# MediMate Development Roadmap

Based on MediMate Developer Documentation Section 4.0  
Cross-referenced with Architecture (§5), Features (§8), Security (§7), API (§11), Database (§10), and UI/UX (§9)

## 📋 Phase 1: Core Medication System (MVP)

**Documentation:** §4.3  
**Timeline:** Foundation Phase  
**Primary Goal:** Establish robust medication management foundation

### Authentication & User Management

Reference: §7.3 (Authentication & Authorization), §11.4 (Authentication Endpoints)

* [ ] User registration with email/password (§11.4 - POST /auth/register)
* [ ] JWT-based authentication with HttpOnly cookies (§7.3.A)
* [ ] Secure login/logout functionality (§11.4 - POST /auth/login, /auth/logout)
* [ ] Password reset and recovery (§7.3)
* [ ] User profile management (§11.5 - GET/PATCH /users/profile)

### Medication Management

Reference: §8.3 (Feature 1 - Medication Management System), §10.3 (Database Schema)

* [ ] Add new medication (name, dosage, frequency) (§8.3 - Step 1)
* [ ] Edit existing medications (§8.3)
* [ ] Delete medications (§8.3)
* [ ] Set medication schedules (daily, weekly, custom) (§8.3 - Step 1)
* [ ] Define start and end dates for medications (§10.3.b - medications collection)
* [ ] Medication list view with filters (§9 - UI/UX principles)

### Smart Reminders & Notifications

Reference: §8.4 (Feature 2 - Smart Reminders), §12 (Notification System)

* [ ] Firebase Cloud Messaging integration (§12.8 - Cloud Notification Delivery)
* [ ] Time-based medication reminders (§8.4 - Step 3)
* [ ] Push notification delivery (§12.3 - Cloud Notification Engine)
* [ ] Snooze/postpone reminder functionality (§8.4 - Step 4)
* [ ] "Taken Later" option (§8.4 - Step 4)
* [ ] Notification preferences settings (§8.9 - Settings & Privacy Controls, §12.11)

### Medication Logs

Reference: §8.3 (Medication Management), §10.3 (Database - logs collection)

* [ ] Auto-record medication intake status (§8.3 - Step 5)
* [ ] Mark as "Taken" (§8.3 - Step 5)
* [ ] Mark as "Missed" (§8.3 - Step 5)
* [ ] Mark as "Skipped" (§8.3 - Step 5)
* [ ] View medication history (§10.3 - logs collection)
* [ ] Edit/correct log entries (§8.3)

### Refill Management

Reference: §8.3 (Medication Management System)

* [ ] Track medication inventory (§8.3)
* [ ] Low stock detection (§8.3)
* [ ] Refill reminder notifications (§12.4 - Notification Categories)
* [ ] Manual refill logging (§8.3)

### Adherence Analytics

Reference: §8.6 (Feature 4 - Adherence Analytics), §13 (Export & Reporting)

* [ ] Calculate adherence percentage (§8.6 - Step 2)
* [ ] Display adherence charts (daily/weekly/monthly) (§8.6 - Step 3)
* [ ] Completion rate visualization (§8.6 - Step 4)
* [ ] Streak tracking (§8.6)
* [ ] Export adherence reports (CSV/PDF) (§13 - Export and Reporting Feature)

### Offline Capability

Reference: §12.7 (Local Notification Scheduling), §12.9 (Offline Logging & Sync)

* [ ] Local data storage (IndexedDB/AsyncStorage) (§12.7)
* [ ] Offline medication scheduling (§12.7)
* [ ] Queue actions for sync (§12.9 - Sync Process)
* [ ] Auto-sync when online (§12.9 - Step 4)
* [ ] Conflict resolution (§12.12 - Error Handling)

### Backend Infrastructure

Reference: §5.4 (Backend Architecture), §6.4 (Backend Stack), §11 (API Documentation)

