

# MindLog

## FHIR-Based Bidirectional EHR Integration

### Development Prompt & Technical Specification

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**Target EHR Platforms:**

Oracle Health (Millennium Platform) | Epic (EpicCare)

Repository: <https://github.com/sudoshi/MindLog>

Version: 1.0 | February 2026

Standards: HL7 FHIR R4 | SMART on FHIR v2 | US Core 6.1 | ONC PRO FHIR IG

# 1. Executive Summary & Project Context

## 1.1 About MindLog

MindLog is a mental wellness tracking platform built as an Expo-based React Native mobile application with a Supabase backend. It enables patients with bipolar disorder, anxiety, and depression to record daily mood assessments, sleep patterns, exercise, medication adherence, triggers, symptoms, and journal entries. Clinicians (psychiatrists, psychologists, and general practitioners) access a web-based dashboard to review longitudinal patient data and intervene proactively.

The application is structured as a TypeScript monorepo (Turborepo) with separate packages for the mobile app, API layer, and shared components. The current data model uses PostgreSQL (via Supabase) with a schema designed around patient-reported outcomes.

## 1.2 Purpose of This Prompt

This document serves as the comprehensive development prompt for implementing FHIR R4-based bidirectional data integration between MindLog and two major EHR platforms: Oracle Health (formerly Cerner, built on the Millennium platform) and Epic (EpicCare). The integration must support both inbound data flows (reading patient context, medications, diagnoses, and care plans from the EHR) and outbound data flows (writing patient-reported outcome data, questionnaire responses, and clinical observations back to the EHR).

## 1.3 Regulatory & Standards Context

All integration work must comply with the following standards and regulatory frameworks:

- HL7 FHIR R4 (v4.0.1) as the data exchange standard
- SMART on FHIR v2 (SMART App Launch Implementation Guide 2.0) for authorization
- US Core Implementation Guide STU 6.1.0 for data profiles
- ONC Patient-Reported Outcomes (PRO) FHIR Implementation Guide for PRO data write-back
- USCDI v3/v4 data elements for interoperability compliance
- 21st Century Cures Act and ONC Information Blocking Rule requirements
- HIPAA Privacy and Security Rule requirements for PHI in transit and at rest
- TEFCA framework alignment for future nationwide exchange readiness

## 2. Architecture Overview

### 2.1 Integration Architecture Pattern

MindLog shall implement a FHIR facade / middleware integration layer that mediates between the Expo mobile client, the Supabase backend, and the target EHR FHIR endpoints. The architecture follows a hub-and-spoke model where the MindLog backend acts as the integration hub.

Layer	Technology	Responsibility
Mobile Client	Expo / React Native + TypeScript	SMART on FHIR standalone launch, patient authentication via EHR patient portal, local survey administration, offline queue
Integration Middleware	Supabase Edge Functions (Deno) or Node.js service	FHIR resource transformation, OAuth 2.0 token management, request routing, retry logic, audit logging
FHIR Client Library	fhirclient.js (npm: fhirclient)	SMART on FHIR authorization flow, FHIR API calls, token refresh
Backend Data Store	Supabase PostgreSQL	Local data persistence, FHIR resource caching, sync state management, conflict resolution
EHR FHIR Endpoints	Oracle Health R4 API / Epic on FHIR R4	Authoritative clinical data source and write-back target

### 2.2 Dual Launch Mode Support

MindLog must support two SMART on FHIR launch modes:

**Standalone Launch (Primary):** The patient opens MindLog independently on their mobile device. The app initiates SMART on FHIR standalone launch, redirecting to the EHR's patient portal (MyChart for Epic, HealtheLife/Patient Portal for Oracle Health) for authentication. Upon successful auth, the app receives an access token scoped to the patient's record, enabling both read and write operations against the EHR's FHIR endpoint.

**EHR Launch (Secondary):** A clinician launches MindLog from within the EHR as a SMART on FHIR embedded app. The EHR provides patient context (FHIR Patient ID), practitioner context, and encounter context through the launch parameters. This mode is used by clinicians to review MindLog data within their EHR workflow and is authorized with provider-level scopes.

## 3. Authentication & Authorization (SMART on FHIR v2)

### 3.1 OAuth 2.0 Flow Requirements

Implement the SMART App Launch Implementation Guide 2.0 authorization framework. Both Epic and Oracle Health support this standard, though with platform-specific nuances.

#### 3.1.1 Discovery

On app initialization, MindLog must discover the EHR's authorization endpoints by fetching the FHIR server's CapabilityStatement or .well-known/smart-configuration:

```
GET {FHIR_BASE_URL}/.well-known/smart-configuration
GET {FHIR_BASE_URL}/metadata (CapabilityStatement)
```

Parse the response to extract: authorization\_endpoint, token\_endpoint, revocation\_endpoint, introspection\_endpoint, supported scopes, PKCE support, and token\_endpoint\_auth\_methods\_supported.

