Requirement & Design Specification
HIV Clinic Appointment Booking System

Version: 2.0

January 2025

Record of Changes

Version	Date	A* M, D	In charge	Change Description
V1.0	28/6	A	KhoaDDSE196260	Create document Add requirements, Add actors (1.1) Design Specification
V1.0	28/6	A	TuanTMSE192397	Add descriptions for guest and admin (1.2.b) Authentication & User Management (2.1)
V1.0	28/6	A	DatNTSE194083	Add Use Case Diagram (1.2.a) Add Requirement Speciality
V1.0	28/6	A	AnPPSE196260	Add Use case Table(1.2.1) Add Screen-Flow Diagram (2.1) (2.2) Screen Descriptions, Appendix Add Requirement Speciality
V2.0	Jan 2025	M	Background Agent	Updated to use definitive 27 use cases from evaluation Aligned with HIV_Clinic_Use_Cases.md Corrected use case specifications and design details

Table 1: Version Change Log

**A - Added M - Modified D - Deleted*

Contents

1 Overview

1.1 User Requirements

1.1.1 Actors

The HIV Clinic Appointment Booking System involves five main actors who interact with the system to perform various healthcare-related tasks. The system follows an inheritance model where all authenticated users inherit the basic capabilities of unauthenticated users.

1.2 Actor Description

No	Actor	Description
01	Unauthenticated User	The base actor with public access capabilities. Can browse public website content, register for accounts, and login to the system. All other actors inherit these capabilities.
02	Patient	A registered and authenticated user who receives HIV care. Inherits all base capabilities plus: can manage appointments, view personal medical records and ARV treatments, receive notifications, and access personalized dashboard.
03	Doctor	A registered and authenticated medical professional. Inherits all base capabilities plus: can manage professional availability, handle patient appointments and consultations, prescribe and monitor ARV treatments, and manage patient notifications.
04	Admin	A privileged user responsible for system administration. Inherits all base capabilities plus: manages user accounts across the system, handles user account operations, and monitors appointment oversight.
05	Manager	An authenticated user with operational oversight capabilities. Inherits all base capabilities plus: views comprehensive analytics, manages patient and doctor records, oversees ARV treatment programs, and handles data export operations.

1.2.1 Use Cases

HIV Clinic Management System Use Case Diagram

27 Use Cases (UC-001 through UC-027)

Actors: Unauthenticated User, Authenticated User

SVG Source: diagrams/use_case_diagram.svg

Figure 1: HIV Clinic Management System Use Case Diagram

a. Diagram(s) The system provides 27 comprehensive use cases organized by actor roles, following an inheritance model where authenticated users inherit public access capabilities while adding role-specific functionalities for HIV clinic management.

b. Use Case Descriptions

ID	Feature	Use Case	Use Case Description
Unauthenticated User (Base Capabilities)			
UC-001	Public Information	Browse Public Website	View HIV information, educational content, and blog posts accessible to all visitors
UC-002	Account Management	User Registration	Patients and doctors can register for new accounts with role-based system access
UC-003	Authentication	User Login	Authenticate using username/password with JWT token-based security
Authenticated User (Common Capabilities)			
UC-004	Authentication	User Logout	Secure session termination and cleanup for all authenticated users
UC-005	Profile Management	Update Profile	Manage personal information, contact details, profile images, and privacy settings
UC-006	Security	Change Password	Password modification with validation and security checks
Patient Services			
UC-007	Dashboard	View Patient Dashboard	Overview of appointments, treatments, and personal health statistics
UC-008	Appointment	Manage Appointments	Book, view, and cancel appointments with available doctors
UC-009	Medical Records	Manage Personal Medical Records	View and update personal medical records and information
UC-010	HIV Treatment	View ARV Treatments	View HIV antiretroviral treatment regimens and status
UC-011	Communication	View Notifications	Receive and view system notifications and reminders
Doctor Services			
UC-012	Dashboard	View Doctor Dashboard	Professional dashboard with patient appointments and notifications
UC-013	Appointment	Manage Appointments	View, manage patient appointments, and update appointment status
UC-014	Scheduling	Manage Availability Slots	Create, update, and delete availability time slots for appointments
UC-015	Patient Care	Access Patient Records	View comprehensive patient medical records during consultations
UC-016	HIV Treatment	Manage ARV Treatments	Prescribe and monitor HIV antiretroviral treatments

