DATA ANALYSIS MODEL FOLLOWING THE BUSINESS INTELLIGENCE PRINCIPLES:

A CASE STUDY OF DISTRICT HEALTH PROMOTION HOSPITAL IN THAILAND

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ABSTRACT

In the present day, the Business Intelligence System (BI) is extensively discussed and increasingly employed in organizations and in implementing various tasks (e.g., industrial, hospital, agricultural and business-related task). BI is the system for storing, managing, analyzing and presenting data needed for executive's decision's making. The system can either be developed or use existing software to adapt and develop a process based on the principles of BI in order to support the process of gathering information, data analysis and forming a report.

The aim of this research is to analyst of the data from the district health promotion hospital at Ban Mon, San Kamphaeng, Chiang Mai. The data analysis followed the principles of BI. The research methodology included a study on the data before an analysis and display overall result with a program dashboard. This study comprises five steps; (1) gathering information from the JHCIS system and interviewing the staffs of the hospital (2) searching the suitable tools for the BI principle (3) analyzing data with BI system (4) creating report from the data and (5) evaluating the information alongside the users. The results show that analyzing data by integrating multiple tools following the principle of the BI system leads to an easy for users in forming reports and in fully answering all of the executive's questions.

Keywords: Business Intelligence System, District health promotion hospital, Chiang Mai

1. Background

Today's software for business intelligence (BI) is a priority for many organizations in providing information to support management decisions. The principles of BI system start with the system collecting data from a variety of data sources in multiple platforms in order to store the data in a single data warehouse. Moreover, the system can generate reports that enable users to analyze in multiple dimensions. The reports can show a 'drill down' report or display an overall data (i.e., dashboard) of an organization, making BI software widely adapted by business sectors. Nonetheless, utilizing the BI system is scant in government sectors (Vibulsanti, 2009).

Medical services provided by district health promotion hospitals are numerous. They include health promotion, disease control and prevention, medical treatment, rehabilitation and risk factors management for individual, family, community and society levels in the responsible areas. There are three main points that the hospital has operates and focuses on as following:

(1) *Proactive process*: the hospital approaches people and communities by predominantly focusing on health promotion. It aims at managing risk factors that cause health problems. For example, the hospital staffs do the physiotherapy to the patients at their house, visit chronically ill patients at home (diabetes and hypertension) in order to prevent incurrent disease. Moreover, the staffs observe pregnant women and encourage them to start the antenatal care for preventing insufficiency of Iron and Iodine in the infants.

(2) *The services system is linked*: Patients can consult physicians from other sister hospitals and can be transferred to other hospitals at all time. Patient beds are provided for patients in observations without admitting overnight at the hospital. And, in an emergency case, the emergency medical services can be contacted for collecting the patients and providing the first aid before or during the delivery to the hospital.

(3) *Participation of the community*: The community, the habitant and the Local Administrative Organization are highly engaged in the process in order to take care of self, family and community in a sustainable way.

Therefore, the operation of the district health promotion hospital leads to direct effect to people for long term period with the strategy of building faith and trust. In addition, improving landscape architecture, improving the capacity of health term (doctors (if any), pharmacists and nurses), creating a good relationship with the community (Janreung, 1997). The record of people who are received services, are stored in the database of JHCIS system, which is a main program at the Ministry of Health with data processing start from import data as well as display results. If executives officials or reporting requirements, in addition to the program, the authorities need to build JHCIS copy of the report JHCIS program into the system. You can create new reports on demand.

The case study of the district health promotion hospital, Ban Mon, San Kamphaeng, Chiang Mai. The researcher is interested in studying the application of the principles of BI to analyze data. The research findings are expected that the result at district health promotion

hospital can prepare reports for analysis, access to information easily and have the information to answer all questions from executives need.

