Designing and Developing Electronic Health System Using XML & RDM

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Abstract

An examination of many hospitals that recently implemented in King Saudi Arabia(KSA) a little electronic health record (EHR) system finds that clinical and administrative leaders built EHR adoption into their strategic plans to integrate inpatient and outpatient care and provide a continuum of coordinated services. Using Relational Data Base Management (RDM) and eXtend Marker Language (XML) Systems .Successful implementation depended on: strong leadership, full involvement of clinical staff in design and implementation, mandatory staff training, and strict adherence to timeline and budget. The EHR systems facilitate patient safety and quality improvement through: use of checklists, alerts, and predictive tools; embedded clinical guidelines that promote standardized, evidence-based practices; electronic prescribing and test-ordering that reduces errors and redundancy; and discrete data fields that foster use of performance dashboards and compliance reports. The system will be developed using PHP Hiper Page(PHP) as web based system.
Key word: XML, RDM,EHR.EMR,GIS,PHP

I-Introduction

Saudi Arabia with an area of 2.15 million km2 and a populations of about 30 Million , with A number of 256 hospitals .The kingdom of Saudi Arabia (KSA) is have 49 000 beds in government hospital and 14000 .n the private hospitals[1]
A-Terms used in the field include electronic medical record (EMR), electronic patient record (EPR), electronic health record (EHR), computer-based patient record (CPR) etc. These terms can be used interchangeably or generically but some specific differences have been identified. For example, an Electronic Patient Record has been defined as encapsulating a record of care provided by a single site, in contrast to an Electronic Health Record which provides a longitudinal record of a patient's care carried out across different institutions and sectors. But such differentiations are not consistently observed. Geographical Information System (GIS) was used to locate the administrative areas , the places of hospitals.

A. Review of the Health Record in   KSA & Health Care Planning in Saudi Arabia

 Health care planning system in Saudi Arabia has different agencies that play important roles in providing health care to residents. These agencies are The Ministry of Health, The National Guard, The Ministry of Defense and Aviation, and The Ministry of Interior [3]. In addition to these agencies there are specialist hospitals in Saudi Arabia that provide health care to specialist health cases. These agencies provide health care services on the basis of exclusive free health care to all citizens. In addition, the private sector in Saudi Arabia plays an increasingly significant role in the Kingdom and coordinates with the referral network and the regulatory requirements of health sector as a whole [9]. The Ministry of health in Saudi Arabia has seen that the primary objective of both the public and private health sector is to improve the health conditions of all citizens through the provision of comprehensive preventive and curative health services throughout the Kingdom, with particular emphasis on equitable and efficient primary health care (ibid). In order to achieve this
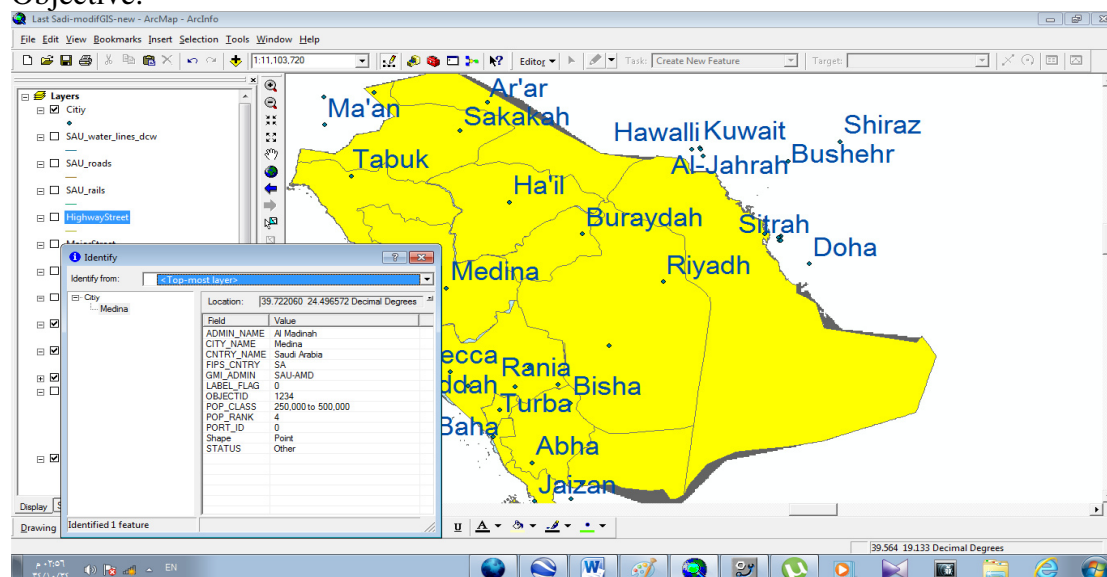Objective.

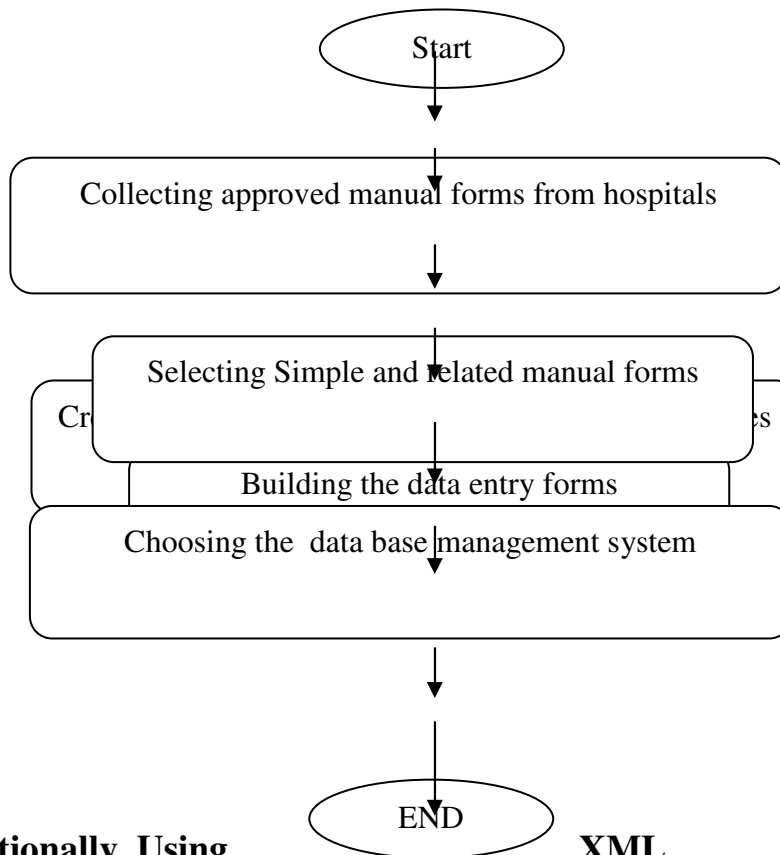**Figure (1) :** shows the map of Saudi Arabia Subareas from [9]