UC-017	Communication	Manage Patient Notifications	Send notifications, view history, and manage templates
Admin Services			
UC-018	Dashboard	View Admin Dashboard	System-wide administrative dashboard with user management tools
UC-019	User Management	Manage Users	Comprehensive user management including account creation, status toggling, and password resets
UC-020	System Oversight	View All Appointments	System-wide appointment oversight and monitoring
Manager Services			
UC-021	Dashboard	View Manager Dashboard	Operational dashboard with comprehensive analytics, data export, and clinic statistics
UC-022	Analytics	View Statistics	Comprehensive clinic statistics and performance metrics
UC-023	Operations	Manage Patient Records	Oversight of patient records, including search and detailed views
UC-024	Operations	Manage Doctor Records	Oversight of doctor records, including search and detailed views
UC-025	Treatment Oversight	Manage ARV Treatments	Monitor ARV treatment programs across the clinic
UC-026	Scheduling	Manage Schedules	Oversee clinic scheduling and appointment distribution
UC-027	Data Management	Export Data (CSV)	Export clinic data in CSV format for reporting and analysis

1.3 Overall Functionalities

1.3.1 Screen Flow

The HIV Clinic system provides role-based screen flows ensuring appropriate access to sensitive medical information:

Overall Screen Flow

Role-based interface navigation

Public → Authentication → Role-specific dashboards

SVG Source: diagrams/user_interface_flow.svg

Figure 2: Overall Screen Flow

1.3.2 Screen Descriptions

#	Feature	Screen	Description
1	Authentication	HOME PAGE	The landing page of the system. Includes brief introduction, access to login/register, blog, and HIV educational content.
2	Authentication	Register Page	Allows users (patients, doctors) to create new accounts with basic info and email verification.
3	Authentication	LOGIN PAGE	Login page for all users. After successful login, users are routed to their respective dashboard based on role.
4	Information	Information Page	Displays HIV clinic information and services. Accessible from Home Page without login.
5	Blog	Blog Page	HIV health education blogs and articles available for reading from the Home Page.
6	Dashboard	Patient Dashboard	Main landing screen after login for patients. Central hub for accessing medical features and appointments.
7	Dashboard	Doctor Dashboard	Professional dashboard for doctors showing patient appointments, availability, and notifications.
8	Dashboard	Admin Dashboard	Administrative dashboard for managing users, viewing system statistics, and monitoring appointments.
9	Dashboard	Manager Dashboard	Operational dashboard with comprehensive analytics, data export, and clinic statistics.
10	Appointment	Appointment Booking	Patient interface for booking appointments with available doctors and time slots.
11	Medical Records	Patient Records	Interface for viewing and managing personal medical records, including HIV treatment history.
12	Treatment	ARV Management	Specialized interface for managing HIV antiretroviral treatments and monitoring adherence.

2 Use Case Specifications

2.1 UC-001 – Browse Public Website

UC ID and Name:	UC-001 – Browse Public Website
Created By:	System Analyst

Date Created:	January 2025
Primary Actor:	Unauthenticated User
Secondary Actors:	None
Description:	Users can view HIV information, educational content, and blog posts without requiring authentication
Trigger:	User accesses the website homepage or navigation menu
Preconditions:	• The system is online and accessible • Public content is available in the system
Postconditions:	• Public HIV information and content is displayed • User can navigate through available public pages
Normal Flow:	1. User opens the website 2. System displays homepage with HIV clinic information 3. User navigates through public content sections 4. User can read educational content and blog posts
Alternative Flows:	**AF-1:** User accesses specific public pages directly via URL
Exceptions:	• EX-1: If public content is unavailable, system displays maintenance message
Business Rules:	• BR-001: Public content must be accessible without authentication • BR-002: HIV educational content must be medically accurate
Assumptions:	• Public content is regularly updated and maintained
Priority:	High
Frequency of Use:	High

