Introduction Study Of Business Intelligence Hospital Medical Recording Data

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Abstract: In every health service facility in a hospital, it is obligatory to make medical records made by doctors and health workers related to the services provided by doctors and other health workers. Medical records made, both outpatient medical records and inpatient medical records, are stored in a medical record file storage area (filling).. Phe management of medical records with the standard Medical Record Information Management (MIRM) is to support orderly administration in the context of efforts to improve health services in hospitals which are supported by a medical record management system that is fast, precise, valuable, accountable, and focuses on patients and safety patients in an integrated manner. The purpose of this system plan is to make it easier for management and leaders to get a visual summary of information for decision making.
Keywords: hospital, medical record, decision.

1. Background

The hospital is a health service institution for individual patients, families and communities with the core of medical services in terms of preventive (prevention), qualitative (healing), rehabilitative (recovery) and promotive (information) as well as educational (education), all of which are carried out in a system. integrated in order to obtain maximum and optimal service [1].

In every health service facility in the hospital, it is obligatory to make medical records made by doctors and health workers related to the services provided by doctors and other health workers. Medical records made, both outpatient medical records and inpatient medical records, are stored in a medical record file storage area (filling). The method of storing medical record files in each health service facility is different, there are two storage events, namely centralized and decentralized.

The quality of hospital services can be said to be good if it is supported by a medical record processing system in obtaining medical record information quickly and on time in accordance with the provisions set by the hospital. Each hospital seeks to obtain, manage, and use information to improve / improve patient care outcomes, individual performance, and overall hospital performance. Although computerization and other technologies increase efficiency, the principles of good information management apply to all methods, both paper-based and electronic. These standards are designed to be compatible with non-computerized systems and future technology, in this case the hospital is expected to develop Business Intelligence to be able to identify information needs,

The purpose of managing medical records in accordance with Medical Record Information Management (MIRM) standards is to support orderly administration in the context of efforts to improve health services in hospitals that are supported by a medical record management system that is fast, precise, valuable, accountable, and patient-focused. and patient safety in an integrated manner.

2. Formulation of the problem

Based on the background described above, the problem formulations in this study are:
a.   How can the application of Business Intelligence Hospital Inpatient Medical Record data help to determine management policy making?
b.   How does Business Intelligence Inpatient Medical Record data make it easier for management and leaders to get a visual summary of information in making decisions?

3. Purpose

Research on the problems described in the problem background section aims as follows:
a.   Helping to determine hospital management policy.
b.   Make it easy for management and leaders to get a summary of visual information in making decisions.

4   Literature review

4.1   Business Intelligence

*Business Intelligence*provides business information and business analysis in the context of the main business processes that lead to decisions and actions. This results in improved business performance. Specifically, Business Intelligence means increasing information in business processes primarily to achieve increased business performance [7].

According to C, Loudon., (2007; Altounjy et al., 2020; Adewumi, 2020; Abdi et al., 2020; Abadia et al., 2020; Aragones et al., 2020), a series of applications and technologies which are analytical tools used to consolidate data, analyze, store and access a lot of data to assist in decision making, such as software for database querying and reporting, tools for data analysis. multidimensional, and data mining.

Steve Williams in 2001 in his book entitled The Profit Impact Of Business Intelligence, states that Business Intelligence is a combination of concepts, approaches, methodologies and products (in the form of software) to manage and manage data - company data into information, to assist in in decision making, improving company performance and increasing company income based on data analysis, business analysis, business processes, and real action [5].

Business Intelligence is a process for extracting company operational data and collecting it in a data warehouse. During the extraction process, transformation can also be carried out by applying various formulas, aggregations, and validations in order to obtain data that is in accordance with the interests of business analysis. Furthermore, the data in the data warehouse is processed using various statistical analyzes in the data mining process, in order to obtain various trends or patterns from the data. The results of these simplifications and summaries are presented to end users who are usually business decision makers. Thus management can make decisions based on actual facts, and notrely solely on intuition and quantitative experience [3].

Some of the benefits that can be obtained if an organization implements business intelligence are as follows [4]:
  a.   Increase the value of organizational data and information.
  b.   Make it easy to visualize data.
  c.   Increase the value of existing information technology investments.
  d.   Creating users who have access to good information (well-informed workers).
  e.   Increase cost efficiency.