* [ ] Node.js + Express API setup (§6.4 - Core Framework)
* [ ] MongoDB database configuration (§6.5 - Database Stack, §10 - Database Schema)
* [ ] RESTful API endpoints (§11 - API Documentation)
* [ ] Input validation (Joi/Zod) (§6.4 - Validation & Middleware)
* [ ] Error handling middleware (§5.9 - Error Handling and Monitoring)
* [ ] Logging system (Winston) (§6.4 - Logging)

## 🎭 Phase 2: Mood & Emotional Wellness

**Documentation:** §4.4  
**Timeline:** After Phase 1 Completion  
**Primary Goal:** Integrate mental health tracking alongside medication management

### Mood Check-In System

Reference: §8.5 (Feature 3 - Mood Tracking), §11.6 (Mood Tracking Endpoints)

* [ ] Emoji-based mood selection interface (§8.5 - Step 1, §9.3.c - Iconography)
* [ ] Color gradient mood scale (§9.3.a - Color Palette)
* [ ] Mood intensity rating (1-10) (§8.5 - Step 1)
* [ ] Descriptive mood tags (Happy, Sad, Anxious, Neutral) (§10.3.c - mood\_logs schema)
* [ ] Time-stamped mood entries (§11.6 - POST /mood-logs)
* [ ] Multiple daily check-ins support (§8.5)

### Mood Journaling

Reference: §8.5 (Mood Tracking and Journaling), §10.3.c (mood\_logs collection)

* [ ] Text-based journal entry (§8.5 - Step 2)
* [ ] Attach notes to mood logs (§10.3.c - notes field)
* [ ] Symptom description field (§8.5 - Step 2)
* [ ] Experience/context logging (§10.3.c - tags field)
* [ ] Journal entry encryption (§7.4.A - Field-level encryption)

### Mood Visualization & Analytics

Reference: §8.6 (Adherence Analytics & Reports), §11.6 (GET /mood-logs)

* [ ] Mood trend charts (line graph) (§8.6 - Step 3, §6.3 - Recharts/Chart.js)
* [ ] Bar chart visualization (§9 - Visual Design System)
* [ ] Emoji-based visual timeline (§9.3.c - Iconography)
* [ ] Daily mood summary (§8.5 - Step 4)
* [ ] Weekly mood patterns (§8.5 - Step 4)
* [ ] Monthly mood overview (§11.6 - query filters)
* [ ] Mood intensity heatmap (§8.6 - Analytics visualization)

### Mood-Medication Correlation

Reference: §2.3 (Integration Between Medication and Mood Scopes), §8.5

* [ ] Basic correlation algorithm (§2.3 - Synergy example)
* [ ] Link mood entries with medication logs (§10.4 - Relationships Overview)
* [ ] Detect patterns (missed doses vs mood dips) (§2.3)
* [ ] Correlation insights display (§8.6 - Step 4)
* [ ] Side effect tracking correlation (§8.5)

### Data Privacy & Control

Reference: §7.5 (Data Privacy & User Consent), §8.9 (Settings & Privacy Controls)

* [ ] End-to-end encryption for mood data (§7.4 - Data Encryption & Protection)
* [ ] User-only access default (§7.5 - User Consent Control)
* [ ] Privacy mode toggle (§8.9, §12.11 - Privacy and Control)
* [ ] Selective data sharing controls (§7.5 - Consent for Caregiver Sharing)
* [ ] Delete mood history option (§7.5 - Right to Erasure)

### Frontend Integration

Reference: §5.3 (Frontend Architecture), §6.3 (Frontend Stack)

* [ ] Chart.js/Recharts implementation (§6.3 - Data Visualization)
* [ ] Responsive mood entry forms (§9.4 - UX Interaction Guidelines)
* [ ] Calendar view for mood history (§9 - Component Standards)
* [ ] Filter by date range (§11.6 - query parameters)
* [ ] Export mood data (CSV/PDF) (§13 - Export and Reporting)

### Backend Extensions

Reference: §5.4 (Backend Architecture), §10.3.c (mood\_logs collection)

