demonstrate the potential value of clinical workflow integration. However, the use of historical controls, nonrandom adoption, a limited clinical setting, vendor involvement, and the absence of provider-liquidity outcomes limit causal and external inference. The intervention also predates nationwide payer API requirements and therefore does not isolate the effects of the FHIR regulatory pathway.

FHIR can reduce semantic and transport friction through standardized resources, terminology, authentication, and workflow interactions. However, Da Vinci implementation guides do not determine all substantive coverage criteria. Technical conformance does not guarantee accurate documentation mapping, appropriate clinical rules, endpoint availability, or actual provider use. Consequently, exposure should be measured using endpoint availability, conformance, production transaction volume, provider activation, and the percentage of eligible requests completed end-to-end through CRD, DTR, and PAS (ASTP/ONC, 2025, 2026a; HL7, 2026).

Provider Liquidity and Revenue-Cycle Transmission

The literature connecting prior authorization to provider liquidity remains limited. Authorization generally occurs before or at scheduling, whereas revenue-cycle analysis frequently begins with charge capture or claim submission. This division obscures a potentially important transmission mechanism: uncertain authorization → delayed scheduling → incomplete authorization → claim edits or denial → appeal/rework → delayed payment → aging receivables.

Days in accounts receivable therefore may reflect administrative and clinical alignment rather than merely billing-department performance.

CMS Healthcare Cost Report Information System (HCRIS) data provide annual financial and utilization information for Medicare-certified institutional providers (CMS, 2026b). These data are useful for national provider-level analysis but are too coarse to identify short-run changes around FHIR implementation. Quarterly financial statements, clearinghouse data, payer remittance data, and provider revenue-cycle extracts are better suited to high-frequency analysis. Physician practices, specialty groups, and ambulatory facilities may require proprietary practice-management data.

Liquidity can also influence treatment decisions. A financially constrained provider facing uncertain authorization may delay scheduling, request financial clearance, avoid high-cost therapy, or reduce participation in administratively burdensome payer arrangements. Such behavior can lower observed authorization denials by preventing requests from being submitted. Rigorous research must therefore examine denominators based on clinically indicated or ordered services rather than only submitted authorization requests.

Transparency Metrics and Measurement Risk

CMS requires affected payers to publicly report prior-authorization statistics for the preceding calendar year. The first reports for CY2025 were due March 31, 2026. Required measures include approval, denial, approval after appeal, approval with extension, and average and median decision times for standard and expedited requests (CMS, 2026a). These disclosures establish an important preimplementation benchmark but do not constitute a harmonized national research database.

The public reports vary in file format, aggregation level, denominator availability, time units, appeal definitions, treatment of extensions, and rounding. Some disclose request counts, whereas others provide only percentages. Some use interval descriptions such as "less than one day." Percentages may not sum to 100% because requests can be pending, withdrawn, partially approved, or otherwise categorized. Appeal percentages may use all requests, denied requests, or appealed denials as denominators.

These differences are substantively important. A metric may be numerically precise while remaining conceptually incomparable with another payer's metric.

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Public reporting may also affect behavior before FHIR APIs become operational. Payers may alter coding, clear backlogs, revise classifications, or streamline processes in anticipation of reporting requirements. Consequently, a study using January 1, 2027 as a single treatment date risks attributing the effects of the 2026 process and transparency requirements to FHIR interoperability.

THEORETICAL FRAMEWORK

Transaction-Cost Economics

Transaction-cost economics proposes that governance structures evolve partly to economize on the costs of specifying, monitoring, and enforcing exchanges under bounded rationality and opportunism (Williamson, 1979). Prior authorization represents a hybrid governance mechanism in which payers exercise ex ante permission authority while providers possess patient-specific clinical knowledge.

The transaction contains substantial asset specificity. Clinical teams, appointment slots, infused medications, imaging capacity, and documentation labor may be committed before payment certainty is established.

FHIR can lower the costs of searching, measuring, communicating, and coordinating. CRD reduces the cost of determining whether authorization is required; DTR reduces the cost of specifying evidence; and PAS reduces the cost of transmission and status reconciliation. Efficiency gains should be greatest where data and payer requirements are repetitive and stable.

However, lower processing costs may also increase the volume of review. If automation reduces the marginal cost of denial or documentation requests, payers may apply more granular utilization-management rules. The net effect is therefore an empirical question rather than a theoretical certainty.

Provider liquidity represents a downstream mechanism. Let C_a represent authorization administrative cost, T_a authorization elapsed time, q the probability of a clean claim, P payment, and k the provider's daily cost of capital. A simplified working-capital burden can be represented as:

$$B = C_a + k[T_a + T_c(q)]P$$

where $T_c(q)$ represents post-service collection time and decreases as clean-claim probability increases. FHIR could improve liquidity by reducing authorization cost, authorization time, and downstream claim defects. Conversely, faster adverse decisions could increase cancellation, uncompensated preparation, and appeal costs.

Asymmetric Information and Screening Error

Health insurance contains substantial information asymmetry regarding patient need, provider effort, treatment effectiveness, and future expenditures (Arrow, 1963). Akerlof's (1970) framework demonstrates how quality uncertainty can affect market exchange when decision makers cannot directly observe important characteristics.

Prior authorization similarly relies on imperfect signals of medical necessity. False positives occur when services are approved despite payer criteria suggesting that they should not be covered; false negatives occur when clinically appropriate services are denied. Appeals reveal only a subset of potential errors because patients and providers differ in their ability and willingness to appeal.

Structured data may improve signal quality by providing standardized evidence. It can also restrict the decision record to information that is encoded and machine-readable. Narrative context, social complexity, prior treatment outside the payer network, and atypical disease trajectories may not be captured adequately.

Accordingly, evaluation should examine initial and final denials, information requests, appeal initiation, overturn rates, clinical concordance, and subgroup error rates. Appeal success is informative but endogenous because appeals are influenced by provider capacity, expected success, patient persistence, and financial stakes.