#### 3.1.2 Required OAuth 2.0 Scopes

MindLog must request the following SMART v2 scopes. Note the SMART v2 granular scope syntax (resource/operation.read vs. resource/\*.\* in v1):

Scope (SMART v2)	Purpose	Launch Mode
openid fhirUser	Identity token for patient/practitioner identification	Both
launch/patient	Request patient selection during standalone launch	Standalone
launch	Receive context from EHR launch	EHR Launch
patient/Patient.read	Read patient demographics	Both
patient/Condition.read	Read diagnoses (bipolar, depression, anxiety ICD-10 codes)	Both
patient/MedicationRequest.read	Read active prescriptions (mood stabilizers, SSRIs, antipsychotics)	Both
patient/Observation.read	Read vital signs, lab results, existing PRO data	Both
patient/Observation.write	Write patient-reported observations back to EHR	Standalone
patient/QuestionnaireResponse.read	Read previously completed questionnaire responses	Both
patient/QuestionnaireResponse.write	Write completed survey responses to EHR	Standalone

patient/CarePlan.read	Read active behavioral health care plans	Both
patient/CareTeam.read	Read care team members for clinician routing	Both
patient/AllergyIntolerance.read	Read medication allergies relevant to psychopharm	Both
patient/DocumentReference.write	Write clinical summaries/reports as PDF documents	Standalone
user/Patient.read	Provider reads patient record in EHR launch context	EHR Launch
user/Observation.write	Provider writes observations in EHR launch context	EHR Launch
offline_access	Refresh tokens for background sync	Standalone

### 3.1.3 PKCE Requirement

Both Epic and Oracle Health mandate Proof Key for Code Exchange (PKCE) with S256 challenge method for public clients (mobile apps). Implement PKCE as follows:

1. Generate a cryptographically random code\_verifier (43–128 characters, unreserved URI characters)
2. Compute code\_challenge = BASE64URL(SHA256(code\_verifier))
3. Include code\_challenge and code\_challenge\_method=S256 in the authorization request
4. Include code\_verifier in the token exchange request

### 3.1.4 Token Management

Implement robust token lifecycle management:

- Store access tokens and refresh tokens securely using expo-secure-store (iOS Keychain / Android Keystore)
- Implement proactive token refresh 60 seconds before expiry using the refresh\_token grant
- Handle token revocation on logout and app uninstall
- Implement exponential backoff retry on 401 Unauthorized responses with automatic token refresh
- Log all token events for audit trail (without logging actual token values)
- Epic access tokens typically expire in 60 minutes; Oracle Health in 570 seconds (9.5 minutes)

## 3.2 Platform-Specific Authorization Notes

**Epic:** Register the app through the Epic App Orchard or directly with customer organizations via the Epic on FHIR developer portal ([fhir.epic.com](https://fhir.epic.com)). Epic supports both patient standalone launch and EHR launch. For patient-facing apps, use Individual Access Services (IAS). Epic's FHIR

Sandbox (February 2026 version) is available for development testing. Hyperdrive must be at the latest version.

**Oracle Health:** Register via the Oracle Health FHIR developer portal. Oracle Health Millennium Platform APIs support R4 exclusively (DSTU2 is deprecated). The sandbox environment uses tenant ID ec2458f2-1e24-41c8-b71b-0e701af7583d for testing. Oracle Health supports the US Core QuestionnaireResponse Profile from STU 6.1.0.

## 4. Inbound Data Flows (EHR to MindLog)

The following FHIR resources must be read from the EHR and synchronized to MindLog's Supabase database. Each resource type includes the specific search parameters, clinical relevance, and platform-specific considerations.

### 4.1 Patient Demographics

Attribute	Specification
FHIR Resource	Patient
Operation	Read (GET Patient/{id})
Key Fields	name, birthDate, gender, telecom, address, communication.language, identifier (MRN)
Clinical Rationale	Demographics contextualize survey interpretation. Age affects medication dosing norms. Language preference drives survey localization. MRN enables clinician cross-reference.
Sync Frequency	On initial link + daily refresh
US Core Profile	US Core Patient Profile

### 4.2 Active Diagnoses (Conditions)

Attribute	Specification
FHIR Resource	Condition
Operation	Search (GET Condition?patient={id}&clinical-status=active&category=problem-list-item)
Key ICD-10 Codes	F31.x (Bipolar disorders), F32.x/F33.x (Depressive disorders), F40.x/F41.x (Anxiety disorders), F43.x (PTSD/adjustment disorders), F90.x (ADHD, common comorbidity)
Clinical Rationale	Active diagnoses drive adaptive survey logic. A patient with bipolar F31.x should receive mania screening items (ASRM). A patient with only F32.x (MDD) skips mania items. Comorbid anxiety triggers GAD-7 items.
Sync Frequency	On initial link + weekly refresh
US Core Profile	US Core Condition Problems and Health Concerns Profile