B-Benefits of EMRs

1. Replace paper-based medical records which can be incomplete, fragmented (different parts in different locations), hard to read and (sometimes) hard to find.
2. Provide a single, shareable, up to date, accurate, rapidly retrievable source of information, potentially available anywhere at any time. Require less space and administrative resources.
3. Potential for automating, structuring and streamlining clinical workflow.
4. Provide integrated support for a wide range of discrete care activities including decision support, monitoring, electronic prescribing, electronic referrals radiology, laboratory ordering and results display.
5. Maintain a data and information trail that can be readily analyzed for medical audit, research and quality assurance, epidemiological monitoring, disease surveillance.
6. **C. EHR   and Hospital management planning**

1. **EHR Result management** improve ability for all providers participating in the care of a patient in multiple settings to quickly access new and past test results would increase patient safety and the effectiveness of care.
2. **EHR provide** the ability to enter and store orders for prescriptions, tests, and other services in a computer-based system should enhance legibility, reduce duplication, and improve the speed with which orders are executed
3. **EHR suport decision support** , using reminders, prompts, and alerts, computerized decision-support systems would help improve compliance with best clinical practices, ensure regular screenings and other preventive practices, identify possible drug interactions, and facilitate diagnoses and treatments
4. **EHR gives good communication and connectivity** and support efficient, secure, and readily accessible communication among providers and patients would improve the continuity of care, increase the timeliness of diagnoses and treatments, and reduce the frequency of adverse events.
5. **EHR Patient support** give patients access to their health records, provide interactive patient education, and help them carry out home-monitoring and self-testing can improve control of chronic conditions, such as diabetes
6. **EHR give**s Computerized administrative tools, such as scheduling systems, would greatly improve hospitals' and clinics' efficiency and provide more timely service to patients.
7. **EHR rapid progress for** reporting electronic data storage that employs uniform data standards will enable health care organizations to respond more quickly to federal, state, and private reporting requirements, including those that support patient safety and disease surveillance

.**III-The design Methodological of electronics forms based on the existing manual**

A-System flowcharting.

Start

Collecting approved manual forms from hospitals

Selecting Simple and related manual forms

Cr   s

Building the data entry forms

Choosing the data base management system

END

B-Functionally Using   XML

Stylus Studio X15 XML Enterprise Suite Software was used to edit the contents of the system

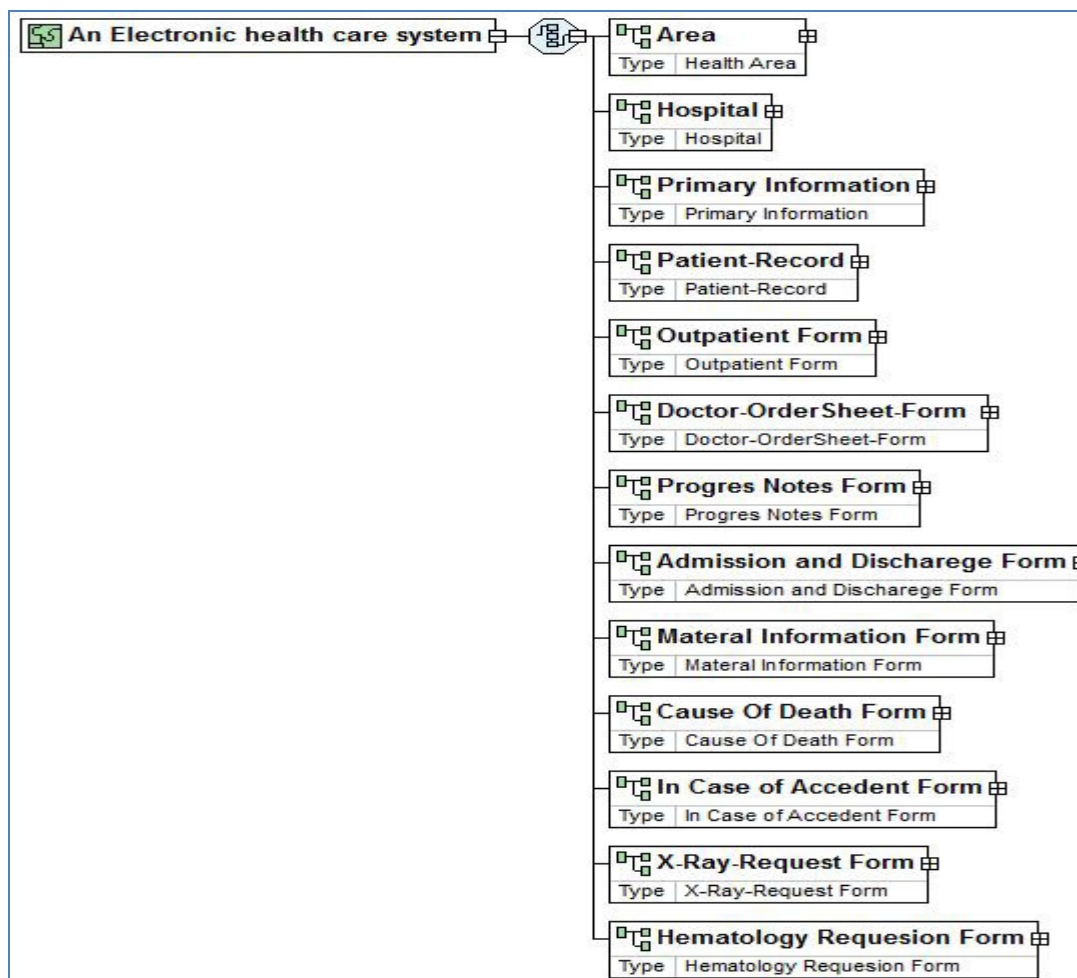Developing the security forms and the login

Create reports and queries for searching

Figure (1)-XML Instance Representation of the whole EHR system diagram

C--XML Instance Representation of the whole EHR system code

<Area> Health Area </Area> [1]

<Hospital> Hospital </Hospital> [1]

<Primary Information> Primary Information </Primary Information> [1]

<Patient-Record> Patient-Record </Patient-Record> [1]

<Outpatient Form> Outpatient Form </Outpatient Form> [1]

<Doctor-OrderSheet-Form > Doctor-OrderSheet-Form </Doctor-OrderSheet-Form >

<Progres Notes Form> Progres Notes Form </Progres Notes Form> [1]

