Stunting Data Warehouse Modeling for Dashboards at the P2KBP3A Office

Arik Sofan Tohir[1], Suryono[2], Luluk Susiloningtyas[3], Aris Dwi Cahyono[4], Fannidya Hamdani Zeho[5]
[1,2,3,4,5]Administrasi Kesehatan, STIKES Pamenang Kediri
E-mail: [1]*arik.sofan.tohir@gmail.com*, [2]suryono.sanjaya@gmail.com
Coresponden Author : *arik.sofan.tohir@gmail.com*

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Abstrak – *The P2KBP3A Office of Kediri Regency is one of the agencies that handles stunting issues. To collect data on children under two years of age (baduta) in each village, this agency is assisted by cadres in each region. The data that has been collected certainly needs to be processed in order to produce information that is useful for decision makers in determining policies. Processing large amounts of data requires data warehouse technology as one of the solutions. In designing this data warehouse, the Nine Step Kimball method with the Star Schema diagram model was used. With this data warehouse, information on the number of stunting cases in each area can be obtained, starting from the sub-district level, village, to hamlet. Additionally, data can also be viewed based on the target and the status of that target, whether it is normal, stunted, wasted, stunted and wasted, or pre-stunted.*
Keywords *— data warehouse, nine steo kimbal, stunting, DP2KBP3A*

1. INTRODUCTION

In this era of rapid digitalization, technological advances have had a significant impact on various fields, including the use of information technology in data storage and processing. The existence of digitally stored and interconnected data facilitates the data processing process. By utilizing technology, interconnected data can be presented as useful information for users, especially for policy makers in determining the direction of policies to be taken.

The Population Control, Family Planning, Women's Empowerment, and Child Protection Agency (DP2KBP3A) of Kediri Regency is one of the agencies that handles stunting data and oversees 26 subdistricts. Transaction data is constantly growing and updated every month. Of course, this periodic addition of data can affect application performance if not managed properly.

Problems arise when management (decision makers) need detailed and timely information related to transactional data for analysis in determining policy. Therefore, technology is needed to help overcome these problems. Thus, a data warehouse is needed to support data management that can be used as a source of information in data analysis [1].

Stunting remains an important global issue that needs to be addressed worldwide. In fact, stunting has been identified as one of the main focuses in global nutrition improvement targets until 2025 [2]. Various health problems can affect the growth and development of children, including nutritional problems [12]. Stunting is caused by inadequate nutrient intake or insufficient nutrient intake in children, which can occur both during pregnancy and after birth. This condition is influenced by various factors, including family economic status, parental height, number of family members, and exclusive breastfeeding by the mother, which plays a significant role in a child's growth and development during the first 1,000 days of life (HPK) [3]. Stunting is a condition in which a child's nutritional status is based on their length or height, and occurs while the fetus is still in the womb and only becomes apparent when the child is 2 years or 24 months old [5]. Stunting is a physical growth disorder characterized by a decrease in growth rate and is the impact of nutritional imbalance, where stunting is based on the length-for-age (PB/U) or height-for-age (TB/U) index with a limit (z-score) of less than -2 [10]. In other literature it is also stated that stunting can be caused by various factors such as lack of knowledge from parents, parenting patterns, malnutrition, low birth weight and economic status [11].

Based on the above issues, this data warehouse modeling will design a model that can meet several management or policy-making needs to formulate and take strategic steps that must be implemented. One of the

purposes of a data warehouse is to integrate a company's data sources into a single data repository, which can then be used to run data queries to generate reports that facilitate user analysis and decision-making more easily, quickly, and accurately [13]. This data warehouse modeling will be compiled using available transactional data. In overcoming this problem, data warehouse modeling aims to unite data from various sources and provide better visibility. Data warehouse modeling enables companies to conduct in-depth analysis and planning with the aim of improving more informative decision-making capabilities [6].

In data warehouses, there are several schemas that can be used, including snowflake, star, and galaxy models. This study will use the star schema model by utilizing transactional data or Online Transactional Processing (OLTP) stored in the MySQL Relational Database Management System (RDBMS)..