2.2 UC-002 – User Registration

UC ID and Name:	UC-002 – User Registration
Created By:	System Analyst
Date Created:	January 2025
Primary Actor:	Unauthenticated User
Secondary Actors:	System
Description:	New users (patients and doctors) can create accounts with role-based access to the HIV clinic system
Trigger:	User clicks "Register" from homepage or login page
Preconditions:	• User is not currently logged in • Registration system is operational
Postconditions:	• New user account is created in the system • User receives confirmation notification • User can login with new credentials
Normal Flow:	1. User accesses registration form 2. User provides required information (name, email, phone, role) 3. User creates username and password 4. System validates input data 5. System creates new user account 6. System sends confirmation notification
Alternative Flows: **AF-2:** Invalid data format → System highlights errors for correction	**AF-1:** Email already exists → System shows error and suggests login
Exceptions:	• EX-1: System error during registration → Show error message and retry option

Business Rules:	• BR-003: Email addresses must be unique in the system • BR-004: Passwords must meet security requirements • BR-005: Doctor registrations require additional verification
Assumptions:	• Users provide accurate contact information
Priority:	High
Frequency of Use:	Medium

2.3 UC-003 – User Login

UC ID and Name:	UC-003 – User Login
Created By:	System Analyst
Date Created:	January 2025
Primary Actor:	Unauthenticated User
Secondary Actors:	System
Description:	Existing users authenticate using username/password with JWT token-based security
Trigger:	User accesses login page and submits credentials
Preconditions:	• A registered account exists • The user is not currently logged in • Authentication system is operational
Postconditions:	• The user is authenticated • The user is redirected to their personal dashboard • Login activity is logged for security

Normal Flow:	1. User enters username/email and password 2. The system validates the credentials 3. System generates JWT token 4. User is redirected to appropriate dashboard based on role 5. System logs successful login
Alternative Flows: **AF-2:** Account disabled → System shows account status message	**AF-1:** Invalid credentials → System shows error message
Exceptions:	• EX-1: Multiple failed attempts → Account temporarily locked • EX-2: System authentication error → Show retry option
Business Rules:	• BR-006: Maximum 3 failed login attempts before temporary account lockout • BR-007: Session timeout after 2 hours of inactivity • BR-008: All login attempts must be logged for security audit
Assumptions:	• The account is active and verified • The user provides correct credentials
Priority:	High
Frequency of Use:	High

2.4 UC-008 – Manage Appointments

UC ID and Name:	UC-008 – Manage Appointments
Created By:	System Analyst
Date Created:	January 2025

Primary Actor:	Patient
Secondary Actors:	System, Doctor
Description:	Patients can book, view, and cancel appointments with available doctors
Trigger:	Patient accesses appointment management section
Preconditions:	• Patient is logged in to the system • At least one doctor has available appointment slots
Postconditions:	• Appointment is successfully booked, viewed, or cancelled • Doctor and patient receive appropriate notifications • Appointment status is updated in the system
Normal Flow:	**Booking:** 1. Patient selects doctor from available list 2. Patient chooses available date and time slot 3. Patient provides appointment notes (optional) 4. System creates appointment and updates availability 5. System sends confirmation to patient and doctor **Viewing:** 1. Patient accesses appointment list 2. System displays past, current, and future appointments 3. Patient can view appointment details **Cancelling:** 1. Patient selects appointment to cancel 2. Patient provides cancellation reason 3. System cancels appointment and frees time slot 4. System notifies doctor of cancellation
Alternative Flows:	**AF-1:** No available slots → System suggests alternative dates

