# INTELLIGENT IRAQI HEALTH SYSTEM (IIHS) USING ONLINE ANALYTICAL PROCESS (OLAP) MODEL

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**ABSTRACT**. Intelligent Iraqi Health System (IIHS) is an intelligence system using a set of methodologies, architectures, processes, and business intelligence technology. These technologies integrate huge amounts of right data and present the information in the given time. IIHS analyzes the data from operational systems into meaningful and useful information by using data warehousing technologies. The main function of IIHS technology is to produce analytical report, which helps the management make right decision making. Business Intelligence (BI) component, called Data Warehouse (DW) is a database designed to support decision making. The DW takes data from operational applications and loads the data to the destination DW to provide the information for supporting decision making. The Iraqi Ministry of Health, which is responsible agency to manage health activities in Iraq, needs an analytical report for strategic decision making. This paper has explained how to design and develop (IIHS) by using Online Analytical Process (OLAP) model to be used by decision makers in the Iraqi Ministry of Health. Computer System Usability Questionnaire (CSUQ) was used to evaluate the prototype of the IIHS. Finally, this paper provides a guide for BI developers and decision maker in the Iraqi Ministry of Health the benefit of OLAP model for developing information systems.

**Keywords**: Business Intelligence, Data Warehouse, OLAP, Health Information

## INTRODUCTION

Iraqi Ministry of Health is the center of responsibility for all of medical activities in the country. It covers a wide array of areas including clinics, planning, prevention, health inspections, and medication. The management level needs a good strategic planning and decision making tools to achieve their mission. Right now, Iraqi Ministry of Health doesn't have any analytical tools to handle the channel of management, analysis, and monitoring the health activities. Without analytical reports, it will be exhausted and difficult to manage a team to have a right picture about fundamental levels of information with the huge number of the operational database. The operational database lacks of effective organization, sorting of objective analysis, which is a very difficult use it to make a decision (Zhang, 2009). The main problem for operational database that has not been able to meet the requirements of the decision makers that need an intelligent analysis tool (Tong, Cui, & Song, 2008). Therefore, the information must be realistic, accurate and systematic is needed to derive and determine the achievement of organizational objectives. The main objectives of this study are determining the right requirements for developing BI, designing and developing a BI system

by using the DW Model for analytical reports, finally to validate and evaluate the usability and the performance of BI System. DW model is one of the Business Intelligence BI technologies to extract, summarize, cleansing and transform data from various sources to the analytical report.

## LITERATURE REVIEW

BI is a set of concepts, applications, methodologies and skills that are used to collect a widely separated data in the organization and turning it into useful information. (Hancock, Christian, Toren, & Roger, 2007) This information can be displayed by analysts and decision-makers using BI reporting and analysis capabilities. BI solutions, typically permit the organizations to gather, access, store and analyze corporate data sources for business planning and decision-making purpose (Mun, 2007; Ta'a, Azman, & AbuBakar, 2006). Figure 2 is despites the conceptual architecture for BI.

1. Transactional databases: sources data are often relational databases; it comes from one or more operational database.
2. Extraction, transformation, and loading (ETL): data sources are transferred and consolidated (copy data) into the data warehouse, but it's more complicated than just copy or moving data.
3. Data warehouse (DW): transformed data is transferred and merge into relational database called a "data warehouse." Data warehouse physically resides in relational systems such as Microsoft SQL Server, Oracle or IBM's DB2. A data warehouse contains the read-only data representing the organization's information at regular points in time- monthly, daily, or hourly. The important considerations in DW are data quality and query speed.
4. Business Intelligence (BI): BI systems can generate any kind of reports that allow managers and decision-maker to treat organization's information using a variety of applications and tools such as: OLAP, live reporting, scorecards, or data mining. (Nescu, 2007)

## INTELLIGENT IRAQI HEALTH (IIHS) REQUIREMENTS, PROTOTYPE DESIGN AND DEVELOPMENT

This paper proposes suggests how to design and develop IIHS by using an OLAP model in the Iraqi Ministry of Health. First, the prototype began with the requirements analysis. The gathered requirements are based on Statistics Center in the Iraqi Ministry of Health and the results show in Table 1.