Business Intelligence consists of four component levels and a metadata management module. The components that interact with each other to facilitate the basic functions of business intelligence are extracting data from the company's operational system, storing the extracted data into a data warehouse, and pulling stored data for various business analysis applications. The following are the levels in the architecture that are interrelated with each other, in order to help the running of the Business Intelligence function, namely [8]:
  a.   Operational system level
  b.   Data acquisition level
  c.   Data storage level
  d.   Analytical level

4.2   Business Intelligence Architecture

The architecture of business intelligence has three main components, namely: data source, data warehouse, and data marts, business intelligence methodology [2].
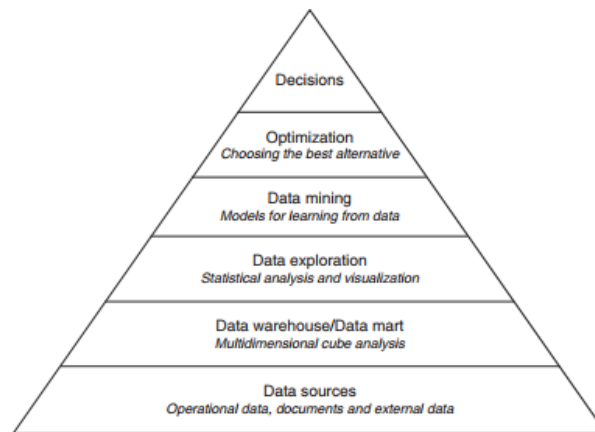
Figure 1. Architecture*Business Intelligence [12]*

a.   Data Source

In the first step, what must be done is to combine and integrate the data stored in the primary storage, while in the secondary storage the data will be heterogeneous according to its origin and type.

b.   Business Intelligence Methodology

The data that has been extracted will be ready to be used as material in mathematical models and analytical methods in Business Intelligence to support the decision-making process.

c.   Data Warehouses and Data Marts

At this stage, Extraction, Transform, Load (ETL) activities are carried out to extract and transform data. Data originating from different sources is stored in one database storage which will then be used in the Business Intelligence analysis process. This database will then be used in data warehouses and data marts.

d.   Data Exploration

In the third stage of the pyramid, tools will be found to perform passive analysis of Business Intelligence which consists of a query and reporting system such as statistical methods. This method is said to be a passive method because the decision maker has asked to make the best hypothesis or extract data according to the criteria. Then by using analysis tools, the request for decision makers will be immediately implemented.

e.   Optimization

The stage where the search for the most optimal model is carried out in finding the best solution or alternative for decision making.

f.   Decisions

Located at the top of the pyramid, where the user will choose a specific decision looking at the various solutions and alternatives provided. However, even though the Business Intelligence method is available and successful in its implementation, the decision remains in the hands of the decision maker where it is possible to take into account the conditions of the company's competition.

4.3   OLTP

OLTP, which is a high performance system, is designed to handle transaction processes that occur in a company and enter the company's data into the database [2]. OLTP system allows multiple users to access data at the same time and perform the processes they need. All summations that are stored from the daily transactions of the company are the history of the company. OLTP provides a more detailed view of data because it stores operational data, providing a larger, editable view of data.

4.4   OLAP

The term OLAP describes a technology that uses a multidimensional view of a number of data to provide faster access to strategic information for advanced purposes [2].

OLAP allows users to gain a deeper understanding of various aspects of their company data with fast, consistent and interactive access to various possible views of the data. The main operational structure of OLAP is based on a concept called a cube. The cube in OLAP is a multidimensional data structure that allows fast existing analysis, it can also be defined as the ability to efficiently manipulate and analyze data from various perspectives, which aims to generate knowledge, store historical data and data in OLAP cannot be changed. [11].

4.5   ETL

The process is carried out to integrate data sources that come from OLTP in each department in an organization [7].

The processes contained in ETL are Extract, Transform and Load, the following is an explanation of each of these ETL activities.

1.   *Extract* is the initial stage of the ETL activity which plays a role in accommodating all the required data which is taken and then extracted.

2.   The second process in ETL activities is transform, that is, the extracted data will undergo a transformation process, the process that occurs is to change the existing codes into codes which are standardization that is set from the start so that all the data that comes out of the process has a standard the same one.

3.   The last process is load, which is the process of sending all data to the final storage place, namely the data warehouse. All data that goes through this process means that it is ready to be used and accessed for the company's strategic interests.

4.6   Metadata

Documenting the data contained in the data warehouse, it is recommended to create a specific information structure known as metadata. Metadata is also called data description. Metadata indicates for each data warehouse attribute the original source of the data. The documentation provided by the metadata must be kept up to date to reflect changes in the data warehouse structure [12].

