GlucoCare

A Clinical Decision-Support and Self-Management System for Patients with Diabetes

- Case Study: Sir Albert Cook Hospital, Kampala

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Live system

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Overview of the Project

The problem

Patients keep glucose readings on paper or from memory, so the history is incomplete. Clinicians lose consultation time on fragmented records, dangerous trends go unnoticed between visits, and prescribing can happen without verified vital signs.

The aim

To design, implement and evaluate a web-based self-management and clinical decision-support system that validates glucometer readings, measures data reliability, flags abnormal glucose patterns and gives clinicians explainable alerts.

What it does

- Patients log readings with the meal context and see their trends
- Rules based on ADA targets flag lows, highs and patterns, with the reason written out
- Clinicians triage alerts; prescribing is locked until vitals are recorded
- The front desk registers patients, records vitals and makes referrals

4
kinds of user: patient, clinician, front desk, administrator

16
tables in PostgreSQL

51 of 51
automated checks passed

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Module Description

1 Accounts and security

Sign-in with lockout after 5 failures, pages by role, optional two-factor codes, password reset and automatic sign-out.

2 Glucose logging

Patients enter a reading in mg/dL or mmol/L with the meal context, and see their history and trend charts.

3 Validation and reliability

Rejects impossible values and duplicates, asks to confirm extreme ones, and rates data confidence from 14-day adherence.

4 Decision-support engine

Checks readings against each patient's targets and patterns, and writes an explained alert such as Critical Risk, High Data Confidence.

5 Clinician care

Alerts listed by risk, per-patient targets, vitals, and prescribing locked until vitals are under 24 hours old, with an allergy check.

6 Front desk

Registers patients, records vitals and makes referrals. Sees the open alerts without patient names.

7 Administration

Manages staff and patients, reads the audit trail, and tests the engine on simulated patients.

7 modules

Together they link home monitoring to clinic triage. The system supports the clinician and never changes treatment on its own.

Operational Environment

Software

- PHP 8 on Apache
- PostgreSQL database (Supabase or an own server)
- Tailwind CSS and JavaScript
- Chart.js for glucose trend charts
- Installable web app, works on phones

Hardware and devices

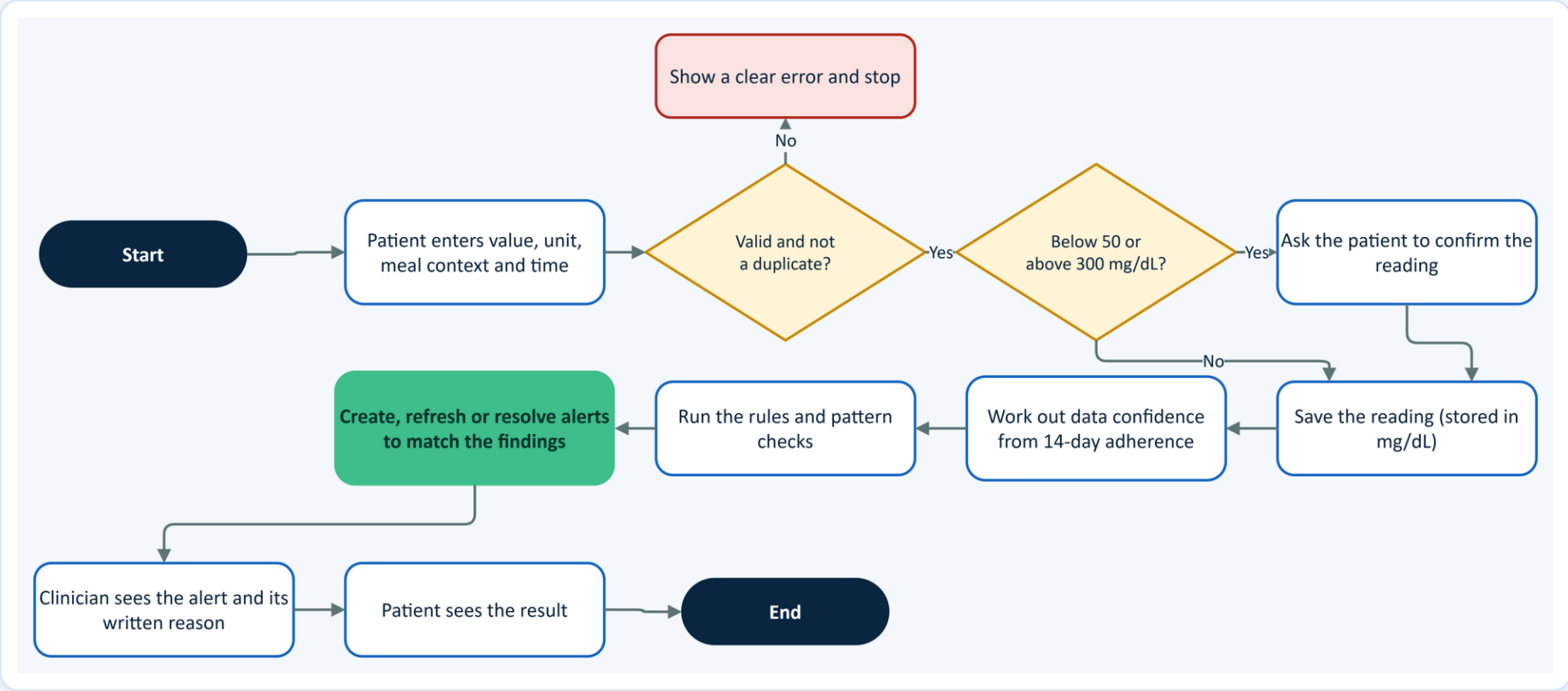
- Hospital desktop computers
- Patients' smartphones with a browser
- Wi-Fi network
- The patient's own glucometer; readings are typed in
- No special hardware is needed