* [ ] mood\_logs collection in MongoDB (§10.3.c)
* [ ] Mood analytics API endpoints (§11.6 - Mood Tracking Endpoints)
* [ ] Data aggregation queries (§10.5 - Aggregate Pipelines)
* [ ] Correlation computation service (§8.5 - Analytics module)
* [ ] Mood data validation (§6.4 - Validation & Middleware)

## 👥 Phase 3: Caregiver & Shared Access

**Documentation:** §4.5  
**Timeline:** After Phase 2 Completion  
**Primary Goal:** Enable secure collaboration between patients and caregivers

### Role-Based Access Control (RBAC)

Reference: §7.3.B (RBAC), §10.3.a (users collection - role field)

* [ ] Define user roles (Patient, Caregiver, Admin) (§7.3.B - Defined Roles)
* [ ] Role assignment system (§10.3.a - role field)
* [ ] Permission matrix implementation (§7.3.B - Implementation Approach)
* [ ] RBAC middleware development (§6.4 - Validation & Middleware)
* [ ] Role verification on API routes (§11.11 - API Security)

### Caregiver Invitation System

Reference: §8.7 (Feature 5 - Caregiver and Shared Access), §10.3.b (caregivers collection)

* [ ] Email invitation functionality (§8.7 - Step 1)
* [ ] QR code invitation option (§8.7 - Step 1)
* [ ] Invitation link generation (§8.7 - Step 1: /api/caregiver/invite)
* [ ] Token-based access control (§7.3.A - JWT Authentication)
* [ ] Invitation expiry mechanism (§8.7 - Developer Notes: token expiration)

### Caregiver Dashboard

Reference: §8.7 (Caregiver and Shared Access), §3.2.B (Caregivers user group)

* [ ] View patient medication adherence (§8.7 - Step 3)
* [ ] Access mood trend summaries (§8.7 - Step 3)
* [ ] Missed dose alerts (§3.2.B - Primary Needs)
* [ ] Patient progress overview (§8.7 - Frontend: Caregiver View)
* [ ] Multi-patient management (§10.3.b - assignedPatients array)

### Permission Management

Reference: §7.5 (Data Privacy & User Consent), §8.7 (Caregiver Access)

* [ ] Grant caregiver access (§8.7 - Step 2)
* [ ] Revoke caregiver access (§8.7 - Step 4)
* [ ] Define permission levels (view-only, edit, full) (§10.3.b - caregivers permissions)
* [ ] Consent-based data sharing (§7.5 - Consent for Caregiver Sharing)
* [ ] Permission history log (§8.7 - Developer Notes: audit logs)

### Communication Features

Reference: §11.7 (Messaging Endpoints), §10.3.d (chat\_messages collection)

* [ ] Secure text messaging (Patient ↔ Caregiver) (§11.7 - POST /messages/send)
* [ ] Emoji/reaction support (§11.7)
* [ ] Message read receipts (§10.3.d - isRead field)
* [ ] Message history (§11.7 - GET /messages/conversation)
* [ ] Push notification for new messages (§11.7 - Developer Notes)

### Audit & Security

Reference: §7.6 (Logging, Auditing & Monitoring), §8.7 (Developer Notes)

* [ ] Log all caregiver access events (§7.6.B - Audit Trails)
* [ ] Track data modifications by caregivers (§7.6.B)
* [ ] Compliance audit trails (§10.3 - admin\_audit collection)
* [ ] Admin review dashboard (§8.7)
* [ ] Suspicious activity alerts (§5.9 - Error Handling and Monitoring)

### UI Components

Reference: §9 (UI/UX Design Principles), §8.7 (Frontend)

* [ ] Caregiver-specific dashboard layout (§8.7 - Separate "Caregiver View")
* [ ] Summary cards for patient data (§9.6 - Component Standards: Card)
* [ ] Notification center for caregivers (§11.8 - Notification Endpoints)
* [ ] Quick action buttons (§9.4 - UX Interaction Guidelines)
* [ ] Patient switching interface (§10.3.b - assignedPatients)