2. Methodology

This research is developed to illustrate the concept of data analysis using principles of BI. As Fig 1 represents the sequence of operations starting at (1) The data source of the district health promotion hospital from JHCIS program and asked authorities to demand information on the decision. (2) The researcher finds the appropriate tools that can gather information from various data sources that can be stored in the data warehouse system. (3) The researcher analyze data from the data source through the extraction process, data conversion and bring data into the data warehouse system, it also can create multidimensional data to the data processing in a report (Online Analysis Process: OLAP). (4) Create reports based on the needs of the agency and (5) The report has been forwarded to the Head of district health promotion hospital, Ban Mon. Doctors and nurses use JHCIS and they have priority in the use of information, including third persons to assess information obtained from the analysis.
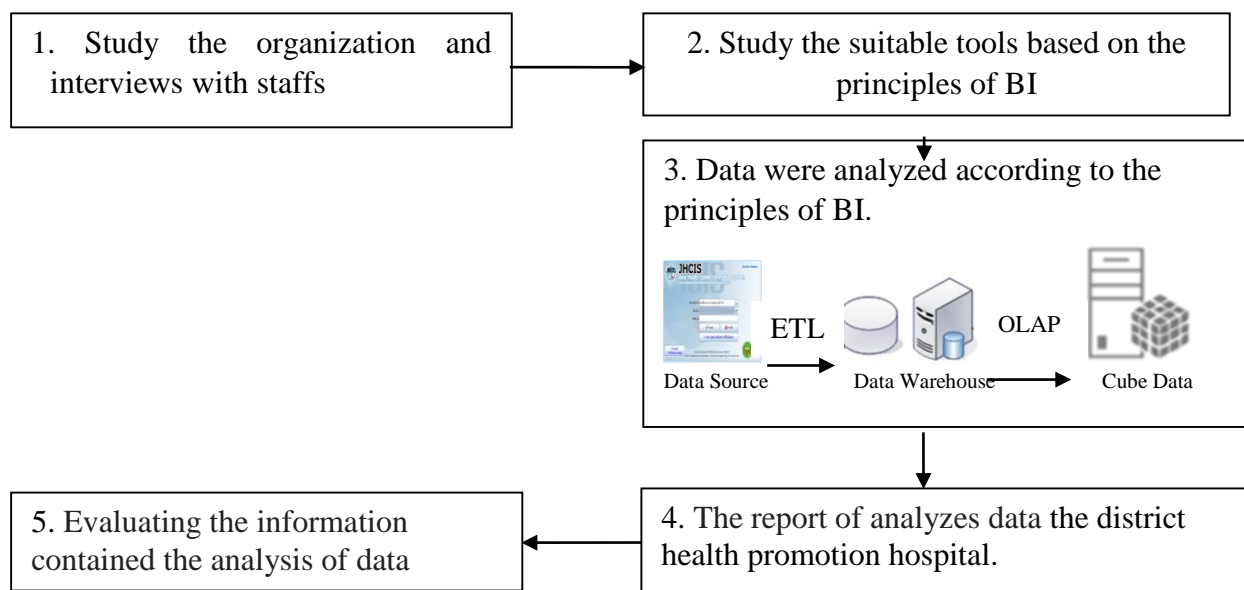

Fig.1. Framework for data analysis the district health promotion hospital, Ban Mon, San Kamphaeng, Chiang Mai

3. LITERATURE REVIEW

BI plays a crucial role to achieve competitive edge over competitors in the challenging economy. Businesses using a BI methodology are able to develop intelligence based information systems to gain useful business insight and make faster and more reliable business decisions. While many organizations are starting to use BI in many areas of their businesses and make substantial gains, they have not taken advantage of this in Human

Resource Management area. Leading BI vendors look into the BI and data analytics features incorporated in the Human Resource Management modules. (Kapoor and Bhushan, 2010)

Business process intelligence provides information to improve organizational performance. Generally such information not only improves an organizations ability to accomplish business objectives, but may also lead to the identification of information that could facilitate competitive advantage. There have been many approaches to rationalize business performance through dimensional modelling by utilizing an information flow model that involves the specification of activity dimensions during business process modelling. (Kaula and Rajeev, 2015)