Runs online on

- Hostinger VPS: 2 vCPU, 8 GB memory
- Ubuntu 24.04 LTS
- Docker: PHP-Apache and PostgreSQL 15
- Caddy gives automatic HTTPS
- glucocare.rwenzorilabs.com

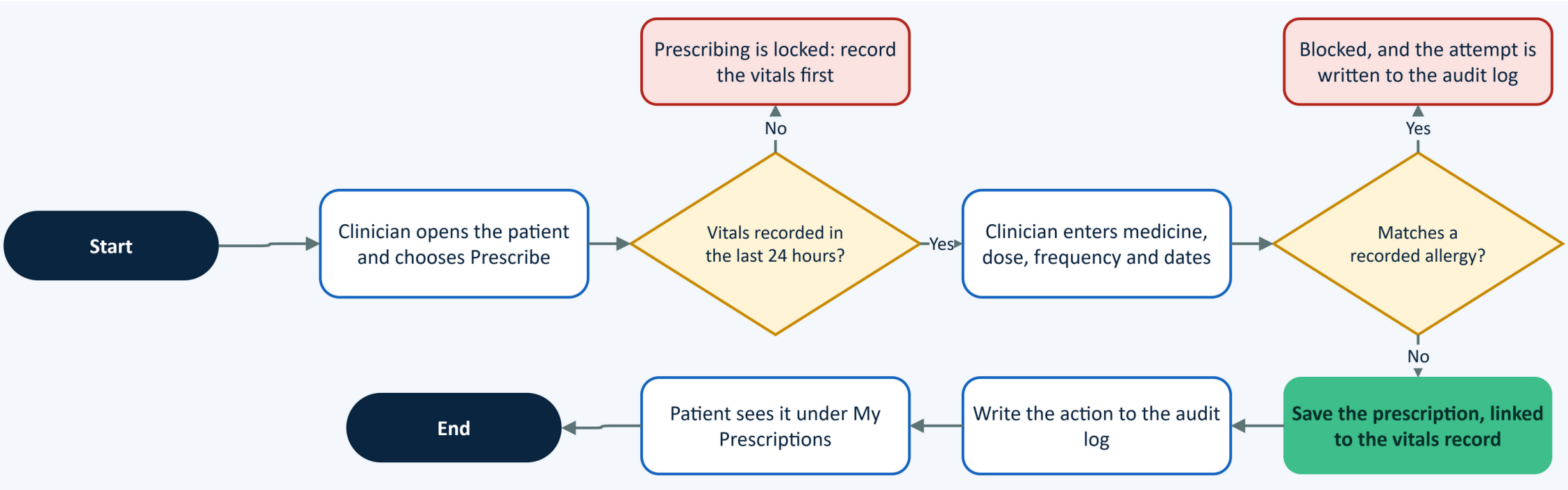
Security: password hashing, CSRF tokens, prepared statements, audit log **Messages:** clinician email digest, patient SMS