The development of a data warehouse can provide strategic benefits for businesses due to its ability to: (1) access large amounts of data, (2) present consistent data, and (3) perform rapid analysis. These advantages enable the provision of information needed by organizations [1]. In addition, data warehouses excel at processing data that requires complex queries and calculations with large numbers of data records. Data is crucial evidence. Because data that has been processed into evidence must still be interpreted subjectively, the process of developing policy recommendations quickly is a requirement for policy analysts [8]. The results of this data warehouse modeling will form the basis for creating dashboards displayed using the PHP programming language with the CodeIgniter framework.

2. RESEARCH METHOD

This study uses a qualitative method, which is an approach or technique for collecting and analyzing data descriptively with the aim of understanding the phenomenon being studied from the perspective of the subject or participant [4]. The figure below shows the research method scheme used to design the data warehouse requirements at the P2KBP3A Office of Kediri Regency.

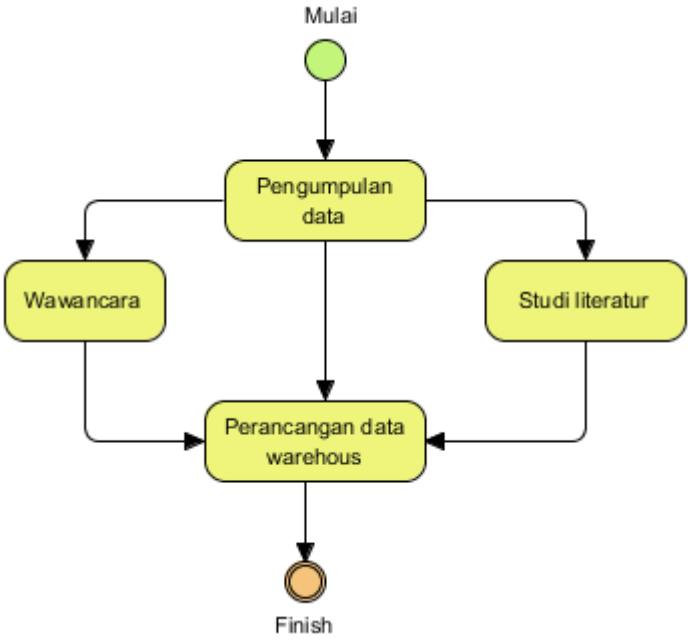


Figure 1. Research Method

2.1. Data collection

At this stage, researchers collect data to obtain information about the data available and to be used in data warehouse modeling. The Online Transactional Processing (OLTP) data model that has been used at the P2KBP3A Office is also reviewed. From the results of this data collection, it is hoped that a general overview of the output that will be the result of the data warehouse can be obtained.

2.2. *I*nterview

Next, after the data has been collected, interviews are conducted with users. This process aims to gather information about user needs related to the data to be displayed in the dashboard. Thus, the information obtained can be truly useful and serve as a basis for decision-making in determining strategic policy measures.

2.3. Literature review

This process aims to identify information from data that agencies have permitted to be collected and studied in greater depth to support research.

2.4. Data warehouse design

After the data collection, interviews, and literature study processes have been completed, the next stage is data warehouse design. Data warehouse is responsible for storing, integrating, and distributing access requirements [7]. One method that is often used in designing a data warehouse is the Nine Steps Design method [9]. Kimball & Ross said there are nine steps in building a data warehouse, known as the nine - step design methodology [14]. This process consists of nine steps based on Kimball's methodology (Nine Step Kimball) as shown in the following figure.