BI Solutions represents the use of applications by companies to manage process and analyze data and to provide substantiated decision. In the context of Semantic Web development trend is to integrate semantic unstructured data, making BI solutions to be redesigned in such as a manner that can analyze, process and synthesize. In addition, traditional data and data integrated with semantic another form and structure, this invariably leads appearance of new BI solution, is called Semantic Business Intelligence. (Dinu et al,2012)

4. RESULT

This study follows the process of developing the principles of BI into five steps for the district health promotion hospital, Ban Mon, San Kamphaeng, Chiang Mai in Thailand. The details are as follows

4.1 Problem identification and motivation

The information contain details of the hospital. Job statistics service, subscribers service and employees data are required to submit information to the authorities of the Chiang Mai Province. The operation is led by the sample data. It is accepted for treatment and pharmaceutical warehouse in the township seven villages and a population of patients in the area with access to medical services. Volumes and disbursement of supplies per day were produced. The information contained in JCHIS. The preparation of the database structure and format reports. Where appropriate, with a view to analyze the relationship and predict the outcome of the likely potential to meet the needs of the organization based on the principles of BI. To help executives use the information in planning and decision making using BI Tool. .

4.2 Design and development

Fig.2 illustrates the system architecture, which consists mainly of internal data sources and a three-tier structure: data warehouse server, OLAP server, and front-end tools. The system is developed with SQL Server 2005; Analyzer 2005; Extract, Transform and Load data (ETL); OLAP multidimensional design tools and Microsoft Excel.
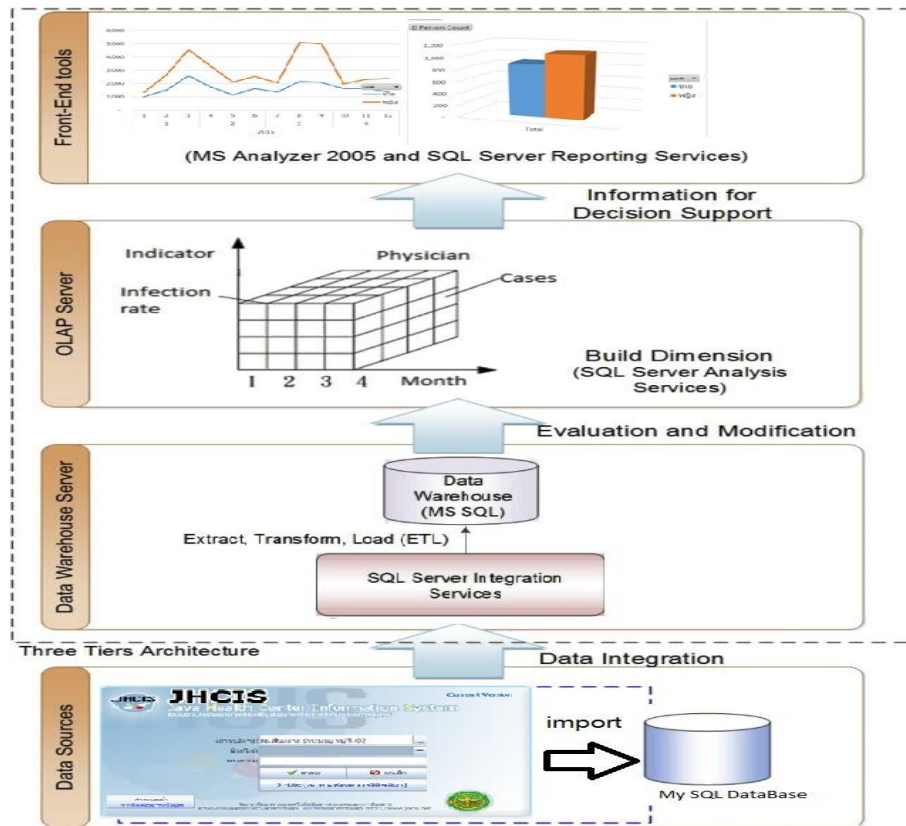
Fig. 2. System architecture.

