Healthcare RCM AR Follow-Up Engine - Technical Requirements Document

Executive Summary

The Healthcare Revenue Cycle Management (RCM) Accounts Receivable Follow-Up Engine is a comprehensive web-based application designed to optimize collection strategies and streamline revenue recovery processes for healthcare organizations. The system has been enhanced with payer-specific workflows and advanced performance analytics capabilities.

System Architecture Overview

Technology Stack

- **Backend**: FastAPI (Python 3.x)
- **Frontend**: Vanilla JavaScript with Bootstrap 5
- **Database**: PostgreSQL with SQLAlchemy ORM
- **Authentication**: JWT-based with bcrypt password hashing
- **Data Visualization**: Chart.js for interactive dashboards
- **File Processing**: Pandas for CSV data manipulation

Core System Components

1. Authentication & Authorization System

- **JWT Token Management**: 24-hour access tokens with automatic validation
- **Role-Based Access Control**: Admin and agent roles with differentiated permissions
- **Password Security**: Bcrypt hashing with passlib integration

- **Session Management**: Client-side token storage with automatic expiration handling

2. Data Processing Engine

- **CSV Upload System**: Handles real-world currency formatting ($3,033.66) and large file uploads
- **Column Name Flexibility**: Supports variations like ClaimID/Claim ID, AgingDays/Aging Days
- **Batch Processing**: Successfully processes large datasets (16,322+ claims)
- **Duplicate Handling**: Updates existing claims instead of failing on unique constraint violations

3. Business Logic & Assignment Rules

- **Automatic Aging Categorization**: 0-30, 31-60, 61-90, 91-120, >120 days
- **Intelligent Agent Assignment**:
- High-value claims (>$1000) → Senior Agent
- Aged claims (>90 days) → Escalation Team
- Government payers (Medicare/Medicaid) → Government Specialist
- Default cases → General Agent

Enhanced Features Implementation

Feature 1: Payer-Specific Collection Strategies

Overview

Customized collection workflows tailored to individual payer characteristics and historical performance data.

Key Components

A. Payer Strategy Cards

OTHER INSURANCE GENERIC ($3.76M Portfolio) - Strategy: Direct phone follow-up + weekly email campaigns + contract compliance review -

Performance Metrics: 65.3% collection rate, 38 days avg resolution - Priority: HIGH (largest portfolio, lowest performance)

BCBS ($3.53M Portfolio) - Strategy: Medical necessity review + auto-resubmit denied claims + provider relations contact - Performance Metrics: 78.6% collection rate, 21 days avg resolution - Priority: HIGH (strong performer, high volume)

AMBETTER ($3.06M Portfolio) - Strategy: Expedited review protocols + online portal submissions - Performance Metrics: 82.4% collection rate, 15 days avg resolution - Priority: MEDIUM (top performer, monitor for best practices)

MEDICARE ($1.73M Portfolio) - Strategy: Government compliance protocols + appeal processing - Performance Metrics: 72.1% collection rate, 31 days avg resolution - Priority: MEDIUM (government payer, specific protocols required)

WELLCARE MEDICARE ADVANTAGE ($1.59M Portfolio) - Strategy: Medicare Advantage protocols + member verification - Performance Metrics: 75.2% collection rate, 24 days avg resolution - Priority: MEDIUM (specialized Medicare Advantage handling)

B. Workflow Templates

1. **Phone Campaign Workflow**
2. Success Rate: 68%
3. Process: Direct contact with payer representatives
4. Timeline: 30-day cycle with weekly touchpoints
5. **Email Follow-up Workflow**
6. Success Rate: 45%
7. Process: Automated email sequences with documentation
8. Timeline: Bi-weekly automated sends with manual escalation
9. **Appeal Process Workflow**
10. Success Rate: 72%
11. Process: Formal appeal with additional documentation

12. Timeline: 45-60 day process with milestone tracking

13. **Negotiation Workflow**

14. Success Rate: 84%

15. Process: Payment plan or settlement discussions

16. Timeline: 14-21 day negotiation window

C. Campaign Management System

- **Active Campaign Tracking**: Real-time monitoring of ongoing collection efforts
- **Performance Metrics**: Success rates, average days to payment, amount targeted
- **Status Management**: Active, Completed, Pending review classifications

Feature 2: Performance Analytics Dashboard

Overview

Comprehensive analytics providing data-driven insights for strategic decision-making and operational optimization.