Algorithmic Governance

Algorithmic governance involves regulation through automated infrastructures, rules, scores, and data-driven classification (Yeung, 2018). Prior authorization distributes governance across benefit design, clinical policy libraries, utilization-management vendors, EHR prompts, documentation templates, human reviewers, and appeal systems.

Automation can encode normative judgments about what constitutes sufficient evidence, when a request is complete, and which deviations justify denial, even when no machine-learning model is involved.

The principal governance risks include automation bias and opacity. A fast and consistent denial may appear objective even when the underlying evidence model is flawed. Historical utilization or spending variables can also reproduce structural inequities.

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Obermeyer et al. (2019), for example, demonstrated how a cost-based proxy produced racial bias in a widely used population-health algorithm.

FHIR-based authorization systems should therefore be assessed not only for technical conformance but also for evidence completeness, rule transparency, clinical appropriateness, human review, explainability, contestability, and subgroup error.

Integrated Causal Model

Table 1 Integrated Theoretical Pathways and Competing Predictions

Layer	Observable construct	Efficiency pathway	Exclusion pathway
FHIR workflow capability	CRD/DTR/PAS embedded in EHR; endpoint availability; transaction share	Lower discovery, documentation, and transmission cost	Potentially cheaper high-volume screening
Decision process	Completeness, review routing, rule application, human escalation	Faster decisions; fewer information cycles	Faster denials; rigid criteria; automation bias
Provider operations	Scheduling, financial clearance, claim edits, appeal labor	Higher clean-claim rate; shorter A/R; lower labor	Cancellation, rework, appeal queues, write-offs
Patient access	Time to treatment, substitution, abandonment, acute-care use	Earlier treatment and continuity	Automated exclusion or deterrence
Distribution	Provider cash reserves; rurality; safety-net share; patient vulnerability	Largest gains for burdened providers	Largest harms where data and appeal capacity are weakest

Empirical Review

Table 2: Empirical Evidence on Prior-Authorization Delay, Denial, and Digital Workflow

Study	Design/sample	Principal finding	Contribution	Limitation
HHS OIG (2022)	Random sample review of denied MA authorizations and payments	13% of denied authorization requests met Medicare coverage rules; 18% of denied payments met coverage and billing rules	Direct clinical review; identifies error mechanisms	2019 cases; selected denials; not an ePA evaluation
Wallace et al. (2020)	225 rheumatology patients prescribed infusible medications	PA associated with longer time to infusion; initial denials had median 50 days; 82% later approved	Patient-level timing and medication exposure	Single health system; observational; pre-FHIR
Chino et al. (2023)	Convenience survey of 178 cancer patients with PA experience	69% reported delay; 22% did not receive recommended care; 10% paid out of pocket	Patient-centered access and burden	Selection and recall bias; no control group
Shin et al. (2024)	206 initially denied radiation-oncology cases	Most ultimately approved; 34.9% of treated cases delayed, mean 7.8 days	Detailed clinical consequences and appeal pathway	Selected denied cases at one academic center
Chen et al. (2025)	6,551 radiation-oncology cases; integrated software vs historical controls	Denials fell 7.6% to 2.6%; median authorization time 4.2 to 2.8 business days	Large operational sample; workflow intervention	Historical controls; vendor-linked; not regulatory FHIR adoption

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Study	Design/sample	Principal finding	Contribution	Limitation
Thom et al. (2026)	Survey of patients and caregivers with PA experience	59.1% patient and 75.8% caregiver delays; involvement associated with worse outcomes	Current patient/caregiver perspective	Convenience sample; self-report; cross-sectional
This study	32 payer-program CY2025 public disclosures plus prospective 2024–2030 panel	Preimplementation benchmark; causal estimands for process, liquidity, access, and equity	Separates 2026 and 2027 shocks; released replication data	Public baseline selected and heterogeneous; post-adoption estimates pending

Regulatory and Technical Context

Table 3: Regulatory Timeline and Empirical Implications as of July 25, 2026

Date	Requirement or event	Identification relevance
February 8, 2024	CMS-0057-F published at 89 Fed. Reg. 8758; effective April 8, 2024	Creates process, transparency, API, and provider-measure requirements
January 1, 2026	Operational requirements generally begin	72-hour expedited and 7-day standard decisions for affected payers other than FFE QHP exception; specific denial reasons
March 31, 2026	First public metrics deadline	CY2025 approval, denial, appeal, extension, and turnaround disclosures
October 1, 2025 onward	HTI-4 certification criteria effective when modules certify	CRD, DTR, PAS and related workflow/subscription criteria
January 1, 2027	Principal CMS API compliance date	Patient, provider, payer-to-payer, and prior-authorization APIs; actual production dates may vary
CY2027	Electronic prior-authorization measure begins	At least one electronic request using CEHRT, subject to exclusions
April 10, 2026	CMS-0062-P proposed	Would extend electronic authorization and faster decisions to drugs and adopt additional FHIR transaction standards if finalized

The proposed 2026 rule addressing drug prior authorization was not included in the completed CY2025 baseline because it was not final at the evidence cutoff. It should therefore be treated as a potential future regulatory shock for later panel analyses rather than as part of the principal treatment definition (CMS, 2026c). The present study focuses on non-drug items and services covered by CMS-0057-F. Drug authorization will be analyzed separately if CMS-0062-P or a successor rule is finalized.

RESEARCH METHODOLOGY

Study Design

The study consists of two complementary components. Component A is a reproducible pre-implementation analysis of publicly disclosed CY2025 payer data. Component B is a prospective causal evaluation protocol covering 2024–2030 that will be populated as verified FHIR production adoption and postimplementation outcomes become observable.

This distinction is essential because the principal API deadline occurs after the study's evidence cutoff of July 25, 2026. The baseline therefore does not estimate an effect of FHIR. Instead, it describes the regulatory and operational starting point against which future effects can be evaluated.