**Table 1. Requirements**

| No | Requirements | Priority |
|---|---|---|
| 1 | The system needs to determine the percentage of appearance for each disease for different genders and years. | High |
| 2 | The system needs to determine the percentage of appearance for each disease in different states and years. | High |
| 3 | The system needs to determine the percentage of appearance for each disease in different hospitals and years. | High |

| | | |
|---|---|---|
| 4 | The system needs to determine the total (%) diseases appear in Iraq. | Medium |
| 5 | The system needs to compare the percentage of appearance for the same type of disease in different years. | High |
| 6 | The system user needs to determine the total patient categorized by genders and states according to the times. | High |

Furthermore, in order to design and develop IIHS the use case diagram in Unified Modeling Language (UML) is used to model the requirement. Although many requirements are important, some are more important than others, and the reporting requirements should be prioritized. Therefore, to identify which requirements are the most critical. In our system, we have functional requirements which are Log in, Register Member, View Report, Doing ETL and generate reports. We have also three main actors (Manager, Admin, and Staff) as shown in the Use Case. The use Case diagram is a set of scenarios that explaining an interaction between both the user and system. The use case diagram aims to show the relationship between users and use cases. This scenario based technique can assist to walk through the whole system or process, step by step, as a user, it helps to understand how the system or service would work on this project. The requirement for IIHS prototype needs multiple use cases to understand the functionality of the whole system. Figure 1show the Use Case Diagram for IIHS.

