Backwork

x278: An Agent-Native Standard for Prior Authorization

Folding the gatekeeping handshake into the action, so the human touches only the exceptions.

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ABSTRACT

x278 is a proposed open protocol for agent-driven prior authorization. It lets a provider-side agent and a payer-side agent exchange a structured authorization request, documentation requirements, and determinations over the FHIR prior authorization infrastructure that CMS-0057-F requires for impacted payers. It is designed to interoperate with Da Vinci PAS, DTR, CRD, and, where applicable, the X12 278 transaction, rather than replace them.

The core move is the same one that made micropayments viable: remove a coordination cost everyone treated as fixed. Here the cost is human relay. The protocol turns missing documentation, denial reasons, and pended review into explicit machine-readable next steps. A provider agent submits a structured request; the payer agent returns an approved, denied, info-needed, or pended response; and the provider agent either attaches evidence, waits for review, or initiates an appeal using the same authorization context. Human reviewers are reserved for cases that need clinical judgment. Each determination is signed, giving both sides a verifiable receipt and an auditable record.

When the payer can adjudicate deterministically, x278 targets a synchronous response in seconds. When it cannot, the protocol preserves continuity through a pended state, subscriptions, retry tokens, and signed determinations, rather than blocking the workflow.

1 Motivation

Prior authorization is the clearest example of a process where the human is pure friction. A provider's office and a payer exchange forms, faxes, and phone holds; for the large majority of requests, no one on either end is exercising judgment. They are relaying. The clinical facts are already in the chart, the coverage rule is already written, and the answer is deterministic. Yet the request still moves at the speed of a fax queue and a callback.

The American Medical Association's annual survey of the problem is blunt about the scale. The 2025 AMA Prior Authorization Physician Survey reports that practices complete an average of 40 prior authorizations per physician per week and spend 13 hours of physician and staff time each week completing them, time that is mostly clerical relay rather than medical decision-making. That burden is the coordination cost. It is large not because the decisions are hard but because the channel is human.

Every attempt to fix this has kept the human in the loop. Payer web portals still require a person to log in and re-key what the chart already knows. Even the electronic transaction that was supposed to solve it, the X12 278, is treated as a back-office formality and is frequently abandoned in favor of the fax for anything non-trivial. These systems were designed for a human operator, so they carry all of the human-operator friction: logins, manual entry, status calls, and resubmission from scratch when something is missing.

The motivation behind x278 is to redesign the authorization exchange for the actor that is about to be performing it: a software agent on each side. When the requester is a machine, the login screen, the portal, the fax cover sheet, and the status call are not features. They are drag. Strip them out, express the exchange as a stateless handshake against a shared rule set, and the only remaining human step is the one that actually needs a human.

2 Where Prior Authorization Fails Today

2.1 The Channel Is Human, So It Moves at Human Speed

Authorization latency is not a function of decision difficulty. It is a function of how many human handoffs sit between the request and the answer. A faxed request waits in a queue, gets keyed into a payer system by a person,

may trigger a callback for missing documentation, and is then re-faxed. Each hop adds hours or days. Standard determinations routinely take multiple business days even though the underlying rule could be evaluated instantly.

2.2 Rejection Is Opaque, So It Cannot Be Acted On

When a request is denied or pended for more information, the provider often learns only that something was wrong, not precisely what. The staff re-gather documents, guess at the gap, and resubmit blind, restarting the queue. This blind-reapply loop is the single largest source of wasted effort, and it exists only because the rejection is not machine-readable and actionable.

2.3 The Audit Trail Is a Pile of Faxes

Because the exchange happens across phone calls and paper, there is no clean, verifiable record of who asked for what, what was promised, and when. Disputes and appeals become archaeology.

2.4 The Comparison

CHANNEL	LATENCY	HUMAN TOUCHES	CODED DENIAL REASON	AUDIT TRAIL	AGENT-NATIVE
Fax / phone	Days	Many	No	Poor	No
Payer web portal	Hours–days	Manual entry	Partial	Partial	No
X12 278 (EDI)	Minutes–hours	Some	Limited	Yes	No
FHIR PAS (CMS-0057-F)	Seconds–minutes	Some	Yes	Yes	Partial
x278 (agent-native)	**Sub-15s***	**Exceptions only**	**Yes, coded**	**Yes, signed**	**Yes**

Table 1: Authorization channels compared. x278 keeps the FHIR rails and removes the human relay. *Synchronous response when the payer can adjudicate deterministically; requests needing review or data return a pended or info-needed state.