### 4.3 Active Medications

Attribute	Specification
FHIR Resource	MedicationRequest

Operation	Search (GET MedicationRequest?patient={id}&status=active&intent=order)
Key Drug Classes	Mood stabilizers (lithium, valproate, lamotrigine, carbamazepine), SSRIs/SNRIs, Atypical antipsychotics (quetiapine, aripiprazole, lurasidone), Benzodiazepines, Sleep aids (trazodone, hydroxyzine)
Key Fields	medicationCodeableConcept (RxNorm codes), dosageInstruction, status, authoredOn, requester
Clinical Rationale	Medication list populates the adherence tracking module. Enables medication-specific side effect monitoring. Drug class informs which survey items to present (e.g., lithium requires renal/thyroid monitoring prompts).
Sync Frequency	On initial link + daily refresh
US Core Profile	US Core MedicationRequest Profile

## 4.4 Observations (Vitals, Labs, Existing PROs)

Attribute	Specification
FHIR Resource	Observation
Operations	GET Observation?patient={id}&category=vital-signs (weight, BMI for metabolic monitoring)   GET Observation?patient={id}&category=laboratory (lithium levels, TSH, metabolic panel)   GET Observation?patient={id}&category=survey (existing PRO data)
Key LOINC Codes	29463-7 (Weight), 39156-5 (BMI), 14334-7 (Lithium level), 3016-3 (TSH), 44249-1 (PHQ-9 total), 70274-6 (GAD-7 total), 89209-1 (PROMIS Global Health)
Clinical Rationale	Lab values contextualize symptom reports (e.g., hypothyroid TSH may explain fatigue/depression). Weight trends track metabolic side effects of atypical antipsychotics. Existing PRO scores provide longitudinal comparison baseline.
Sync Frequency	On initial link + daily for vitals, weekly for labs
US Core Profile	US Core Observation Profiles (Vitals, Lab, Survey)

## 4.5 Care Plan & Care Team

Attribute	Specification
FHIR Resources	CarePlan, CareTeam
Operations	GET CarePlan?patient={id}&status=active&category=mental-health   GET CareTeam?patient={id}&status=active
Key Fields	CarePlan: activity, goal, description   CareTeam: participant (role, member reference to Practitioner)
Clinical Rationale	Care plan goals inform personalized survey prompts and motivational messaging. Care team members determine which clinicians receive alert

	notifications from MindLog. Identifies the prescribing psychiatrist vs. therapist vs. PCP.
Sync Frequency	On initial link + weekly refresh

## 4.6 Allergy / Intolerance

Read AllergyIntolerance resources to support medication adherence tracking (avoid suggesting medications the patient is allergic to in any educational content) and to contextualize side effect reports.

## 5. Outbound Data Flows (MindLog to EHR) — Write-Back

This is the most critical and technically complex portion of the integration. Writing patient-generated health data (PGHD) back to the EHR requires precise FHIR resource construction, correct LOINC coding, and compliance with the ONC PRO FHIR Implementation Guide.

### 5.1 FHIR Resource Strategy for Write-Back

MindLog will write data to the EHR using two primary FHIR resource types, chosen based on the nature of the data:

Data Type	FHIR Resource	Rationale
Validated instrument scores (PHQ-9, GAD-7, ASRM, ISI, C-SSRS)	QuestionnaireResponse + Observation (derived scores)	QuestionnaireResponse captures the full item-level detail. A derived Observation with the total score and LOINC code integrates into the EHR's flowsheet/results review for clinician consumption.
Daily mood/sleep/energy ratings	Observation (category: survey)	Individual data points with LOINC codes. Filed to EHR flowsheet rows for trend visualization.
Medication adherence reports	Observation (category: survey) with custom LOINC/SNOMED coding	Adherence data as structured observations. USCDI v5 is adding medication adherence as a data class.
Suicidal ideation safety alerts	Observation (category: survey) + Flag resource (if supported)	Critical safety data. Must trigger EHR-side alerting workflow. C-SSRS screening LOINC: 93267-4.
Journal entries / free text summaries	DocumentReference (attachment: PDF)	Unstructured text submitted as a PDF attachment linked to the patient's chart via DocumentReference.
Session/encounter summaries for clinicians	DocumentReference (attachment: PDF) or DiagnosticReport	Longitudinal summary reports generated by MindLog for clinician review.