AF-2: Appointment within 24 hours → Requires confirmation	
Exceptions:	• EX-1: Slot becomes unavailable during booking → Show updated availability • EX-2: System error during booking → Rollback changes and show error
Business Rules:	• BR-009: Patients cannot book overlapping or conflicting appointments • BR-010: Cancellations within 24 hours may incur penalties • BR-011: Maximum 3 future appointments per patient
Assumptions:	• Doctor availability is accurately maintained
Priority:	Critical
Frequency of Use:	High

2.5 UC-016 – Manage ARV Treatments

UC ID and Name:	UC-016 – Manage ARV Treatments
Created By:	System Analyst
Date Created:	January 2025
Primary Actor:	Doctor
Secondary Actors:	Patient, System
Description:	Doctors can prescribe and monitor HIV antiretroviral treatments including regimen management and adherence tracking
Trigger:	Doctor accesses ARV treatment management during patient consultation

Preconditions:	• Doctor is logged in and has patient access permissions • Patient has an active medical record • Doctor is viewing patient during active consultation
Postconditions:	• ARV treatment regimen is prescribed or updated • Patient receives treatment schedule and instructions • Treatment adherence monitoring is activated • Medical record is updated with treatment information
Normal Flow:	**Prescribing:** 1. Doctor reviews patient's medical history and current condition 2. Doctor selects appropriate ARV regimen from available options 3. Doctor specifies dosage, frequency, and treatment duration 4. Doctor enters treatment goals and monitoring parameters 5. System creates treatment plan and schedules reminders **Monitoring:** 1. Doctor reviews patient adherence reports 2. Doctor assesses treatment effectiveness and side effects 3. Doctor adjusts regimen if necessary 4. Doctor documents treatment response and next steps
Alternative Flows: **AF-2:** Treatment modification needed → Doctor updates existing regimen	**AF-1:** Patient has drug allergies → System alerts and suggests alternatives

AF-3: Poor adherence detected → Doctor schedules counseling session	
Exceptions:	• EX-1: Drug interaction detected → System blocks prescription and suggests alternatives • EX-2: Patient medical record incomplete → Request additional information
Business Rules:	• BR-012: Only licensed doctors can prescribe ARV treatments • BR-013: All ARV prescriptions must be documented and logged • BR-014: Patient consent required for treatment changes • BR-015: Regular adherence monitoring is mandatory
Assumptions:	• Doctor has current knowledge of ARV treatment protocols • Patient will follow prescribed treatment regimen
Priority:	Critical
Frequency of Use:	High

3 Design Specifications

3.1 Authentication System

3.1.1 User Login

This screen allows users to authenticate into the system with role-based access to appropriate functionalities.

Related Use Cases: UC-003 - User Login

UI Design

Field Name	Field Type	Description
Username*	Text Box	User enters registered username or email address for authentication

Password*	Password Box	User enters password (masked input for security)
Login	Button	Submits authentication request to server
Register	Hyperlink	Redirects to user registration page for new users
Forgot Password?	Hyperlink	Contact admin for password reset (no self-service)

Database Access

Table	CRUD	Description
Users	R	Verify username/email and password hash for authentication
Roles	R	Retrieve user role information for authorization
LoginActivity	C	Log login attempt for security audit

```
-- 1. Authenticate user credentials
SELECT u.UserID, u.Username, u.Email, u.IsActive, r.RoleName
FROM Users u
INNER JOIN Roles r ON u.RoleID = r.RoleID
WHERE (u.Username = ? OR u.Email = ?) AND u.IsActive = 1

-- 2. Log login activity
INSERT INTO LoginActivity
(UserID, UsernameAttempted, AttemptTime, IsSuccess, IPAddress, UserAgent)
VALUES (?, ?, GETDATE(), ?, ?, ?)
```

3.2 Appointment Management

3.2.1 Appointment Booking

This screen enables patients to book appointments with available doctors by selecting from available time slots.