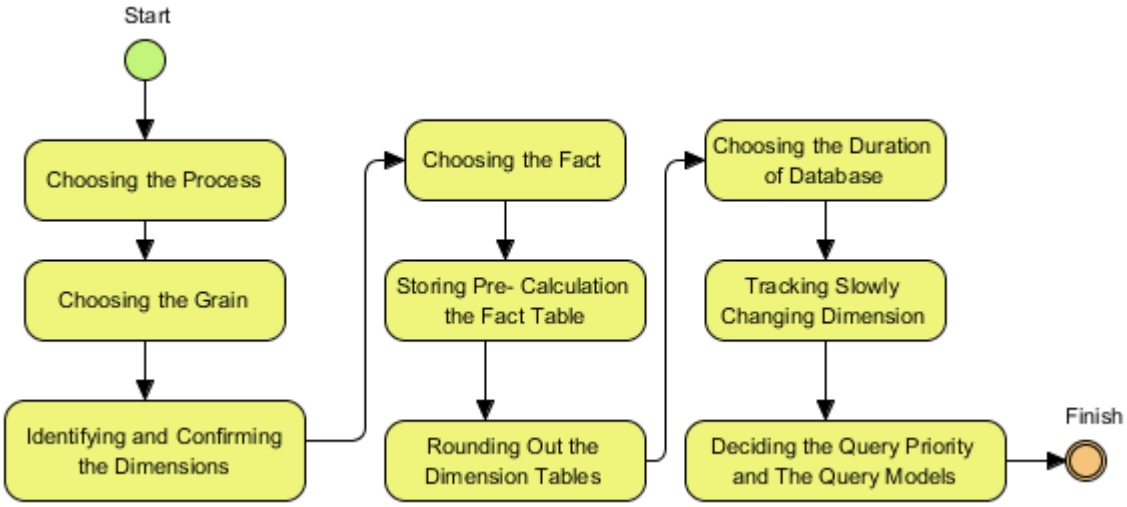


Figure 2. Nine Step Kimball

2.4.1. Choosing the process

This initial step aims to determine the business processes of an agency that can be used to meet important business-related needs. In this case, the step is intended to meet the needs of the Population Control, Family Planning, Women's Empowerment, and Child Protection Agency (DP2KBP3A) of Kediri Regency.

2.4.2. Choosing the grain

The next step is to select data sources to determine the data to be entered into the fact table. This fact table serves to represent the data facts. Furthermore, this fact table will become the basis for determining the dimension table, which acts as an information support.

2.4.3. Identifying and Confirming the Dimensions

At this stage, the process of identifying dimension tables and their connections with the fact tables selected in the previous process is carried out. Thus, more detailed information and a comprehensive overview of the fact tables will be obtained.

2.4.4. Choosing the fact

The selection of fact tables is the next step. This stage aims to determine the measures required by each fact table along with the information used in the fact table.

2.4.5. Storing pre- calculation the fact table

The next step is to calculate the important attributes that will be stored in the database.

2.4.6. Rounding out the dimension tables

This stage aims to complete the description of each attribute in the dimension table that contains structured information.

2.4.7. Choosing the duration of database

The database duration selection stage aims to determine the time range of data that will be entered into the data warehouse.

2.4.8. Tracking slowly changing

This step aims to determine the basic type of changes to the dimension table, such as changing attributes, creating new records, and creating alternative attributes.

2.4.9. Deciding the query priority and the query models

The ninth stage aims to design the physical data warehouse and identify potential problems that may arise during the physical design process.

3. RESULTS AND DISCUSSION

3.1. Business processes in progress

Every agency or company needs a structured business process for data collection so that all stages run optimally. The following is the business process flow implemented by the Office of Population Control, Family Planning, Women's Empowerment, and Child Protection (DP2KBP3A).