### 5.2 QuestionnaireResponse Write-Back (Validated Instruments)

For each validated instrument administered in MindLog (PHQ-9, GAD-7, ASRM, ISI, C-SSRS), construct a QuestionnaireResponse resource per the ONC PRO FHIR IG pattern:

#### 5.2.1 Resource Construction Requirements

- questionnaire: Reference to the canonical Questionnaire URL or the EHR's internal Questionnaire ID
- status: “completed” for submitted surveys
- subject: Reference to Patient/{FHIR\_ID}

- authored: ISO 8601 timestamp of survey completion
- author: Reference to Patient/{FHIR\_ID} (self-reported) or Device reference for app-generated
- source: Reference to Patient/{FHIR\_ID} (who provided the answers)
- item[]: Array of item responses with linkId mapping to the Questionnaire definition, with answer values as valueInteger, valueCoding, or valueString

## 5.2.2 Platform-Specific Write-Back Behavior

**Oracle Health (Millennium):** Oracle Health supports QuestionnaireResponse Create (POST) and Update (PUT) operations. The Questionnaire resource is read-only and maps to Social History categories in Millennium. The linkId values must correspond to Oracle Health's internal questionnaire definitions. Oracle Health supports the US Core QuestionnaireResponse Profile from STU 6.1.0. When writing, include item.id if one was returned on read. The meta.security field is populated when confidential answers are present.

**Epic:** Epic supports QuestionnaireResponse via its Flowsheet and Questionnaire APIs. For PRO data, Epic's preferred pattern is to file data via Observation.Create with LOINC-coded flowsheet rows. Epic's Incoming Flowsheet Data interfaces support a flag in OBX-17 to indicate whether data was manually entered (available from November 2025). Epic requires LOINC-mapped flowsheet row configuration by customer implementation teams. Coordinate with each Epic customer's clinical informatics team to map MindLog instruments to their flowsheet build.

## 5.3 Observation Write-Back (Daily Metrics & Scores)

For daily tracking data and derived instrument scores, construct Observation resources with precise LOINC coding:

MindLog Data Element	LOINC Code	LOINC Display	Value Type	Category
PHQ-9 Total Score	44249-1	PHQ-9 Total Score	valueInteger (0-27)	survey
GAD-7 Total Score	70274-6	GAD-7 Total Score	valueInteger (0-21)	survey
ASRM Total Score	89556-5	Altman Self-Rating Mania Scale Total	valueInteger (0-20)	survey
ISI Total Score	70253-0	Insomnia Severity Index Total	valueInteger (0-28)	survey
C-SSRS Suicidal Ideation	93267-4	C-SSRS Suicidal Ideation Screen	valueCoding (Yes/No)	survey
PHQ-2 Total Score	55758-7	PHQ-2 Total Score	valueInteger (0-6)	survey
Self-reported Mood	75310-4	Mood Assessment	valueInteger (1-5)	survey

(1-10)			10)	
Sleep Duration (hours)	93832-4	Sleep Duration	valueQuantity (hours)	vital-signs
Sleep Quality Rating	28323-4	Sleep Quality	valueInteger (1-5)	survey
Exercise Duration (minutes)	68516-4	Exercise Activity Duration	valueQuantity (minutes)	activity
Medication Adherence	418633004 (SNOMED)	Medication Compliance	valueCoding	survey
Self-reported Anxiety Level	70274-6	GAD-7 derived or VAS	valueInteger (1-10)	survey
Self-reported Energy Level	28316-8	Energy/Fatigue Assessment	valueInteger (1-10)	survey

### 5.3.1 Observation Resource Construction Pattern

Each Observation write-back must include:

- resourceType: "Observation"
- status: "final" for completed entries
- category: Array containing the appropriate Observation category coding (survey, vital-signs, activity)
- code: CodeableConcept with LOINC system (<http://loinc.org>) and code
- subject: Reference to Patient/{FHIR\_ID}
- effectiveDateTime: ISO 8601 timestamp of when the patient recorded the data
- issued: ISO 8601 timestamp of when MindLog submitted the data
- performer: Reference to Patient/{FHIR\_ID} (self-reported data)
- value[x]: The appropriate value type (valueInteger, valueQuantity, valueCoding, valueString)
- note: Optional text annotation (e.g., patient comments, context)
- derivedFrom: Reference to the QuestionnaireResponse if this is a derived score

### 5.3.2 Critical Write-Back Constraints by Platform

**Oracle Health:** Observation.Create supports vital-signs, laboratory, and imaging categories. For survey-category observations, Oracle Health files data via QuestionnaireResponse. Social history observations are read-only in many Millennium builds. Work with each customer's Oracle Health team to determine which flowsheet rows accept external data filing.

**Epic:** Epic's Observation.Create is primarily designed for vital signs (blood pressure, pulse ox, etc.) and specific LOINC-mapped flowsheet rows. PRO scores must be filed to LOINC-mapped flowsheet rows that are pre-configured by the customer's Epic build team. Direct Observation.Create for arbitrary LOINC codes may not be supported without customer-side

configuration. Epic's preferred approach for PRO data is via their Patient-Entered Flowsheet Data workflow.