Component A: CY2025 Payer Disclosure Dataset

Public payer transparency pages and metric files were reviewed. Inclusion required an identifiable payer-program unit and at least one reported CY2025 measure of standard or expedited approval, denial, appeal, or turnaround.

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The final dataset contains 32 payer-program observations from Health Net/Centene, UCare, Vaya Health, Colorado Community Health Alliance, Contra Costa Health Plan, Optimum HealthCare, and Highmark Health Options. Included programs span Medicare Advantage, Medicaid managed care, Medicaid fee-for-service, dual-eligible plans, and Marketplace qualified health plans (Colorado Community Health Alliance, 2026; Contra Costa Health Plan, 2026; Health Net, 2026; Highmark Health Options, 2026; Optimum HealthCare, 2026; UCare, 2026; Vaya Health, 2026).

Future extraction should be independently reproduced by two reviewers, with discrepancies resolved against the original disclosure. The replication file contains payer parent, plan or program, state, contract identifier, program category, standard and expedited request counts, approval and denial percentages, appeal approval, mean and median decision time, reporting period, extraction date, source URL, and transformation notes.

Standard request durations were converted to days and expedited durations to hours. Day-hour-minute strings were converted to continuous measures. Values reported as "less than one day" were coded as 0.5 day in the primary analysis and as 0 and 0.99 days in sensitivity analyses. Missing request counts and primary outcomes were not imputed.

The total Vaya request volume was retained separately because standard and expedited denominators were not separately reported. Percentages were not required to sum to 100%; discrepancies were retained and flagged.

Request-weighted statistics were calculated only for observations with known denominators. The unweighted mean represents the average reported payer-program observation, whereas the request-weighted mean approximates the average reported request within the count-complete sample. Neither statistic is nationally representative because the sample is not probability based, affected payer disclosures are not centrally indexed, employer-sponsored plans are excluded from CMS-0057-F, and service mix is unavailable.

Variables and Measurement

Table 4: Core Constructs and Measurement Strategy

Construct	Operational definition	Preferred source
Treatment: FHIR go-live	Verified production availability of CRD/DTR/PAS for a payer-program and service set	Payer endpoint, conformance statement, CHPL certification, provider/EHR attestation, successful transaction logs
Treatment intensity	Share of eligible authorization requests completed end-to-end electronically	PAS transaction count / eligible PA requests; separately measure CRD and DTR use
Authorization speed	Mean, median, p90/p95 elapsed time; 72-hour and 7-day compliance	Payer logs, CMS metrics, clearinghouse/vendor logs
Decision quality	Initial denial, final denial, information request, appeal, overturn, partial approval, criteria concordance	Payer metrics, appeals files, blinded clinical audit
Claim performance	Authorization-related initial and final denials, clean-claim rate, resubmission cycles	835 remittance, 837 claims, claim-status and denial-reason data
Provider liquidity	A/R days, >90-day A/R share, cash-conversion time, days cash on hand, operating cash margin, short-term borrowing	Provider general ledger, revenue-cycle extracts, audited financials, HCRIS
Patient access	Order-to-treatment days, rescheduling, abandonment, substitution, ED use, hospitalization	EHR orders/scheduling, claims/encounters, patient survey
Equity modifiers	Race/ethnicity, disability, dual status, rurality, deprivation, language; provider safety-net and cash reserve	Enrollment, EHR, Area Deprivation Index, provider and hospital files

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Prospective Data Sources

Table 5: Prospective Data Architecture

Source	Contribution	Access/limitation
Payer prior-authorization metrics	Contract/plan/state annual approval, denial, appeal, extension, and time measures	Public; annual; fragmented; begins with CY2025
Payer API and transaction logs	Endpoint availability, version, uptime, response, CRD/DTR/PAS transactions	Requires payer/vendor agreements for transaction counts
CHPL and real-world testing	Certification criteria, product/version, real-world testing evidence	Public; validates capability, not provider use
Medicare claims/encounters	Service use, dates, payer, payments, acute-care outcomes	Research-identifiable data and data-use agreement
T-MSIS Analytic Files	Medicaid enrollment, claims, managed-care plans, providers, payments	Research-identifiable files; state data-quality variation
HCRIS hospital cost reports	Annual provider characteristics, utilization, costs, financial statements	Public; annual and lagged
Provider revenue-cycle data	A/R aging, claim edits, denials, authorization identifiers, cash posting	High-frequency but proprietary
EHR orders and scheduling	Clinical indication, order date, treatment date, cancellation, substitution	Necessary to measure suppressed or abandoned requests
Patient/provider surveys	Administrative effort, anxiety, abandonment, unobserved burden	Use validated instruments and probability sampling where possible

CMS HCRIS contains annual cost reports for Medicare-certified institutional providers, including financial-statement and utilization information (CMS, 2026b). T-MSIS Analytic Files contain Medicaid and CHIP enrollment, utilization, payment, managed-care, and provider information (Medicaid.gov, 2026). The Certified Health IT Product List (CHPL) provides an official registry of certified health IT products, but certification must be supplemented with evidence of production transactions to avoid classifying unused technical capability as treatment (ASTP/ONC, 2026b).

Identification Strategy

The primary estimand is the average treatment effect on the treated (ATT) for payer-programs and provider-payer dyads following verified FHIR production go-live.

Because adoption is expected to occur at different times and treatment effects may vary across event time, the principal estimator will be the group-time ATT of Callaway and Sant'Anna (2021), using not-yet-treated or never-treated units as controls when defensible. An interaction-weighted event study following Sun and Abraham (2021) will provide a complementary specification. Conventional two-way fixed effects will be used only as a diagnostic because staggered adoption can generate problematic weighting under treatment-effect heterogeneity (Goodman-Bacon, 2021; Roth et al., 2023).