## 🤖 Phase 4: AI Insights & Predictive Analytics

**Documentation:** §4.6, §14 (AI and Analytics - Future Phase)  
**Timeline:** After Phase 3 Completion  
**Primary Goal:** Transform MediMate into an intelligent health assistant

### AI Infrastructure

Reference: §14.2 (Architecture Overview), §6.7 (AI & Analytics Stack)

* [ ] Python microservices setup (TensorFlow/PyTorch) (§14.2.3 - Model Training Service)
* [ ] GCP AI Platform configuration (§6.7 - Core AI Tools)
* [ ] Docker containerization for AI models (§14.4 - Deployment & Microservices)
* [ ] Kubernetes deployment for scaling (§14.2.4 - Model Serving)
* [ ] Model serving API endpoints (§14.2.4 - REST/gRPC microservices)

### Adherence Prediction Model

Reference: §14.2.3 (Model Training Service - Medication Adherence)

* [ ] Collect historical adherence data (§14.2.1 - Data Ingestion Layer)
* [ ] Feature engineering (time, routine, context) (§14.2.2 - Feature Engineering)
* [ ] Train adherence prediction model (§14.2.3 - Random Forest/LSTM)
* [ ] Real-time adherence risk scoring (§14.2.4 - Real-time inference)
* [ ] Proactive reminder adjustments (§14.5 - Use Cases)

### Mood-Medication Correlation AI

Reference: §14.2.3 (Model Training - Mood Prediction), §4.6

* [ ] Time-series mood analysis (LSTM/GRU) (§14.2.3 - Mood Prediction model)
* [ ] Medication impact detection (§14.5 - Mood-Medication Correlation)
* [ ] Side effect pattern recognition (§14.2.3 - Drug Interaction Detection)
* [ ] Emotional state forecasting (§14.2.3 - Mood Prediction)
* [ ] Personalized insights generation (§14.2.5 - Analytics & Visualization)

### Smart Recommendation Engine

Reference: §14.2.3 (Personalized Recommendation Engine), §4.6

* [ ] Optimal medication timing suggestions (§14.5 - Personalized Self-Care)
* [ ] Reminder frequency optimization (§14.5)
* [ ] Lifestyle tips based on patterns (§14.2.3 - Content recommendations)
* [ ] Self-care activity recommendations (§14.5)
* [ ] Therapy prompt suggestions (§14.5)

### Natural Language Processing (NLP)

Reference: §14.2.3 (Drug Interaction Detection - NLP), §4.6

* [ ] Mood journal text analysis (§14.5 - Use Cases & Developer Notes)
* [ ] Sentiment detection (§14.2.3 - NLP for symptoms)
* [ ] Stress indicator identification (§4.6 - NLP)
* [ ] Symptom extraction from notes (§14.2.3 - Drug Side Effect Detection)
* [ ] Automated tagging system (§14.2.2 - Feature Engineering)

### Anomaly Detection

Reference: §14.2.3 (Anomaly Detection model), §14.5

* [ ] Sudden mood decline detection (§14.5 - Anomaly Detection use case)
* [ ] Irregular medication patterns (§14.5)
* [ ] Unusual behavior flagging (§14.2.3 - Threshold-based alerts)
* [ ] Early warning alerts (§14.5)
* [ ] Escalation to caregiver/admin (§14.5 - notify caregiver/admin)

### Data Privacy for AI

Reference: §14.3 (Data Privacy & Security), §7.5

* [ ] Data anonymization pipeline (§14.3 - Anonymization)
* [ ] Federated learning exploration (§14.6 - Future Considerations)
* [ ] GDPR/HIPAA compliance for AI processing (§14.3 - Regulatory Compliance)
* [ ] User consent for AI features (§7.5 - User Consent Control)
* [ ] Opt-out mechanisms (§7.5)