4.7   Dimensional Model

A logic design that aims to display data in a standard and intuitive form that allows high-performance access [2].

The dimensional model uses the concept of the relationship model between entities with several important limitations. Each dimensional model consists of a table with a composite key, called a fact table. Meanwhile, a smaller set of tables is called a dimension table.

The dimensional model that is often used is the star schema or snowflake which is easy to understand and suits business requirements, supports simple business queries and provides superior query performance by minimizing join tables.

4.8   *Star Schema*

*Star schema*This is a multi-dimensional representation distinguished by two types of tables, namely fact tables and dimension tables [12]. Star schema is a logical structure that has a fact table containing factual data in the middle or surrounded by dimension tables containing reference data or information that can usually be normalized [2].

There are two types of star schema division, namely fact table and dimension table [12].

a.   Fact Table

A table that generally hangs something that can be measured (measure) and is historical in nature, and is a collection of foreign keys from the primary keys contained in each dimensional table.

b.   Dimension Table

The table contains the categories with a detailed summary which can be a report. In general, it can be called the dimensions associated with the surrounding entities in the organizational process.

4.9   Medical records

Medical records are written evidence (paper / electronic) that records various health information such as assessment findings, care plans, details on the implementation of care and treatment, integrated patient progress notes, as well as patient discharge summaries made by care professionals (PPA) [8] . Organizing medical records is a process of activity that starts when the patient is admitted to the hospital to the recording of medical data, nursing, patient service manager (MPP), and other PPA as long as the patient receives care. The activity was continued with the handling of medical records which included storage and use for the benefit of patients or other purposes. The purpose of managing medical records and health information is to support orderly administration in the context of efforts to improve health services in hospitals supported by a medical record management system that is fast, precise, valuable, accountable, and focuses on patients and patient safety in an integrated manner. Medical records have the following uses:

1.   A means of communication between professional caregivers (PPA) that provides patient care (communication);

2.   The basis for calculating the cost of services to patients (financial billing);

3.   Providers of special data that are very useful for research and education purposes (research and education);

4.   The basis for planning the care that should be provided to the patient (assessment);

5.   Useful materials for analysis, research, and evaluation of the quality of services provided to patients (clinical audit);

6.   A source of memory that must be documented as well as material for accountability and reporting;

7.   Written / recorded evidence of all service actions, disease progression, and medication during the patient's visit / hospitalization;

8.   Protection of legal interests for patients, hospitals, and caregivers professionals (legal documentation).

5. Star Schema design

The design of this star schema diagram is a stage in designing the database design. Star schema is made based on each information according to user needs. This diagram is useful for showing the database schema that is shaped like a star so that it can help in designing a system for the ETL process and visualizing data on the hospital dataset.

The following is a star schema made for system design as follows:
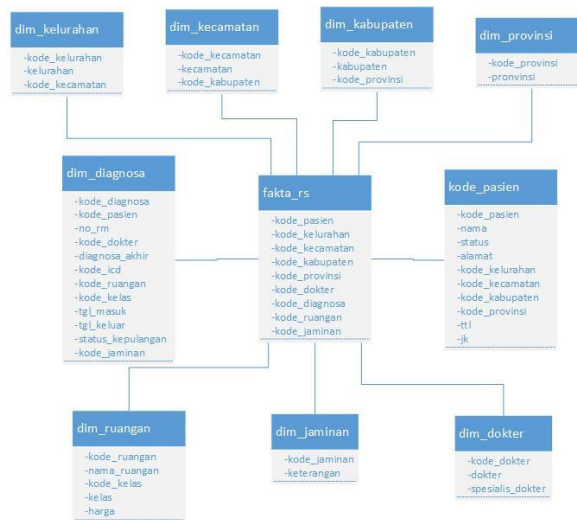
Figure 2. Star Schema hospital system

5.   Extract Hospital Overall Data

In this first process, the process of selecting or retrieving data from one or several sources is carried out and reading or accessing the selected data. So, the process is carried out by integrating all production data in excel into the database. The process carried out for data integration into the database is as follows:

a.   SQL Script RS

This process aims to create the desired table in the database, this process will create a data_rs database with fields that match Excel data.

b.   Microsoft Excel Input

This process is useful for entering hospital data in an excel file into the data_rs database that was created in the previous process.

c.   Unique Rows

This process is performed to remove duplicate rows from the input stream and filter only unique rows as input data to be integrated into the database.