<Admission and Discharege Form> Admission and Discharege Form </Admission and Discharege Form> [1]

<Materal Information Form> Materal Information Form </Materal Information Form> [1]

<Cause Of Death Form> Cause Of Death Form </Cause Of Death Form> [1]

<In Case of Accedent Form> In Case of Accedent Form </In Case of Accedent Form> [1]

<X-Ray-Request Form> X-Ray-Request Form </X-Ray-Request Form> [1]

<Hematology Requesion Form> Hematology Requesion Form </Hematology Requesion Form> [1]
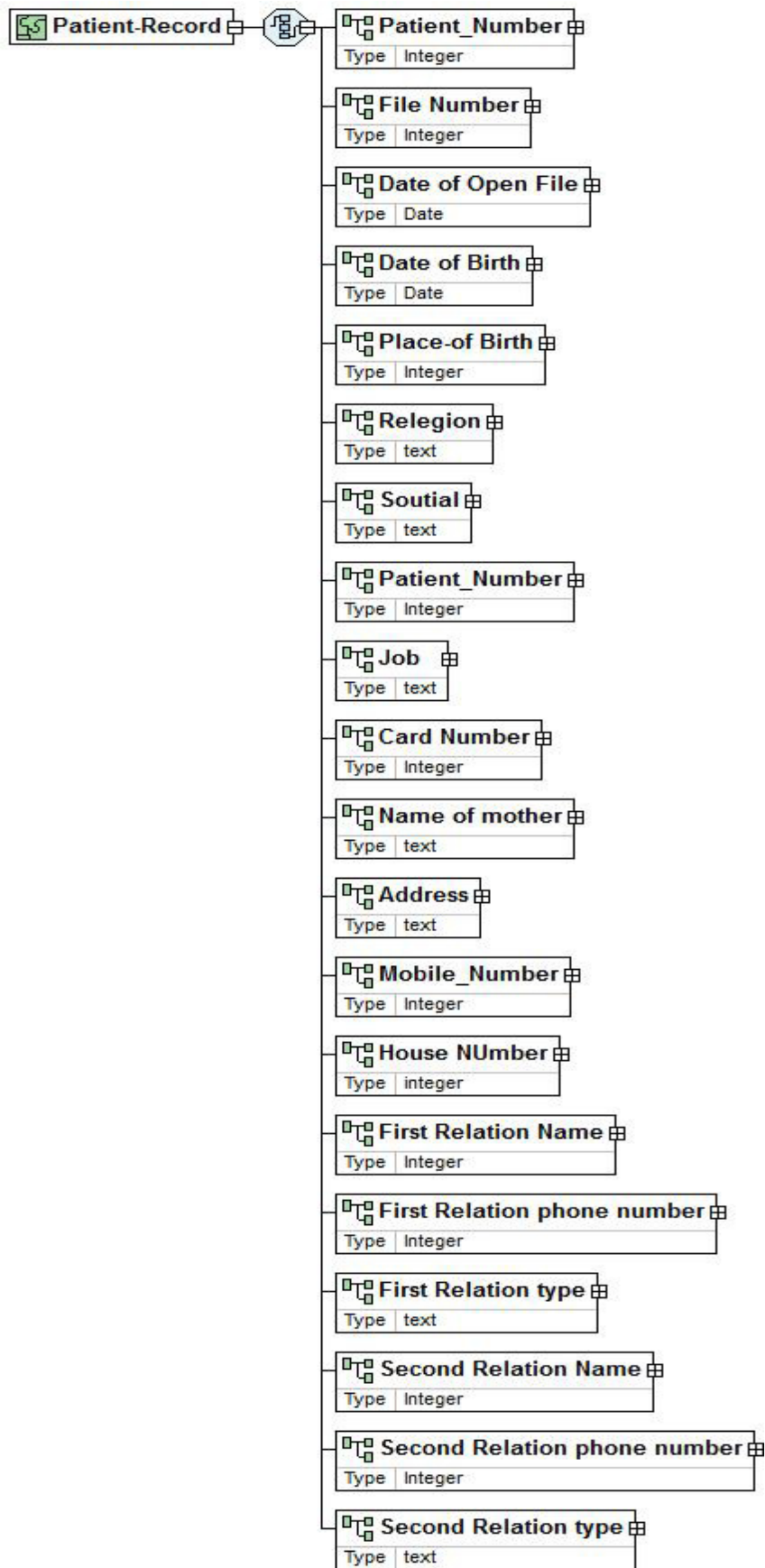
Figure (2)-XML Instance Representation of the Patient Record system diagram

E--XML Instance Representation of the Patient Record EHR system code
<Patient_Number> Integer </Patient_Number> [1]
<File Number> Integer </File Number> [1]
<Date of Open File> Date </Date of Open File> [1]
<Date of Birth> Date </Date of Birth> [1]
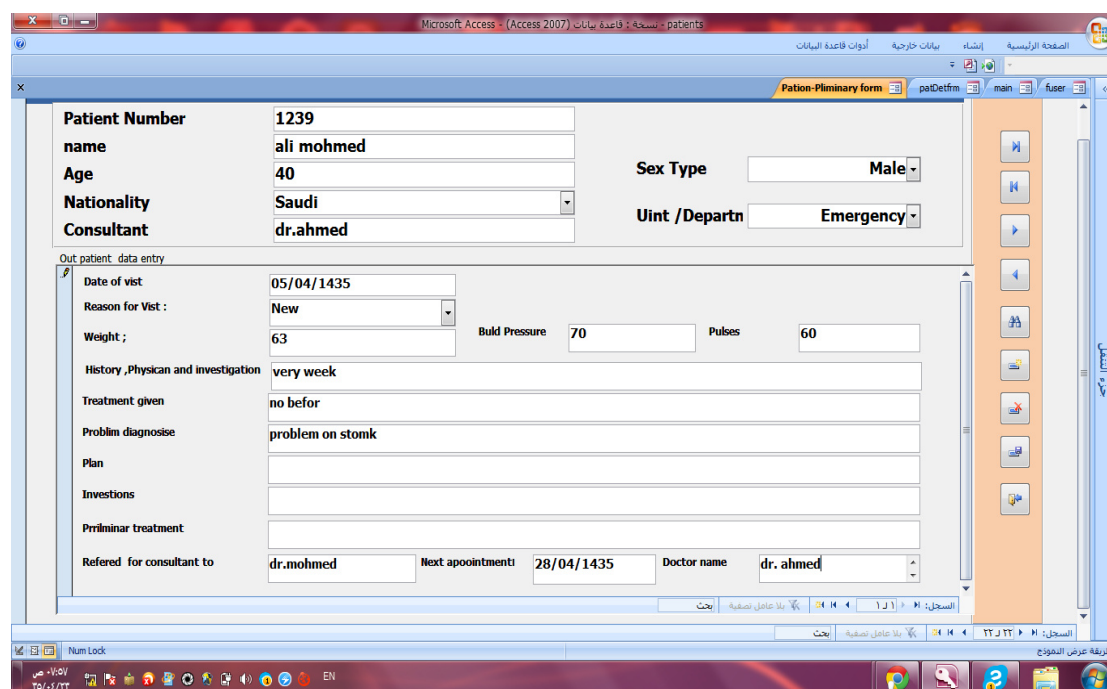<Place-of Birth> Integer </Place-of Birth> [1]
<Relegion> text </Relegion> [1]
<Soutial> text </Soutial> [1]
<Patient_Number> Integer </Patient_Number> [1]
<Job> text </Job> [1]
<Card Number> Integer </Card Number> [1]
<Name of mother> text </Name of mother> [1]
<Address> text </Address> [1]
<Mobile_Number> Integer </Mobile_Number> [1]
<House NUmber> integer </House NUmber> [1]
<First Relation Name> Integer </First Relation Name> [1]
<First Relation phone number> Integer </First Relation phone number> [1]
<First Relation type> text </First Relation type> [1]
<Second Relation Name> Integer </Second Relation Name> [1]
<Second Relation phone number> Integer </Second Relation phone number> [1]
<Second Relation type> text </Second Relation type> [1]
</...>

