

```
// Hospital Management System MongoDB Design
```

```
// Patient data collection
```

```
{  
  "_id": ObjectId("..."),  
  "patient_id": "P001",  
  "name": "John Doe",  
  "dob": ISODate("1985-04-15"),  
  "gender": "Male",  
  "phone": "+1234567890",  
  "email": "john.doe@email.com",  
  "address": {  
    "street": "123 Main St",  
    "city": "New York",  
    "state": "NY",  
    "zip": "10001"  
  },  
  "emergency_contact": {  
    "name": "Jane Doe",  
    "phone": "+1234567891"  
  },  
  "created_at": ISODate("2025-04-01")  
}
```

```
// doctors` Collection
```

```
{  
  "_id": ObjectId("..."),  
  "doctor_id": "D001",  
  "name": "Dr. Alice Smith",  
}
```

```
"specialization": "Cardiology",
"department_id": "DEPT01",
"phone": "+1987654321",
"email": "alice.smith@hospital.com",
"experience_years": 10,
"available_days": ["Mon", "Wed", "Fri"],
"shift_start": "09:00",
"shift_end": "17:00"
}
```

```
// appointments` Collection
```

```
{
  "_id": ObjectId("..."),
  "appointment_id": "A001",
  "patient_id": "P001",
  "doctor_id": "D001",
  "department_id": "DEPT01",
  "date": ISODate("2025-04-05T10:00:00Z"),
  "status": "Scheduled", // Scheduled, Completed, Cancelled
  "reason": "Routine Checkup",
  "notes": "Patient has high blood pressure."
}
```

```
// departments` Collection
```

```
{
  "_id": ObjectId("..."),
  "department_id": "DEPT01",
  "name": "Cardiology",
  "head_doctor_id": "D001",
}
```

```
"floor": 3,  
"contact_phone": "+1234567890 ext. 101",  
"description": "Heart and cardiovascular care"  
}
```

```
// staff` Collection (Nurses, Admins, etc.)
```

```
{  
  "_id": ObjectId("..."),  
  "staff_id": "S001",  
  "name": "Emily Johnson",  
  "role": "Nurse",  
  "department_id": "DEPT01",  
  "phone": "+1234567892",  
  "email": "emily@hospital.com",  
  "shift": "Day",  
  "hire_date": ISODate("2023-06-15")  
}
```

```
// rooms` Collection
```

```
{  
  "_id": ObjectId("..."),  
  "room_id": "R101",  
  "room_type": "ICU", // General, ICU, Operation, Maternity  
  "department_id": "DEPT01",  
  "floor": 3,  
  "status": "Available", // Available, Occupied, Maintenance  
  "assigned_patient_id": null // or "P001" if occupied  
}
```

```
// `bills` Collection
{
  "_id": ObjectId("..."),
  "bill_id": "B001",
  "patient_id": "P001",
  "appointment_id": "A001",
  "items": [
    {
      "description": "Consultation Fee",
      "amount": 100.00
    },
    {
      "description": "ECG Test",
      "amount": 150.00
    }
  ],
  "total_amount": 250.00,
  "payment_status": "Paid", // Paid, Unpaid, Partial
  "issued_date": ISODate("2025-04-05"),
  "paid_date": ISODate("2025-04-05"),
  "payment_method": "Credit Card"
}
```

```
// medical_records` Collection
{
  "_id": ObjectId("..."),
  "record_id": "MR001",
  "patient_id": "P001",
  "doctor_id": "D001",
```

```
"visit_date": ISODate("2025-04-05"),
"diagnosis": "Hypertension",
"treatment": "Prescribed medication and lifestyle changes",
"prescriptions": [
  {
    "medication": "Lisinopril",
    "dosage": "10mg daily",
    "duration_days": 30
  }
],
"lab_tests": [
  {
    "test_name": "Blood Pressure",
    "result": "150/95 mmHg",
    "status": "Completed"
  }
],
"next_followup": ISODate("2025-05-05")
}
```

// Sample Data Insertion (MongoDB Shell)

// Use hospital_db

// Insert a patient

```
db.patients.insertOne({
  "patient_id": "P001",
  "name": "John Doe",
  "dob": ISODate("1985-04-15"),
  "gender": "Male",
```

```
"phone": "+1234567890",
"email": "john.doe@email.com",
"address": {
  "street": "123 Main St",
  "city": "New York",
  "state": "NY",
  "zip": "10001"
},
"emergency_contact": {
  "name": "Jane Doe",
  "phone": "+1234567891"
},
"created_at": new Date()
});
```

```
// Insert a doctor
db.doctors.insertOne({
  "doctor_id": "D001",
  "name": "Dr. Alice Smith",
  "specialization": "Cardiology",
  "department_id": "DEPT01",
  "phone": "+1987654321",
  "email": "alice.smith@hospital.com",
  "experience_years": 10,
  "available_days": ["Mon", "Wed", "Fri"],
  "shift_start": "09:00",
  "shift_end": "17:00"
});
```

```
// Insert a department
db.departments.insertOne({
  "department_id": "DEPT01",
  "name": "Cardiology",
  "head_doctor_id": "D001",
  "floor": 3,
  "contact_phone": "+1234567890 ext. 101",
  "description": "Heart and cardiovascular care"
});
```

```
// Find all patients treated by a doctor, javascript
db.appointments.aggregate([
  {
    $match: { "doctor_id": "D001" }
  },
  {
    $lookup: {
      from: "patients",
      localField: "patient_id",
      foreignField: "patient_id",
      as: "patient_info"
    }
  },
  {
    $unwind: "$patient_info"
  },
  {
    $project: {
      "patient_name": "$patient_info.name",
```

```
    "appointment_date": "$date",  
    "reason": 1  
  }  
}  
]);
```

// Get unpaid bills

```
db.bills.find( { "payment_status": "Unpaid" }, { "bill_id": 1, "patient_id": 1, "total_amount": 1 } );
```

// List all available ICU rooms, Javascript

```
db.rooms.find({  
  "room_type": "ICU",  
  "status": "Available"  
});
```

// Count appointments per department

```
db.appointments.aggregate([  
  {  
    $group: {  
      _id: "$department_id",  
      total_appointments: { $sum: 1 }  
    }  
  },  
  {  
    $lookup: {  
      from: "departments",  
      localField: "_id",  
      foreignField: "department_id",  
      as: "dept"    }  
  }  
]);
```



```

    }
  },
  {
    $unwind: "$dept"
  },
  {
    $project: {
      department: "$dept.name",
      count: "$total_appointments"
    }
  }
];

```

// Indexing for Performance

// Indexes

```
db.patients.createIndex({ "patient_id": 1 }, { unique: true });
```

```
db.patients.createIndex({ "email": 1 }, { unique: true });
```

```
db.doctors.createIndex({ "doctor_id": 1 }, { unique: true });
```

```
db.doctors.createIndex({ "specialization": 1 });
```

```
db.appointments.createIndex({ "patient_id": 1 });
```

```
db.appointments.createIndex({ "doctor_id": 1 });
```

```
db.appointments.createIndex({ "date": 1 });
```

```
db.bills.createIndex({ "patient_id": 1 });
```

```
db.bills.createIndex({ "payment_status": 1 });
```

```
db.medical_records.createIndex({ "patient_id": 1, "visit_date": -1 });
```