The event-study form for outcome Y in provider i , payer-program p , and quarter t is:

$Y_{ipt} = \alpha_{ip} + \lambda_t + \sum_{k \neq -1} \beta_k 1[t - G_p = k] + X_{ipt}'\gamma + \varepsilon_{ipt}$ Where α_{ip} is a provider-payer-dyad fixed effect, λ_t is a calendar-quarter fixed effect, k indexes event time, and the quarter preceding adoption is excluded. Where support allows, effects will be introduced by state, service line, and EHR provider by time.

Distinguishing Regulatory Shocks

The design identifies three potentially distinct shocks.

Anticipatory effects: Planning and workflow changes following rule publication and implementation preparation. 2026 process and transparency shock: Decision-time requirements, denial-reason requirements, and public reporting. 2027 FHIR treatment: Verified production implementation and subsequent increases in electronic transaction share. A single January 1, 2027 treatment indicator would conflate these mechanisms. The preferred specification therefore uses payer-specific implementation dates and treatment intensity.

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Provider Liquidity Analysis

Provider liquidity will additionally be analyzed using a difference-in-differences-in-differences design. The third dimension is prepolicy exposure to affected payers or authorization-intensive services. High exposure will be defined using 2024 payer revenue or ordered-service shares, fixed before treatment. This prevents post-treatment exposure from contaminating treatment assignment. The coefficient on the interaction of postperiod, treated payer, and high exposure estimates whether liquidity changes are concentrated among providers for whom prior authorization was operationally important.

Patient Access Analysis

Patient access models will use clinical order or episode-level data. Competing-risk survival models will evaluate time to treatment, treatment substitution, abandonment, and insurance change. Linear probability or Poisson models will estimate acute-care utilization at 30 and 90 days.

Where possible, blinded clinical reviewers will assess authorization decisions against applicable coverage criteria. This will permit estimation of false denials and false approvals rather than relying solely on approval rates.

Identification Assumptions and Diagnostics

The prospective design requires several assumptions:

Conditional parallel trends: Treatment and comparison units would have followed similar outcome trajectories in the absence of FHIR adoption, conditional on fixed effects and covariates.

Limited anticipation: Outcomes should not respond before treatment unless planning effects are explicitly modeled.

Stable treatment definition: Production capability and actual use must be measured consistently over time.

Limited spillovers: Provider workflows may standardize across payers, creating partial treatment of ostensibly untreated contracts.

No endogenous outcome composition: FHIR adoption should not alter which clinical orders enter the authorization dataset.

Consistent outcome definitions: Variables must be harmonized before pooling.

Diagnostics will include event-study leads, equivalence tests for substantively meaningful pre-trend differences, placebo adoption dates, placebo outcomes, alternative control groups, stacked cohort designs, and leave-one-payer and leave-one-state analyses.

Standard errors will be clustered at the adoption-unit and provider-payer-dyad levels as appropriate. Wild-cluster bootstrap and randomization inference will supplement asymptotic inference when the number of clusters is small.

CY2025 Baseline Statistical Analysis

The baseline analysis reports unweighted and request-weighted descriptive statistics, Pearson and Spearman correlations, and exploratory regression models.

The principal cross-sectional model uses reported mean standard decision time and broad program type to predict reported standard denial percentage. HC3 standard errors are used because variance differs substantially across payer-program observations and the sample is small.

Two weighted sensitivity analyses use standard request counts and the square root of standard request counts. Full count weighting approximates a request-level relationship but gives disproportionate influence to a small number of large contracts. Square-root weighting reduces this concentration.

A parent-payer fixed-effects model evaluates whether the association persists within organizations. Because only seven parent organizations are represented, this analysis is considered exploratory.

All p values are two-sided. The baseline analysis is descriptive and exploratory; it does not make causal or family-wise claims. The prospective study will preregister primary outcomes, event windows, treatment definitions, and multiplicity procedures. Secondary outcome families will be evaluated using false-discovery-rate control, with emphasis placed on confidence intervals rather than dichotomous statistical significance. Statistical power will be evaluated through simulation incorporating plausible cluster counts, intracluster correlation, staggered adoption, and residual variance.

RESULTS

Sample and Data Quality

Table 6: CY2025 Baseline Sample Composition

Program category	Programs	With standard count	Known standard requests	Mean denial %	Mean decision days
Marketplace/QHP	1	1	120,652	8.00	0.50

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Program category	Programs	With standard count	Known standard requests	Mean denial %	Mean decision days
Medicaid FFS	5	3	55,858	5.32	2.96
Medicaid managed	10	8	3,578,346	17.46	4.38
Medicare Advantage	16	15	1,208,273	14.29	2.49

The dataset contains 32 payer-program observations. Standard request counts were available for 27 observations, representing 4,963,129 requests. Expedited request counts were also available for 27 observations, representing 757,804 requests. The largest standard denominator was Health Net Medi-Cal, with 3,096,168 requests. This concentration substantially explains the difference between unweighted and request-weighted estimates.

Reporting quality was heterogeneous. Several records lacked separate standard denominators. Contra Costa Health Plan reported approval and denial percentages that did not sum to 100%, used all requests rather than appealed denials for its reported appeal percentage, and disclosed an urgent-turnaround configuration issue. One Health Net contract reported a mean expedited time below its median. Several Highmark contracts reported multiple expedited-request figures.

These observations were retained and flagged rather than excluded because selective exclusion could introduce outcome-dependent selection. Their influence should nevertheless be evaluated in sensitivity analyses.

Descriptive Results

Table 7: Unweighted Descriptive Statistics

Metric	n	Mean	SD	Median	IQR	Range
Standard denial rate (%)	32	13.68	16.06	5.67	3.30–14.75	1.00–48.00
Standard mean time (days)	32	3.09	2.31	3.00	0.88–4.85	0.50–8.00
Standard median time (days)	32	2.50	2.83	1.00	0.50–4.25	0.00–8.00
Appeal approval (%)	31	47.04	25.76	39.90	31.21–75.50	0.00–87.00
Expedited denial rate (%)	32	7.93	7.05	6.00	3.14–8.25	0.10–32.50
Expedited mean time (hours)	32	19.89	11.35	18.00	12.00–24.00	0.00–49.92

Across payer-program observations, the mean standard denial rate was 13.68% (SD = 16.06), with a median of 5.67% and a range of 1% to 48%. The unweighted mean standard decision time was 3.09 days.

