Healthcare Claims Database - Business Analyst User's Guide

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Introduction

This guide provides business analysts with comprehensive documentation for analyzing healthcare claims data in our Snowflake database. The database captures the complete claims lifecycle from patient encounters through payment and appeals, supporting revenue cycle management, denial analysis, and operational reporting.

Purpose and Scope

- **Primary Use**: Claims processing analytics, revenue cycle management, and operational reporting
- **Data Coverage**: Patient demographics, provider networks, claims submissions, payments, denials, and appeals
- **Update Frequency**: Real-time claims processing with daily batch updates for payments and adjustments

Database Overview

Schema Organization

The database uses a single schema `healthcare` containing:

- 17 core tables capturing claims processing data
- 15 analytical views for common business reports
- Comprehensive foreign key relationships ensuring data integrity

Data Volume Expectations

Entity	Typical Volume	Growth Rate
Patients	Millions	10-15% annually
Claims	Tens of millions	25-30% annually
Claim Line Items	Hundreds of millions	30-35% annually
Payments	Tens of millions	25-30% annually
Denials	Millions	15-20% of claims

Core Business Entities

Patient and Coverage

Patient records contain demographics and contact information. Each patient can have multiple **Patient Insurance** records representing primary, secondary, or tertiary coverage. The coverage includes benefit details like deductibles, copays, and out-of-pocket maximums.

Business Impact: Understanding patient coverage helps predict collection rates and patient financial responsibility.

Provider Network

Provider entities represent individual healthcare practitioners with NPIs and specialties. **Facility** entities represent locations where services are delivered. These determine reimbursement rates and network status.

Business Impact: Provider performance directly affects denial rates and reimbursement efficiency.

Encounters and Clinical Data

Encounter represents a patient visit or admission, linking to:

- **Diagnosis** codes (ICD-10) indicating medical conditions
- **Procedure** codes (CPT/HCPCS) documenting services performed

Business Impact: Clinical coding accuracy drives appropriate reimbursement and reduces denials.

Claims Processing Core

Claim Header

The **Claim** table contains submission details, financial summaries, and status tracking. Key fields include:

- Total charges (billed amount)
- Allowed amount (contracted rate)

- Paid amount (actual reimbursement)
- Patient responsibility breakdown

Claim Line Items

Claim Line Item records individual services with procedure codes, modifiers, units, and line-level financial details. Each line can be separately adjudicated.

Payment and Adjustments

Payment records track remittances, while **Payment Adjustment** details contractual write-offs and denial reasons using standard CARC/RARC codes.

Denial Management

Denial records capture rejection reasons, categories (Medical Necessity, Authorization, Eligibility), and appeal deadlines. **Appeal** tracks multi-level appeal processes and recovery amounts.

Business Impact: Effective denial management can recover 40-60% of initially denied claims.

Supporting Entities

- **Prior Authorization**: Pre-approval tracking linked to claims
- **Coordination of Benefits**: Multi-payer claim handling
- **Fee Schedule**: Contracted rates by procedure and payer

Understanding Claims Processing Flow

Standard Workflow

1. **Patient Encounter** → Clinical services delivered
2. **Coding** → Diagnoses and procedures assigned
3. **Claim Submission** → Sent to primary payer
4. **Adjudication** → Payer processes claim
5. **Payment/Denial** → Reimbursement or rejection
6. **Appeals** → Denial challenges if applicable
7. **Secondary Billing** → COB if multiple payers
8. **Patient Billing** → Remaining responsibility

Status Progression

- **Submitted** → Initial transmission

- **Pending** → Under review
- **Approved** → Payment authorized
- **Denied** → Rejected (requires action)
- **Appealed** → Under reconsideration

Key Reporting Views

Financial Performance Views

v_claims_summary_dashboard

Purpose: Executive-level claims metrics by month, status, and type
Key Metrics: Claim volumes, total charges, payments, write-offs, days to payment
Use Cases: Monthly performance reviews, trend analysis, C-suite reporting

v_revenue_cycle_kpis

Purpose: Core revenue cycle performance indicators
Key Metrics: Net collection rate, denial rate, days in AR, AR turnover
Use Cases: Revenue cycle optimization, benchmarking, goal setting

v_monthly_trends

Purpose: Time-series analysis with month-over-month comparisons
Key Metrics: Claim volumes, unique patients, approval rates, growth percentages
Use Cases: Forecasting, seasonality analysis, capacity planning

Denial Management Views

v_denial_analysis

Purpose: Comprehensive denial patterns and recovery rates
Key Metrics: Denial counts by category, appeal success rates, amount recovered
Use Cases: Denial prevention programs, appeal prioritization, training needs

v_appeal_success_analysis

Purpose: Appeal effectiveness by denial category and level
Key Metrics: Success rates, average recovery amounts, decision timeframes
Use Cases: Appeal strategy optimization, ROI analysis on appeal efforts

Provider and Payer Analytics

v_provider_performance

Purpose: Individual provider metrics for network management
Key Metrics: Claim volumes, reimbursement rates, denial rates, submission lag
Use Cases: Provider scorecards, credentialing reviews, training identification

v_payer_performance

Purpose: Insurance company payment patterns and efficiency
Key Metrics: Payment velocity, denial rates, payment-to-allowed ratios
Use Cases: Contract negotiations, payer scorecards, payment variance analysis

v_procedure_profitability

Purpose: Service line financial performance
Key Metrics: Procedure volumes, reimbursement rates, total adjustments
Use Cases: Service line optimization, pricing strategies, contract analysis