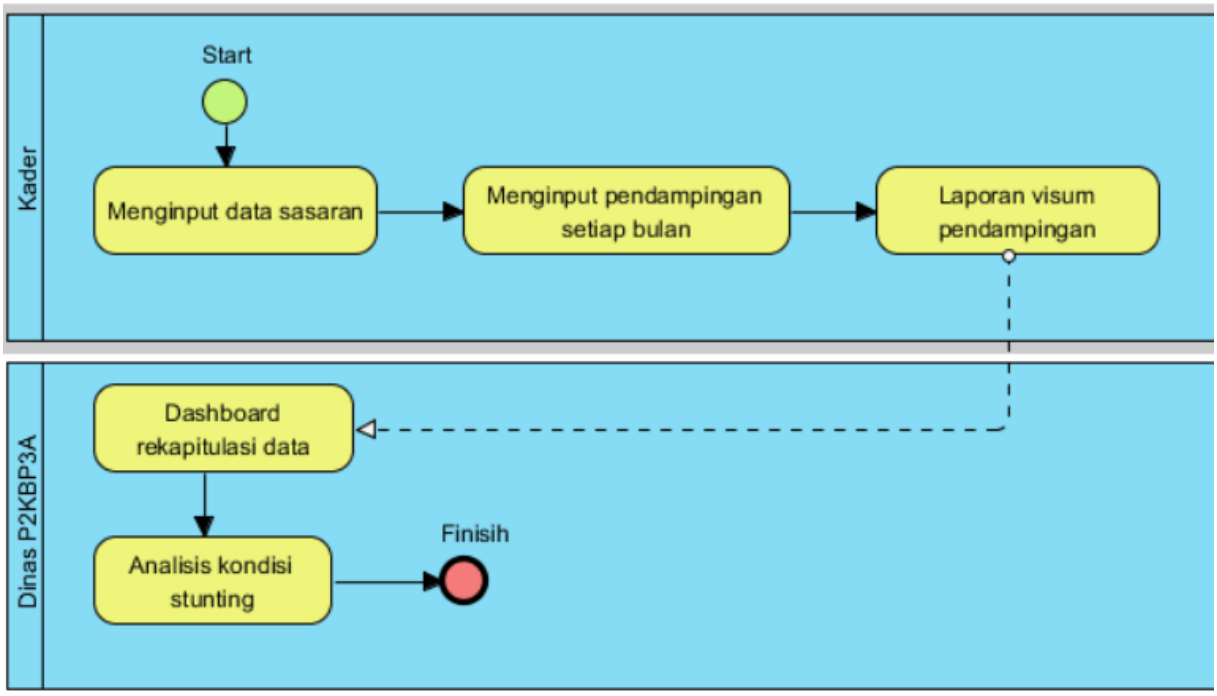


Figure 3. Business Process

Figure 3 shows the business process in operation, which involves two main components, namely :

1. Cadres are a group of assistants consisting of members of the Family Planning Association (KB), the Family Welfare Movement (PKK), and health workers. In the ongoing business process, all data is obtained from data input carried out by cadres spread across all villages in Kediri Regency. These cadres will record all target children in each area. The target data input includes all children, whether normal, stunted, wasted, stunted and wasted, or pre-stunted. The results of this target data input will serve as the primary data for the accompaniment or visitation process conducted by the cadres. Subsequently, this data undergoes a compilation process to generate periodic information on stunting conditions. With regular data updates, up-to-date information is obtained, which can be used as a basis for strategic decision-making.
2. The P2KBP3A Office is the final recipient of data entered by cadres. This is where the data warehouse function is carried out, as it acts as the final recipient of data and the party that will make policies related to existing stunting conditions.

3.2. Data warehouse modeling

For the data warehouse modeling that will be used, Kimball's nine-step methodology is applied with the following stages

1. *Choosing the process*

The business processes running at the PD2KBP3A service in Kediri Regency include:

a. Target data collection
b. Regular assistance for each target by family planning cadres, PKK, and health workers
c. Inputting data from assistance
d. Reporting on the results of medical examinations carried out by cadres

2. *Choosing the grain*
Choosing the grain here means analyzing and selecting the fact tables to be used. At the P2KBP3A Office, the information to be used for this data warehouse is information related to the factors causing stunting, wasting, stunting wasting, and pre-stunting.

3. *Identifying and Confirming the Dimensions*
Data warehouse design at this stage involves identifying dimension tables that will be linked to fact tables. Dimension tables are used to display factual data that can be viewed from various perspectives, thereby providing a more detailed picture of stunting from different angles in accordance with user preferences..

Table 1. Dimension

Dimension Table	Description	Grain
dim_kecamatan	Terdiri dari atribut id,kecamatan	Input data pendampingan
dim_desa	Terdiri dari atribut id,desa	Input data pendampingan
dim_dusun	Terdiri dari atribut id,dusun	Input data pendampingan
dim_status	Terdiri dari atribut id, status	Input data pendampingan
dim_penyebab	Terdiri dari atribut id, penyebab	Input data pendampingan
dim_date	Terdiri dari atribut id, date_update	Input data pendampingan
dim_sasaran	Terdiri dari atribut id_sasasaran, nama, tgl_lahir, usia, nama_ibu, nik_ibu, rt, rw,tb,bb	Input data pendampingan

4. *Choosing the fact*
In this fourth stage, the fact table to be implemented into all dimension tables defined in the previous stage is determined. This fact table will generate complete data information. As the main table, the fact table is the result of transactional data processing (OLTP) that has been processed so that it is ready for use in analysis in the Online Analytical Processing (OLAP) process.

Table 2. Fact Table

Fact	Attribute
Fact_stunting	Id, id_kecamatan, id_desa, id_dusun,id_sasaran, id_status,id_penyebab,id_date, jumlah

5. *Storing pre calculation the fact table*
In the fifth stage, calculations are performed on the fact table and the pre-calculated data is stored. The table below explains the pre-calculation process in calculating data derived from transactions entered by users in their respective work areas.