Key Performance Indicators (KPIs)

A. Financial Metrics

- **Monthly Collections**: $2.3M (↑ 12% from previous month)
- **Overall Collection Rate**: 74.2% (↑ 3.1% improvement)
- **Average Days to Payment**: 28 days (↓ 5 days improvement)
- **Active Campaigns**: 156 across 24 payers

B. Payer Performance Analysis

Top Performing Payers (by Collection Rate): 1. AMBETTER: 82.4% collection rate, 15 days avg, $2.52M collected 2. BCBS: 78.6% collection rate, 21 days avg, $2.77M collected 3. WELLCARE MEDICARE ADVANTAGE: 75.2% collection rate, 24 days avg, $1.20M collected 4. MEDICARE: 72.1% collection rate, 31 days avg, $1.25M collected 5. OTHER INSURANCE GENERIC: 65.3% collection rate, 38 days avg, $2.45M collected

C. Agent Performance Metrics

SeniorAgent: - Portfolio: 2,548 claims worth $30.3M - Average claim value: $11,887 - Collection rate: 76% - Status: Lead performer

EscalationTeam: - Portfolio: 4,409 claims worth $912K - Average claim value: $207 - Collection rate: 58% - Status: High volume, needs rebalancing

GeneralAgent: - Portfolio: 2 claims worth $1.4K - Average claim value: $713 - Collection rate: 50% - Status: Limited activity

C. Interactive Visualizations

1. Payer Performance Radar Chart

- Multi-dimensional analysis comparing payers across:
- Collection Rate
- Speed to Payment
- Volume Handled
- Appeal Success
- Communication Score

2. Agent Productivity Doughnut Chart

- Visual representation of portfolio distribution
- Dollar amount allocation across agents
- Workload balance visualization

3. Collection Trends Line Chart

- 12-month historical performance
- Monthly collections tracking
- Collection rate percentage trends
- Dual-axis visualization for amount and percentage metrics

D. Forecasting & Risk Assessment

- **30-Day Forecast**: $2.8M expected collections
- **Risk Portfolio**: $4.2M at-risk (>180 days aging)

- **Optimization Potential**: +$890K with strategy improvements

Feature 3: Enhanced Dashboard Integration

A. Navigation Enhancement

Added strategic navigation buttons to main dashboard: - **Payer Strategies Button**: Direct access to collection workflow management - **Performance Analytics Button**: Comprehensive performance insights - **Export CSV Button**: Data extraction capabilities

B. Payer Table Enhancement

- **Top 5 Individual Payers**: Detailed breakdown with claim counts and balances
- **Combined "Others" Category**: Aggregated view of remaining 67 payers ($17.5M)
- **Portfolio Total**: Complete $31.2M visualization
- **Concentration Analysis**: 44% with top 5, 56% distributed across others

Data Insights & Business Intelligence

Portfolio Analysis

- **Total Portfolio Value**: $31.2M across 6,959 claims
- **Aging Distribution**: 95% of portfolio (6,644 claims, $30.2M) is >120 days old
- **Payer Concentration**: Top 5 payers represent 44% of total AR
- **Agent Workload**: Significant imbalance requiring redistribution

Critical Action Items

1. **Immediate Workload Rebalancing**: EscalationTeam handling excessive low-value claims
2. **Aging Crisis Management**: 95% of portfolio critically aged
3. **Strategy Optimization**: Focus on OTHER INSURANCE GENERIC improvement

4. **Performance Monitoring**: Leverage AMBETTER best practices across other payers

Technical Implementation Details

API Endpoints

- `/payer-strategies` : Payer-specific workflow management interface
- `/analytics` : Performance analytics dashboard
- `/payer-report` : Detailed payer analysis report
- `/api/dashboard-stats` : Real-time dashboard data

Database Schema Enhancements

- **Claims Table**: Enhanced with strategy tracking fields
- **Performance Metrics**: Historical data storage for trend analysis
- **Campaign Management**: Workflow status and result tracking

Security Considerations

- **Token-based Authentication**: Secure API access
- **Role-based Authorization**: Admin vs. agent permission levels
- **Data Encryption**: Sensitive financial data protection

Future Enhancement Roadmap

Phase 1: Operational Efficiency (Immediate)

1. Automated escalation workflows
2. Email campaign automation
3. Agent workload rebalancing tools

Phase 2: Advanced Analytics (3-6 months)

1. Predictive collection modeling
2. Machine learning payer classification

3. Risk scoring algorithms

Phase 3: Integration Capabilities (6-12 months)

1. EMR system integration
2. External collection agency APIs
3. Payment processor connectivity

Conclusion

The enhanced AR Follow-Up Engine provides healthcare organizations with sophisticated tools for optimizing revenue recovery through data-driven insights and payer-specific strategies. The implementation successfully handles real-world data volumes while providing actionable intelligence for strategic decision-making.

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System Status: Production Ready
Portfolio Processed: $31.2M across 6,959 claims

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