Flowchart: Logging a Glucose Reading



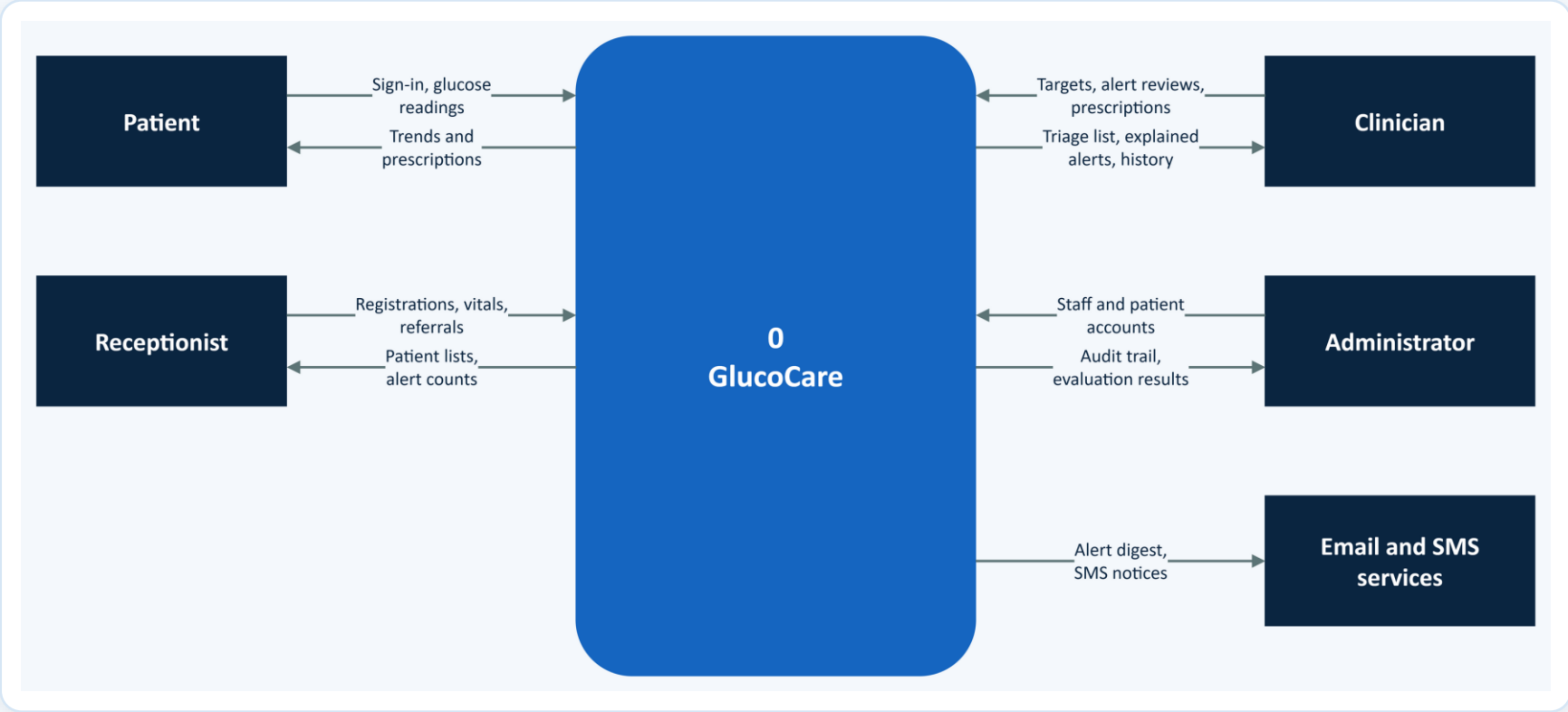
Impossible values and duplicates are stopped, extreme values need the patient to confirm, and alerts are created, refreshed or resolved to match the data.

