



University
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Deliverable #:

Moroccan National Health Services (e.g.: Conceptual Design)

Data Management Course
UM6P College of Computing

Professor: Karima Echihabi **Program:** Computer Engineering
Session: Fall 2025

Team Information

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Repository Link	https://github.com/Youssefbenhammouda/DBMS-IndexFive

1 Introduction

The Moroccan National Health Services (MNHS) requires a comprehensive database to manage patient care, staff operations, hospitals, appointments, prescriptions, medications, insurance, billing, and emergencies. This deliverable provides the Entity–Relationship (ER) model for the MNHS system. It captures the main entities, their attributes, and relationships to support both operational queries (e.g., patient admission, prescription tracking) and future analytics (e.g., staff workload, medication demand). The ERD ensures data consistency, supports scalability, and aligns with healthcare management requirements in Morocco.

2 Requirements

This deliverable covers:

- Patient management (personal info, insurance, address, phone, history).
- Staff management (practitioners, caregiving staff, technical staff, certifications).
- Hospital and department management (region, city, wards, specialties).
- Appointment scheduling (patient, staff, department, time, reason).
- Prescription handling (doctor, dosage, duration, medication).
- Medication inventory (pharmacy stock, suppliers, prices, restock dates).
- Insurance and billing management.
- Emergency cases and triage management.
- Linking hospitals, departments, and services under MNHS.

3 Methodology

Below we explain each entity and its relationships, with cardinalities. In our notation:

- **Bold line** = $(1 \dots N)$
- Normal line = $(0 \dots N)$
- **Bold Arrow** = (1)
- Normal Arrow = $(0, 1)$

Patient

Attributes: `internal_id`, `full_name`, `CIN`, `sex`, `birth_date`, `blood_grp`.

- Aggregation: grouped with `Location` (province, city, street, postal code) and `Phone`. A patient may have $0 \dots N$ locations and each one of them has one phone.
- Relation with `Insurance`: a patient can have $1 \dots N$ insurances.
- Relation with `Emergency`: a patient can be admitted in $0 \dots N$ emergencies.
- Relation with `Appointment`: a patient can have $0 \dots N$ appointments, each appointment must involve exactly 1 patient.
- Relation with `Prescription`: a patient can have $0 \dots N$ prescriptions.

Insurance

Attributes: `insur_id`, `coverage_type`.

- Each insurance must be linked to $0 \dots N$ patient.
- An insurance can have $0 \dots N$ bills.

Bill

Attributes: `bill_id`, `generation_time`.

- A bill can be attached to exactly 1 insurance.

Appointment

Attributes: `app_id`, `date`, `time`, `status`, `reason`.

- Each appointment must be linked to exactly 1 patient.
- Each appointment must be linked to exactly 1 staff.
- Each appointment must be linked to exactly 1 department.
- Patients, staff, and departments may have $0 \dots N$ appointments.

Staff (Hierarchy)

Attributes: `staff_id`. Specializations (hierarchy):

- `Practitioners`: license number, specialty.
- `Caregiving staff`: ward, grade.
- `Technical staff`: modality/equipment.

Relations:

- **work_in**: each staff must belong to exactly $0 \dots N$ department. A department may have $0 \dots N$ staff.
- **Handles**: staff can handle $0 \dots N$ emergencies. An emergency can be handled by $0 \dots N$ staff.
- **has_cert**: staff can have $0 \dots N$ certifications. Each certification must belong to 0 or 1 staff.
- **Appointment**: each appointment must be linked to exactly 1 staff.
- **Prescription**: each prescription must be issued by $0 \dots N$ staff.

Department

Attributes: `dept_id`, `name`.

- Each department must belong to exactly 1 hospital. A hospital can have $0 \dots N$ departments.
- Staff and appointments are linked to departments as described above.

Hospital

Attributes: `hos_id`, `name`, `city`, `region`.

- Each hospital must have $1 \dots N$ pharmacy inventory.
- A hospital may have $0 \dots N$ departments.

Pharmacy Inventory

Attributes: `phar_id`.

- **Relation with Medication**: an inventory can contain $0 \dots N$ medications. Relationship attributes: `quantity`, `unit price`, `reorder level`, `last restock timestamp`.

Medication

Attributes: `drug_id`, `name`, `strength`, `form`, `active_ingredient`, `manufacturer`, `therapeutic_class`.

- May be contained in $0 \dots N$ inventories.
- Must be included in $0 \dots N$ prescriptions. Relationship attributes: `dosage`, `duration`.

Prescription

Attributes: `prescrip_id`, `date`.