3 How x278 Works

x278 is a proposed open protocol that lets two software agents complete a prior authorization autonomously. It does not invent a new transaction or a new regulatory rail. It re-expresses the Da Vinci PAS, DTR, and CRD FHIR profiles, and the X12 278 transaction where applicable, as a stateless exchange that an agent can drive end to end, and it adds one rule: every response must tell the requester exactly what to do next.

The design borrows directly from the HTTP 402 pattern in x402. In x402, a request without payment returns a structured “here is what to pay” response, and the client retries with the payment attached. In x278, a request that cannot be approved yet returns a structured “here is exactly what is missing or pending” response, and the agent retries with the evidence or waits for review. The rejection ships the spec.

3.1 Example Integration

A payer exposes a single endpoint that adjudicates against its published rule set:

```
authorizationMiddleware({
  ruleSet: "payer://acme-health/medical-policy@2026.2",
```

```
  documentationProfiles: "davinci-dtr",
  signWith: "did:web:acme-health.example"
})
```

A provider system calls it the way it would call any service, with no portal and no fax:

```
const result = await x278.request({
  patient,        // member id, dob
  provider,       // npi, tin
  service,        // CPT/HCPCS code, ICD-10 dx, place of service, dates
});
```

3.2 Core Authorization Flow

1. **Provider agent requests authorization.** It submits a structured request with the patient, the rendering provider, and the requested service (procedure code, diagnosis, place of service, dates, urgency).
2. **Payer agent evaluates against the rule set.** The published medical policy is applied deterministically to the request.
3. **Payer agent returns one of four states.**
   - **approved**: an authorization number, the approved units, and the validity window.
   - **denied**: a specific coded reason, human-readable text, and the appeal path.
   - **info-needed**: the exact list of required documentation, expressed as DTR questionnaires, plus a token to resume. The next action is on the provider.
   - **pended**: the request is accepted but not yet final, for example because it is in clinical review or awaiting payer-side processing. The next action is to wait, with updates delivered by subscription. Da Vinci PAS supports this when a synchronous answer is not possible.
4. **Provider agent acts on the response.** On `info-needed`, the agent attaches the requested documentation and resubmits against the same authorization id, with no re-keying and no new queue. On `pended`, it subscribes for the determination. On `denied`, it corrects and resubmits or files an appeal.
5. **Human handles the exception only.** When the rule set cannot resolve the request on its own, for example a true medical-necessity judgment, it returns `pended` with a pending reason of `human-review` and is routed to a clinical reviewer. The reviewer's determination re-enters the same signed, logged flow.
6. **Determination is signed and logged.** The final determination is cryptographically signed by the payer and appended to an audit log both parties can verify.