Appeal approval averaged 47.04% across 31 observations, with a range from 0% to 87%. The substantial variation indicates heterogeneity in both initial decisions and appeal processes.

Request weighting materially changed the estimates. Among count-complete observations, the standard denial rate was 3.71%, the approval rate was 96.21%, and the weighted mean reported decision time was 2.01 days. The weighted expedited denial rate was 5.18%.

These estimates should not be interpreted as national rates. They represent selected-sample request-weighted statistics and are dominated by large contracts.

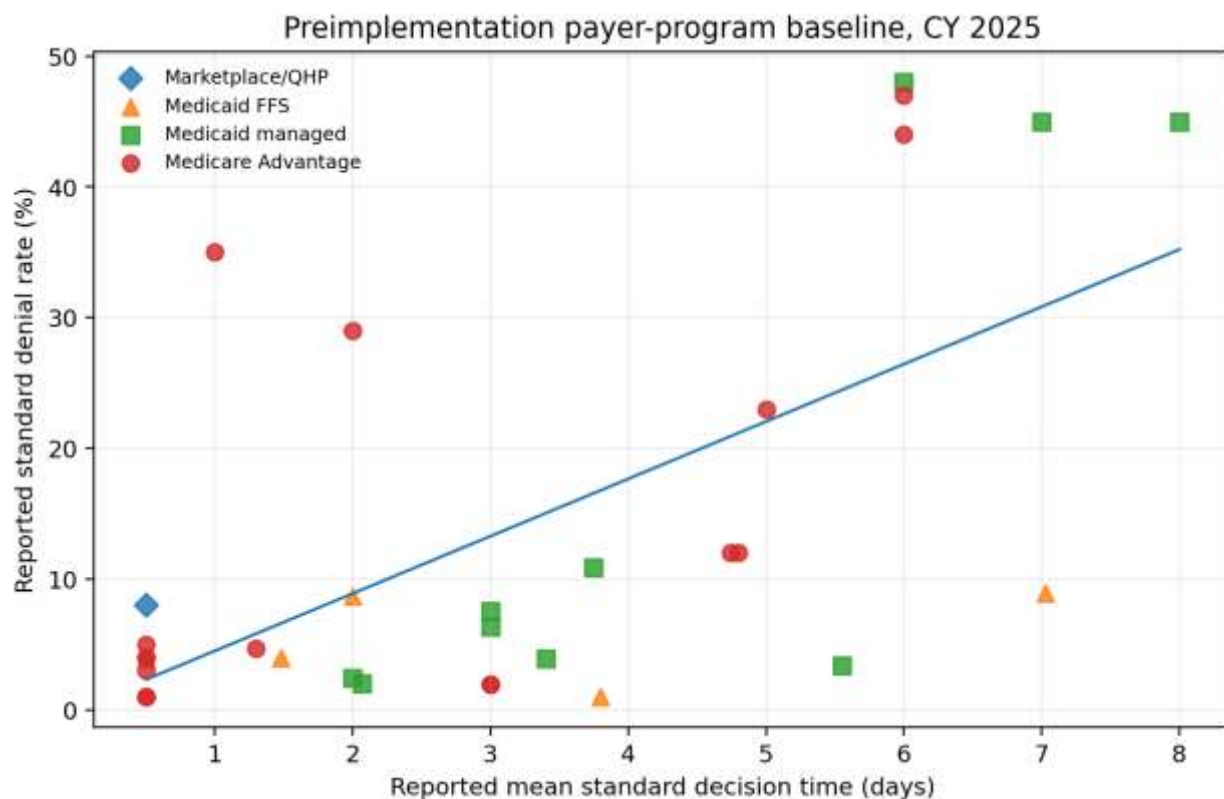


Figure 1: Reported Standard Denial Rate and Mean Decision Time, CY2025 Baseline

Note. The fitted line is descriptive. Values reported as "less than one day" are coded as 0.5 day. The figure does not estimate the causal effect of FHIR adoption.

Correlations and Exploratory Regression

Table 8: Association Between Reported Standard Decision Time and Denial Rate

Model/statistic	Estimate	Robust SE	95% CI	p	n
Pearson correlation: mean days → denial	0.630	—	—	0.0001	32
Spearman correlation: mean days → denial	0.536	—	—	0.0016	32
OLS, HC3, program adjusted	4.863	1.265	2.384 to 7.342	0.0001	32
WLS, request count	3.236	2.441	—	0.1849	27
WLS, square-root request count	5.497	1.488	—	0.0002	27
OLS with parent-payer fixed effects	1.928	0.491	—	0.0001	32

Reported mean standard decision time was positively associated with standard denial rate (Pearson $r = .63$, $p < .001$; Spearman $p = .54$, $p = .002$). Median decision time demonstrated a similar positive association with denial rate (Pearson $r = .69$, $p < .001$). Expedited mean decision time was also positively associated with expedited denial rate (Pearson $r = .50$, $p = .004$).

In the HC3-adjusted model, each additional reported mean standard decision day was associated with a 4.86-percentage-point higher standard denial rate (95% CI [2.38, 7.34], $p < .001$). The model explained approximately 47% of the cross-sectional variation ($R^2 = .469$).

Full request-count weighting reduced the coefficient to 3.24 percentage points and produced an imprecise estimate ($p = .185$), reflecting the influence of very large, low-denial contracts. Square-root weighting yielded an estimated association of 5.50 percentage points per additional day ($p < .001$).

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Denial rate was inversely associated with appeal approval in rank-based analysis ($p = -.36$, $p = .048$), while longer mean decision time was more strongly associated with lower appeal approval ($p = -.61$, $p < .001$).