d.   Select Values

The process of determining which fields will be used and will be displayed in the data_rs database.

e.   Table Output

This process is carried out in order to produce processed data that can be displayed in the database with the table name data_rs. The database used is MySQL / phpMyAdmin.
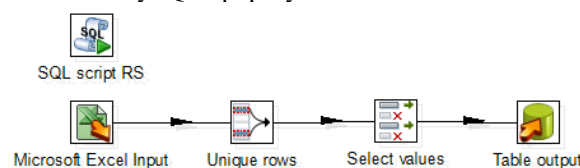
Figure 3. The process of data integration into the database

After the process is executed, the resulting data execution results will be generated as below.

Figure 4. execution result of the integration process

6. Hospital Dataset Dimension Table Design

This section will explain the dimension tables contained in the star schema design with the hospital dataset which is part of the transform process. The following is a list of dimension tables:
1. Diagnostic Dimensions
2. Doctor Dimensions
3. Guarantee Dimensions
4. Patient Dimensions
5. Room Dimensions
6. Kelurahan Dimensions
7. District Dimensions
8. District Dimensions
9. Provincial Dimension

In the dimension table design section, the same ETL process is carried out, so that the explanation will discuss one of the dimensional table designs, namely the Diagnostic Dimension Table as follows:

a. SQL Script diagnostics

This process aims to create the desired table in the database, this process will create a data_rs database with fields that match the data that will be needed in the diagnostic dimension.

b. Input table

This process is useful for entering hospital data into the database from the extract process to determine the diagnostic dimension table fields as needed.

c. Add sequence

The process that occurs is a step for adding sequence to the data stream. The sequence is an integer value that can change its value based on the data that will be entered in the diagnostic dimension.

d. Unique rows

This process is performed to remove duplicate rows from the input stream and filter only unique rows as input data to be integrated into the database.

e. Select values

The process of determining the fields that will be used and will be displayed in the data_rs database with a diagnostic dimension table.

f. Output table

This process is carried out in order to produce processed data that can be displayed in the data_rs database with the table name dim_diagnosa. The database used is MySQL / phpMyAdmin.
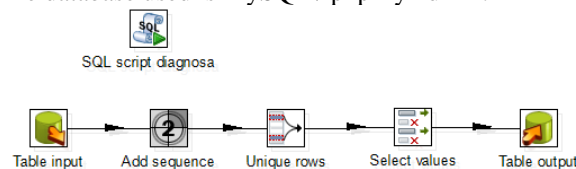

Figure 5. Diagnostic dimension table

After the process of making the item dimension table is executed, the execution results will be seen in this process as follows.

Figure 5. execution result

7. Hospital Fact Table Design

The transform process further explains in designing fact tables for hospital datasets. This table will contain factual data derived from all data in dimension tables that have been previously designed.

a. SQL Script fact_rs

This process aims to create the desired table in the database, this process will create a data_rs database with fields that match the data that will be needed in the hospital data fact table.

b. Input table

This process is useful for entering hospital data into the database from the extract process to determine the hospital fact table fields as needed.

c. Lookup Database (dim_diagnosa, dim_dokter, etc.)

This process is a step to find rows in a table that is integrated in the database. In this process, rows will get primary key from each dimension table.

d. Select Values

The process of determining which fields will be used and will be displayed on the data_rs database with a hospital data fact table that contains the surrogate key data from each dimension table.

e. Output table

This process is carried out with the aim of producing processed data that can be displayed in the hospital data database with the name fact_rs table. The database used is MySQL / phpMyAdmin.
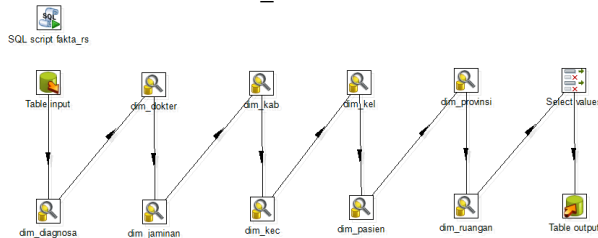

Figure 6. The transform process

After the process of making the item dimension table is executed, the execution results will be seen in this process as follows.

Figure 7. Execution result of the transform process

8. Conclusion

Based on the discussion that has been described in the design section, it can be concluded that the system that has been designed can be continued in the implementation process, namely the design of the user interface, ETL Development, Application Development (Dashboard Design) to produce visualization of hospital medic record data.

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