For decision-making, hospital management required to access data that retrieve from a variety of internal databases including JHCIS system, patient safety reports (MS SQL database), and physicians' profiles. Given these diverse data sources, the hospital established a three-tier structure as proposed by Strum (2000). In the first tier, the data warehouse layer provides access to data hosted within the boundaries of the system, along with data expose by other networked systems and accessed through different data sources. The features data warehouse structure are summarized in Table 1 and Table 2 which are divided into two groups of measure and dimensions.

Table 1. Numerical data on the use of patient records.

Details	Tables	Examples
Record of service to patients in the area.	FactTable_Dim	The number of patients who come in and take charge.

Table 2. Data related to the use of patient data in a table to store multi dimension data

Dimensions	Table	Example
Time Dimension	Time_Dim	- year - quarter - month - day of week - visit date
Disease Dimension	Disease_Dim	-group disease code - group disease name - disease code - disease name
Person Dimension	Person_Dim	- person id - name - sex - birthdate - age - job
Service Dimension	Service_Dim	- visit no - right group name - eye check - tooth check - nutrition check - family plan - home survey
Drug Dimension	Drug_Dim	- drug code - drug name

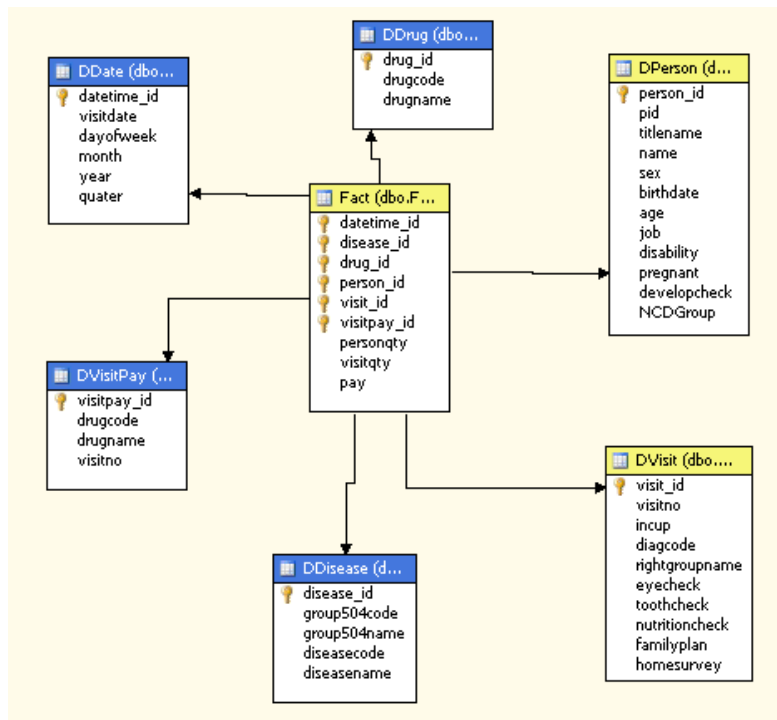Design data warehouse structure use star schema as shown in Fig.3

