Cabo Health - Product Requirements Document (PRD)

Version: 1.0
Date: November 3, 2025
Author: MiniMax Agent
Status: Draft

Table of Contents

Executive Summary

Cabo Health is a comprehensive functional medicine platform that revolutionizes how healthcare providers and patients approach wellness through AI-powered biomarker analysis. The platform bridges the gap between traditional lab reports and actionable health insights using functional medicine principles.

Problem Statement

- Traditional lab reports use disease-focused reference ranges
- Lack of personalized health optimization recommendations
- Time-consuming manual analysis by healthcare providers
- Limited patient understanding of health data

Solution

- AI-powered functional medicine analysis using optimal health ranges
- Comprehensive biomarker classification system (OPTIMO/ACEPTABLE/SUBOPTIMO/ANOMALO)
- Automated workflow from PDF upload to doctor review and approval
- Educational insights for both patients and healthcare providers

Product Overview

Cabo Health is a full-stack web application designed to streamline functional medicine analysis through intelligent automation and comprehensive health data management.

Key Value Propositions

For Healthcare Providers:
- Automated biomarker analysis using AI
- Comprehensive functional medicine reports
- Streamlined patient management workflow
- Evidence-based health optimization recommendations

For Patients:
- Easy PDF lab report upload
- Clear health status visualization
- Educational content and insights
- Progress tracking over time

For Both:
- Secure, HIPAA-compliant data handling
- Real-time notifications and updates
- Mobile-responsive design
- Cloud-based accessibility

User Personas & Roles

Primary Users

1. Functional Medicine Doctors

Demographics: Licensed healthcare providers specializing in functional medicine
Goals:
- Efficiently analyze patient lab reports
- Provide optimal health recommendations

- Track patient progress over time
- Streamline consultation workflows

Pain Points:
- Time-consuming manual analysis
- Lack of standardized functional ranges
- Difficult patient communication of complex data
- Disorganized patient management

Technology Comfort: Medium to High

2. Health-Conscious Patients

Demographics: Individuals proactive about their health optimization
Goals:
- Understand their health data clearly
- Receive actionable health recommendations
- Track health improvements over time
- Access to expert medical guidance

Pain Points:
- Confusing traditional lab reports
- Lack of personalized health insights
- Difficulty understanding medical terminology
- Need for expert interpretation

Technology Comfort: Medium

Secondary Users

3. Healthcare Administrators

Demographics: Practice managers and healthcare administrators
Goals:
- Efficient patient management
- Billing and appointment coordination
- Provider performance tracking
- Compliance monitoring

Core Features

1. User Authentication & Role Management

- **Dual-role authentication system** (Doctors/Patients)
- **Supabase Auth integration** with row-level security
- **Profile management** with professional credentials for doctors

- **Secure session management**

2. PDF Lab Report Processing

- **Multi-format PDF support** (upload via drag-and-drop)
- **Automated text extraction** using edge functions
- **Data validation** and parsing
- **Secure file storage** with access controls

3. AI-Powered Biomarker Analysis

- **GROQ LLaMA 3.3 70B model integration**
- **Functional medicine optimal ranges** application
- **Automated classification** into four categories:
- **OPTIMO:** Optimal range
- **ACEPTABLE:** Acceptable range
- **SUBOPTIMO:** Suboptimal range
- **ANOMALO:** Anomalous range requiring attention

4. Comprehensive Biomarker Database

- **60+ biomarkers** across 9 medical categories:
- Lipid Panel (8 biomarkers)
- Thyroid Function (6 biomarkers)
- Glucose Metabolism (5 biomarkers)
- Inflammatory Markers (7 biomarkers)
- Kidney Function (6 biomarkers)
- Liver Function (7 biomarkers)
- Vitamins & Minerals (10 biomarkers)
- Hormones (8 biomarkers)
- Blood Chemistry (3 biomarkers)

5. Doctor Review Workflow

- **Review queue** for pending analyses
- **Interactive analysis interface**
- **Approval/rejection capabilities**
- **Custom annotations and notes**
- **Patient communication tools**

6. Patient Dashboard

- **Health status overview**
- **Biomarker visualization charts**
- **Progress tracking over time**
- **Educational content and insights**
- **Doctor recommendations display**

7. Notification System

- **Email notifications** for key events
- **Real-time updates** in the application
- **Status tracking** throughout the process
- **Appointment reminders**