Flowchart: Prescribing a Medicine



Prescribing is locked until vitals are under 24 hours old. A medicine that matches a recorded allergy is blocked and logged. The system never suggests doses.

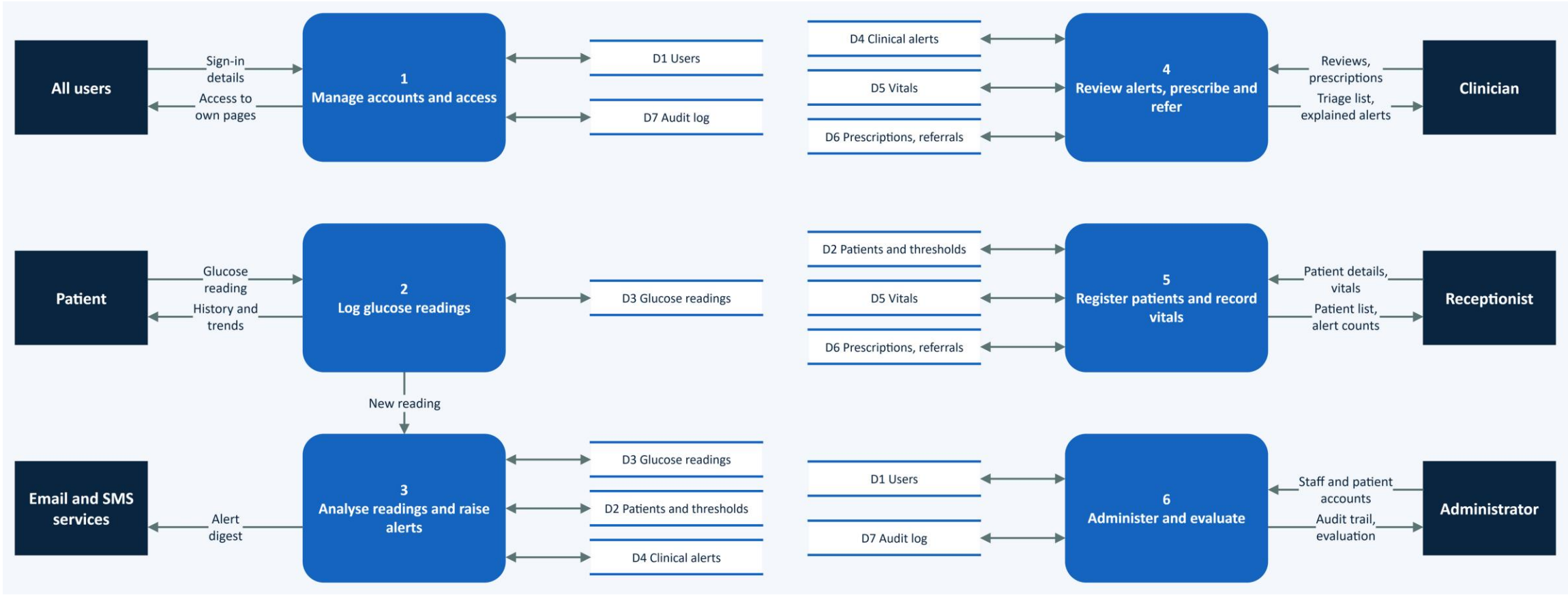