These relationships may reflect program composition, reporting differences, differential appeal capacity, operational inefficiency, or substantive decision processes. They should not be interpreted as evidence that longer waiting causes higher denial.

Sensitivity analyses coding Highmark's "less than one day" observations as 0 or 0.99 days left the positive association materially unchanged. The program-adjusted coefficient ranged from approximately 4.59 to 5.10 percentage points per day. The parent fixed-effects estimate was smaller but remained positive. Because observations are concentrated within only seven parent organizations, the high model fit is treated as exploratory rather than confirmatory.

DISCUSSION OF FINDINGS

The CY2025 pre-implementation baseline reveals a prior-authorization system characterized by substantial heterogeneity, concentration, and measurement fragility. The mean disclosed payer-program denial rate was 13.68%, whereas the request-weighted estimate was 3.71%. Both statistics are valid for different estimands. Their divergence demonstrates why a single headline national denial rate can be misleading. Large contracts involving millions of requests can dominate weighted averages while masking substantially higher denial rates in smaller Medicaid, dual-eligible, or regional programs.

The positive association between decision time and denial rate challenges a simple model in which longer review necessarily reflects more careful decision making and therefore fewer denials. In this selected sample, slower programs generally reported more denials. Several explanations are plausible. Operationally, incomplete requirements, repeated documentation, queueing, and poor first-pass matching could generate both delay and denial. Alternatively, complex services and vulnerable populations may experience both longer review and stricter criteria. Finally, reporting differences may produce part of the association. The prospective provider-payer and patient-episode panels are designed to distinguish these explanations.

The results also demonstrate why speed cannot be treated as a proxy for access. Some payer-programs reported short decision times while maintaining substantial denial rates. Expedited requests were generally processed relatively quickly, but expedited denial rates ranged from 0.1% to 32.5%. Administrative speed and decision generosity are therefore distinct dimensions of performance.

A meaningful policy dashboard should report these dimensions jointly: initial denial, final denial, information requests, appeal initiation, appeal overturn, treatment delay, and clinically inappropriate decisions.

The mean appeal approval rate of 47.04% is similarly difficult to interpret because payer definitions and denominators differ. A high overturn rate may signal inaccurate or excessively conservative initial decisions, but a low overturn rate may reflect accurate screening, limited appeal capacity, or inaccessible appeal procedures. Patients and providers with greater administrative resources may be more likely to appeal. CMS should therefore require reporting of the number of denials, number appealed, appeal-stage disposition, appeal turnaround time, and whether the authorized service was ultimately received.

Provider Liquidity as a Policy Outcome

Provider liquidity represents a missing link between administrative reform and health-system structure. A small oncology practice that purchases medications or reserves treatment capacity before authorization faces a different financial exposure than an integrated payer-provider organization with greater capital reserves.

If FHIR reduces claim defects and administrative rework, providers should experience improvements in A/R days, cash conversion, and short-term borrowing requirements. If FHIR primarily accelerates denials without improving decision criteria or documentation completeness, providers may experience faster cancellation and reduced service delivery without corresponding improvements in cash conversion.

Liquidity should therefore be treated simultaneously as an outcome, mediator, and moderator.

Measurement and Governance

The baseline also reveals a governance problem in public data. The first reporting year already contains inconsistent units, missing denominators, incomparable appeal definitions, percentages that do not sum to 100%, repeated counts, and identified configuration errors. These are not merely formatting problems. They affect the substantive interpretation of access and fairness. Machine-readable reporting schemas, validation rules, stable identifiers, versioned definitions, and independent audits are necessary if public authorization metrics are to support accountability.

Separating the 2026 and 2027 Shocks

The regulatory sequence creates a valuable natural-experiment setting, but the treatment must be measured carefully. Process requirements and public reporting may improve authorization outcomes before FHIR APIs become operational. Some payers will

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implement early; others may technically comply while experiencing little provider use; still others may deploy CRD, DTR, or PAS incrementally.

Actual production transaction share is therefore preferable to statutory compliance dates as a continuous measure of treatment. The January 1, 2027 date should be treated as an important institutional milestone and source of implementation pressure, but not as a sufficient measure of exposure.

Automation Versus Automated Exclusion

The theoretical framework yields a clear empirical criterion.

Automation represents successful authorization reform when it reduces transaction costs, classification errors, provider financing burdens, and patient delays while preserving clinically appropriate review.

Automation represents automated exclusion when it improves response speed or technical conformance but increases final denials, deterrence, treatment substitution, abandonment, inequitable errors, or uncompensated provider effort.

These effects may coexist. A system may improve access for some services while increasing exclusion for others. Evaluation must therefore remain multidimensional.

Robustness, Falsification, and Reproducibility

Table 9: Prespecified Robustness and Falsification Tests

Domain	Implementation	Purpose
Alternative estimators	Callaway–Sant’Anna, Sun–Abraham, stacked cohort, imputation-based DiD	Avoid negative weights and heterogeneous-treatment contamination
Treatment definitions	Go-live date; endpoint availability; first successful PAS; ePA share thresholds; full CRD+DTR+PAS	Test exposure misclassification and partial implementation
Pretrends	Graph leads; joint tests; equivalence bounds; cohort-specific trends	Assess parallel trends without treating nonsignificance as proof
Placebos	Pseudo go-live dates; services not requiring PA; payment outcomes unrelated to PA	Detect coincident payer or revenue-cycle changes
Composition	Fixed clinical-order cohorts; inverse-probability selection weights; bounds for missing requests	Detect deterrence and suppressed submission
Reporting quality	Exclude flagged records; source fixed effects; interval-censoring; denominator harmonization	Quantify sensitivity to first-year disclosures
Inference	Payer/provider clustering; two-way clustering; wild bootstrap; randomization inference	Address dependence and few-cluster bias
Spillovers	Provider FHIR saturation; untreated payer outcomes within adopting providers	Measure workflow standardization beyond treated contracts
Equity	Clinical error and delay by subgroup; intersectional strata; shrinkage for small cells	Avoid unstable parity claims and protect privacy

The prospective analysis plan should be preregistered before postimplementation outcomes are analyzed. It should specify primary outcomes, treatment hierarchy, event windows, control construction, exclusions, and data-quality thresholds.