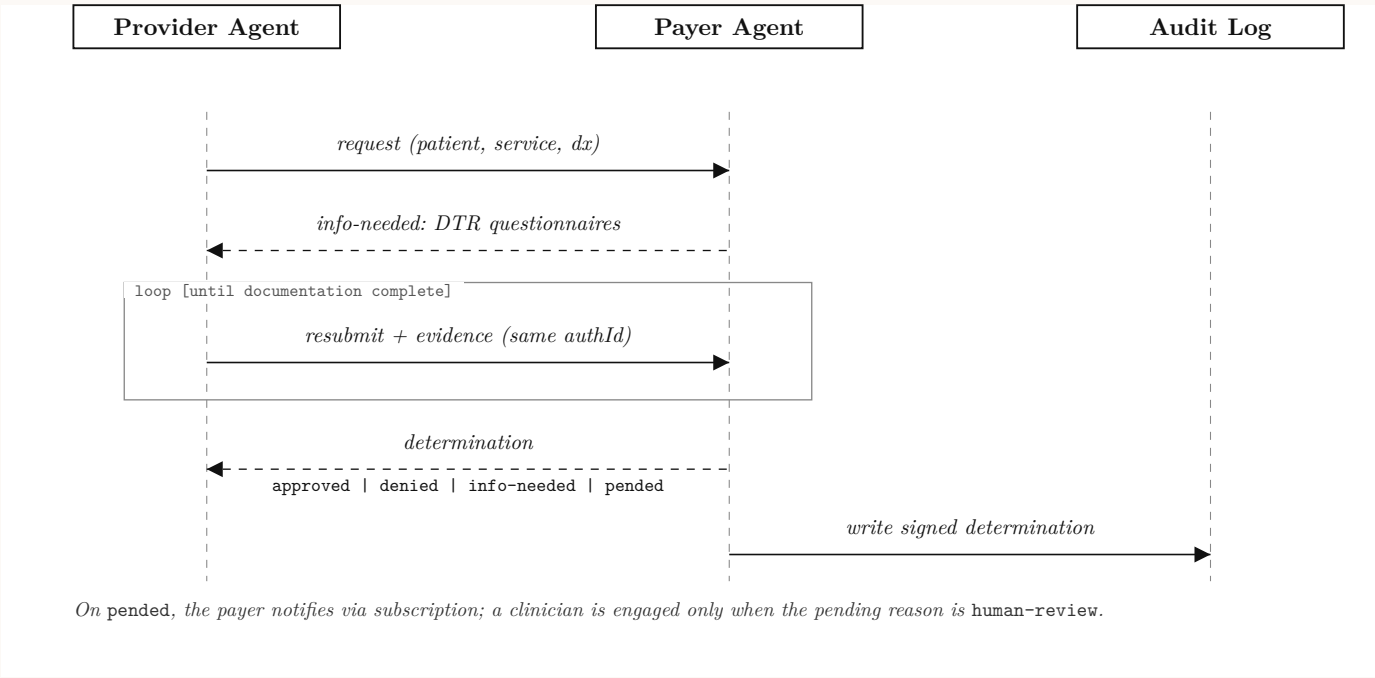

Figure 1: The x278 authorization exchange. Time flows downward. A request resolves to one of four states; `info-needed` and `pended` are non-terminal, so the provider agent resubmits the same `authId` or subscribes for the result. The signed determination is written to a shared audit log.

4 x278 Enables Frictionless Authorization

x278 removes the account, portal, and relay friction from authorization, enabling a request to be resolved in a single automated round trip whenever the rule set is sufficient. The comparison below shows the same request under the traditional process and under x278.

TRADITIONAL PROCESS	WITH X278
• Staff logs into a payer portal or prepares a fax. • Clinical facts already in the chart are re-keyed by hand. • Request sits in a queue for hours or days. • A denial or pend returns little detail; staff guess at the gap. • Resubmission starts the queue over.	1. Provider agent submits a structured request. 2. Payer agent evaluates against the published rule set. 3. Response is approved, denied with a specific reason, info-needed with the exact list, or pended. 4. On info-needed, the agent attaches evidence and retries the same auth id; on pended, it subscribes for the result. 5. The signed determination is returned and logged, synchronously when the payer can adjudicate deterministically.

Table 2: The same authorization, human-relayed versus agent-native.

4.1 Documentation As a Retry, Not a Restart

The behavior that makes x278 work is that an `info-needed` response is actionable. It carries machine-readable Documentation Templates and Rules (DTR) describing precisely what evidence satisfies the policy, so the provider agent can gather and attach it automatically and resubmit. The blind-reapply loop disappears.

5 Machine-First Determination

5.1 Designing for the Agent, Not the Operator

Today's authorization tools are built for a human operator and inherit every human-operator cost. x278 inverts the assumption. The primary actor on each side is an agent, so the protocol keeps only what an agent needs: a structured request, a deterministic rule set, an actionable response, and a signature. The portal, the cover sheet, and the status call are removed because no machine needs them.

This lets the two sides:

- **Resolve the deterministic majority autonomously**, with no human relay on either end.
- **Escalate only true exceptions** to a clinical reviewer, with the full request and the specific unmet criterion attached, so the reviewer starts with context instead of a fax.
- **Operate against a versioned, published rule set**, so the provider can evaluate likely approval before submitting and avoid doomed requests entirely.

5.2 The Human Stays Where Judgment Lives

x278 is not an attempt to remove clinicians from medical decisions. It removes them from clerical relay. The exception path is a first-class part of the protocol: when the rule set returns `human-review`, the request is queued to a reviewer with everything needed to decide, and the reviewer's determination re-enters the same signed, logged flow.

6 Simplifying Operations

6.1 Denials That Can Be Acted On

CMS-0057-F requires payers to give a specific reason for denied prior authorizations. x278 strengthens that into a machine-readable coded reason paired with human-readable text, plus the appeal path, so the provider agent can correct and resubmit or initiate an appeal without a human decoding a letter.

