ER Diagram - PART 1

PATIENTS

int	patient_id	PK	NOT NULL, AUTO_INCREMENT
string	gender		CHECK(gender IN ('M','F','Other'))
int	age		CHECK(age >= 18 AND age <= 120)
string	region		CHECK(region IN ('North','South','East','West'))
date	signup_date		NOT NULL, DEFAULT CURRENT_DATE
string	status		CHECK(status IN ('Active','Inactive','Churned')) - derived
int	days_to_first_appointment		derived
int	total_appointments		derived
float	no_show_rate		CHECK(no_show_rate >= 0 AND no_show_rate <= 1) - derived
int	engagement_score		CHECK(engagement_score >= 0 AND engagement_score <= 100) - derived
string	risk_level		CHECK(risk_level IN ('Low','Medium','High')) - derived
date	last_active_date		derived

schedules   performs   has

APPOINTMENTS

int	appointment_id	PK	NOT NULL, UNIQUE
int	patient_id	FK	NOT NULL, ON DELETE CASCADE
date	scheduled_date		NOT NULL, CHECK(scheduled_date >= signup_date)
string	attended_flag		NOT NULL, CHECK(attended_flag IN ('Y','N'))
string	provider_type		NOT NULL, CHECK(provider_type IN ('GP','Specialist','Therapist'))
time	appointment_time		CHECK(appointment_time BETWEEN '08:00' AND '18:00') - derived
int	duration_minutes		DEFAULT 30, CHECK(duration_minutes IN (15,30,45,60)) - derived
string	appointment_status		CHECK(status IN ('Scheduled','Completed','Cancelled','No-Show')) - derived
decimal	appointment_cost		CHECK(appointment_cost >= 0) - derived

ENGAGEMENT

int	engagement_id	PK	NOT NULL, AUTO_INCREMENT - derived
int	patient_id	FK	NOT NULL, ON DELETE CASCADE
date	date		NOT NULL, CHECK(date >= signup_date)
string	action_type		NOT NULL, CHECK(action_type IN ('login','article','message','video','appointment_booking','profile_update'))
int	action_count		NOT NULL, CHECK(action_count > 0)
int	session_duration_seconds		CHECK(session_duration_seconds >= 0) - derived
string	device_type		CHECK(device_type IN ('Web','Mobile','Tablet')) - derived
string	engagement_quality		CHECK(quality IN ('High','Medium','Low')) - derived