Figure (3)- the Patient Record system data entry screen for the Outpatient Data entry Screen

IV-Creation of Rational Data base system and Tables

A-Relations between tables was established and generated figure (3) ,forms was build of the patient data entry ,consists of :

1- Hospital manpower basic information
2- Patients basic information
3- Outpatient transaction record
4- The clinical system
5- Martial information
6- In case of accident
7- Death causes
8- Doctor orders
9- X_ray
10- operation
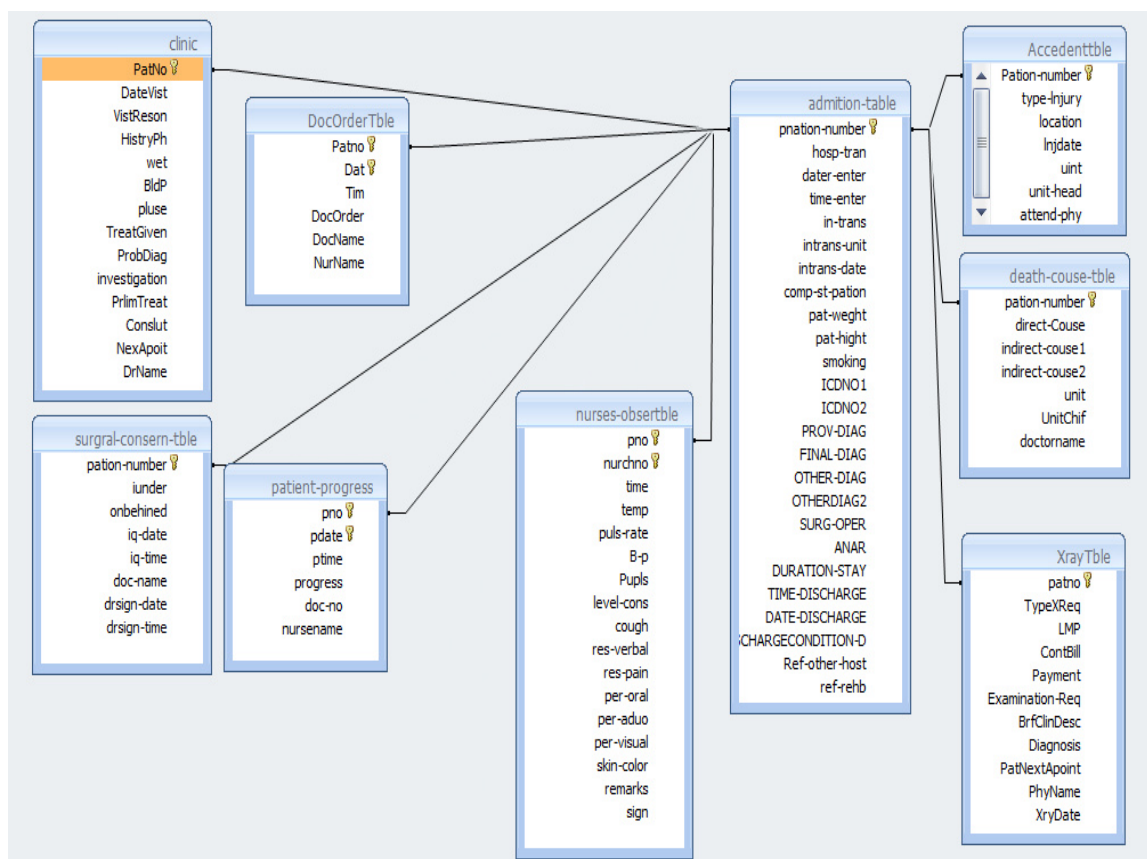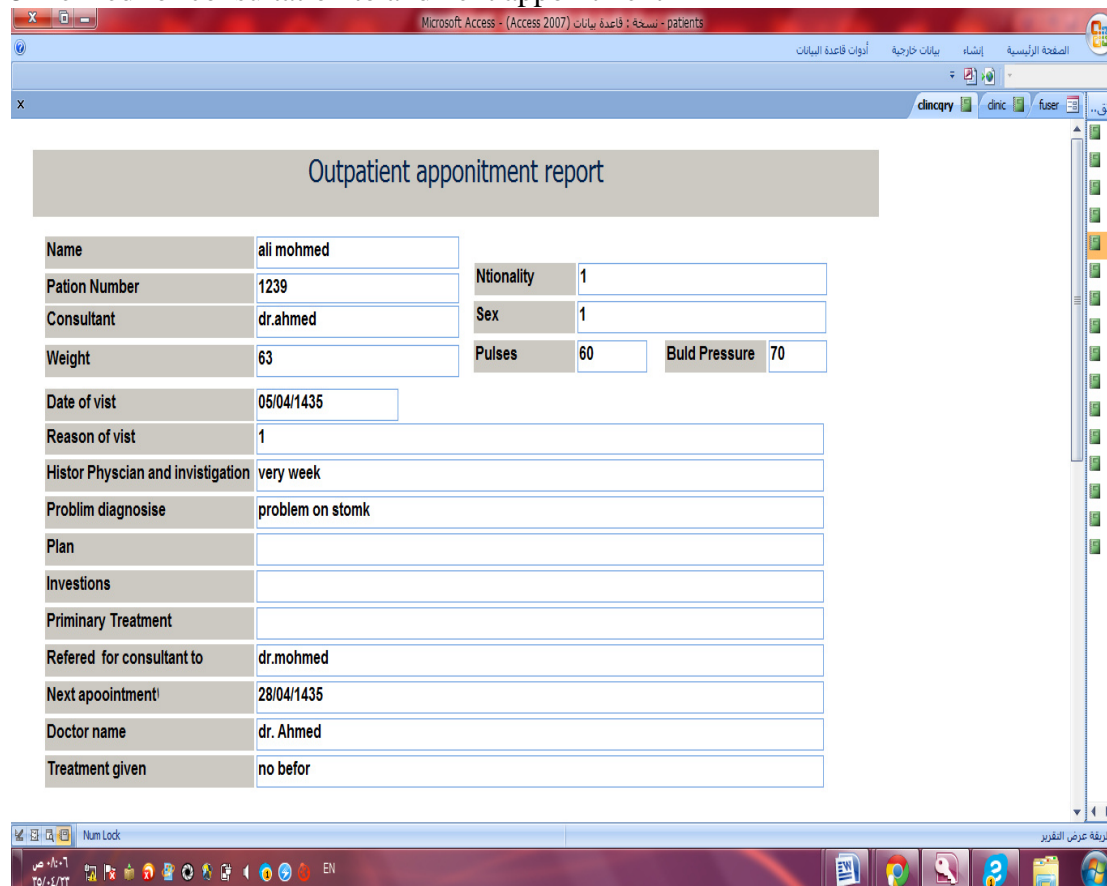
Figure(4) The relations between tables of the system