6.2 A Verifiable Audit Trail

Each determination is signed by the payer and appended to an audit log both sides can verify, optionally anchored to an external ledger for tamper evidence. Appeals and disputes become a lookup against signed records instead of an archaeology project across faxes and call logs.

6.3 Built on Rails That Are Already Mandated

x278 does not require a new regulatory rail or a new CMS API family. It layers an agent-native protocol and a signed-receipt model on top of the FHIR prior authorization infrastructure that CMS-0057-F already requires impacted payers (Medicare Advantage organizations, state Medicaid and CHIP programs, Medicaid and CHIP managed care entities, and QHP issuers on the federal exchanges) to build. Adoption rides an existing deadline rather than asking for new infrastructure from scratch.

7 Why Now

The timing is set by regulation, not by hope. Under CMS-0057-F, finalized in January 2024:

- Operational provisions and faster turnaround times take effect generally beginning January 1, 2026, including the requirement to give a specific reason for denials. Certain impacted payers must return standard determinations within 7 calendar days and expedited determinations within 72 hours. QHP issuers on the federal exchanges are excluded from that specific timeframe rule.
- The four mandated FHIR APIs, including the Prior Authorization API, must be live generally by January 1, 2027. The API must identify documentation requirements and support approval, denial with a specific reason, or a request for more information.
- Public reporting of prior authorization metrics begins in 2026.

CMS estimates the rule will save about $15 billion over ten years, a figure CMS presents as an estimate rather than a guarantee. Every impacted payer is already building FHIR-based authorization rails on a fixed deadline. x278 is the layer that makes those rails agent-to-agent, exactly when both providers and payers are deploying agents anyway.

One scope boundary matters. CMS-0057-F excludes drugs from both the Prior Authorization API and the process requirements, because the standards and timeframes for drug authorization differ. x278's baseline follows that scope and targets medical items and services. A separate proposed rule, CMS-0062-P, would extend prior authorization requirements to drugs; x278 drug support is treated as a future extension over pharmacy or ePA rails, not part of this baseline.

8 The x278 Spec

8.1 Request: Provider Agent to Payer Agent

The provider agent submits a structured authorization request. Minimal shape:

```
{
  "patient":  { "memberId": "A1234567", "dob": "1971-03-02" },
  "provider": { "npi": "1972648392", "tin": "84-1234567" },
  "service": {
    "code": "27447",
    "codeSystem": "CPT",
    "diagnosis": ["M17.11"],
    "placeOfService": "21",
    "requestedStart": "2026-06-01",
    "units": 1,
    "urgency": "standard"
  },
  "supportingInfo": []
}
```

8.2 Response: One of Four States

The payer agent answers with a single, machine-readable determination. The `status` field carries the outcome; `nextAction` tells the agent what to do; and `pendingReason` and `determinationBy` describe the path rather than the outcome, keeping state and actor separate.

```
{
  "authId": "278-9f2c1a",
  "status": "info-needed",
  "nextAction": "attach-evidence",
```

```
  "ruleSetVersion": "acme-health/medical-policy@2026.2",
  "documentationRequired": [
    {
      "id": "conservative-tx-6wk",
      "description": "Evidence of ≥ 6 weeks of conservative treatment",
      "questionnaire": "https://acme-health.example/Questionnaire/cons-tx-6wk"
    }
  ],
  "resumeToken": "rt_b7e4...",
  "expiresAt": "2026-06-08T00:00:00Z",
  "determinationBy": null
}
```

A pended response, returned when the payer cannot answer synchronously, carries a subscription instead of a document list:

```
{
  "authId": "278-9f2c1a",
  "status": "pended",
  "nextAction": "await-payer",
  "pendingReason": "human-review",
  "subscription": "https://acme-health.example/Subscription/278-9f2c1a",
  "expiresAt": "2026-06-08T00:00:00Z",
  "determinationBy": "clinical-reviewer"
}
```

STATUS	MEANING AND KEY FIELDS
`approved`	`authNumber`, `approvedUnits`, `validFrom`, `validThrough`.
`denied`	`reasonCode`, `reasonText`, `appealPath`.
`info-needed`	`documentationRequired[]` (DTR questionnaires), `resumeToken`, `expiresAt`.
`pended`	`pendingReason` (`human-review`, `payer-processing`, `external-records`), `subscription`.
`error`	`reasonCode`, `reasonText` for malformed or unprocessable requests.

Table 3: Determination states. `status` is the outcome; `pendingReason` and `determinationBy` describe the path. Every non-approval is actionable.