Fig.3. Relations for the database in the form star schema

This layer exposes generic interfaces that can be used by the components in the OLAP server layer. The district health promotion hospital used SQL server Integration Services tools to import ETL into the data warehouse from databases for health insurance information, hospital accreditations, and medical quality indicators. For example, the hospital conducted ETL procedures to gather differently formatted information from several sources into the SQL server data warehouse, using indicator rules and dimension tables (Fig. 2 and Fig.4).
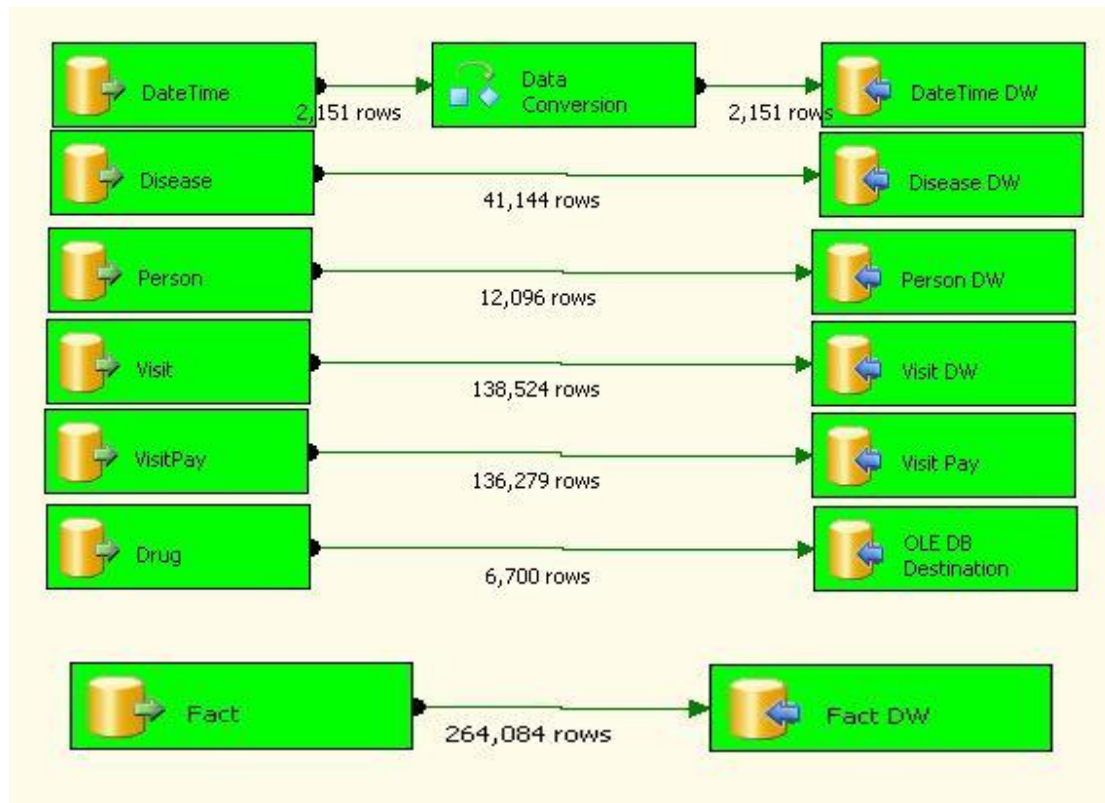
Fig.4. Extract data from the source to the data warehouse through the ETL process

In the second tier, the OLAP server layer implements the system's core functionality, and encapsulates the relevant analysis logic. Some of the OLAP server layer's components may provide service interfaces for other users. Furthermore, OLAP tools enable users to analyze multidimensional data interactivity from multiple perspectives. OLAP consists of three basic analytical operations: roll-up, drill-down, and slicing. For example, through the implemented system all physicians can access monthly information for infection rate trends through the roll-up function (Fig. 2)

