IMPLEMENT OF APRIORIAL ALGORITHM FOR PROCUREMENT OF MEDICINE AND HEALTH EQUIPMENT ON RADIOLOGY DEPARTMENT OF MAYAPADA HOSPITAL

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Abstract— *The pattern of drug and medical device needs at Mayapada Hospital in South Jakarta has a tendency to be repeated and similar in a relatively long period of time, especially in one particular department, because the cases found are often similar or even similar. Ensuring the availability of stock in each department's deposit is very vital, because the procurement of medical equipment must go through a certain process and time, so there are often cases where there is a critical resus but the equipment needed in the deposit does not meet the needs or escape from inventory and must indent first. By calculating the tendency (Apriori Association) demand patterns in the relevant departments, especially in the radiology department at Mayapada Hospital, South Jakarta, a rule was formed that resulted in a pattern of dependency between itemsets that had supporting criteria in the form of support of 33.3% and Confidence by 85%, where the items that appear are items with a high frequency of appearance and association, so they can be taken into consideration to ensure the availability of drugs and medical devices.*

Keywords: *An Apriori Algoritm, Assosiation, Frequent, Indent, Itemset.*

Intisari— Pola kebutuhan obat dan alat kesehatan pada Mayapada Hospital Jakarta Selatan memiliki kecendrungan perulangan dan sejenis dalam rentang waktu yang relatif lama, terutama pada satu departemen tertentu, karena kasus yang ditemukan seringkali memiliki kemiripan atau bahkan sama. Menjamin ketersediaan stok di deposit masing-masing departemen merupakan hal yang sangat vital, karena pengadaan alat-alat kesehatan harus melalui proses dan waktu tertentu, sehingga sering terjadi kasus dimana terdapat resus yang kritis namun alat yang dibutuhkan dalam deposit tidak memenuhi kebutuhan atau luput dari persediaan dan harus melakukan indent terlebih dahulu. Dengan dilakukannya perhitungan kecendrungan (*Asosiasi Apriori)* pola permintaan pada departemen terkait, khususnya pada departemen radiologi di rumah sakit Mayapada Hospital Jakarta Selatan, diperoleh suatu aturan yang terbentuk dengan menghasilkan pola ketergantungan antar *itemset* yang memiliki kriteria pendukung berupa *support* sebesar 33,3% dan *Confidence* sebesar 85%, dimana *item* yang muncul merupakan *item* dengan frekuensi kemunculan dan keterkaitan yang kuat, sehingga dapat dijadikan bahan pertimbangan untuk menjamin ketersediaan obat dan alat kesehatan.

Kata Kunci: Algoritma Apriori, Asosiasi, Frekuensi, Indent, Itemset.

PENDAHULUAN

Mayapada Hospital South Jakarta is a leading private hospital with international standards. One very vital facility regarding the diagnosis status of patients is the radiology department which is doing imaging or better known as x-ray x-rays. In its activities, the radiology department not only carries out medical activities with machines but also requires drugs and other medical devices.

In the procurement process, the radiology department checks the department's deposit, then

looks at its functional level with the remaining stock with the level of needs and cases that are often found. Then the radiology officer requests the items that must be re-stocked, to be forwarded to the pharmaceutical warehouse department.

Due to the increasing medical activities, especially in the radiology department where researchers conducted research, several problems were found. One of the problems found was the case where the need for drugs and medical devices available in radiological deposits and pharmaceutical warehouses was lacking, delays in the distribution of goods, to the void of stock. Even though the number of indent frequencies of the item is always routine so that related and emerging items have a high level and tendency of similarity between items by looking at the history of previous indent transactions.

The absence of standard methods used in dealing with drug supply problems in Srikandi clinics often causes problems, especially when requiring certain drugs in large quantities. This is because the purchase of drugs to meet the supply of drugs in pharmacies is only based on drug data that will run out. The application of data mining algorithms can help in analyzing drug inventory data so as to produce information that can be used in planning drug supplies in the clinic Srikandi (Elmayati, 2017).

Planning for drug needs will affect the procurement, distribution, and use of drugs in health care facilities (Febrian, Dzulfaqor, Lestari, Romadhon, & Widodo, 2018). The availability of types and quantities of drugs that are fast enough needed by agencies that provide health services is very important.

The supply of medical equipment with a very large amount can cause a lot of risks, such as the number of costs incurred to store medical devices and also prone to theft risk. The supply of medical devices can have an influence on the quality of health services used. Data mining using an algorithm can be used to determine the associative relationship of item combinations by using the calculation of support and confidence of an itemset. A priori algorithm for analyzing and determining the purchase of medical devices Data mining using apriori algorithm can be used in the health sector to determine patterns of drug purchase (Yanto & Khoiriah, 2015).