LAB_RESULTS

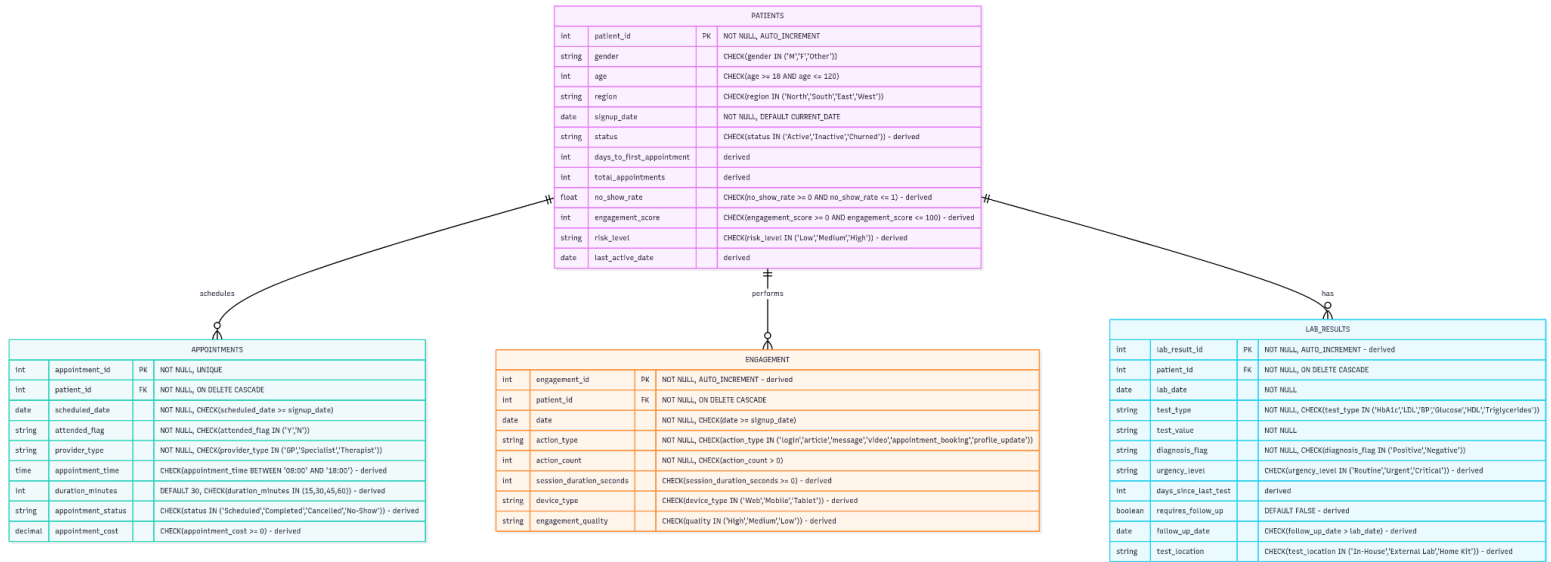|			
int	lab_result_id	PK	NOT NULL, AUTO_INCREMENT - derived
int	patient_id	FK	NOT NULL, ON DELETE CASCADE
date	lab_date		NOT NULL
string	test_type		NOT NULL, CHECK(test_type IN ('HbA1c','LDL','BP','Glucose','HDL','Triglycerides'))
string	test_value		NOT NULL
string	diagnosis_flag		NOT NULL, CHECK(diagnosis_flag IN ('Positive','Negative'))
string	urgency_level		CHECK(urgency_level IN ('Routine','Urgent','Critical')) - derived
int	days_since_last_test		derived
boolean	requires_follow_up		DEFAULT FALSE - derived
date	follow_up_date		CHECK(follow_up_date > lab_date) - derived
string	test_location		CHECK(test_location IN ('In-House','External Lab','Home Kit')) - derived

Data Model Documentation :

PRIMARY KEYS AND FOREIGN KEYS

Primary Keys (PK):
- PATIENTS: patient_id (AUTO_INCREMENT, NOT NULL)
- APPOINTMENTS: appointment_id (UNIQUE, NOT NULL)
- ENGAGEMENT: engagement_id (AUTO_INCREMENT, derived composite key)
- LAB_RESULTS: lab_result_id (AUTO_INCREMENT, derived composite key)

Foreign Keys (FK):
- APPOINTMENTS: patient_id → PATIENTS.patient_id (ON DELETE CASCADE)
- ENGAGEMENT: patient_id → PATIENTS.patient_id (ON DELETE CASCADE)
- LAB_RESULTS: patient_id → PATIENTS.patient_id (ON DELETE CASCADE)

RELATIONSHIPS & CARDINALITY

- PATIENTS to APPOINTMENTS: One-to-Many (1:N) - Mandatory participation on APPOINTMENTS side
- PATIENTS to ENGAGEMENT: One-to-Many (1:N) - Optional participation
- PATIENTS to LAB_RESULTS: One-to-Many (1:N) - Optional participation

DATABASE CONSTRAINTS

PATIENTS Table Constraints:

- patient_id: PRIMARY KEY, AUTO_INCREMENT, NOT NULL
- gender: CHECK constraint - Must be 'M', 'F', or 'Other'
- age: CHECK constraint - Must be between 18 and 120 (legal adults only)
- region: CHECK constraint - Limited to 'North', 'South', 'East', 'West'
- signup_date: NOT NULL, DEFAULT CURRENT_DATE
- status: CHECK constraint - 'Active', 'Inactive', or 'Churned' (derived)
- no_show_rate: CHECK constraint - Must be between 0 and 1 (percentage as decimal)
- engagement_score: CHECK constraint - Must be between 0 and 100
- risk_level: CHECK constraint - 'Low', 'Medium', or 'High' (derived from engagement patterns)