Related Use Cases: UC-008 - Manage Appointments, UC-014 - Manage Availability Slots

UI Design

Field Name	Field Type	Description

Doctor Selection*	Dropdown	List of available doctors with specialties
Appointment Date*	Date Picker	Calendar widget for selecting appointment date
Available Time Slots*	Radio Buttons	Dynamic list of available time slots for selected doctor/date
Appointment Notes	Text Area	Optional notes about appointment purpose or concerns
Book Appointment	Button	Submit appointment booking request
Cancel	Button	Return to previous screen without booking

Database Access

Table	**CRUD**	**Description**
Users	R	Retrieve available doctors with their specialties
DoctorAvailabilitySlots	R, U	Query available slots and mark as booked
Appointments	C	Create new appointment record
Notifications	C	Schedule appointment reminder notifications

```
-- 1. Get available doctors
SELECT u.UserID, u.FirstName, u.LastName, dp.Bio, s.SpecialtyName
FROM Users u
INNER JOIN DoctorProfiles dp ON u.UserID = dp.UserID
LEFT JOIN Specialties s ON dp.SpecialtyID = s.SpecialtyID
WHERE u.RoleID = (SELECT RoleID FROM Roles WHERE RoleName = 'Doctor')
AND u.IsActive = 1

-- 2. Get available time slots
SELECT AvailabilitySlotID, SlotDate, StartTime, EndTime
FROM DoctorAvailabilitySlots
WHERE DoctorUserID = ? AND SlotDate = ? AND IsBooked = 0
ORDER BY StartTime

-- 3. Create appointment
INSERT INTO Appointments
(PatientUserID, DoctorUserID, AvailabilitySlotID, AppointmentDateTime,
 Status, AppointmentNotes, CreatedAt, UpdatedAt)
VALUES (?, ?, ?, ?, 'Scheduled', ?, GETDATE(), GETDATE())

-- 4. Update availability slot
```

```
UPDATE DoctorAvailabilitySlots
SET IsBooked = 1, UpdatedAt = GETDATE()
WHERE AvailabilitySlotID = ?
```

3.3 ARV Treatment Management

3.3.1 ARV Treatment Prescription

This screen enables doctors to prescribe and monitor HIV antiretroviral treatments for patients.

Related Use Cases: UC-016 - Manage ARV Treatments, UC-015 - Access Patient Records

UI Design

Field Name	Field Type	Description
Patient Information	Display Panel	Shows patient name, ID, and current treatment status
Current Regimens	Table	Lists active ARV regimens with start dates and adherence
Available ARV Drugs	Multi-select	List of available antiretroviral medications
Dosage*	Text Box	Medication dosage specifications
Frequency*	Dropdown	Daily frequency (once, twice, three times daily)
Treatment Duration*	Date Picker	Expected treatment duration or review date
Treatment Goals	Text Area	Clinical goals and expected outcomes
Monitoring Schedule	Dropdown	Follow-up monitoring frequency
Special Instructions	Text Area	Additional patient instructions or warnings
Prescribe Treatment	Button	Submit new ARV treatment prescription
Update Existing	Button	Modify current treatment regimen
View Adherence	Button	Access patient adherence reports

Database Access

Table	CRUD	Description
ARVTreatments	C,R,U	Create, view, and update ARV treatment records
ARVDrugs	R	Retrieve available antiretroviral medications
PatientRecords	R,U	Access patient medical records and update treatment history
AdherenceTracking	C,R	Create adherence monitoring and view reports
Notifications	C	Create medication reminders for patients

```
-- 1. Get patient current ARV treatments
SELECT ARVTreatmentID, Regimen, StartDate, EndDate,
       Adherence, SideEffects, IsActive
FROM ARVTreatments
WHERE PatientUserID = ? AND IsActive = 1
ORDER BY StartDate DESC

-- 2. Create new ARV treatment
INSERT INTO ARVTreatments
(PatientUserID, DoctorUserID, Regimen, Dosage, Frequency,
 StartDate, ExpectedEndDate, TreatmentGoals, Instructions,
 IsActive, CreatedAt, UpdatedAt)
VALUES (?, ?, ?, ?, ?, ?, ?, ?, ?, 1, GETDATE(), GETDATE())

-- 3. Update patient medical record
UPDATE PatientRecords
SET CurrentMedications = ?, ARVStatus = ?, UpdatedAt = GETDATE()
WHERE PatientUserID = ?

-- 4. Create adherence tracking
INSERT INTO AdherenceTracking
(ARVTreatmentID, TrackingDate, AdherenceRate, Notes, CreatedAt)
VALUES (?, GETDATE(), 100, 'Initial prescription', GETDATE())
```

3.4 Patient Records Management

3.4.1 Patient Medical Records

This screen provides comprehensive medical record management for HIV patients including treatment history and current medications.