Table 3. Pre-calculation of fact tables

Fact	Pre- calculation
Fact_stunting	Jumlah

6. *Rounding out the dimension tables*
This stage serves to complete the dimension tables that have been identified previously. The following table shows the data types that will be used for each dimension. The data is sourced from transactions (OLTP) that have been entered by users according to their respective work areas.

Table 4. Completing the dimension table

Dimension Table	Attribute	Type	Description
dim_kecamatan	Id kecamatan	Int Varchar	The amount of stunting data can be viewed based on subdistricts
dim_desa	Id desa	Int Varchar	The amount of stunting data can be viewed based on the village
dim_dusun	Id dusun	Int Varchar	The amount of stunting data can be viewed based on hamlets

dim_status	Id status	Int Varchar	The amount of stunting data can be seen based on the target status, for example : stunting, wasting, stunting wasting, pra-stunting, normal
dim_penyebab	Id penyebab	Int Varchar	The amount of data on stunting can be viewed based on the causes of stunting, for example: karena pola asuh, faktor ekonomi, dll
dim_date	Id date_update	Int date	The amount of stunting data can be seen based on the latest data
dim_sasaran	id_sasasaran nama tgl_lahir usia nama_ibu nik_ibu rt rw tb bb nik_anak	Varchar Varchar Date Int Varchar Char Varchar Varchar Double Double Char	Stunting data reports can be viewed by target name and address

7. *Choosing the duration of database*
   The P2KBP3A agency will use data from the last two years in this data warehouse.
8. *Tracking slowly changing*
   At this stage, it is highly likely that attributes will change because the data for each target will be updated every month. If there is a change in data, the dimension table will store the new data without deleting the old data.

Table 5. Changes in attributes

Dimensi	Attribute
dim_sasaran	usia
dim_date	date_update

9. *Deciding the query priority and the query models*
   In the final stage of designing the data warehouse at the P2KBP3A Office, an ETL (extract, transform, load) process was carried out on all assistance or visit data that had been inputted by cadres in each working area on a regular basis.

3.3. *Star schema*
The following are the results of the star scheama in data warehouse modeling at the P2KBP3A Office.

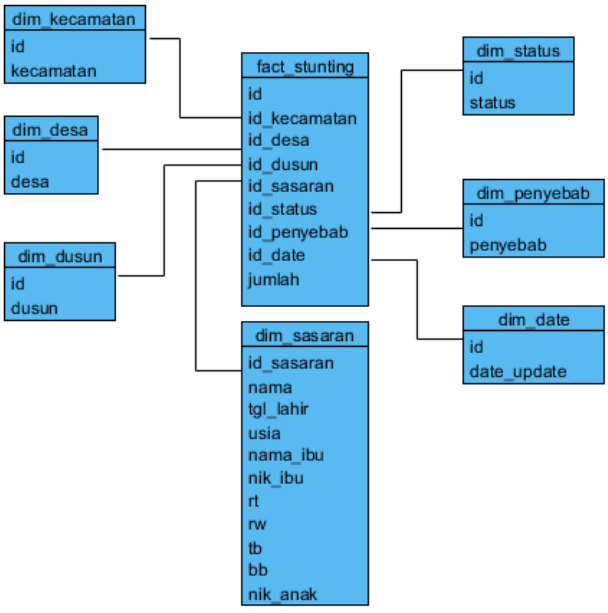


Figure 4. Star schema

The results of star schema modeling consist of several dimension tables and one fact table. The fact table has dimension tables that provide supporting data for existing facts.

Table 6. S*tar Schema*

Table	Attribute
fact_stunting	id (pk) id_kecamatan (fk) id_desa (fk) id_dusun (fk) id_sasaran (fk) id_status (fk) id_penyebab (fk) id_date (fk) jumlah
dim_kecamatan	id (pk) kecamatan
dim_desa	id (pk) desa
dim_dusun	id (pk) dusun
dim_status	id (pk) status
dim_penyebab	id (pk) penyebab
dim_sasaran	id_sasaran (pk) nama tgl_lahir usia nama_ibu nik_ibu rt rw tb bb nik_anak

The following is the implementation of data warehouse results displayed in a dashboard to illustrate the condition of stunting. The data on this dashboard (Figure 5) comes from inputs from cadres according to their respective working areas. The data displayed will be updated dynamically according to the latest conditions. This display is expected to provide a visual overview of the condition of stunting in Kediri Regency. For the implementation of the dashboard and Online Analytical Processing (OLAP), the CodeIgniter framework, which is one of the PHP programming language frameworks, is used.