Analytical code should be version controlled. Raw public files should be archived with checksums. Data transformations should be executed through scripted pipelines, and published tables should be reproducible from the released analytical dataset.

Restricted patient and provider-financial data cannot be publicly released. However, synthetic data, metadata, code, data dictionaries, and reproducible examples should be provided.

LIMITATIONS OF STUDY

Several limitations are identified and should be considered:

- The CY2025 payer sample is purposive and incomplete. It cannot be generalized to all affected payers, employer-sponsored plans, or U.S. prior-authorization requests.

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- Public metrics are payer-reported, aggregated, and heterogeneous. Service mix, patient risk, clinical complexity, and exact denominator definitions are often unavailable.
- The baseline is cross-sectional. Correlations and regression coefficients describe associations and cannot establish causal effects of decision time, denial policy, or FHIR adoption.
- Annual metrics may conceal tail delays, service-specific exclusion, partial approvals, missing-information cycles, withdrawals, and requests deterred before submission.
- Provider A/R and liquidity are influenced by many factors beyond authorization, including coding, staffing, reimbursement rates, contract terms, claim edits, cybersecurity events, acquisitions, and macroeconomic conditions.
- FHIR adoption may be endogenous. Technically capable organizations may adopt earlier, while organizations with severe workflow problems may delay or accelerate adoption. Modern difference-in-differences methods can reduce but cannot eliminate selection concerns.
- Equity analysis may be limited by incomplete race, ethnicity, disability, language, and social-risk data. Small-cell protection may further reduce subgroup precision.
- The regulatory environment remains dynamic. CMS-0062-P could expand electronic authorization requirements to drugs and alter standards, measures, or implementation dates. Subsequent guidance may also modify compliance and reporting requirements.

Policy Recommendations

Table 10: Policy Recommendations for Efficient and Accountable Electronic Prior Authorization

Recommendation	Operational policy
Create a national machine-readable metrics repository	CMS should require contract/plan/state files in a common JSON/CSV schema with stable identifiers, numerators, denominators, unit definitions, and downloadable history.
Expand outcome definitions	Report initial and final approval, partial approval, withdrawal, abandonment, information request, extension, appeal initiation, overturn, and p90/p95 turnaround, stratified by service category.
Measure actual interoperability use	Publish endpoint URLs, supported implementation-guide versions, uptime, successful transaction counts, eligible request counts, and CRD/DTR/PAS completion share.
Audit data and algorithms	Independent audits should validate metrics, clinical-policy implementation, missing-information logic, and adverse-decision accuracy. Material discrepancies should trigger correction and enforcement.
Require contestable adverse decisions	Every denial should include a specific reason, applicable criterion, evidence considered, missing evidence, rule/version identifier, qualified reviewer, and a usable appeal path.
Preserve qualified human review	Fully automated adverse decisions should not be final where clinical judgment is material. Human reviewers should have authority, relevant expertise, and access to the complete record.
Protect provider liquidity	Adopt automatic authorization or deemed approval after missed deadlines, prompt-pay interest for authorization-caused claim delay, continuity of authorization, standardized attachments, and support for small/rural providers.
Use clinically grounded equity audits	Evaluate subgroup false-denial, overturn, delay, abandonment, and treatment substitution against clinical benchmarks rather than approval parity alone.
Separate technical from policy performance	Certification and API conformance should be necessary but not sufficient for success. Access, cash-flow, and clinical outcomes should determine regulatory evaluation.

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Recommendation	Operational policy
Extend coverage cautiously	If drug prior authorization is brought into the FHIR framework, preserve separate drug-specific timeframes, formulary logic, and clinical safeguards; do not pool drug and non-drug outcomes without stratification.

Implications for Providers

Providers should develop payer endpoint registries, map authorization workflows, standardize authorization identifiers on claims, automate reconciliation between authorization and scheduling, analyze denial reasons, and monitor A/R by payer and service line. Boards and finance leaders should treat authorization interoperability as both a working-capital and patient-access initiative rather than solely an information-technology project.

Implications for Payers

Payer governance should include clinical-policy version control, transparent evidence mapping, simulation before rule deployment, monitoring for incomplete data and subgroup error, and escalation thresholds. A faster response is beneficial only when the underlying classification and appeal systems are accurate, proportionate, clinically appropriate, and contestable.

CONCLUSION

FHIR-based prior authorization could remove one of the most persistent sources of administrative friction in U.S. health care. It could also make restrictive decisions cheaper, faster, and more scalable. Endpoint conformance, response time, or approval rate alone cannot distinguish between these possibilities.

The CY2025 baseline establishes an important pre-implementation distribution before the principal API deadline. It demonstrates substantial payer-program heterogeneity, a pronounced difference between unweighted and request-weighted denial estimates, a positive association between reported decision time and denial rate, and significant limitations in first-year public reporting. These findings support a multidimensional evaluation that incorporates provider liquidity and patient access alongside traditional authorization metrics.

The proposed causal framework separates the 2026 process and transparency changes from actual FHIR production adoption, measures treatment using verified implementation and transaction intensity, applies modern staggered difference-in-differences methods, and integrates authorization records with claims, provider finance, clinical orders, scheduling, and patient outcomes.

The central policy test is straightforward: interoperability succeeds when it reduces transaction costs and errors while improving cash conversion and timely, equitable receipt of clinically appropriate care. When it merely produces faster adverse determinations, it does not reform authorization; it automates exclusion.

Data Availability and Replication Statement

The accompanying Excel workbook and CSV file contain the 32-row CY2025 payer-program baseline, source register, variable dictionary, transformation notes, and summary statistics. The data were extracted from public payer websites on July 25, 2026.