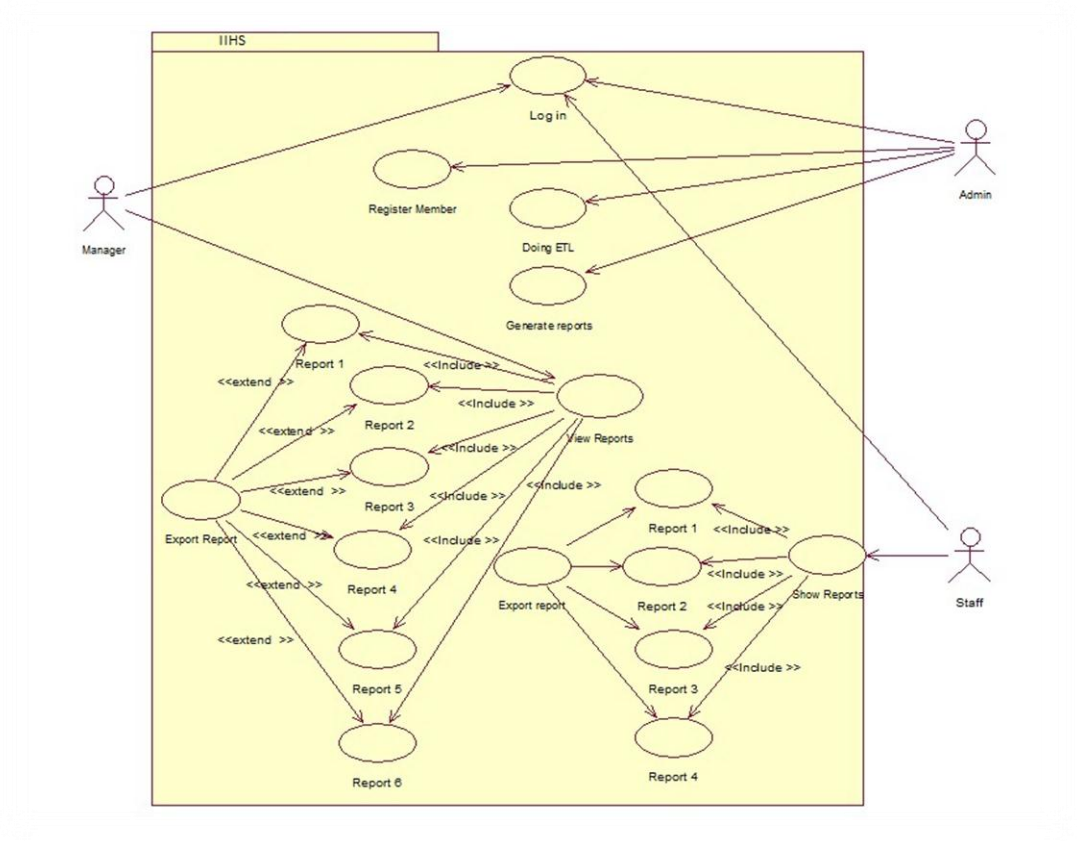


**Figure 1. Use Case Diagram Level 1 for IIHS**

## IIHS ARCHITECTURE FOR DEVELOPING ANALYTICAL REPORTS

IIHS architecture consists of data sources, integration services (ETL), DW layer (Dimensional Modeling), analytical services and presentation layer for developing Iraqi health analytical reports. Figure 2 below shows IIHS architecture for developing analytical reports in this model.

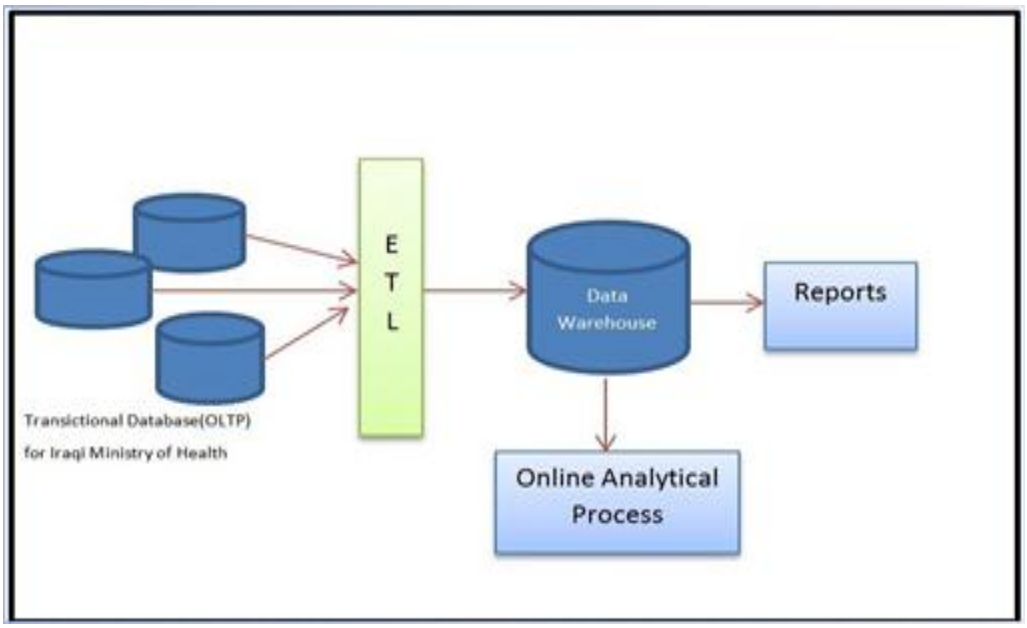


**Figure 2. IIHS Architecture**

The decision makers need multiple data sources to build an analytical report. However, the data are integrated and located in different locations. The ETL Tools was used to cleanse and summarize the data. This process involves in the extract, transfer and loading the data from several data sources to DW with the dimensional modeling design. The IIHS dimensional model is designed based on a Star Schema which is consisting, dimension and fact tables. The fact table contains measures (the total number of disease appearance in Iraq) and foreign/surrogate keys, which refer to primary keys in the dimension tables. Dimension tables in IIHS, hold descriptive data that reflect the dimensions, or attributes health domain as a hospital type, disease category, gender, state, and time dimensions.