Data mining can be used to manipulate data into more valuable information obtained by extracting and recognizing important patterns of data contained in a database (Ristianingrum & Sulastri, 2017). This study aims to find the tendency between one item to another, where the stronger the emerging trends will be used as a reference in the hospital policy process in ensuring the availability of these items when needed so that the procurement process can always be fulfilled.

MATERIALS AND METHODS

To measure the level of need for drugs and medical devices that will be carried out to find the level of tendency between itemset using apriori algorithm, there are several steps that are carried out, namely:

A. Data Source Analysis

1. Amount of Deposit Stock

The main factor in the procurement of drugs and medical devices in the radiology department is to look at the amount of available stock deposited. If it is estimated to be sufficient for several indent periods and rare cases, the indenting process will be carried out in the next indent period.

2. Indent Order Period

The order period is the scheduled time to procure goods. The researcher uses the time limit of goods orders on routine procurement transactions and some random transactions.

3. Department of destination.

There are two departments that aim to supply drugs and medical devices, namely main store pharmacy and inpatient pharmacy. Because the main store pharmacy tends to have very few items, the researchers used data from the procurement of drugs and medical devices aimed at the pharmaceutical department alone and ignored transactions in the main store pharmacy department.

4. Case Rate Against Drug Needs.

The author uses and sets the assumption that items that frequently and tend to appear routinely in indent transactions as items that are often used where in many cases the use of drugs and medical devices tends to be the same.

B. Data Processing Process

In the process of processing data in this study, as mentioned above, this research uses the A Priori Algorithm method in finding data processing. The steps taken are as follows:

1. The process of counting Candidate Candidates

The first step taken is to tabulate and define the itemset that arises from the entire transaction, with the aim to facilitate the calculation and determine the total overall appearance of the item against the total number of transactions that exist within a certain period.

2. Process of Calculating Support Candidates

After tabulation data has been made, then the templates that appear have been identified and the total number of transactions that have taken the next step is to carry out the calculation and determination of minimum 1-itemset and 2-itemset support.
The determination of this support is calculated using the formula that has been determined as follows:
To calculate the 1-itemset support value the formula used is:

$$Support\ (A) = \frac{\sum Transaksi\ Mengandung\ A}{\sum Transaksi}\ x\ 100\% \text{ .....(1)}$$

After getting a profit of each value from 1-itemset, the determination of the support value can be done, henceforth the items selected from the minimum support are then used as candidates for calculating the 2-itemset value. Whereas to calculate the 2-itemset support value the formula used is:

$$Support\ (A,B) = \frac{\sum Transaksi\ Mengandung\ A\ dan\ B}{\sum Transaksi} x100\% \text{ .....(2)}$$

Next, after getting the results of each frequency value, and the minimum support value has been determined, then the association rules are made.

A. Making Association Rules

Based on the support value that has met the criteria, and the combination of the itemset that meets the minimum standard, then the confidence value will be calculated, i.e. the strength of the item in the total transaction containing the item.
To calculate the confidence value of an itemset combination, use the following formula:

$$Confidence = P(B|A) : \frac{\sum Transaksi\ Mengandung\ A\ dan\ B}{\sum Transaksi\ Mengandung\ A} x\ 100\% \text{ .....(3)}$$

By finding the value of confidence it will be matched with the minimum support value of a predetermined combination of items, where both the value of support and confidence have a minimum value for each parameter specified. After the combination pattern is found, it is made as a conclusion from the calculation of the association rules and as an item that has the strongest support and confidence criteria.

RESULTS AND DISCUSSION

In the process of processing data mining so as to produce a conclusion in the form of information, the stages that have been tested in the process are needed, then based on that the writer will use the following methods and stages:

A. Data Analysis

In this study, researchers used the results of indent order transactions from the radiology department to the inpatient pharmaceutical department. Whereby following the applicable indent period, then in normal time that is twice weekly indent orders and the number of normal transactions in a year reaches 100 transactions. In this study, researchers took a span of three years (2016-2019), with 250 transaction data to be processed and then used as a useful source of information for both the radiology department and the pharmaceutical department.

B. Formation of candidates and Itemset Frequencies

The types of items contained in all drug and medical device indent transactions along with the number of occurrences of each itemset of the total number of indent order transactions that occur during the period will be used as a research benchmark.

1. Formation of the Set-Item Frequency list

The first thing to do is to make a frequency list based on the indent order data that has been obtained.