Finally, in the third tier, information of the data dimensions has already been processed, summarized and displayed for the user to explore and analyze. User can change dimensional view of data, view a summary or drill down each section as needed. For example, Q: how many of male and female patient who visited hospital in 2015, Ans: 19,827 male and 35,432 female (Fig. 5) or Q: what is the number of patient to check diabetes disease, Ans: 23,137 people (Fig. 6) or Q: what is the total costs of medicines per month and per day in 2015, Ans: (Fig. 7).
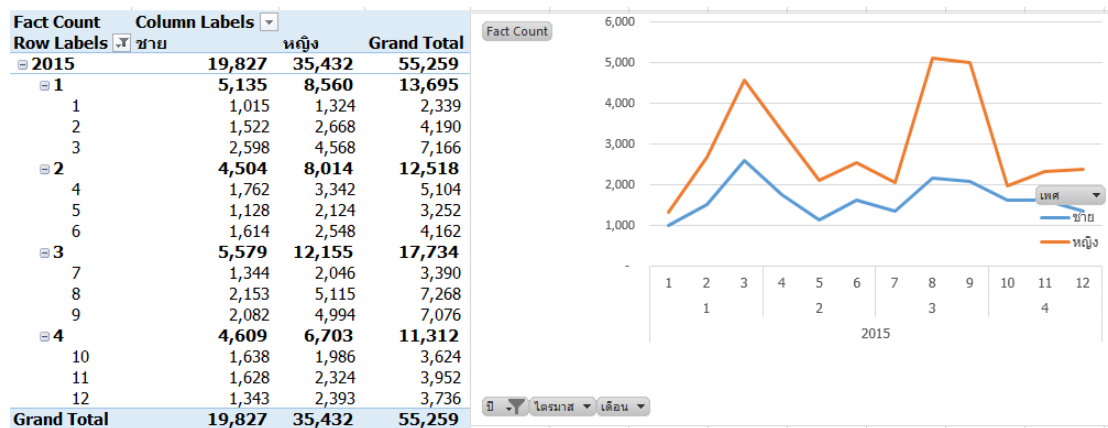
Fact Count	Column Labels		
Row Labels	ชาย	หญิง	Grand Total
2015	19,827	35,432	55,259
1	5,135	8,560	13,695
1	1,015	1,324	2,339
2	1,522	2,668	4,190
3	2,598	4,568	7,166
2	4,504	8,014	12,518
4	1,762	3,342	5,104
5	1,128	2,124	3,252
6	1,614	2,548	4,162
3	5,579	12,155	17,734
7	1,344	2,046	3,390
8	2,153	5,115	7,268
9	2,082	4,994	7,076
4	4,609	6,703	11,312
10	1,638	1,986	3,624
11	1,628	2,324	3,952
12	1,343	2,393	3,736
Grand Total	19,827	35,432	55,259

Fig.5. Reports of number of male and female in 2015

Row Labels	Fact Count
Special Screening for Diabetes	11,023
Diabetes type insulin dependent No complications	8
Diabetes does not rely on insulin. No complications	3,828
diabetes does not rely on insulin. Combined with kidney complications	31
diabetes does not rely on insulin. Combined with other detailed complicati	8,247
Grand Total	23,137
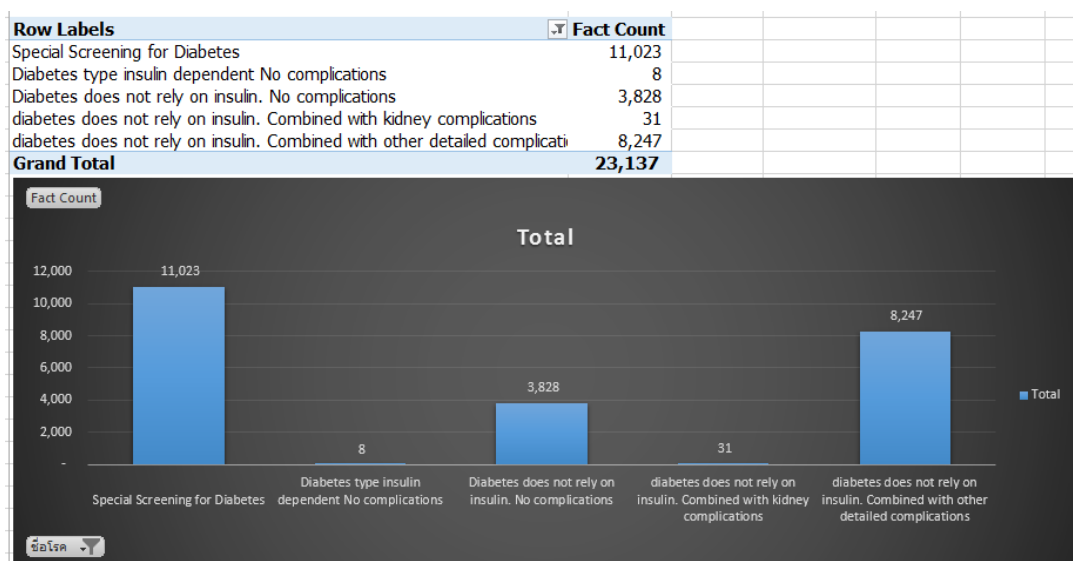
Fig.6. The report of the number users who were checked diabetes.