## 5.4 DocumentReference Write-Back (Reports & Journals)

For unstructured content (journal entries, longitudinal reports, clinical summaries), MindLog generates a PDF document and submits it via DocumentReference.Create:

- Generate the PDF server-side (Supabase Edge Function) using a template engine
- Encode the PDF as base64 and include it as the DocumentReference.content.attachment.data
- Set DocumentReference.type with appropriate LOINC code (e.g., 11488-4 for Consultation note, 34117-2 for History and physical note, or a custom type for patient-reported data)
- Set DocumentReference.category to Clinical Note
- Set DocumentReference.subject to the Patient reference
- Set DocumentReference.date to the report generation timestamp
- Set DocumentReference.author to indicate MindLog as the source system

## 5.5 Safety-Critical Write-Back: Suicidal Ideation Alerts

When a patient endorses suicidal ideation (C-SSRS screening positive or PHQ-9 Item 9 score greater than 0), MindLog must implement a dual-path alert:

1. Immediate In-App Response: Display crisis resources (988 Suicide & Crisis Lifeline), safety planning tools, and local emergency contacts immediately within the mobile app. This is NOT dependent on EHR integration.
2. EHR Write-Back: Submit an Observation with LOINC 93267-4 (C-SSRS screen) and/or 44261-6 (PHQ-9 Item 9) with the positive value. This should trigger EHR-side clinical decision support rules (BPA in Epic, Discern in Oracle Health) that alert the care team.
3. Notification Service: If the EHR does not have CDS rules configured for these LOINC codes, MindLog's backend must independently notify the patient's care team via a secure channel (FHIR Communication resource, secure messaging API, or fallback email/SMS to the CareTeam practitioner contacts).

## 6. FHIR Resource Mapping & Terminology Binding

### 6.1 Code Systems Required

Code System	OID / URL	Usage in MindLog
LOINC	<a href="http://loinc.org">http://loinc.org</a>	Observation codes, Questionnaire item codes, Document types
SNOMED CT	<a href="http://snomed.info/sct">http://snomed.info/sct</a>	Clinical findings, medication concepts, body structures
ICD-10-CM	<a href="http://hl7.org/fhir/sid/icd-10-cm">http://hl7.org/fhir/sid/icd-10-cm</a>	Condition/Diagnosis codes (F31.x, F32.x, F41.x)
RxNorm	<a href="http://www.nlm.nih.gov/research/umls/rxnorm">http://www.nlm.nih.gov/research/umls/rxnorm</a>	Medication codes for psychotropic medications
UCUM	<a href="http://unitsofmeasure.org">http://unitsofmeasure.org</a>	Units of measure (hours, minutes, mg, mL)
Observation Category	<a href="http://terminology.hl7.org/CodeSystem/observation-category">http://terminology.hl7.org/CodeSystem/observation-category</a>	survey, vital-signs, activity, laboratory
Oracle Health Nomenclature	<a href="https://fhir.cerner.com/{tenant}/nomenclature">https://fhir.cerner.com/{tenant}/nomenclature</a>	Oracle Health proprietary answer codes for QuestionnaireResponse

### 6.2 Validated Instrument Questionnaire Definitions

MindLog must maintain FHIR Questionnaire resource definitions for each validated instrument. These serve as the structural template for QuestionnaireResponse construction and can be served from MindLog's own FHIR server or referenced by canonical URL.

Instrument	LOINC Panel Code	Items	Score Range	Frequency in MindLog
PHQ-9	44249-1	9 items (44250-9 through 44255-8 + 44258-2, 44259-0, 44260-8, 44261-6)	0-27	Weekly
PHQ-2	55758-7	2 items (44250-9, 44255-8)	0-6	Daily screen
GAD-7	70274-6	7 items (70275-3 through 70280-3, 71429-5)	0-21	Weekly
GAD-2	N/A (subset)	2 items from GAD-7	0-6	Daily screen
ASRM (Altman)	89556-5	5 items	0-20	Weekly (bipolar only)
ISI (Insomnia Severity)	70253-0	7 items	0-28	Biweekly

C-SSRS Screener	93267-4	3-6 items (adaptive)	Categorica l	Weekly + triggered
WHO-5 Well-Being	75246-0	5 items	0-25 (raw), 0-100%	Weekly
SDS (Sheehan Disability)	N/A	3 items	0-30	Monthly

# 7. Synchronization Engine Design

## 7.1 Sync Architecture Requirements

MindLog must implement a robust, offline-capable synchronization engine that handles intermittent connectivity, token expiration, EHR downtime, and data conflicts.

### 7.1.1 Offline-First Design

All survey data is first persisted to the local Supabase (or local SQLite cache on the mobile device), then queued for EHR write-back. The patient experience must never be blocked by EHR connectivity issues.