Data Flow Diagram: Level 0



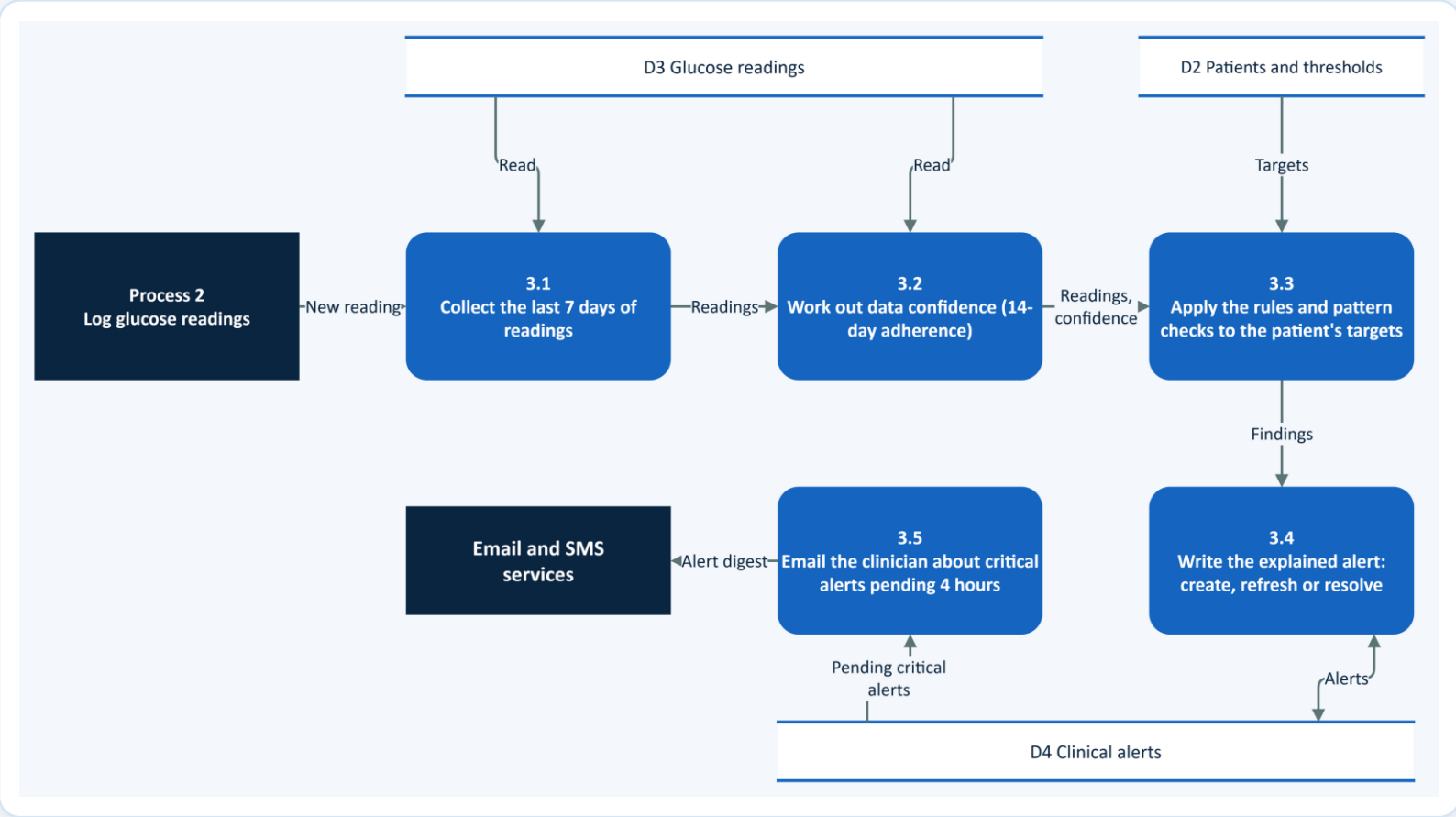
Outside party | Process | Data store | Data flow

Level 0 shows the whole system as one process, with four kinds of user and the email and SMS services.