### Model Management

Reference: §14.4 (Development Workflow), §14.5

* [ ] Model versioning system (§14.4 - Step 5: versioned models)
* [ ] A/B testing framework (§14.4)
* [ ] Performance monitoring (§14.4)
* [ ] Automated retraining pipelines (§14.4 - Feedback Loop)
* [ ] Rollback capability (§14.4 - rollback capability)

## 🏥 Phase 5: Clinical & Cloud Expansion

**Documentation:** §4.7  
**Timeline:** After Phase 4 Completion  
**Primary Goal:** Enterprise-grade scalability and clinical integration

### Doctor/Professional Portal

Reference: §4.7, §3.2.C (Healthcare Professionals)

* [ ] Clinician account creation (§4.7 - Doctor/Professional Portal)
* [ ] HIPAA-compliant authentication (§7.8 - HIPAA compliance)
* [ ] Patient adherence report access (§3.2.C - Primary Needs)
* [ ] Mood trend visualization for doctors (§3.2.C)
* [ ] Clinical notes interface (§4.7)
* [ ] Prescription management integration (§4.7)

### EMR Integration

Reference: §4.7 (Data Export & EMR Integration), §8.8 (Export Tools)

* [ ] HL7/FHIR data format support (§4.7)
* [ ] EMR system API connectors (§4.7 - modular APIs)
* [ ] Bi-directional data sync (§4.7)
* [ ] Patient record import (§4.7)
* [ ] Medication history export (§3.2.C - Exportable insights)
* [ ] Interoperability standards compliance (§4.7)

### Data Export & Reporting

Reference: §13 (Export and Reporting Feature), §11.9 (Reporting Endpoints)

* [ ] PDF report generation (§13.3 - Key Functionalities)
* [ ] CSV data export (§13.5 - Developer Implementation: CSV Generation)
* [ ] XLSX format support (§13.3)
* [ ] JSON API for third-party integrations (§13.3)
* [ ] Automated periodic reports (§13.8 - Future Enhancements)
* [ ] Custom report templates (§13.8)

### Cloud Scalability

Reference: §5.8 (Scalability and Deployment), §6.6 (Cloud Infrastructure)

* [ ] Full GCP migration (§6.6 - Google Cloud Platform)
* [ ] Kubernetes cluster optimization (§6.6 - Kubernetes GKE)
* [ ] Load balancer configuration (§5.8 - Horizontal Scaling)
* [ ] Auto-scaling policies (§6.6 - Cloud Run)
* [ ] Multi-region deployment (§6.6)
* [ ] CDN integration (§6.6)

### Admin Panel

Reference: §4.7 (Admin Panel), §7.3.B (Admin role)

* [ ] User management dashboard (§4.7)
* [ ] System analytics overview (§4.7)
* [ ] Compliance monitoring tools (§7.8 - Compliance & Regulatory)
* [ ] Role assignment interface (§7.3.B - RBAC)
* [ ] Audit log viewer (§7.6.B - Audit Trails)
* [ ] Performance metrics dashboard (§5.9 - Monitoring)

### Advanced Security

Reference: §7 (Security and Privacy Framework), §4.7

* [ ] End-to-end encryption for all data (§7.4 - Data Encryption)
* [ ] Zero-knowledge architecture exploration (§4.7)
* [ ] Advanced threat detection (§7.9.C - Incident Response)
* [ ] Penetration testing (§7.10 - Security Testing)
* [ ] Security audit compliance (§7.8)
* [ ] SOC 2 certification preparation (§7.8)

### Third-Party Integrations

Reference: §4.7 (Modular APIs), §5.6 (External Services Integration)

* [ ] Pharmacy API connections (§4.7)
* [ ] Insurance provider integrations (§4.7)
* [ ] Wearable device data sync (§5.6)
* [ ] Telemedicine platform connectivity (§4.7)
* [ ] Laboratory result integration (§4.7)
* [ ] Appointment scheduling systems (§4.7)

### Enterprise Features

Reference: §4.7 (Clinical & Cloud Expansion)