APPOINTMENTS Table Constraints:
- appointment_id: PRIMARY KEY, UNIQUE, NOT NULL
- patient_id: FOREIGN KEY, NOT NULL, CASCADE DELETE
- scheduled_date: NOT NULL, Must be >= patient's signup_date
- attended_flag: NOT NULL, CHECK constraint - Only 'Y' or 'N'
- provider_type: NOT NULL, CHECK constraint - 'GP', 'Specialist', or 'Therapist'
- appointment_time: CHECK constraint - Between 08:00 and 18:00 (business hours)
- duration_minutes: DEFAULT 30, CHECK constraint - Must be 15, 30, 45, or 60
- appointment_cost: CHECK constraint - Must be >= 0

ENGAGEMENT Table Constraints:
- engagement_id: PRIMARY KEY, AUTO_INCREMENT
- patient_id: FOREIGN KEY, NOT NULL, CASCADE DELETE
- date: NOT NULL, Must be >= patient's signup_date
- action_type: NOT NULL, CHECK constraint - Limited to defined action types
- action_count: NOT NULL, Must be > 0
- session_duration_seconds: CHECK constraint - Must be >= 0
- device_type: CHECK constraint - 'Web', 'Mobile', or 'Tablet'
- engagement_quality: CHECK constraint - 'High', 'Medium', or 'Low'

LAB_RESULTS Table Constraints:
- lab_result_id: PRIMARY KEY, AUTO_INCREMENT
- patient_id: FOREIGN KEY, NOT NULL, CASCADE DELETE
- lab_date: NOT NULL
- test_type: NOT NULL, CHECK constraint - Limited to defined test types
- test_value: NOT NULL
- diagnosis_flag: NOT NULL, CHECK constraint - 'Positive' or 'Negative'
- urgency_level: CHECK constraint - 'Routine', 'Urgent', or 'Critical'
- requires_follow_up: DEFAULT FALSE
- follow_up_date: Must be > lab_date when populated
- test_location: CHECK constraint - 'In-House', 'External Lab', or 'Home Kit'

DERIVED ATTRIBUTES

PATIENTS Table:

- status: Status is calculated from the last activity date (Active: >30 days; Inactive: 30-90 days; Churned: > 90 days)
- days_to_first_appointment: DATEDIFF(fsignup_date, first appointment_date)
- total_appointments: total_appointments COUNT(appointments) each patient
- no_show_rate: COUNT(attended_flag='N') / COUNT(appointments)
- engagement_score: Engagement is not calculated as a total score but is distributed weights on the frequency, recency, and variety of actions
- risk_level: Determined as a factor of no_show_rate and engagement_score
- last_active_date: last_active_date MAX(engagement.date, appointments.scheduled date)

APPOINTMENTS Table:

- appointment_time: Calculated from scheduled_date and/or business logic
- duration_minutes: Provider_type based (GP=30, Specialist=45, Therapist=60)
- appointment_status: Determined from attended_flag and scheduled_date
- appointment_cost: Provider type and duration based

ENGAGEMENT Table:

- engagement_id: AUTO_INCREMENT for uniqueness
- session_duration_seconds: Computed from session timestamps
- device_type: Extracted from user agent or session metadata
- engagement_quality: Derived from action_count and session_duration

LAB RESULTS Table:

- lab_result_id: AUTO_INCREMENT for uniqueness
- urgency_level: Assigned from value ranges and diagnosis_flag
- days_since_last_test: Computed from previous test of same type
- requires_follow_up: Diagnostic_flag='positive' or abnormal values
- follow_up_date: Determined by the ranking
- test_location: Scheduling system or test_type based