B-Outpatient FORM data entry :

Consists of master form and detail form , the master form consists of :-
patient number, patient name , age, sex, nationality ,the consultants and the unit or the department ,The detail of the system consist of :-

1-Date, time, reason for visit , type of visiting t, weight, blood pressure, the hurt pulse

2-History , physical examination and investigation

3-The treatment given to the patient , the problems and the diagnoses

4-Priminary treatment

5-Refrred for consultation to and next appointment
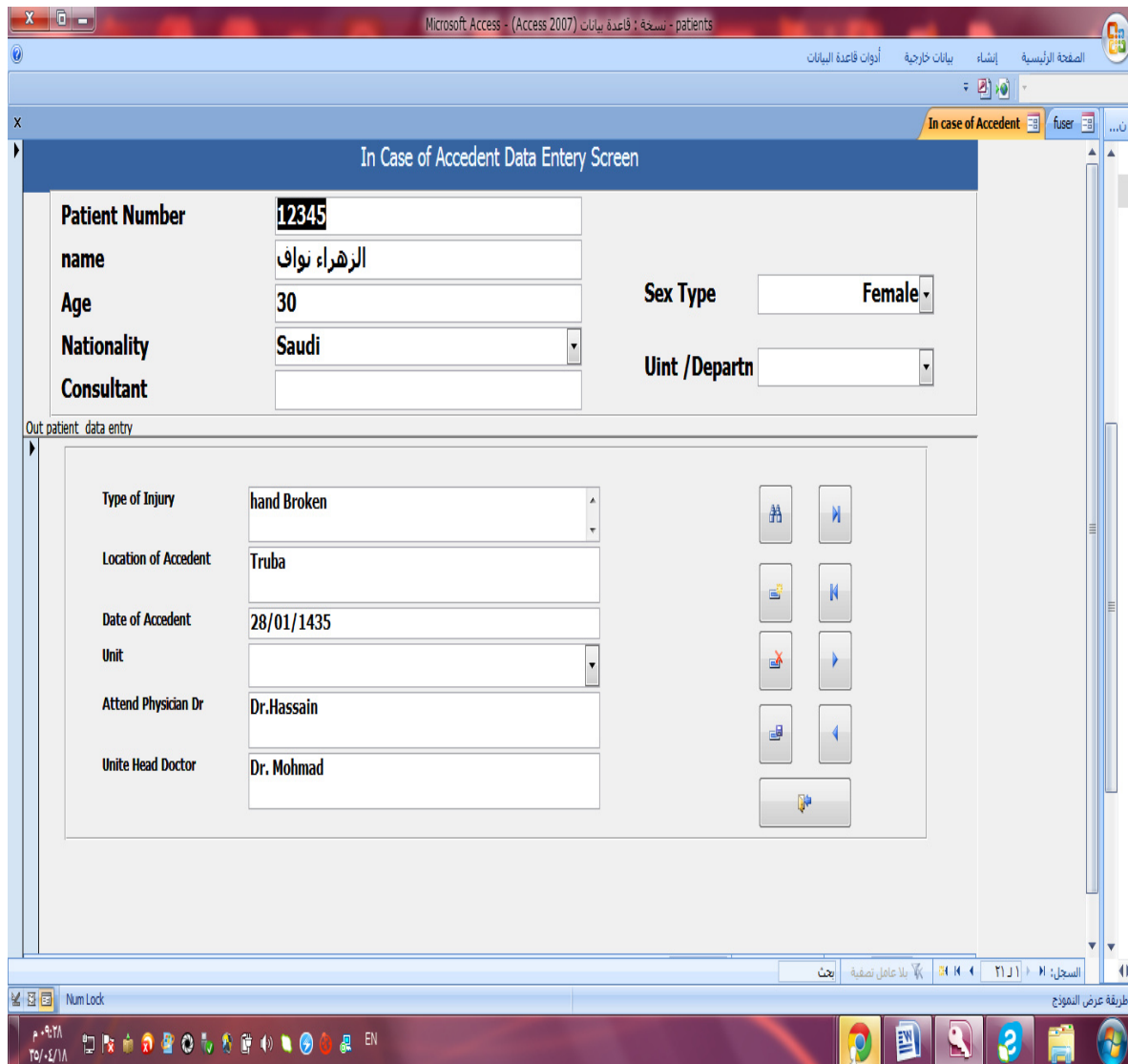
Figure (5) Shows the Outpatient next appointment report

C-In case of accident data entry master detail

   The master form consists of in case of accident was linked with the patient basic inform at like :-

The patient number, patient name , Age, nationality, sex type, department and the consultant doctor using the patient number as the primary key , the incase of accident Type of Injury , location of accident , the date of accident ,Attend physician Dr., Unit head dr. A report was designed for printing the accident in many types ,time of the accident, the attend physician figure (6).The purpose of the form is to record the data of patients the in case of accident information