With the large number of the reports' requirements, the OLAP was appeared to provide the management level with deeper understanding and knowledge about many aspects of their organization data through fast, consistent, interactive access to a wide variety of possible views of the data. For IIHS prototype, SQL Server Analysis Services (SSAS) was used to create the IIHS OLAP cube. OLAP cube can also be defined as the ability of manipulating and analyzing data from multiple perspectives due to some limitations of relational databases. Furthermore, It can be identified as a good tool in the DW to come with the results (Mo et al., 2010). This result identifies by the manager to increase the organization work to reach the highest position between organizations by it. The term multidimensional cube is used because of the multi layers of data that used in his architectural to show the result. Nowadays, OLAP is known as the best and strongest technique among the BI tools (Moskalenko, 2008). Figure 3 shows the diagram of IIHS Online Analytical Processing.

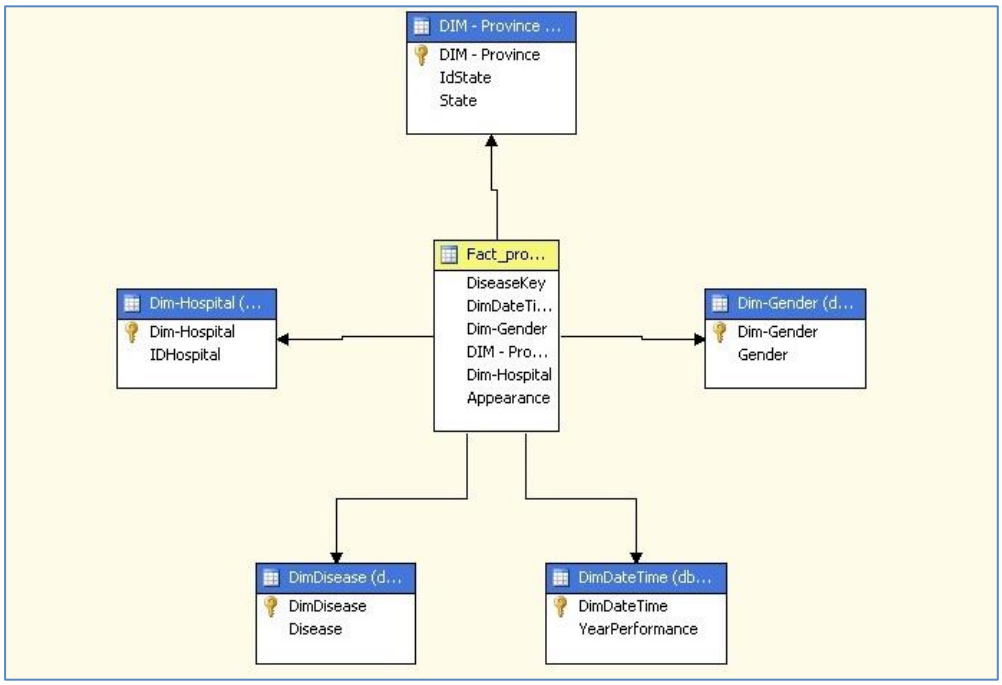


**Figure 3. Star Schema Model of IIHS**

For a presentation layer, SQL Server Reporting Services (SSRS) was used to create IIHS analytical reports. SSRS is a server-based reporting platform that provides comprehensive reporting functionality for a variety of data sources (Lisin & Joseph, 2006). It is used to determine the data set, type of chart for each report and create a flexible analytical report. The collection of reports is stored in the central repository and made accessible to the users through a web-based application. Figure 4 shows the examples of IIHS analytical reports in the web based application.