8.3 Retry and Resume

On `info-needed`, the provider agent completes the questionnaires and resubmits against the same `authId` using the `resumeToken` the request resumes where it paused rather than re-entering the queue. On `pended`, the agent registers the returned `subscription` and is notified when the determination is final.

9 Technical Specifications

9.1 Determination Object

FIELD	DESCRIPTION
`authId`	Stable identifier for this authorization across the request, any retries, and the final determination.
`status`	`approved`, `denied`, `info-needed`, `pended`, or `error`.
`nextAction`	`none`, `attach-evidence`, `await-payer`, `appeal`, or `contact-payer`.
`pendingReason`	On `pended`: `human-review`, `payer-processing`, or `external-records`. Otherwise `null`.
`determinationBy`	`rules`, `clinical-reviewer`, or `null`, distinguishing autonomous from escalated decisions.
`ruleSetVersion`	The exact published policy version the determination was evaluated against.
`expiresAt`	Timestamp after which a pended request or resume token is no longer valid.
`signature`	Payer signature over the canonical request and determination (see Signing).

Table 4: Core determination fields. State and actor are kept separate.

9.2 Recording the Determination

A determination can be recorded through several mechanisms depending on the parties' needs:

- **Direct exchange**: the signed determination returned inline to the provider agent.
- **FHIR-anchored**: written back as a PAS `ClaimResponse` for systems already on FHIR.
- **Ledger-anchored**: a hash of the determination committed to an external append-only log for tamper-evident audit across organizations.

9.3 FHIR / PAS Mapping

x278 is a thin agent-facing shape over Da Vinci PAS, which uses FHIR `Claim` and `ClaimResponse` for prior authorization, submitted as a PAS Bundle through the `Claim $submit` operation and converted to X12 278/275 where applicable. The mapping is explicit so x278 is not a duplicate standard but a convenience layer:

X278 FIELD	PAS / FHIR MAPPING
`authId`	`ClaimResponse.identifier`, or the payer-assigned authorization identifier.
`status`	`ClaimResponse.outcome`, `ClaimResponse.disposition`, and item-level adjudication.
`documentationRequired[]`	DTR `Questionnaire` or PAS supporting-information request.
`service.code`	`Claim.item.productOrService`.
`diagnosis[]`	`Claim.diagnosis.diagnosisCodeableConcept`.
`provider.npi`	`Claim.provider.identifier`.
`pended` + `subscription`	PAS pended response plus FHIR `Subscription` for updates.
`signature`	Detached x278 receipt, or a FHIR `Provenance` / `Signature` profile.

Table 5: x278 to Da Vinci PAS field mapping.

9.4 Security and Authorization

x278 inherits the security model CMS-0057-F points to rather than inventing one. The signature layer sits on top of standard FHIR authorization, not in place of it.

```
Transport            HTTPS
App authorization    SMART Backend Services / OAuth2 / OIDC
Endpoint discovery   payer registry, FHIR directory, or configured payer endpoint
Request identity     provider-organization identity, NPI/TIN binding, client assertion
Authorization scope  prior authorization request and response
Signature layer      detached x278 receipt over the canonical payload
Audit                FHIR AuditEvent / Provenance, plus the signed x278 determination receipt
```

9.5 Signing

Every final determination is signed by the payer agent over the canonical request and the determination body, so the provider holds a verifiable receipt of what was returned, by which rule set version, and when. The mechanics are specified, not implied:

```
signature.alg              ES256 | EdDSA
signature.format           JWS detached payload | COSE_Sign1
signature.canonicalization RFC 8785 JCS for JSON, or FHIR canonical JSON
signature.keyId            JWKS URL or DID URL
requestHash                SHA-256 over the canonical request
ruleSetVersion             included in the signed payload
issuedAt                   timestamp
nonce / idempotencyKey     replay protection
```

9.6 Trust Model

The payer's signature proves what determination was returned for a specific canonical request, policy version, timestamp, and payer key. It is a verifiable receipt. Independent reproduction of the decision is possible only when the payer also publishes executable rules and canonical data mappings; absent that, the signature attests

to what was returned, not that the adjudication was correct. x278 is explicit about this boundary rather than overclaiming provability.