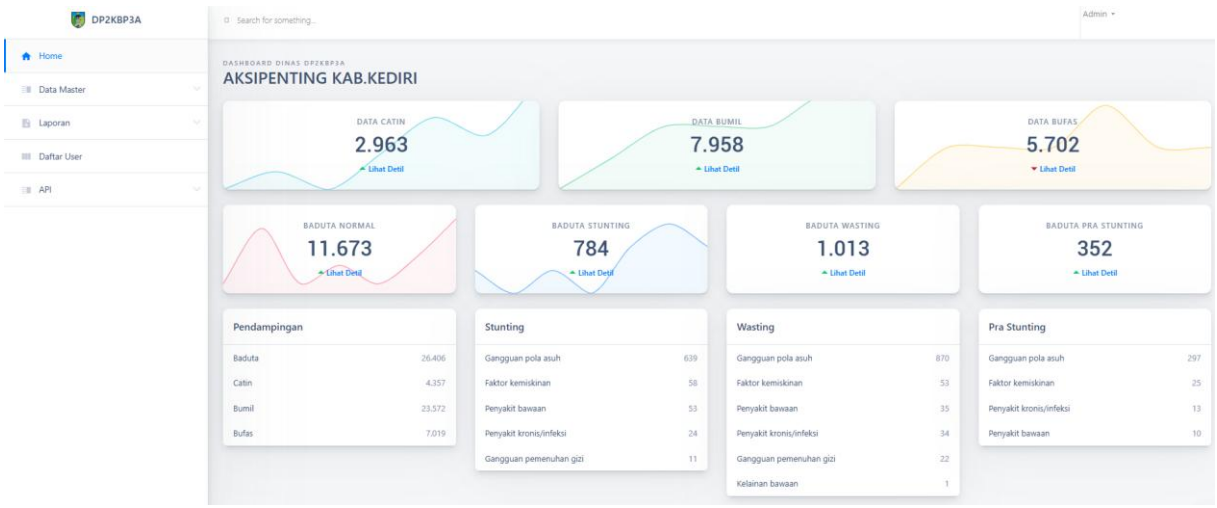
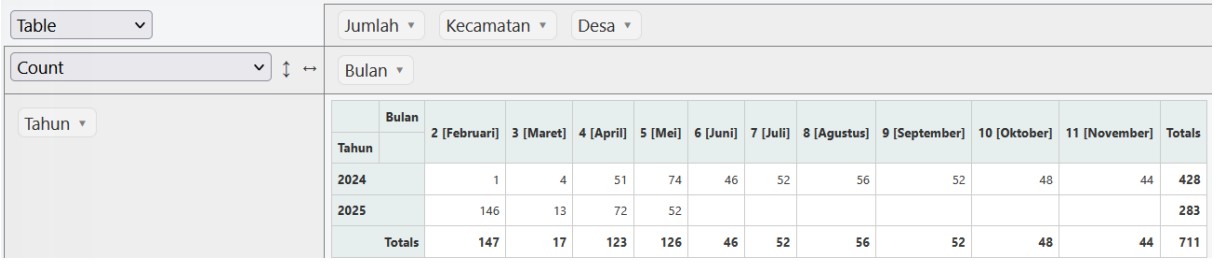