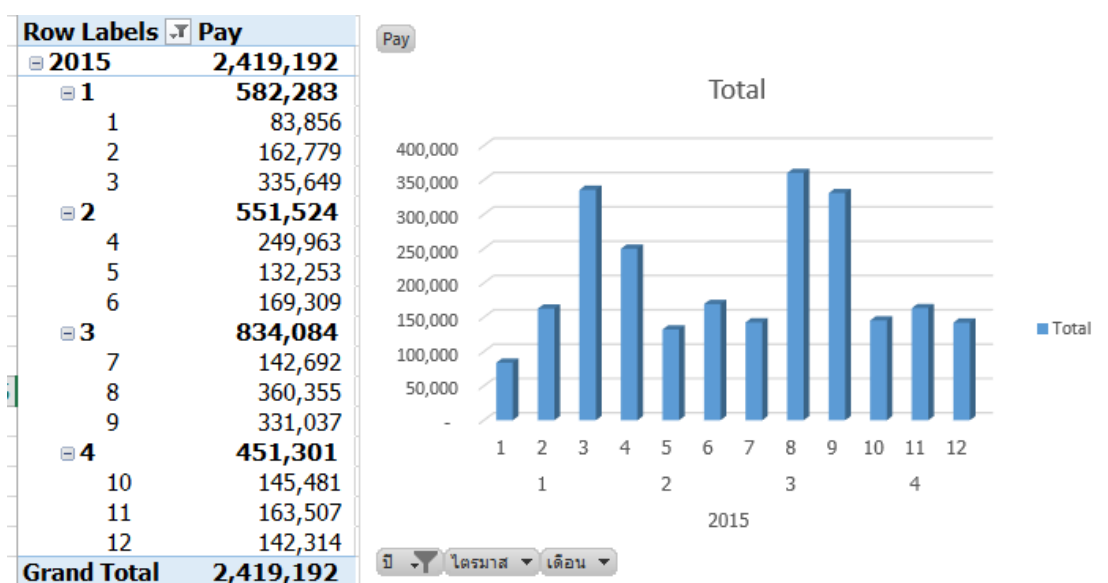| Row Labels	Pay
2015	2,419,192
1	582,283
1	83,856
2	162,779
3	335,649
2	551,524
4	249,963
5	132,253
6	169,309
3	834,084
7	142,692
8	360,355
9	331,037
4	451,301
10	145,481
11	163,507
12	142,314
Grand Total	2,419,192

Fig.7.The report of summary dispensing medicines per month, per day.

5. Evaluation

System implement is followed by usability testing. Assessment information gained from data analysis. The research has led to the analysis of information obtained from the evaluation of the Chief of the district health promotion hospital, doctors and nurses who are an individual with a focus on the analysis of this report. The researchers used an interview technique with a question in the interview is relatively easy to obtain reports and the usefulness of the information obtained from the analysis. The appraiser's opinion facilitate and benefit from learning how to prepare a report based on the principles of BI in a short time.

6. Conclusions

This study reports the development and assessment of data analysis model following the BI principles for the district health promotion hospital Ban Mon, San Kamphaeng, Chiang Mai. The system integrates and provides the user to access easily to medical and patient data, also improves the correctness and timeliness of remedial action, thus reducing problems and increase overall efficiency. For the analysis of the data storage system it has been found that the use of information technology mostly use Microsoft Office that is based on Window operation system, except JHCIS, which has to run on Linux operation system. Therefore, the database has to be transferred to other operation system. In addition, there is an OLAP technology that manages the structure of the data from the fact table stored in the archives to look like cubes and the cube contains quantitative data that corresponds to the dimension of the data at each level, it helps making the query of the cube quickly. It also supports the data analysis of the large-scale at the district health promotion hospital. Inquiries can rotate the spatial dimension of a data into an interesting perspective for analyzing data in an infinite form. For the last step of analyzing the data of the health promotion hospital, the presentation of data intends to give users to understand easily. After testing the actual use by users, it has been found that users have a benefit from learning the use of data analysis systems in a shorter time frame and the users can access to information as their needed.

7. References

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