User Workflows

Patient Workflow

1. **Registration & Onboarding**
   - Create account with email verification
   - Complete health profile
   - Upload initial lab reports (PDF)

2. **Report Processing**
   - PDF upload and validation
   - AI analysis initialization
   - Doctor assignment notification
   - Status tracking dashboard

3. **Results Review**
   - Receive notifications when analysis is complete
   - Review approved analysis results
   - Access educational insights
   - Download or share reports

4. **Ongoing Management**
   - Schedule follow-up consultations
   - Upload additional lab reports
   - Track progress over time
   - Receive health recommendations

Doctor Workflow

1. **Registration & Verification**
   - Create professional account
   - Submit credentials verification
   - Complete professional profile

2. **Review Process**
   - Access assigned patient analyses
   - Review AI-generated insights
   - Add professional annotations
   - Approve or request modifications

3. **Patient Communication**
   - Send approved analyses to patients
   - Provide additional recommendations
   - Schedule follow-up appointments
   - Track patient progress

4. **Practice Management**
   - Monitor review queue
   - Track patient outcomes
   - Generate practice reports
   - Manage patient relationships

Technical Architecture

Frontend Stack

- **React 18** with TypeScript for type safety
- **Vite** for fast development and build process
- **Tailwind CSS** for responsive UI design
- **React Router** for navigation and protected routes
- **React Query** for state management and caching
- **Chart.js** for data visualization

Backend Stack

- **Supabase** as Backend-as-a-Service
- PostgreSQL database
- Authentication and authorization
- Real-time subscriptions
- File storage

- Edge Functions for serverless computing

AI Integration

- **GROQ API** with LLaMA 3.3 70B model
- **Edge function** for secure AI processing
- **Functional medicine prompt engineering**
- **Structured JSON output** for analysis results

Infrastructure

- **Cloud deployment** ready
- **CDN integration** for global performance
- **Environment-based configuration**
- **Automated CI/CD** pipelines

Database Schema

Core Tables

1. `doctors`

```
- id (UUID, Primary Key)
- email (String, Unique)
- name (String)
- specialization (String)
- license_number (String)
- created_at (Timestamp)
- updated_at (Timestamp)
```

2. `patients`

```
- id (UUID, Primary Key)
- user_id (UUID, Foreign Key to auth.users)
- email (String)
- name (String)
- date_of_birth (Date)
- gender (String)
- created_at (Timestamp)
- updated_at (Timestamp)
```

3. `analyses`

```
- id (UUID, Primary Key)
- patient_id (UUID, Foreign Key)
- doctor_id (UUID, Foreign Key)
- status (Enum: pending, reviewing, approved, rejected)
- ai_summary (Text)
- doctor_notes (Text)
- created_at (Timestamp)
- updated_at (Timestamp)
```

4. `biomarkers`

```
- id (UUID, Primary Key)
- name (String)
- category (String)
- unit (String)
- optimal_min (Decimal)
- optimal_max (Decimal)
- acceptable_min (Decimal)
- acceptable_max (Decimal)
- created_at (Timestamp)
```

5. `biomarker_results`

```
- id (UUID, Primary Key)
- analysis_id (UUID, Foreign Key)
- biomarker_id (UUID, Foreign Key)
- value (Decimal)
- unit (String)
- classification (Enum: OPTIMO, ACEPTABLE, SUBOPTIMO, ANOMALO)
- interpretation (Text)
- created_at (Timestamp)
```

AI Integration

GROQ Implementation

- **Model:** LLaMA 3.3 70B via GROQ API
- **Edge Function:** `/supabase/functions/analyze-biomarkers`
- **Prompt Engineering:** Specialized functional medicine prompts
- **Output:** Structured JSON analysis with classifications

Analysis Process

1. **Text Extraction:** Parse PDF content for biomarker values
2. **Data Validation:** Verify extracted data format and completeness
3. **AI Analysis:** Process using functional medicine principles
4. **Classification:** Apply optimal range classifications
5. **Summary Generation:** Create comprehensive health insights

Quality Assurance

- **Validation checks** for extracted values
- **Range verification** against known biomarker limits
- **Error handling** for incomplete or invalid data
- **Fallback mechanisms** for AI processing failures