Figure (6) In case of accident data entry master detail

D-Cause of death data entry screen

Cause of death form: Consists of master form and of patient basic data

The master form consists of :patient number, patient name , age, sex, nationality ,the consultants and the unit or the department

Figure (7) Cause of death data entry screen paper form
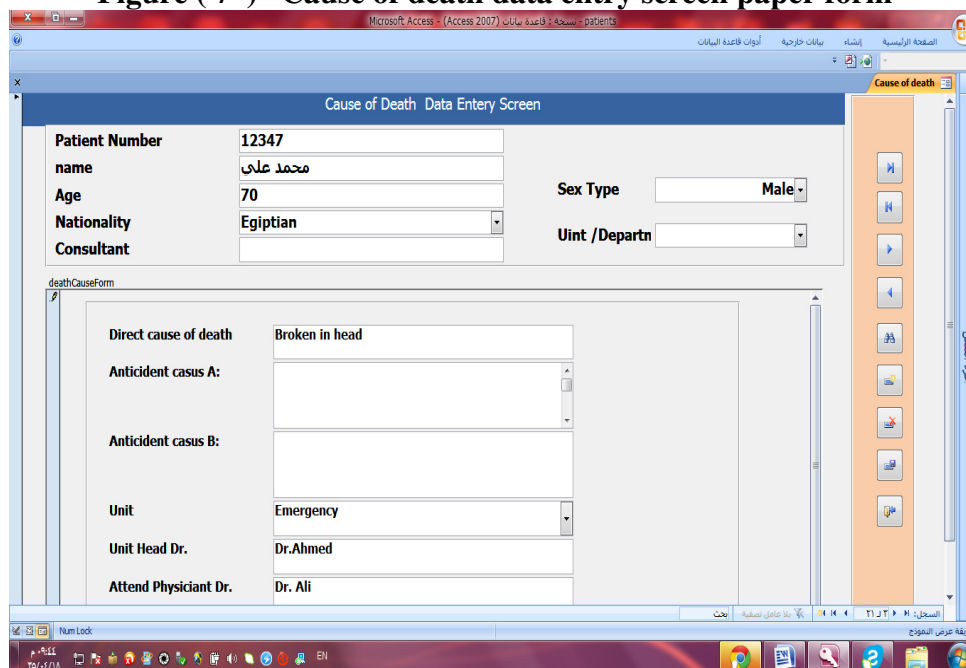
Figure (8) Cause of Death data entry master detail form

The cause of death   contains :-

1-Direct cause, anticiedent cause A:

2- anticiedent cause B

3- the date and the signature of the doctor

4-.Attend physician Dr., Unit head dr.

The purpose of the form is to record the data of patients and the in case of death the information

F-Doctor Order data entry screen

Consists of master form and of patient basic data **,** patient number, patient name , age ,sex, nationality ,the consultants and the unit or the department

The detail of the doctor order for consists of

1-the patient number

2- the date , the time when the doctor visit the patient

3-,the doctor orders

4- department and the nurse name

5-The physician name
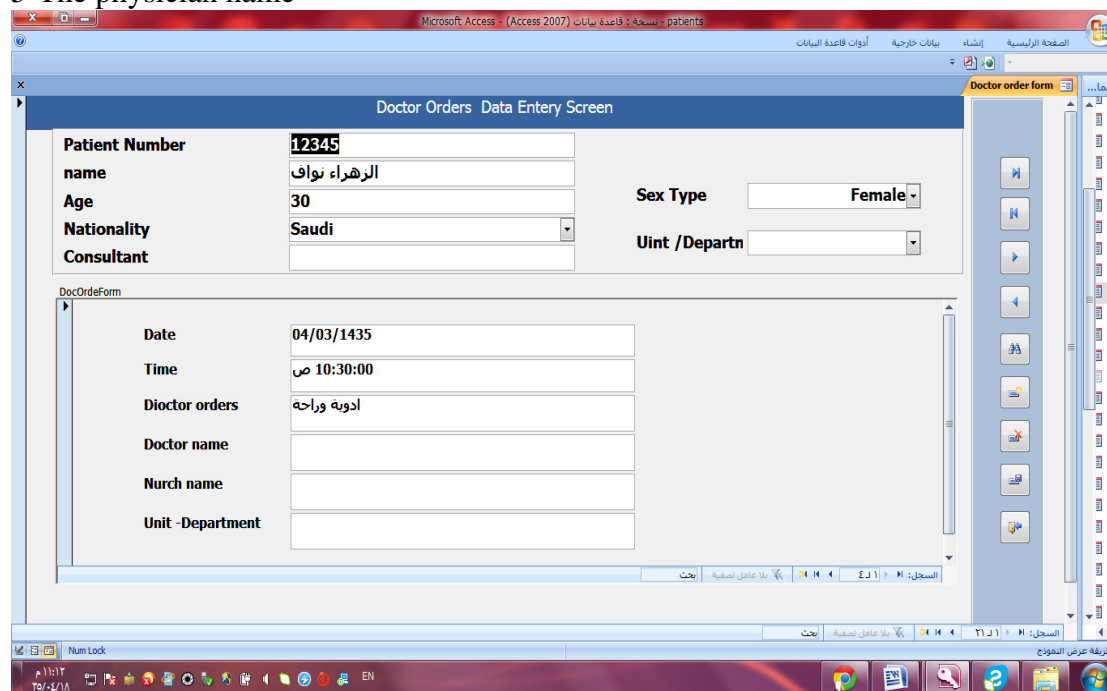
Figure (9) Doctor orders **Data entry form**

H-Clinical chemistry requisition form

Consists of master form and of patient basic data **,** patient number, patient name , age, sex, nationality ,the consultants and the unit or the department