Related Use Cases: UC-009 - Manage Personal Medical Records, UC-015 - Access Patient Records

UI Design

Field Name	Field Type	Description
Medical History	Text Area	Comprehensive medical history including HIV diagnosis details
Current Allergies	Text Area	Known allergies and adverse drug reactions
Current Medications	Text Area	List of current medications including ARV regimens
Blood Type	Dropdown	ABO blood type classification
Emergency Contact	Text Box	Emergency contact person name
Emergency Phone	Text Box	Emergency contact phone number
Clinical Notes	Text Area	Doctor's clinical observations and notes
ARV Status	Display Field	Current HIV treatment status and viral load
Last CD4 Count	Text Box	Most recent CD4 cell count
Save Record	Button	Save medical record updates
View ARV History	Button	Access complete HIV treatment history
Generate Report	Button	Create medical summary report

Database Access

Table	CRUD	Description
PatientRecords	R,U	Retrieve and update patient medical records
ARVTreatments	R	Access HIV treatment history
LabResults	R,C	View and add laboratory test results
Users	R	Verify patient and doctor access permissions
MedicalHistory	C,R,U	Manage detailed medical history entries

```
-- 1. Retrieve complete patient record
SELECT pr.RecordID, pr.PatientUserID, pr.MedicalHistory, pr.Allergies,
       pr.CurrentMedications, pr.BloodType, pr.EmergencyContact,
       pr.EmergencyPhone, pr.Notes, pr.ARVStatus, pr.LastCD4Count,
       pr.UpdatedAt
FROM PatientRecords pr
WHERE pr.PatientUserID = ?
```

```
-- 2. Update patient record
UPDATE PatientRecords
SET MedicalHistory = ?, Allergies = ?, CurrentMedications = ?,
    BloodType = ?, EmergencyContact = ?, EmergencyPhone = ?,
    Notes = ?, LastCD4Count = ?, UpdatedAt = GETDATE()
WHERE PatientUserID = ?

-- 3. Get ARV treatment summary
SELECT COUNT(*) as TotalTreatments,
       MAX(StartDate) as LastTreatmentStart,
       AVG(Adherence) as AverageAdherence
FROM ARVTreatments
WHERE PatientUserID = ?

-- 4. Get recent lab results
SELECT TestType, TestValue, TestDate, ReferenceRange
FROM LabResults
WHERE PatientUserID = ?
ORDER BY TestDate DESC
```

4 Appendix

4.1 Use Case Relationships

4.1.1 Include Relationships

- **UC-008 (Manage Appointments)** includes **UC-014 (Manage Availability Slots)** - appointment booking requires checking doctor availability
- **UC-013 (Manage Appointments)** includes **UC-015 (Access Patient Records)** - managing appointments requires patient record access
- **UC-016 (Manage ARV Treatments)** includes **UC-015 (Access Patient Records)** - treatment management requires patient record access
- **UC-017 (Manage Patient Notifications)** includes **UC-015 (Access Patient Records)** - sending notifications requires patient information
- **UC-019 (Manage Users)** includes **UC-020 (View All Appointments)** - user management includes appointment oversight

4.1.2 Extend Relationships

- **UC-009 (Manage Personal Medical Records)** extends **UC-008 (Manage Appointments)** - medical record updates may occur during appointment management
- **UC-011 (View Notifications)** extends **UC-007 (View Patient Dashboard)** - notifications are displayed as part of dashboard functionality
- **UC-005 (Update Profile)** extends **UC-006 (Change Password)** - profile updates may include password changes