Operational Efficiency Views

v_claims_aging

Purpose: Outstanding claims by age buckets
Key Metrics: Claims counts and dollars by 30/60/90/120+ day buckets
Use Cases: AR management, collection prioritization, write-off decisions

v_claims_processing_status

Purpose: Real-time snapshot of claims pipeline
Key Metrics: Claims by status, average age, aged inventory counts
Use Cases: Daily operations management, bottleneck identification

v_facility_utilization

Purpose: Location-based encounter and financial metrics
Key Metrics: Encounter types, length of stay, total charges and reimbursement
Use Cases: Facility performance, capacity planning, resource allocation

Patient Financial Views

v_patient_financial_responsibility

Purpose: Patient balance management and high-dollar account identification
Key Metrics: Total responsibility, payment components, high-balance flags

Use Cases: Patient collections, financial counseling, bad debt prediction

v_cob_summary

Purpose: Multi-payer coordination effectiveness
Key Metrics: Primary/secondary payment splits, combined payment rates
Use Cases: COB process optimization, secondary billing efficiency

Clinical and Utilization Views

v_diagnosis_analysis

Purpose: Disease prevalence and associated costs
Key Metrics: Diagnosis frequency, total charges, average payments
Use Cases: Population health, care management programs, risk adjustment

v_prior_auth_effectiveness

Purpose: Authorization impact on claim approval rates
Key Metrics: Auth volumes, approval rates with/without auth, days from auth to claim
Use Cases: Prior auth program evaluation, process improvement

Common Business Queries

Finding Claims with Specific Issues

```sql
-- Claims denied for authorization issues in last 30 days
SELECT * FROM v_denial_analysis
WHERE denial_category = 'Authorization'
  AND denial_date >= CURRENT_DATE - 30;
```

Provider Comparison

```sql
-- Compare denial rates across specialties
SELECT specialty, AVG(denial_rate_pct) as avg_denial_rate
FROM v_provider_performance
GROUP BY specialty
ORDER BY avg_denial_rate DESC;
```

Revenue Forecasting

```sql
-- Trending monthly revenue with projections
SELECT month, total_paid, month_over_month_growth
FROM v_monthly_trends
WHERE month >= DATEADD('month', -12, CURRENT_DATE);
```

High-Value Recovery Opportunities

```sql
-- Denied claims worth appealing
SELECT c.claim_id, c.total_charge_amount, d.denial_reason
FROM claim c
JOIN denial d ON c.claim_id = d.claim_id
WHERE c.total_charge_amount > 10000
  AND d.appeal_status = 'Not Appealed'
  AND d.appeal_deadline > CURRENT_DATE;
```

Data Quality Considerations

Key Validation Points

1. **Referential Integrity**: All foreign keys must reference valid parent records
2. **Date Consistency**: Service dates ≤ submission dates ≤ payment dates
3. **Financial Balance**: Line item sums should equal claim totals
4. **Status Progression**: Claims should follow logical status transitions

Common Data Issues

- Missing provider NPIs (affects reimbursement rates)
- Incorrect procedure/diagnosis coding (causes denials)
- Duplicate claim submissions (inflates metrics)
- Incomplete COB information (delays secondary processing)

Data Quality Metrics to Monitor

- % of claims with valid authorization numbers
- % of procedures with matching fee schedule entries
- Average lag between service and submission dates
- % of denials with documented reason codes

Best Practices

Query Performance

1. **Use Date Filters**: Always limit date ranges to improve performance
2. **Leverage Views**: Pre-aggregated views are optimized for common queries
3. **Join Carefully**: Start with smaller tables when joining multiple entities
4. **Partition Awareness**: Filter on submission_date when possible (partition key)

Analysis Guidelines

1. **Cohort Consistency**: Compare similar claim types and time periods
2. **Statistical Significance**: Ensure adequate sample sizes for conclusions
3. **Seasonal Adjustments**: Account for known seasonal patterns
4. **Payer Mix Impact**: Normalize metrics by payer when comparing facilities

Reporting Standards

1. **Currency Formatting**: Display financial amounts with 2 decimal places
2. **Percentage Calculations**: Show rates as percentages with 1 decimal place
3. **Date Formats**: Use YYYY-MM-DD for consistency
4. **Null Handling**: Explicitly handle nulls in calculations

Data Privacy and Compliance

1. **PHI Protection**: Never export patient names with SSNs
2. **Minimum Necessary**: Query only required data elements
3. **Audit Trails**: Document data usage for compliance
4. **Access Controls**: Ensure appropriate role-based permissions

Appendix: Quick Reference

Standard Claim Status Values

- Submitted
- Pending
- Approved
- Denied
- Appealed

Common Denial Categories

- Medical Necessity
- Authorization
- Eligibility
- Coding/Billing
- Timely Filing

Key Financial Formulas

- **Net Collection Rate** = (Payments − Credits) / (Charges − Adjustments) × 100
- **Denial Rate** = Denied Claims / Total Claims × 100
- **Days in AR** = Total AR / Average Daily Charges
- **Clean Claim Rate** = Claims Paid on First Submission / Total Claims × 100

Useful Date Functions (Snowflake)

```sql
DATE_TRUNC('month', date_field)  -- First day of month
DATEADD('day', -30, CURRENT_DATE)  -- 30 days ago
DATEDIFF('day', start_date, end_date)  -- Days between dates
```

Support Resources

- Database Administrator: For access requests and performance issues
- Revenue Cycle Team: For business logic and metric definitions
- Compliance Officer: For PHI and regulatory questions
- IT Help Desk: For technical support and tool access