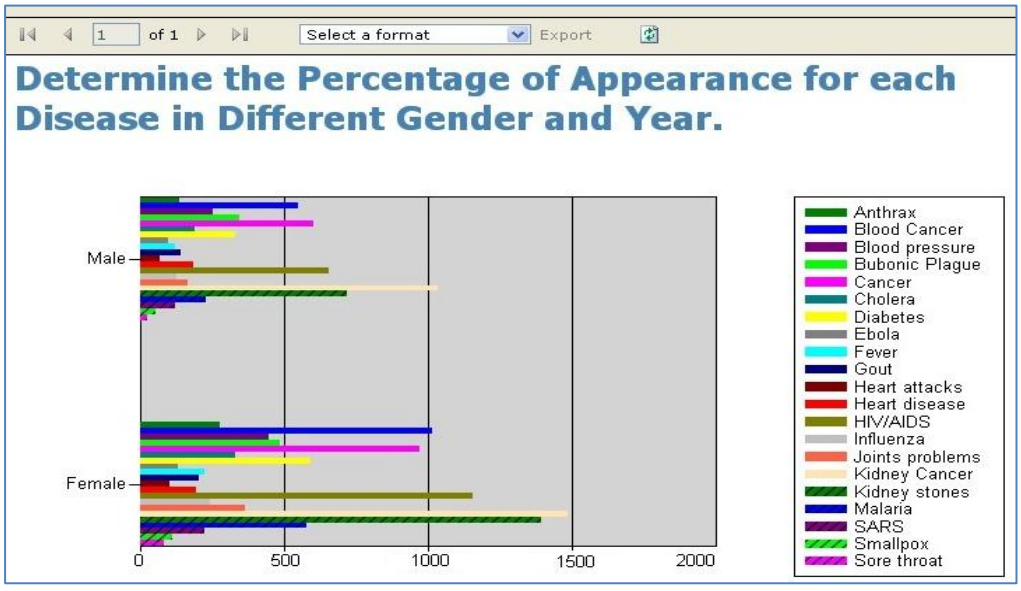


**Figure 4. Example of IIHS OLAP Reports**

IIHS helps Iraqi Ministry of Health management to make better decision making and understanding the information about the health care in Iraq. The important task in IIHS is to

integrate data sources from multiple sources and transform to DW model, which is, enable to present an analytical report from many dimensions.

## EVALUATION

IIHS has been tested through the user feedback system by using the Computer System Usability Questionnaire (CSUQ), which measures satisfaction and consumer usability. The questionnaire is adapted from Lewis (Lewis, 1995), it contains of 19 questions and 7 degrees of Likert scale (1-strongly disagree – 7-strongly agree). There are 20 respondents participated in these questionnaires which are, tested the IIHS prototype by management staff in the Statistics department in the Iraqi Ministry of Health in Basra. The results showed that the users satisfied with the IIHS and strongly agreed that the system is ease to use. Furthermore, the respondents also strongly agreed that the information provided by IIHS is meaningful and easy to understand.

## CONCLUSION AND FUTURE WORK

In conclusion, every organization such as universities, companies, banks and factories have huge operational data for decision making and analytical reports. An operational data comes from different locations, various operating systems and many types of databases should be integrated into analytical data storage. To become a quality and meaningful information, the data should be clean, aggregate and summarize in DW by using OLAP cube. Then, from the OLAP cube, the managers can access to the strategic and analytical reports without referring to the operational system. This research shows the process of how to design and develop analytical reports by using DW and BI applications. This process also can be a guideline to develop other analytical reports in different domains. However, to develop a good BI application, the requirements from system users should be equivalent with the organization objective. Then, OLAP can be developed by using dimensional modeling to produce strategic and analytical reports, especially for top management. DW is an appropriate and excellent technology to develop analytical reports for the management in the organizations. As a future work, we plan to complete building BI dashboard, which can represent the Key Performance Indicators (KPI) by using multi-dimensional analysis in the real time based on strategic analysis, and using the data mining in ETL, the quality of the data is one of the most important concerns in a BI project by using data mining query transformation that allows users to modify or redirect the records depending on the result of the data mining prediction.

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