The detail of the clinical chemistry include the information's of :-

1-Specimen Detail , 2-Lab sample number ,3-Processing priority

4-recived by ,5-Orher test ,6-Clinical history ,7-Reason for ordering the tests

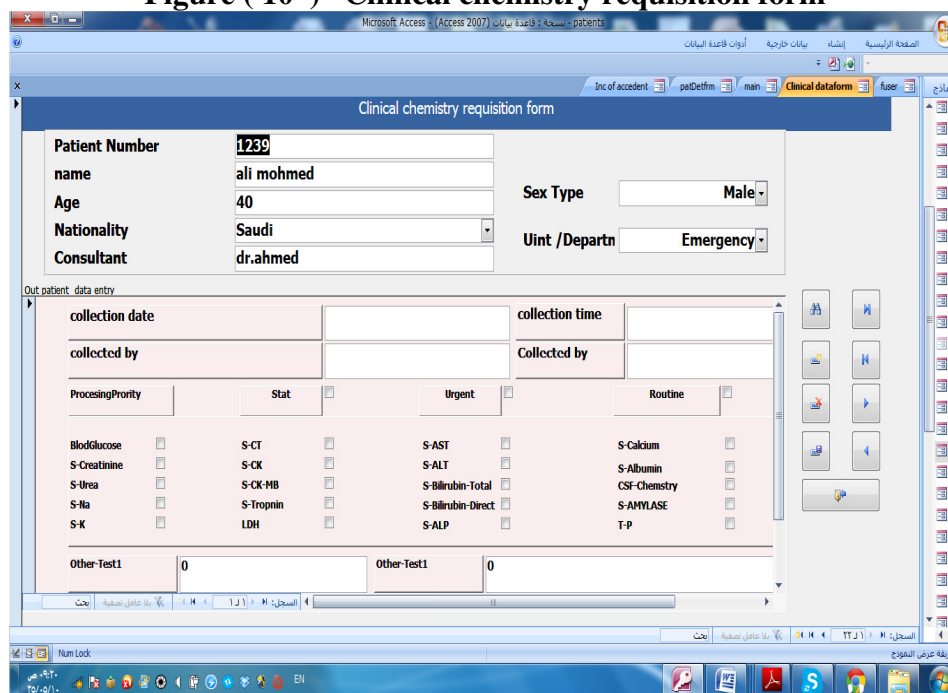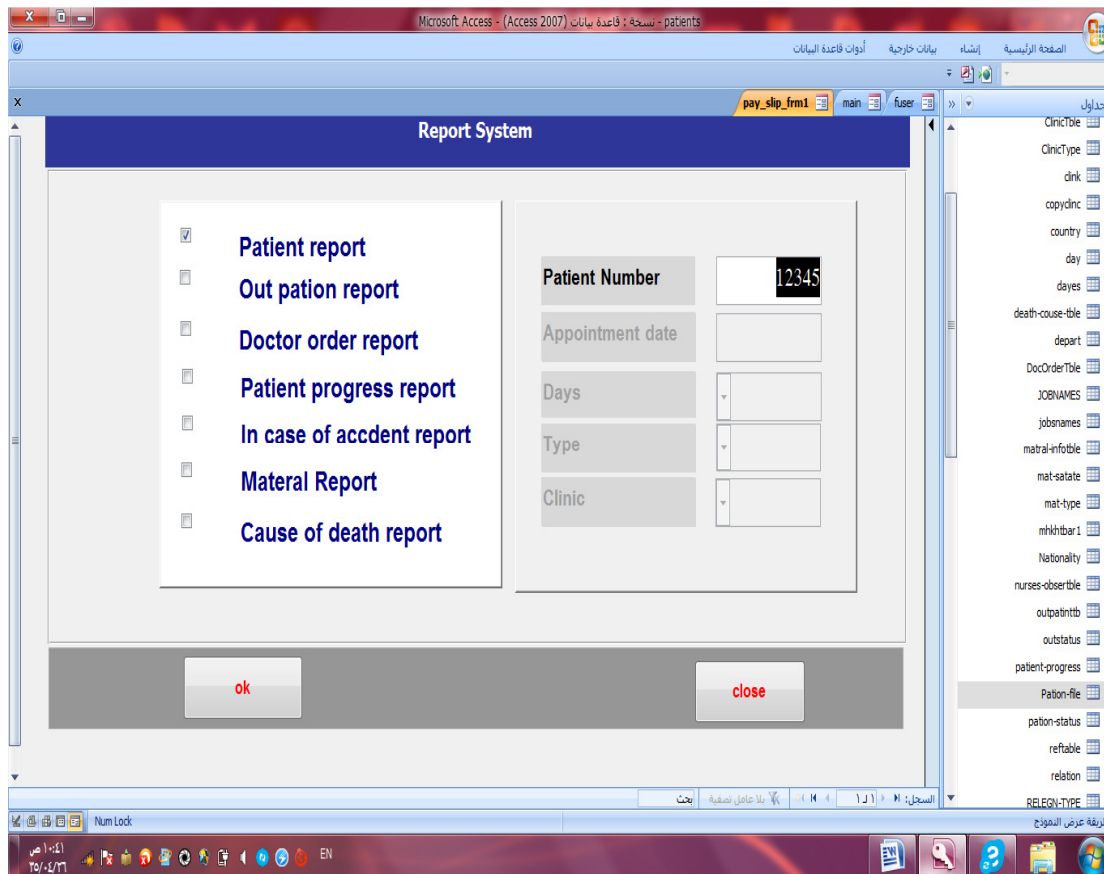**Figure (10)   Clinical chemistry requisition form**

Figure (11) Clinical chemistry requisition data   entry form

## V-Report system screen

The system consists of the following reports

1-paitent report

2-outpatient report

3-Doctor order report

4-Patient progress report

5-In case of accident report

6-Materal Report

7-Cause of death report

1-Pation report :-

The figure (10) shows the selection of the report and entering the number of the patient.
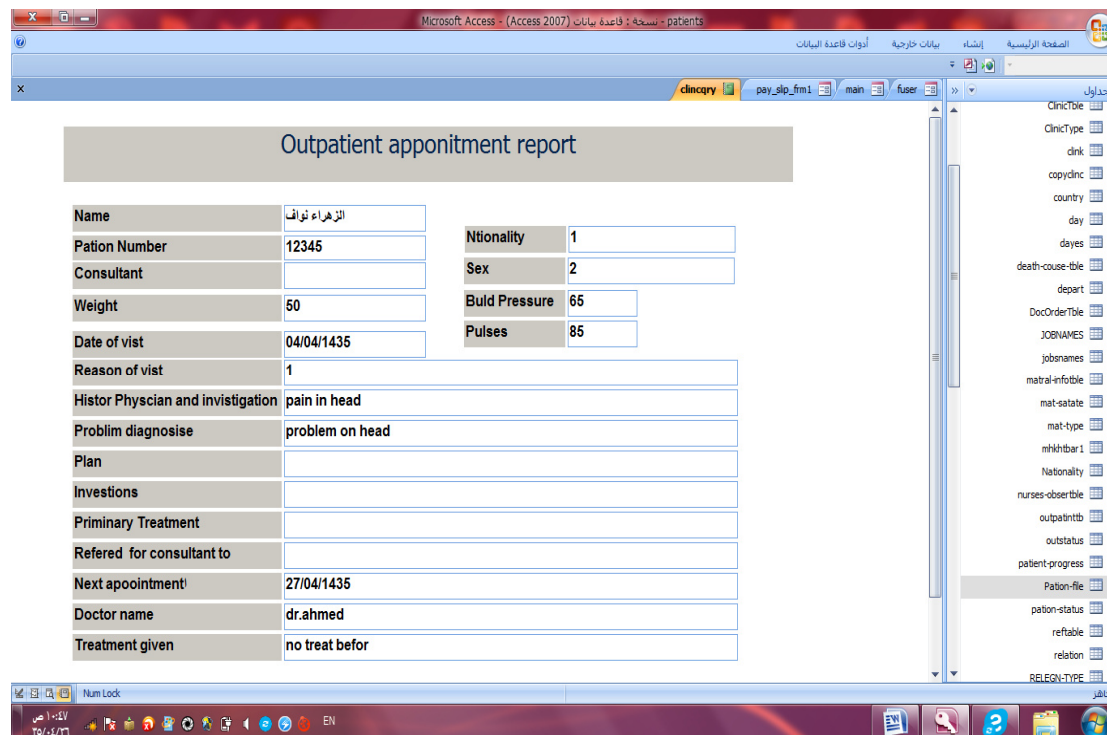
A-Patient reports

