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# OLAP

## Comprehensive analysis of a large pool of clinical data



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**Large pools of clinical data captured in various research work in teaching institutions can help answer complex clinical queries. The following article tries to explain the use of Online Analytical Processing (OLAP) in doing just that.**

It is not uncommon to come across strange kind of research, which most laypersons and even those well versed in medical science or Software Engineering may find stunning. Here are two such examples:

(a) A research in the Medical field suggests that a person belonging to the Hindu Brahmin community in South India is most likely to suffer a myocardial infarction between 4 am and 5 am.

(b) Another research suggests a higher probability of a female offspring developing breast cancer during their lifetime if the mother has had a similar condition.

Research such as this can be relevant from more than one perspective. It can help to prevent the disease or to be better prepared for such an eventuality and to take preventive and corrective actions in time to minimise the impact of such an occurrence.

Most people in the software business will say that this requires data in a structured format to be able to arrive at such research results. The challenge is also to provide accurate information in a reasonable time frame.

Very often such research is presented by organisations, which are specialised in the field of data management, data mining and using complex methods and products that are beyond the means of most hospitals and doctors.

There exists however a substantial number of hospitals worldwide that have digitised their medical records, which in itself must lend itself to an even more complex analysis.

It is, however, often true that Medical record of patients is far from structured. It is also not uncommon to find that wherever a structure does exist observations such as given above may not be available, may not have been captured, may be captured at a later date or may be entered based on the available statistics itself.

**The challenge therefore lies in the following:**

- To decide what data to capture which may be of relevance.
- To capture the data that is relevant for analysis in a manner that it can be readily analysed.
- To establish correlations between apparently disconnected data from across silos of information.
- To determine the parameters for analysis itself based on initial analysis of available statistics.
- To analyse large volumes of data based on multiple parameters.
- To arrive at conclusions based on the data analysis, which point to a correlation and hence a cause and effect relationship.

**The use of OLAP in Other Business applications:**

Online Analytical Processing (OLAP) is a very efficient way of providing the user with a tool that is used for one of the most complex form of Management Information systems used to address the following issues:

- Analysis of data according to the parameters considered important at that point by the user.
- Management reporting for exceptions, summaries, against key performance indicators, trend analysis, comparison over time period analysis and territories, hierarchical analysis and several other queries.
- Business reporting of data, summaries, exceptions, trends and analysis.

OLAP has been used extensively by various organisations for their routine MIS to provide actionable information. We often find that banks vary the interest rates for various time periods, for various types of deposit instruments. The underlying data analysis for such decisions is based on information available with the banks, which enables them to provide specific products to specific target clients, for specific time periods and specific geographical areas.

**OLAP in 21st Century Reporting Engine.**

Interfacing of OLAP is already done in 21st Century Solution for various reports generated through Management Information System (Reporting Engine) for tracking/monitoring the hospital function. This is in fact currently established in Hospital administration and Management Reports.

Main modules of 21st Century healthcare Solution are namely, Administrative: Patient and hospital; and Clinical: EMR / LIS / Advanced Imaging.

Both use Reporting Engine extensively for Clinical reporting and Administrative MIS reporting. MIS reporting is already interfaced with OLAP and uses the same database and XML technology for data storage. Clinical reporting however uses XML to a greater extent due to the nature of data.

### **Unique approach for EMR engine using XML fields.**

The Use of XML type fields lends itself very effectively to creating a database that is both apparently unstructured and at the same time adequately structured to be able to extract vital information from such unstructured data.

It also allows creating a system of restructuring the data dynamically at any point in time without disturbing the available data. 21st Century Health Management Solutions uses this power of XML type fields for capturing Electronic Medical Records in a manner that enables analysis of data according to the users requirements, which may vary between hospitals, across specialities and also over a period of time.

What is even more interesting is the fact that such a change in the content and structure of the data can be carried out without any change in the underlying data structure and hence needs no change in the database or the application used to capture the data.

### **Power of OLAP in tandem with EMR Engine**

The OLAP database is configured on the 21st CHMS product IE 2006 containing the data, including those that are stored as xml type data in the form of User Defined Fields, stored as a structured xml string.



The OLAP cubes contain the relationships between the individual data tables and their relationship across tables, which are defined by linking the appropriate data elements and the measures in a manner so that a query that provides answers for "anything wise, anything, can be sorted and filtered by the criteria defined in the OLAP structure." This can then be used to answer multiple queries without any requirement of a programming effort, without having to predefine the expected outputs or the need for complex and costly software products.

Some of the most commonly used functions on the measures like - sum, count, average, standard deviation, are built into the system. The structure also readily lends itself to easily defining criteria such as exceptions, summaries, and comparisons over a period of time, comparisons across specialities etc.

The advantages in the use of OLAP for EMR is primarily in the prior aggregations of data that is carried out by the OLAP server leading to a quick response to the query and the ability to analyse without pre-specifying the parameters on which the analysis is to be carried out; thereby leading to virtually no additional programming effort after the OLAP cubes have been delivered to the client.

The field names used in the OLAP cubes can also be far more meaningful with appropriate punctuations so that the user is able to relate to the content of the data columns by the name of the field rather than having to rely on the understanding of cryptic names used due to database naming conventions and limitations.

### **Investment on OLAP**

OLAP products range from popular freeware software like Pentaho to premium product and market leader like SAS BI (Business Intelligence) tools. Selection of the tool depends on nature of query and expected performance, and compatibility with XML. We recommend that selection of BI tool / OLAP be done as and when adequate information about nature of data is available. This typically happens in the first year subsequent to implementation.

### **In Conclusion**

The full power of using XML with OLAP comes from an effective method of capturing unstructured data and then carrying out a user definable analysis of the Electronic Medical Records data in a manner that the domain expert, that is, the ultimate user of the data considers significant, without any major programming effort and at a reasonable cost. OLAP specialises in improving performance with large and complex data and EMR engine can easily interface with OLAP solutions. This technology is proven and mature. Tuning of technology for EMR is an important step but it is expected to be a well-defined and controlled exercise.