10 Integration Examples

10.1 Payer-Side (Node / Express)

```
const express = require("express");
const { x278Middleware } = require("@x278/express");

const app = express();

app.post("/authorize", x278Middleware({
  ruleSet: "acme-health/medical-policy@2026.2",
  documentationProfiles: "davinci-dtr",
  signWith: "did:web:acme-health.example",
  onHumanReview: queueToClinicalReviewer,   // exception path
}));

app.listen(3000);
```

10.2 Provider-Side (Client)

```
import { x278Client } from "@x278/client";

const client = new x278Client({ signWith: providerKey });

let result = await client.request({ patient, provider, service });

// drive info-needed → attach evidence; pended → await subscription
while (result.status === "info-needed" || result.status === "pended") {
  if (result.status === "info-needed") {
    const evidence = await gatherEvidence(result.documentationRequired);
    result = await client.resume(result.authId, result.resumeToken, evidence);
  } else {
    result = await client.awaitDetermination(result.subscription);
  }
}

if (result.status === "approved") {
  schedule(result.authNumber, result.validThrough);
} else if (result.status === "denied") {
  appealOrCorrect(result.reasonCode, result.appealPath);
}
```

10.3 Testing and Development

An x278 toolkit ships a local environment with a mock payer agent serving a sample published rule set, fixtures that exercise each determination state including pended and the human-review escalation, and verbose logging of every request, retry, subscription, and signature so integrators can develop without touching production payer systems.

11 Use Cases

Imaging and elective procedures. An orthopedic practice's agent submits a knee arthroplasty request; the payer agent returns `info-needed` for documented conservative treatment, the provider agent attaches the chart evidence, and an authorization is returned in one round trip instead of a week of faxes.

Drug prior authorization (future extension). Drug PA sits outside the CMS-0057-F Prior Authorization API baseline, which excludes drugs. A future x278 extension could carry pharmacy and drug authorization over separate ePA or pharmacy-benefit rails, aligned with the proposed CMS-0062-P rule that would extend prior authorization requirements to drugs.

Continuity across payers. When a member changes plans, the new payer agent can reconcile an existing authorization through the same signed records, reducing repeat reviews.

Pre-submission checks. Because the rule set is published and versioned, a provider agent can evaluate likely approval before submitting and avoid doomed requests, cutting denial volume at the source.

Audit and appeals. A denied request's coded reason and signed record let the provider agent file a clean, correctly-targeted appeal without a human decoding a denial letter.

12 Key Takeaways

Prior authorization is slow and expensive because its channel is human, not because its decisions are hard. x278 redesigns the exchange for the agents that will run it on each side, keeping the clinician only where judgment is actually required.

- Authorization resolves synchronously, in seconds, when the payer can adjudicate deterministically; otherwise it pends without blocking the workflow.
- Every non-approval is actionable: a specific coded denial reason, the exact list of missing documentation, or a pended subscription, so retry replaces blind resubmission.
- Determinations are signed and logged, giving both sides a verifiable receipt instead of a dispute-by-fax loop.
- It layers on the FHIR prior authorization rails CMS-0057-F already requires of impacted payers, so adoption rides an existing deadline rather than a new regulatory rail.

13 Reference Implementation

A reference implementation would provide the core protocol library that handles the request, the determination states including pended, and the resume-with-evidence and await-subscription flows; payer-side middleware for common server frameworks; a provider-side client that drives the loop automatically; signing and verification utilities; and adapters that map x278 onto the Da Vinci PAS, DTR, and CRD FHIR profiles and the X12 278 transaction so it interoperates with the rails payers are already building.

For teams building agent-driven healthcare operations, x278 offers a foundation for authorization that is machine-native by default and human-reviewed only by exception.

14 References

[1] CMS. Interoperability and Prior Authorization Final Rule (CMS-0057-F). Fact sheet and final rule, 2024. cms.gov.

[2] Federal Register. Medicare and Medicaid Programs; Advancing Interoperability and Improving Prior Authorization Processes. 89 FR, Feb 8, 2024.

[3] CMS. Interoperability and Prior Authorization for Drugs Proposed Rule (CMS-0062-P).

[4] American Medical Association. Prior Authorization Physician Survey, 2024–2025.

[5] HL7 Da Vinci. Prior Authorization Support (PAS) FHIR Implementation Guide.

[6] HL7 Da Vinci. Documentation Templates and Rules (DTR) Implementation Guide.

[7] HL7 Da Vinci. Coverage Requirements Discovery (CRD) Implementation Guide.

[8] ASC X12N. 278 Health Care Services Review and 275 Additional Information transactions.

[9] Coinbase. x402: An Open Standard for Internet-Native Payments, 2025.