Figure 1. Dashboard

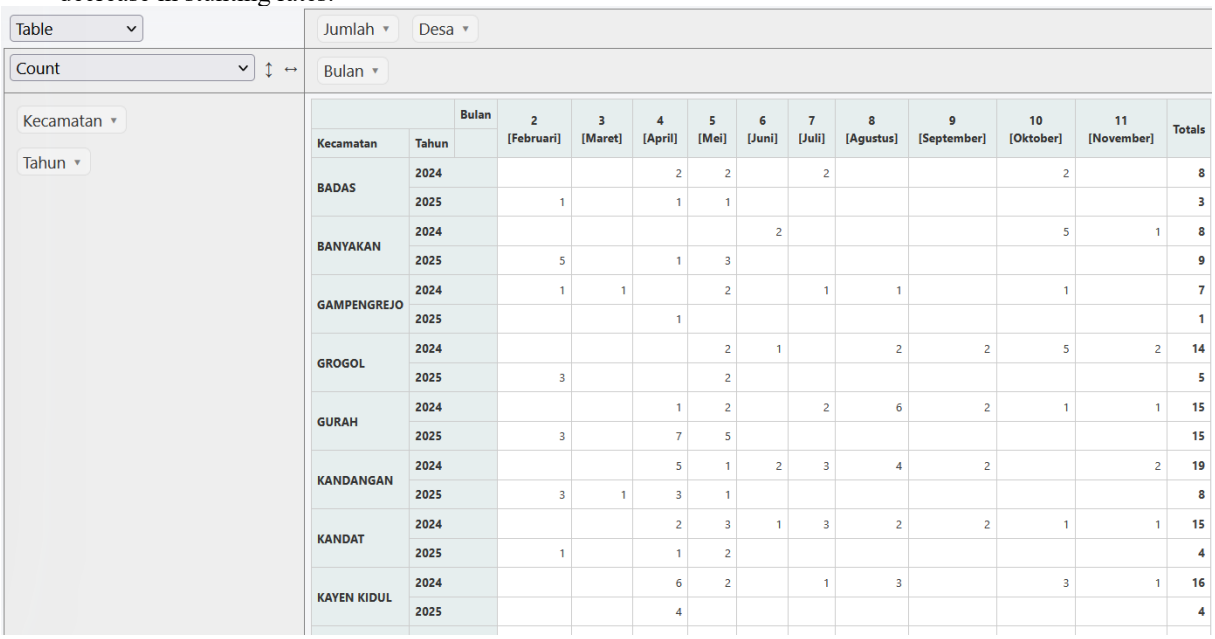
Figure 6 shows the data display in the Online Analytical Processing (OLAP) implementation to show stunting conditions by year. With the application of OLAP in the form of a pivot table, users can display data as needed based on period, number, location, or a combination of all three. Thus, data can be displayed from various perspectives according to user needs.



Tahun \ Bulan	2 [Februari]	3 [Maret]	4 [April]	5 [Mei]	6 [Juni]	7 [Juli]	8 [Agustus]	9 [September]	10 [Oktober]	11 [November]	Totals
2024	1	4	51	74	46	52	56	52	48	44	428
2025	146	13	72	52							283
Totals	147	17	123	126	46	52	56	52	48	44	711

Figire 2. Pivot table of stunting data by year

Figure 7 shows the results of Online Analytical Processing (OLAP) visualization in the form of a pivot table with data perspectives based on a combination of time (year) and region. This display shows in detail the number of stunting cases in each region based on subdistricts. This pivot table visualization also illustrates the dynamics of stunting cases per subdistrict each year and month, including trends in the increase or decrease in stunting rates.



Kecamatan	Tahun	2 [Februari]	3 [Maret]	4 [April]	5 [Mei]	6 [Juni]	7 [Juli]	8 [Agustus]	9 [September]	10 [Oktober]	11 [November]	Totals
BADAS	2024			2	2		2			2		8
	2025	1		1	1							3
BANYAKAN	2024					2				5	1	8
	2025	5		1	3							9
GAMPENGREJO	2024	1	1		2		1	1		1		7
	2025			1								1
GROGOL	2024				2	1		2	2	5	2	14
	2025	3			2							5
GURAH	2024			1	2		2	6	2	1	1	15
	2025	3		7	5							15
KANDANGAN	2024			5	1	2	3	4	2		2	19
	2025	3	1	3	1							8
KANDAT	2024			2	3	1	3	2	2	1	1	15
	2025	1		1	2							4
KAYEN KIDUL	2024			6	2		1	3		3	1	16
	2025			4								4

Figure 7. Pivot table of stunting based on time and place

4. CONCLUSION

Based on the data collection process, needs analysis, and data warehouse modeling, several conclusions can be drawn as follows:

1. This study produced a star schema model for the data warehouse at the P2KBP3A Office of Kediri Regency.
2. From this data warehouse, factual information in the field can be obtained and traced in detail through the dimension tables that have been created.

5. SUGGESTIONS

This study still has several shortcomings that require further improvement and development. Suggestions for further research include:

1. Adding more complete attributes to the target dimension;
2. Applying a data warehouse modeling scheme to Online Analytical Processing (OLAP) for stunting data visualization;

3. Integrating data with all relevant units to accelerate the handling of stunting information.

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