* [ ] Multi-tenant architecture (§4.7)
* [ ] White-label customization (§4.7)
* [ ] SLA guarantees (§5.8 - Scalability)
* [ ] Priority support tier (§4.7)
* [ ] Custom deployment options (§4.7)
* [ ] Dedicated infrastructure (§6.6 - GCP) ] HL7/FHIR data format support
* [ ] EMR system API connectors
* [ ] Bi-directional data sync
* [ ] Patient record import
* [ ] Medication history export
* [ ] Interoperability standards compliance

### Data Export & Reporting

* [ ] PDF report generation
* [ ] CSV data export
* [ ] XLSX format support
* [ ] JSON API for third-party integrations
* [ ] Automated periodic reports
* [ ] Custom report templates

### Cloud Scalability

* [ ] Full GCP migration
* [ ] Kubernetes cluster optimization
* [ ] Load balancer configuration
* [ ] Auto-scaling policies
* [ ] Multi-region deployment
* [ ] CDN integration

### Admin Panel

* [ ] User management dashboard
* [ ] System analytics overview
* [ ] Compliance monitoring tools
* [ ] Role assignment interface
* [ ] Audit log viewer
* [ ] Performance metrics dashboard

### Advanced Security

* [ ] End-to-end encryption for all data
* [ ] Zero-knowledge architecture exploration
* [ ] Advanced threat detection
* [ ] Penetration testing
* [ ] Security audit compliance
* [ ] SOC 2 certification preparation

### Third-Party Integrations

* [ ] Pharmacy API connections
* [ ] Insurance provider integrations
* [ ] Wearable device data sync
* [ ] Telemedicine platform connectivity
* [ ] Laboratory result integration
* [ ] Appointment scheduling systems

### Enterprise Features

* [ ] Multi-tenant architecture
* [ ] White-label customization
* [ ] SLA guarantees
* [ ] Priority support tier
* [ ] Custom deployment options
* [ ] Dedicated infrastructure

## 🔧 Cross-Phase Development Tasks

### DevOps & CI/CD

* [ ] GitHub Actions pipeline setup
* [ ] Automated testing integration
* [ ] Docker image builds
* [ ] Staging environment deployment
* [ ] Production deployment automation
* [ ] Rollback procedures

### Testing

* [ ] Unit test coverage (≥85%)
* [ ] Integration test suites
* [ ] End-to-end UI tests
* [ ] Performance testing
* [ ] Security vulnerability scanning
* [ ] Regression test automation

### Documentation

* [ ] API documentation (Swagger/OpenAPI)
* [ ] Developer onboarding guide
* [ ] User manual
* [ ] Admin documentation
* [ ] Troubleshooting guides
* [ ] Video tutorials

### Compliance & Legal

* [ ] Privacy policy drafting
* [ ] Terms of service
* [ ] HIPAA compliance audit
* [ ] GDPR compliance verification
* [ ] Data retention policies
* [ ] User consent flows

## 📊 Progress Tracking

### Phase Completion Summary

* [ ] **Phase 1:** Core Medication System (MVP) - 0% Complete
* [ ] **Phase 2:** Mood & Emotional Wellness - 0% Complete
* [ ] **Phase 3:** Caregiver & Shared Access - 0% Complete
* [ ] **Phase 4:** AI Insights & Predictive Analytics - 0% Complete
* [ ] **Phase 5:** Clinical & Cloud Expansion - 0% Complete

### Overall Project Progress: 0%

## 🎯 Key Milestones

* [ ] **Milestone 1:** MVP Launch (Phase 1 Complete)
* [ ] **Milestone 2:** Emotional Wellness Integration (Phase 2 Complete)
* [ ] **Milestone 3:** Caregiver Platform Live (Phase 3 Complete)
* [ ] **Milestone 4:** AI-Powered Insights Launch (Phase 4 Complete)
* [ ] **Milestone 5:** Enterprise & Clinical Ready (Phase 5 Complete)

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