Two types of report was designed for the patients , report for one Patient , report for all patient and special report of patients by categories line sex type, nationality
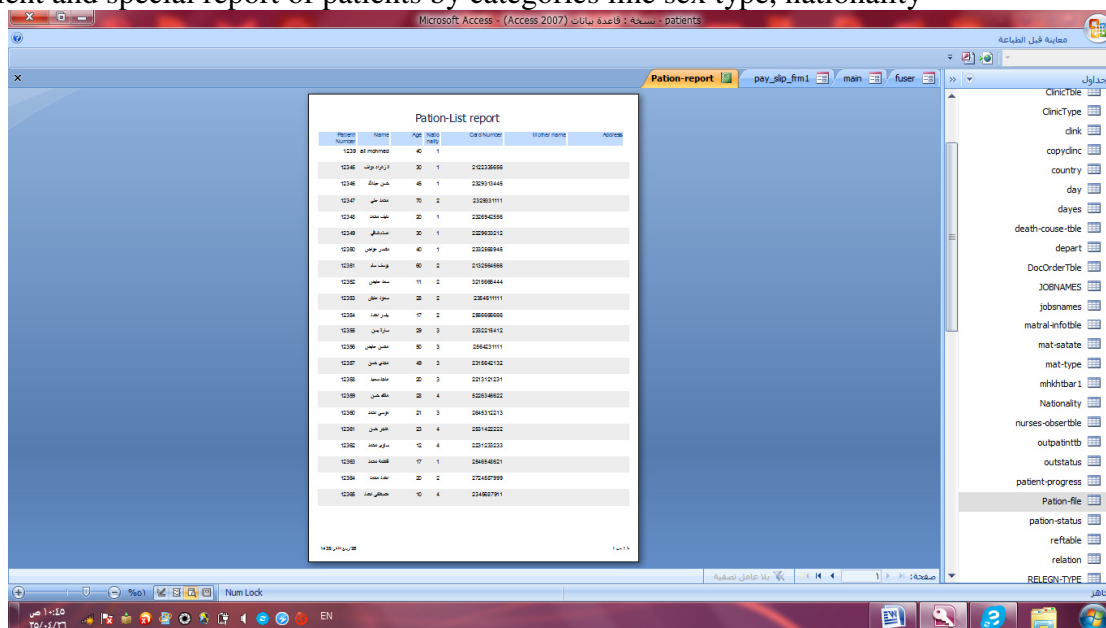
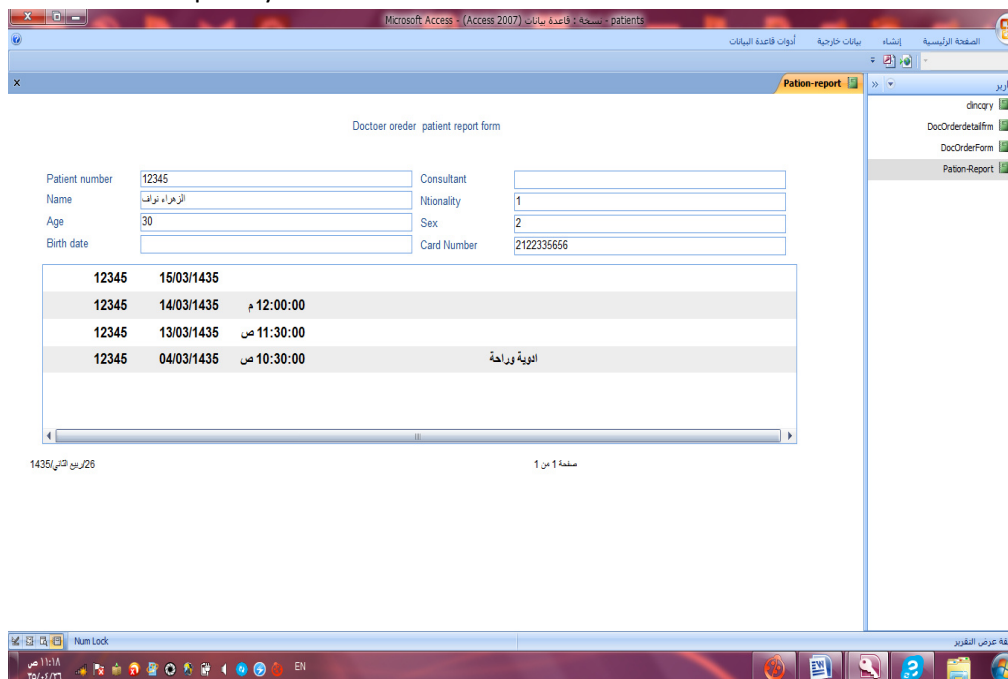The figure (10) shows All patients report system

2-Outpatien report

The figure (10) shows Outpatient appointment report

1- Doctor order report system

The figure (11) shows Doctor order report system

V-Conclusion & Future work

This research provides recommended actions to support the development of an objective EHR usability evidence base and formative policies to systematically improve the usability of EHR systems. In a companion document, *Electronic Health Record Usability: Evaluation and Use Case Framework*, the evolving role of EHRs and the need for a practical, common evaluation framework is discussed. Information design principles tailored to EHR

considerations along with initial approaches to heuristic usability evaluation and representative use cases are also provided. These two companion documents on EHR usability are intended to foster discussion on the importance of usability and guide federally funded research activities as well as inform policy development in this area. Through collaborative efforts between physicians, researchers, and vendors these recommendations and frameworks can be further refined to promote the necessary industry focus on EHR design and its significance to consistently delivering desired improvements in care quality and efficiency. In the future the electronic health system will be developed using PHP to be browsed on the web

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