Data Flow Diagram: Level 1

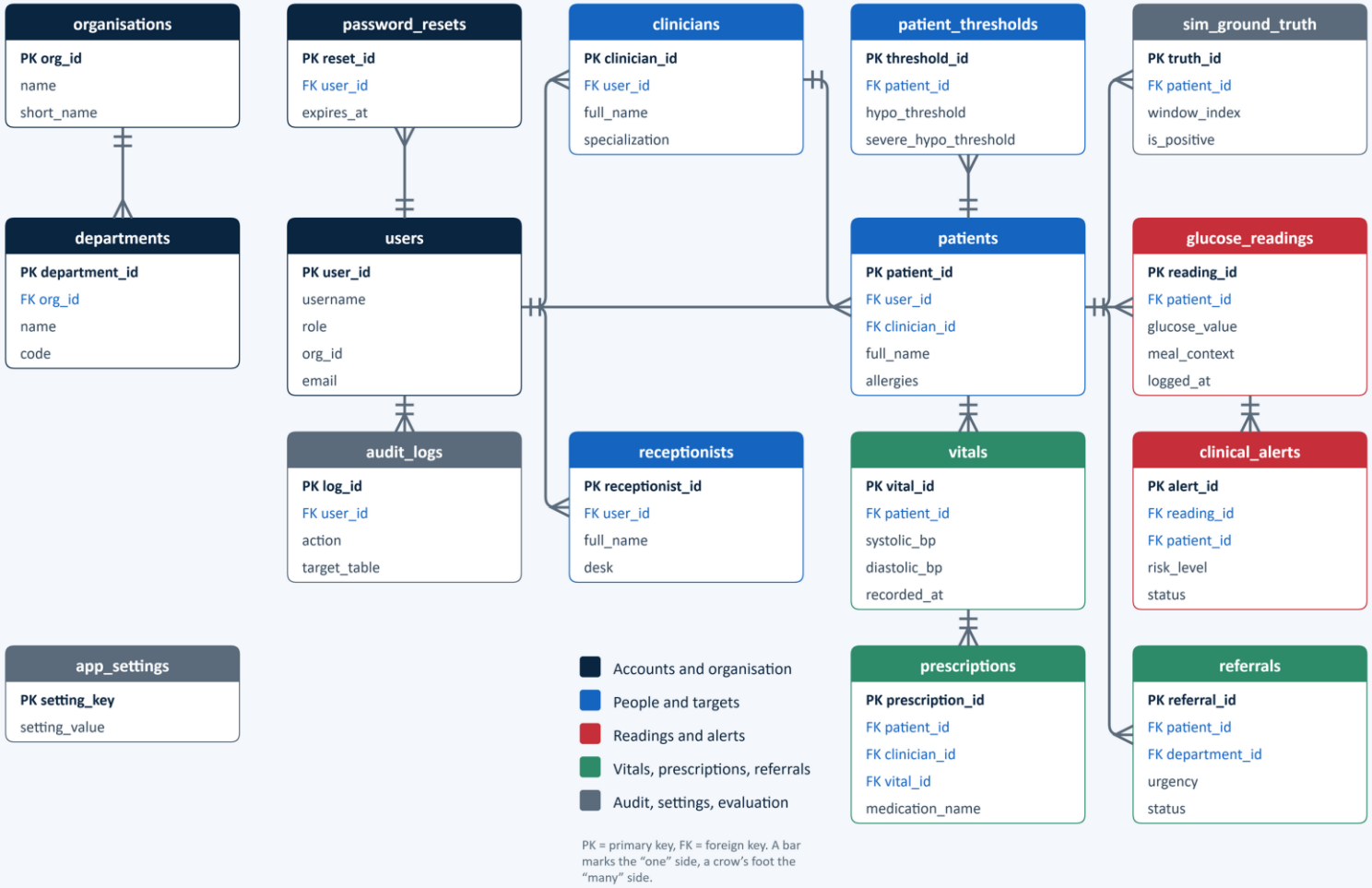


Data Flow Diagram: Level 2



Process 3 opened into five steps: collect the readings, work out data confidence, apply the rules and pattern checks, write the explained alert, and email the clinician about critical alerts that stay pending.

E-R Diagram



16

tables in PostgreSQL

Explained

every alert keeps its reading, risk level and written reason

Linked

each prescription points to the vitals record it was issued against