4.1.3 Generalization Relationships

- **UC-023 (Manage Patient Records)** generalizes **UC-019 (Manage Users)** - patient record management is a specialized form of user management
- **UC-024 (Manage Doctor Records)** generalizes **UC-019 (Manage Users)** - doctor record management is a specialized form of user management
- **UC-008 (Manage Appointments)** generalizes **UC-013 (Manage Appointments)** - patient appointment management is a specialized form of doctor appointment management
- **UC-009 (Manage Personal Medical Records)** generalizes **UC-015 (Access Patient Records)** - personal record management is a specialized form of patient record access

4.2 Business Rules

ID	Category	Rule Definition
BR-001	Public Access	Public content must be accessible without authentication
BR-002	Content Quality	HIV educational content must be medically accurate and reviewed
BR-003	User Management	Email addresses must be unique across all user accounts
BR-004	Security	Passwords must meet minimum security requirements (8+ chars, mixed case, numbers)
BR-005	Registration	Doctor registrations require additional verification and approval

BR-006	Authentication	Maximum 3 failed login attempts before temporary account lockout
BR-007	Session Management	User sessions expire after 2 hours of inactivity
BR-008	Security Audit	All login attempts must be logged for security monitoring
BR-009	Appointment Booking	Patients cannot book overlapping or conflicting appointments
BR-010	Cancellation Policy	Appointment cancellations within 24 hours may incur penalties
BR-011	Appointment Limits	Maximum 3 future appointments allowed per patient
BR-012	Medical Authorization	Only licensed doctors can prescribe ARV treatments
BR-013	Treatment Documentation	All ARV prescriptions must be documented and logged
BR-014	Patient Consent	Patient consent required for all treatment changes
BR-015	Treatment Monitoring	Regular adherence monitoring is mandatory for ARV treatments
BR-016	Data Security	All patient data must be encrypted at rest and in transit
BR-017	Access Control	Role-based access ensures users can only access authorized information
BR-018	Data Retention	Patient medical records must be retained for minimum 7 years
BR-019	Emergency Access	Emergency override allows authorized medical staff to access patient records
BR-020	Notification Preferences	Patients must be able to opt-out of non-critical notifications

4.3 Assumptions & Dependencies

- **AS-1:** Microsoft SQL Server database is available and properly configured for healthcare data storage
- **AS-2:** SMTP email service is configured for sending appointment and medication reminders

- **AS-3:** System users have basic computer literacy and internet access
- **AS-4:** Clinic staff will receive training on HIV patient management workflows
- **AS-5:** All medical staff have proper licensing and authorization to treat HIV patients
- **DE-1:** Integration with existing hospital information systems may be required
- **DE-2:** HIPAA compliance requirements must be met for patient data protection
- **DE-3:** System depends on reliable internet connectivity for real-time operations
- **DE-4:** ARV drug database must be maintained and updated regularly

4.4 Limitations & Exclusions

- System does not include billing or insurance processing capabilities
- Laboratory result integration is limited to manual entry
- Telemedicine or video consultation features are excluded from current scope
- Mobile application development is not part of initial release
- Integration with external pharmacy systems is not included
- Advanced analytics and AI-driven treatment recommendations are excluded
- Multi-language support is not included in initial version
- Integration with external HIV registries or national health databases is excluded

4.5 Technical Specifications

- **Backend Technology:** Spring Boot 3.x with Java 17
- **Frontend Technology:** React 18 with modern JavaScript (ES6+)
- **Database:** Microsoft SQL Server with T-SQL stored procedures
- **Authentication:** JWT (JSON Web Tokens) with BCrypt password hashing
- **API Architecture:** RESTful APIs with JSON data exchange
- **Security:** HTTPS/TLS encryption, CORS configuration, input validation
- **Deployment:** Containerized deployment ready (Docker compatible)
- **Testing:** Unit testing with JUnit, Integration testing with TestContainers