Before publication, original 2025 source files should be archived because payer webpages and downloadable files may subsequently change. The workbook is intended as a transparent research seed rather than a nationally representative CMS dataset.

Postimplementation causal analyses will require additional restricted payer, provider, claims, financial, EHR, and transaction-log data.

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Appendix A. Copy of CY2025 Baseline Data (Selected Fields)

The complete machine-readable dataset, including expedited measures, source URLs, extraction date, and notes, is provided in the accompanying Excel and CSV files. The table below reproduces the principal standard-request fields used in the baseline analysis.

Table A1. Payer-program analytical baseline

Payer parent	Plan/program	Broad program	State	Standard n	Denial %	Mean days	Appeal approval %
Health Net	Health Net Medi-Cal	Medicaid managed	CA	3,096,168	2.45	2.00	39.72
Health Net	CalViva Health Medi-Cal	Medicaid managed	CA	310,319	6.34	3.00	48.28
Health Net	Community Health Plan of Imperial Valley	Medicaid managed	CA	57,406	7.57	3.00	48.05
Health Net	Wellcare by Health Net	Medicare Advantage	CA	184,541	1.94	3.00	77.17
Health Net	Wellcare by Health Net	Medicare Advantage	CA	290,257	1.98	3.00	77.50
UCare	EssentiaCare	Medicare Advantage	MN	382	35.00	1.00	75.00
UCare	UCare Medicare	Medicare Advantage	MN	18,305	29.00	2.00	52.00
UCare	UCare Your Choice	Medicare Advantage	MN	3,837	23.00	5.00	57.00
UCare	Minnesota Senior Health Options	Medicare Advantage	MN	4,469	44.00	6.00	25.00
UCare	UCare Connect + Medicare	Medicare Advantage	MN	3,685	47.00	6.00	30.00
UCare	MinnesotaCare	Medicaid managed	MN	6,208	45.00	8.00	12.00
UCare	Prepaid Medical Assistance Program	Medicaid managed	MN	30,736	48.00	6.00	13.00
UCare	UCare Connect	Medicaid managed	MN	6,578	45.00	7.00	33.00

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Payer parent	Plan/program	Broad program	State	Standard n	Denial %	Mean days	Appeal approval %
Vaya Health	Vaya Tailored Plan	Medicaid managed	NC		3.40	5.55	29.00
Vaya Health	Vaya Medicaid Direct	Medicaid FFS	NC		8.90	7.03	34.00
Colorado Community Health Alliance	Health First Colorado Regional Accountable Entity	Medicaid managed	CO	9,032	3.93	3.40	32.43
Contra Costa Health Plan	Contra Costa Health Plan	Medicaid managed	CA	61,899	10.89	3.75	0.19
Optimum HealthCare	Optimum HealthCare	Medicare Advantage	FL		4.69	1.30	37.00
Highmark Health Options	Highmark Medicare Advantage	Medicare Advantage	PA	463,352	4.00	0.50	78.00
Highmark Health Options	Highmark Medicare Advantage	Medicare Advantage	NY	39,409	1.00	0.50	83.00
Highmark Health Options	Highmark Medicare Advantage	Medicare Advantage	PA	98,307	3.00	0.50	76.00
Highmark Health Options	Highmark Medicare Advantage	Medicare Advantage	WV	41,018	5.00	0.50	84.00
Highmark Health Options	Highmark Medicare Advantage	Medicare Advantage	DE	25,925	1.00	0.50	78.00
Highmark Health Options	Highmark Medicare Advantage	Medicare Advantage	PA	27,105	4.00	0.50	87.00
Highmark Health Options	Highmark Wholecare Medicare Assured	Medicare Advantage	PA	7,010	12.00	4.74	72.00
Highmark Health Options	Highmark Health Options Duals	Medicare Advantage	DE	671	12.00	4.80	
Highmark Health Options	Pennsylvania Medicaid/CHIP FFS	Medicaid FFS	PA	22,141	4.00	1.48	35.00
Highmark Health Options	Delaware Medicaid/CHIP FFS	Medicaid FFS	DE	32,291	1.00	3.80	24.00
Highmark Health Options	West Virginia Medicaid/CHIP FFS	Medicaid FFS	WV	1,426	4.00	0.50	0.00
Highmark Health Options	New York Medicaid/CHIP FFS	Medicaid FFS	NY		8.70	2.00	39.90
Highmark Health Options	Medicaid Managed Care Aggregate	Medicaid managed	Multi-state		2.00	2.07	34.00
Highmark Health Options	Affordable Care Act Marketplace QHP	Marketplace/QHP	Multi-state	120,652	8.00	0.50	47.00

Automating Authorization or Automating Exclusion? FHIR-Driven Prior Authorization, Provider Liquidity, and Healthcare Access in the United States

Appendix B. Variable Dictionary and Transformation Rules

Table B1. Principal data fields

Variable	Definition	Treatment
parent	Payer parent organization as disclosed or inferred from source page	Text
plan	Plan, contract, or program label	Text
program_broad	Harmonized category: Medicare Advantage, Medicaid managed, Medicaid FFS, Marketplace/QHP	Categorical
total_requests	Total requests only where standard/expedited split unavailable	Count; not used as standard denominator
standard_requests	Disclosed standard-request denominator	Count; missing not imputed
standard_denial_pct	Payer-reported standard denial percentage	Percent
appeal_approval_pct	Payer-reported approval after appeal	Percent; denominator may vary and is flagged
standard_mean_days	Payer-reported mean standardized to days	Continuous; “<1 day” coded 0.5 primary
expedited_mean_hours	Payer-reported mean standardized to hours	Continuous
source_url	Public payer page or metric file	URL
notes	Known reporting issues and transformations	Text

Reproducibility note. The analysis script calculates descriptive statistics, correlations, HC3 OLS, count-weighted and square-root-weighted WLS, and the figure from the released CSV. Any publication submission should rerun extraction after archiving the original 2025 reports and should expand the sample through a systematic census of affected payers.



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