### 7.1.2 Sync Queue

Implement a persistent sync queue in Supabase with the following schema:

- id: UUID primary key
- patient\_id: FK to patients table
- resource\_type: FHIR resource type (Observation, QuestionnaireResponse, DocumentReference)
- fhir\_resource: JSONB containing the fully constructed FHIR resource
- target\_ehr: Enum (oracle\_health, epic)
- target\_endpoint: The FHIR base URL for the specific EHR instance
- operation: Enum (create, update)
- status: Enum (pending, in\_progress, completed, failed, retry)
- retry\_count: Integer (max 5 retries)
- next\_retry\_at: Timestamp with exponential backoff calculation
- error\_message: Text for failed operations
- ehr\_resource\_id: The FHIR resource ID returned after successful write (for update operations)
- created\_at: Timestamp
- completed\_at: Timestamp

### 7.1.3 Sync Worker

Implement a background sync worker (Supabase Edge Function or scheduled cron) that processes the queue:

1. Dequeue pending items ordered by priority (safety alerts first, then by created\_at)
2. Validate the FHIR resource against the target EHR's CapabilityStatement
3. Acquire/refresh the OAuth access token for the target EHR
4. Submit the FHIR resource via POST (create) or PUT (update) to the EHR's FHIR endpoint

5. On success: update status to completed, store the returned resource ID
6. On failure: increment retry\_count, calculate next\_retry\_at with exponential backoff (30s, 2m, 8m, 32m, 2h), log the error
7. On permanent failure (5 retries exceeded or 4xx client error): mark as failed, alert the MindLog operations team

## 7.2 Inbound Sync (EHR to MindLog)

Implement polling-based inbound sync (push notifications via FHIR Subscriptions are not universally supported):

- Full sync: On initial patient enrollment, pull all relevant resources
- Incremental sync: Use \_lastUpdated parameter to fetch only changed resources since last sync
- Frequency: Patient demographics and medications daily; conditions, care plans weekly; labs on-demand
- Conflict resolution: EHR data is authoritative for clinical data (medications, diagnoses). MindLog data is authoritative for patient-reported data. Last-write-wins for overlapping PRO data with timestamp comparison.

## 8. Platform-Specific Implementation Details

### 8.1 Oracle Health (Millennium Platform) Implementation

#### 8.1.1 FHIR Endpoint Pattern

Base URL: [https://fhir-ehr-code.cerner.com/r4/{tenant\\_id}/](https://fhir-ehr-code.cerner.com/r4/{tenant_id}/)

Open (unauthenticated): [https://fhir-open.cerner.com/r4/{tenant\\_id}/](https://fhir-open.cerner.com/r4/{tenant_id}/)

Sandbox Tenant: ec2458f2-1e24-41c8-b71b-0e701af7583d

#### 8.1.2 Supported Operations

Resource	Read	Search	Create	Update
Patient	Yes	Yes	No	No
Condition	Yes	Yes	Yes	Yes
MedicationRequest	Yes	Yes	Yes	Yes
Observation	Yes	Yes	Yes (vital-signs, imaging)	Yes
Questionnaire	Yes	Yes	No (read-only)	No
QuestionnaireResponse	Yes	Yes	Yes	Yes
CarePlan	Yes	Yes	No	No
CareTeam	Yes	Yes	No	No
DocumentReference	Yes	Yes	Yes	Yes
AllergyIntolerance	Yes	Yes	Yes	Yes

#### 8.1.3 Oracle Health-Specific Considerations

- QuestionnaireResponse maps to Social History in Millennium. The questionnaire field must reference the Oracle Health-hosted Questionnaire URL pattern: <https://fhir-ehr-code.cerner.com/r4/{tenant}/Questionnaire/{id}>
- Observation.Create for vital-signs requires a performer reference to a Practitioner. For patient-reported data, coordinate with the Oracle Health implementation team to allow Patient as performer.
- Oracle Health uses proprietary nomenclature codes for answer options in QuestionnaireResponse. Map LOINC answer lists to Oracle Health nomenclature via the Questionnaire.item.answerOption.valueCoding system.
- CORS is supported. Oracle Health returns Access-Control-Allow-Origin: \* for FHIR endpoints.
- Pagination uses custom URL-based cursors (pageContext and direction=NEXT parameters).

## 8.2 Epic (EpicCare) Implementation

### 8.2.1 FHIR Endpoint Pattern

Base URL: [https://{{customer\\_domain}}/api/FHIR/R4/](https://{{customer_domain}}/api/FHIR/R4/)

Sandbox: <https://fhir.epic.com/interconnect-fhir-oauth/api/FHIR/R4/>

### 8.2.2 Key Epic Integration Points

- Epic App Orchard: MindLog must be registered and listed in Epic's App Orchard (or Gallery) for production deployment at customer sites. This requires Epic's review process.
- Individual Access Services (IAS): For patient-facing standalone launch, Epic uses IAS which leverages MyChart credentials. Ensure MindLog's OAuth redirect URI is registered.
- Flowsheet Integration: PRO scores in Epic are most effectively integrated via Flowsheet rows. Each LOINC code used by MindLog must be mapped to a Flowsheet row in the customer's Epic build. This is a customer-side configuration task, but MindLog should provide a Flowsheet build guide.
- Patient-Entered Flowsheet Data: Starting November 2025, Epic supports a flag to indicate whether data was manually entered by the patient. Use this flag for MindLog-submitted data.
- Post-filter Search Parameters: Starting May 2024, Epic supports post-filtering on FHIR searches. Use this for efficient filtering of Observations by LOINC code.
- Hyperdrive: Epic's Hyperdrive client must be at the latest version for Sandbox connectivity (February 2026 upgrade).
- USCDI v5 Readiness: Epic is developing FHIR APIs for USCDI v5, which includes medication adherence as a new data class. Plan for future adoption.