- Must be linked to $0 \dots N$ patient.
- Must be linked to exactly $0 \dots N$ staff.
- Must include $0 \dots N$ medications.

Emergency

Attributes: `emerg_id`, `triage_id`, `admission_timestamp`, `outcome`.

- Must involve by $0 \dots N$ patient.
- Can be handled by $0 \dots N$ staff.

Certifications

Attributes: `cert_id`.

- Each certification must belong to exactly 0 or 1 staff.

4 Implementation & Results

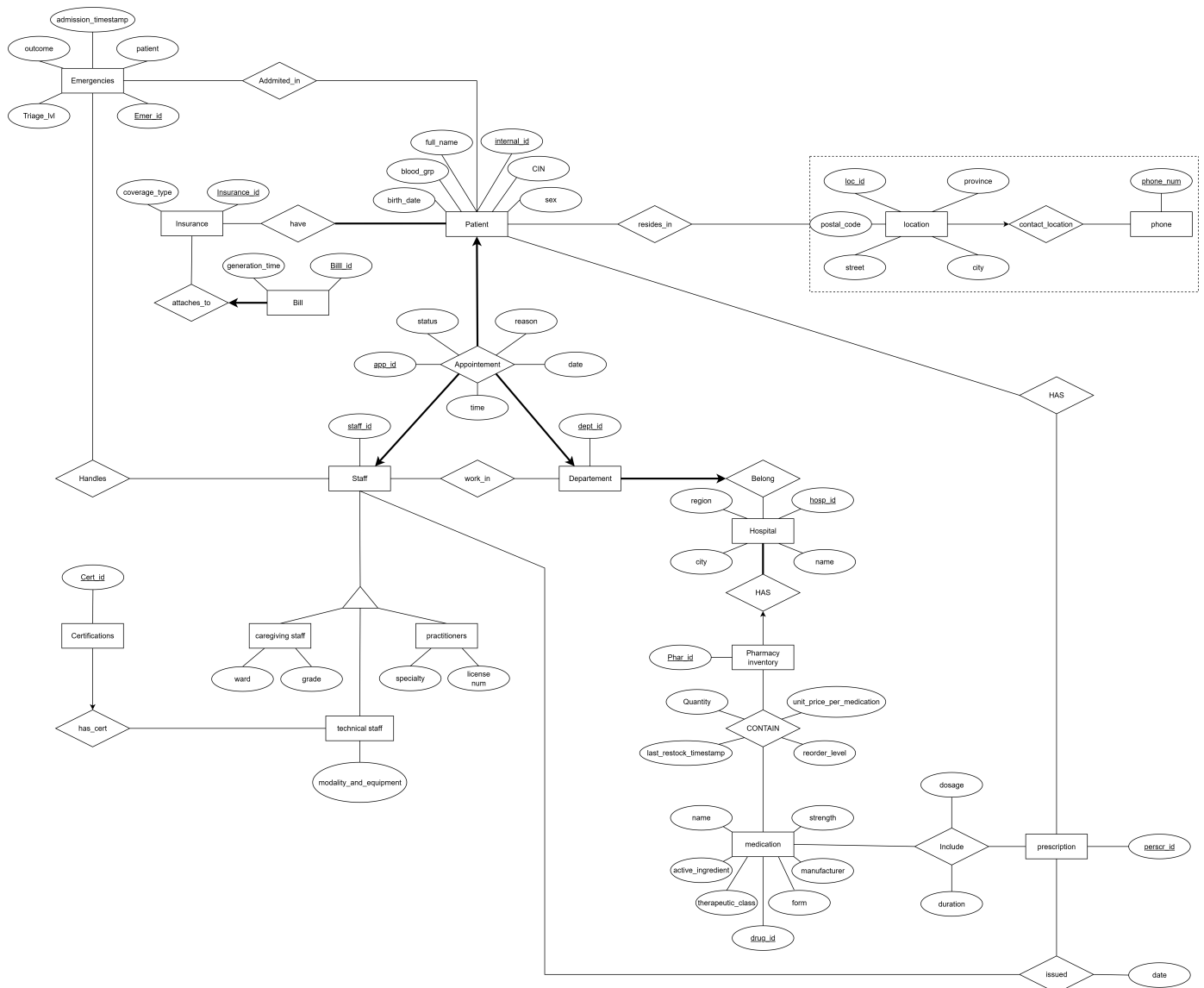


Figure 1: ER Diagram

5 Discussion

Challenges faced, observations, lessons learned.

6 Conclusion

Short summary of the deliverable outcome.