Security & Privacy

Data Protection

- **HIPAA compliance** for all medical data
- **End-to-end encryption** for sensitive information
- **Role-based access control** (RBAC)
- **Row-level security** in Supabase

Authentication

- **Supabase Auth** with email verification
- **Password policies** enforcement
- **Session management** with automatic timeouts
- **Multi-factor authentication** support

Data Storage

- **Encrypted file storage** for PDF reports
- **Secure database** with access controls
- **Automated backups** with encryption
- **Data retention policies** implementation

Compliance

- **GDPR compliance** for international users
- **Medical device** regulation considerations
- **Audit trails** for all data access
- **Data deletion** upon request

Business Requirements

Functional Requirements

User Management

- **User registration** with role selection
- **Profile management** with medical credentials
- **Password reset** functionality
- **Account deactivation**

File Management

- **PDF upload** with format validation
- **File storage** with encryption
- **Access controls** based on user roles
- **Automatic cleanup** of temporary files

Analysis Workflow

- **Automated processing** of uploaded reports
- **Doctor assignment** and notifications
- **Review interface** for medical professionals
- **Approval workflow** with audit trails

Reporting & Analytics

- **Health status dashboards** for patients
- **Practice analytics** for doctors
- **Progress tracking** over time
- **Export capabilities** for reports

Non-Functional Requirements

Performance

- **Page load times** under 3 seconds
- **PDF processing** completion within 60 seconds
- **AI analysis** processing within 120 seconds
- **Concurrent user** support for 100+ users

Scalability

- **Database optimization** for growing datasets
- **CDN integration** for global performance
- **Edge function** auto-scaling
- **Load balancing** for high availability

Reliability

- **99.9% uptime** availability
- **Automated error recovery**
- **Data backup** with point-in-time recovery
- **Disaster recovery** planning

Usability

- **Intuitive interface** design
- **Mobile responsiveness** for all devices
- **Accessibility compliance** (WCAG 2.1)
- **Multi-language support** (future)

Success Metrics

User Adoption

- **Daily Active Users (DAU):** Track user engagement
- **Monthly Active Users (MAU):** Monitor user retention
- **User Registration Rate:** New user acquisition
- **Doctor-Patient Ratio:** Platform utilization

Clinical Outcomes

- **Analysis Completion Rate:** Doctor review efficiency
- **Patient Satisfaction Scores:** User experience quality
- **Time to Analysis:** Processing efficiency
- **Follow-up Engagement:** Long-term usage

Technical Performance

- **System Uptime:** Service availability
- **Response Times:** Performance optimization
- **Error Rates:** System reliability
- **Security Incidents:** Data protection effectiveness

Business Metrics

- **Customer Acquisition Cost (CAC):** Marketing efficiency
- **Customer Lifetime Value (CLV):** Revenue sustainability
- **Churn Rate:** User retention quality
- **Revenue per User:** Monetization success

Future Enhancements

Short-Term (3-6 months)

- **Mobile application** development (React Native)
- **Advanced analytics** and reporting features
- **Integration with EHR** systems
- **Automated appointment** scheduling

Medium-Term (6-12 months)

- **Telemedicine integration** for remote consultations
- **Wearable device** data integration
- **Advanced AI models** for deeper insights
- **Multi-language** support implementation

Long-Term (12+ months)

- **Machine learning** for personalized recommendations
- **Clinical trial** matching capabilities
- **Pharmaceutical** integration for treatment plans
- **International expansion** with local compliance

Technical Improvements

- **Microservices** architecture migration
- **Advanced caching** strategies
- **Real-time collaboration** features
- **Enhanced security** measures

Conclusion

Cabo Health represents a significant advancement in functional medicine technology, combining AI-powered analysis with comprehensive healthcare management. The platform addresses critical pain points in traditional healthcare while providing value for both patients and healthcare providers.

The technical architecture leverages modern cloud technologies to ensure scalability, security, and performance. The comprehensive biomarker database and AI integration provide actionable insights that support optimal health outcomes.

Success will be measured through user adoption, clinical outcomes, and business metrics, with continuous improvement based on user feedback and technological advancements.

Document Control
- **Version History:**
- v1.0 (2025-11-03): Initial PRD creation
- **Review Cycle:** Quarterly
- **Approval Required:** Product Manager, Technical Lead, Medical Advisory Board
- **Distribution:** All stakeholders, development team, medical advisory board