## 9. Security, Privacy & Compliance Requirements

### 9.1 Data Protection

1. Transport Security: All FHIR API communication must use TLS 1.2+ (HTTPS). Certificate pinning is recommended for mobile-to-EHR communication.
2. At-Rest Encryption: All PHI stored in Supabase must be encrypted at rest (AES-256). Supabase provides this by default with PostgreSQL encryption.
3. Token Storage: OAuth tokens stored on-device must use platform-native secure storage (iOS Keychain via expo-secure-store, Android Keystore).
4. No PHI in Logs: Audit logs must never contain actual PHI values. Log FHIR resource IDs, operation types, and timestamps only.
5. Data Minimization: Only sync FHIR resources that MindLog actively uses. Do not bulk-download patient records.

### 9.2 Audit Trail

Maintain a comprehensive audit log for all FHIR interactions:

- Timestamp, user ID, action (read/write), resource type, resource ID, target EHR, HTTP status code, response time
- Provenance: For all write operations, create a FHIR Provenance resource linking the created resource to MindLog as the agent and the patient as the entity
- Audit events must be retained for minimum 6 years per HIPAA requirements

### 9.3 Consent Management

Before initiating any EHR data exchange, MindLog must obtain and record explicit patient consent for:

- Reading their clinical data from the EHR
- Writing their self-reported data back to the EHR (making it part of the medical record)
- Sharing data with specific care team members
- Consent must be revocable at any time, with immediate cessation of data sync
- Store consent records as FHIR Consent resources both locally and (if supported) in the EHR

## 10. Testing Strategy

### 10.1 Sandbox Testing

Platform	Sandbox URL	Test Patient	Notes
Oracle Health	<a href="https://fhir-open.cerner.com/r4/ec2458f2-1e24-41c8-b71b-0e701af7583d/">https://fhir-open.cerner.com/r4/ec2458f2-1e24-41c8-b71b-0e701af7583d/</a>	Patient/12724066, Patient/12508041	Open sandbox for read; authenticated sandbox for write
Epic	<a href="https://fhir.epic.com/interconnect-fhir-oauth/api/FHIR/R4/">https://fhir.epic.com/interconnect-fhir-oauth/api/FHIR/R4/</a>	Derrick Lin (FHIR ID in sandbox)	Requires Epic developer account; February 2026 version available
SMART Health IT	<a href="https://launch.smarthealthit.org/">https://launch.smarthealthit.org/</a>	Synthetic patients	Vendor-neutral SMART on FHIR sandbox for initial development

### 10.2 Test Scenarios

1. SMART Standalone Launch: Patient authenticates via MyChart/Patient Portal, app receives tokens and patient context
2. SMART EHR Launch: Clinician launches MindLog from within Epic/Oracle Health with patient context
3. Inbound Sync: Read Patient, Condition, MedicationRequest, Observation, CarePlan, CareTeam from sandbox
4. QuestionnaireResponse Write: Submit a completed PHQ-9 to the sandbox and verify it appears in the EHR's chart
5. Observation Write: Submit mood and sleep observations and verify they appear in flowsheet/results
6. Suicidal Ideation Alert: Submit a positive C-SSRS screen and verify EHR-side alerting (may require CDS rule configuration in sandbox)
7. Token Expiry: Verify the app gracefully handles expired tokens with automatic refresh
8. Offline Mode: Complete surveys while offline, verify data syncs when connectivity resumes
9. Conflict Resolution: Modify the same resource in both MindLog and EHR, verify correct resolution
10. DocumentReference Write: Generate and submit a PDF report, verify it appears as a document in the patient's chart

### 10.3 Inferno Testing (US Core Compliance)

Run MindLog's FHIR integration against the ONC Inferno test suite (<https://inferno.healthit.gov/>) to verify US Core conformance. This is required for ONC Health IT certification if MindLog pursues 170.315(g)(10) certification.



## 11. Implementation Roadmap

Phase	Scope	Duration	Key Deliverables
Phase 1: Foundation	SMART on FHIR auth framework, fhirclient.js integration, sandbox connectivity, token management	4-6 weeks	Working standalone launch against both sandboxes, token refresh, secure storage
Phase 2: Inbound (Read)	Patient, Condition, MedicationRequest, Observation read operations; Supabase schema for FHIR cache; incremental sync	4-6 weeks	Complete inbound data pipeline, adaptive survey logic driven by diagnoses/medications
Phase 3: Outbound (Write)	QuestionnaireResponse write, Observation write, DocumentReference write; sync queue; retry logic	6-8 weeks	Bidirectional data flow for all validated instruments and daily metrics
Phase 4: Safety & Alerts	C-SSRS/PHQ-9 Item 9 alert pipeline; care team notification; consent management	3-4 weeks	End-to-end safety alert workflow with EHR write-back and clinician notification
Phase 5: Production Hardening	Error handling, audit logging, Inferno testing, Epic App Orchard submission, security review, performance optimization	4-6 weeks	Production-ready integration, ONC compliance artifacts, app marketplace listing
Phase 6: Multi-Site Deployment	Customer-specific EHR configuration guides, flowsheet mapping templates, go-live support playbooks	Ongoing	Repeatable deployment process for new health system customers

## 12. Technology Stack & Dependencies

Component	Technology	Version / Notes
Mobile Framework	Expo (React Native) + TypeScript	SDK 52+ (current MindLog stack)
FHIR Client	fhirclient.js (npm: fhirclient)	Latest; handles SMART auth flow and FHIR API calls
OAuth / Auth	expo-auth-session + expo-secure-store	PKCE support; secure token storage
Backend	Supabase (PostgreSQL + Edge Functions)	Current MindLog stack; Edge Functions in Deno for FHIR middleware
FHIR Validation	fhirpath.js + FHIR resource validators	Client-side resource validation before submission
PDF Generation	react-native-html-to-pdf or server-side (puppeteer/pdf-lib)	For DocumentReference attachment generation
Testing	Jest + Inferno test suite +	Unit tests for FHIR resource construction;

	sandbox environments	integration tests against sandboxes
Monitoring	Sentry (errors) + custom FHIR audit log	Track sync failures, token errors, write-back latency

## 13. Appendix: Key Reference Links

Resource	URL
MindLog Repository	<a href="https://github.com/sudoshi/MindLog">https://github.com/sudoshi/MindLog</a>
HL7 FHIR R4 Specification	<a href="https://hl7.org/fhir/R4/">https://hl7.org/fhir/R4/</a>
SMART App Launch IG v2	<a href="https://hl7.org/fhir/smart-app-launch/">https://hl7.org/fhir/smart-app-launch/</a>
US Core IG STU 6.1	<a href="https://hl7.org/fhir/us/core/STU6.1/">https://hl7.org/fhir/us/core/STU6.1/</a>
ONC PRO FHIR IG	<a href="http://hl7.org/fhir/us/patient-reported-outcomes/">http://hl7.org/fhir/us/patient-reported-outcomes/</a>
Epic on FHIR Developer Portal	<a href="https://fhir.epic.com/">https://fhir.epic.com/</a>
Epic Open APIs	<a href="https://open.epic.com/">https://open.epic.com/</a>
Oracle Health FHIR R4 APIs	<a href="https://docs.oracle.com/en/industries/health/millennium-platform-apis/mrap/">https://docs.oracle.com/en/industries/health/millennium-platform-apis/mrap/</a>
Oracle Health QuestionnaireResponse	<a href="https://fhir.cerner.com/millennium/r4/clinical/diagnostics/questionnaire-response/">https://fhir.cerner.com/millennium/r4/clinical/diagnostics/questionnaire-response/</a>
SMART on FHIR Documentation	<a href="https://docs.smarthealthit.org/">https://docs.smarthealthit.org/</a>
fhirclient.js Library	<a href="https://github.com/smart-on-fhir/client-js">https://github.com/smart-on-fhir/client-js</a>
ONC Inferno Test Suite	<a href="https://inferno.healthit.gov/">https://inferno.healthit.gov/</a>
LOINC Code Search	<a href="https://loinc.org/search/">https://loinc.org/search/</a>
SMART Markers Framework (Reference)	<a href="https://github.com/SMARTMarkers/smartmarkers-ios">https://github.com/SMARTMarkers/smartmarkers-ios</a>
LHC FHIR SDC Questionnaire App	<a href="https://lhcfhirtools.nlm.nih.gov/sdc">https://lhcfhirtools.nlm.nih.gov/sdc</a>
Epic App Orchard / Gallery	<a href="https://appmarket.epic.com/">https://appmarket.epic.com/</a>
TEFCA Framework	<a href="https://www.healthit.gov/topic/interoperability/policy/trusted-exchange-framework-and-common-agreement-tefca">https://www.healthit.gov/topic/interoperability/policy/trusted-exchange-framework-and-common-agreement-tefca</a>

**End of Specification** — This document should be used as the primary development prompt for implementing FHIR-based bidirectional EHR integration in the MindLog application.