Table 1. Example List of Itemset Frequencies

No	Nama Item	Jumlah Transaksi
1	3 Waystopcock Buntut	90 / 250
2	Alcohol Hand	61 / 250
3	Alcohol Swab Pastik	70 / 250
4	Ambu Blue Sensor	57 / 250
5	Apron White	1 / 250
6	Aquapak	8 / 250
7	Aquasonic Gel	55 / 250
8	Betadine SOL	37 / 250
9	Buscopan	15 / 250
10	Coil Connecting Tube	81 / 250
11	Dexamethasone	7 / 250
12	Diphenhydramine	16 / 250
13	Disposible Catheter TIP	48 / 250
14	Disposible Syringe	122 / 250
15	Disp Elektroda	3 / 250

Source: (Afif & Wulandari, 2019)

After knowing each itemset that appears in the transaction along with the frequency of the item's appearance from existing transactions, then it will then enter the stage in the calculation process to find a value that meets the minimum support criteria to the stages of forming the association pattern.

2. Formation of a 1-itemset List

In the process of forming 1 itemset, a minimum support value has been set at 33.3%. This minimum value is considered as an indicator that is sufficient to reduce transactions where if under 33.3% an item is considered less influential on indent order transactions.

The following are examples of calculation of 1-itemset formation:

$$3Waystopcock : \frac{\sum Transaksi\ Mengandung\ 3Ways}{\sum Transaksi} x100\%$$
$$= \frac{90}{250}\ x\ 100\% = 36\%$$

Then with a determined value of support of 33.3%, 1-itemset data can be determined that meet the minimum support criteria as shown in table 2 below:

Table 2. List of 1-itemset that meets the Minimum Support Value of 33.3%

No	Item Name	Number of Transactions	*Support (%)*
1	3Waystopcock Buntut	90	36,0 %
2	Disp Syringe	122	48,8 %
3	Gadoterate Meglumine	106	42,4 %
4	Iohexol 350	95	38,0 %
5	Iopamidol	96	38,4 %
6	Metacosfar	83	33,3 %
7	NaCL 0,9%	107	42,8 %
8	Sens Glove	85	34,0 %
9	Tegaderm	87	34,8 %
10	USG Paper	92	36,8 %
11	Vasofix	88	35, 2%

Source: (Afif & Wulandari, 2019)

3. Formation of a 2-itemset List

The next step is the formation of a combination of 2 itemset patterns. The formation of a frequency pattern of two (2) items is formed from items of the type of medical devices that meet minimum support by combining all items into two combinations, the result of a combination of all types of items. The combination of each item that has been selected will be calculated to determine the combination that meets the 33.3% minimum standard of support in transactions that occur.

The following is an example of a 2-itemset formation calculation:

$$\text{Support (A, B)} = \text{P(A} \cap \text{B)}$$
$$= \frac{\sum Transaksi\ Mengandung\ \text{Sensi Glove dan Iohexol 350}}{\sum Transaksi} x100\%$$
$$= \frac{53}{250}\ x\ 100\% = 21{,}2\%$$

Then, with a determined support value of 33.3%, 2-itemset data can be determined that meet the minimum support criteria as shown in the following table 3:

Table 3. List of 2-itemset that meets the minimum support value of 33.3%

No	Nama Item	Transaksi	*Support (%)*
1	3Waystopcock Buntut ^ Disp Syringe	83/250	33,3 %
2	Disp Syringe ^ NaCL 0,9%	91/250	36,4 %
3	Disp Syringe ^ Vasofix	85/250	34,0 %

Source: (Afif & Wulandari, 2019)

The above data is a combination of two selected data item patterns with predetermined support criteria where the combination of patterns meets the minimum support of 33.3%. The combination data of Waystopcock Buntut with Disposable Syringe, Disp Syringe with 0.9% NaCl, and Disposable Syringe with Vasofix are itemset that meets the minimum support criteria. These results explain that the combination of the two data items is the most in a transaction.

C. Formation of Association Rules

By making item-A as Antecedent and Item B as Consequent, the association rules A → B are applied to be able to calculate the confidence value by determining a minimum confidence value of 85%. Itemset candidates who have met the support value are items that will be a candidate for a combination of values from confidence.

The following is an example of calculating the confidence value:

$$Confidence$$
$$= \text{P(A|B)}: \frac{\sum Transaksi\ Mengandung\ \text{3Ways dan Disp Syringe}}{\sum Transaksi\ \ Mengandung\ 3ways} x100\%$$
$$= \frac{83}{90}\ x\ 100 = 92{,}2\%$$

After getting the results of each confidence value based on the items of the combination that meet the support, then by applying the association rules where the value of support and confidence of each combination of items has met or above the minimum value that has been determined, then the combination that meets these criteria can be seen in the following table 4:

Table 4 Formation of Associations

No	Item Name	*Support(%)*	*Confidence (%)*
1	3Waystopcock Tail ^ Disp Syrin	33,3 %	92,2%
2	NaCL 0,9% ^ Dis Syringe	36,4 %	85,0%
3	Vasofix ^ Disp Syringe	34,0 %	96,5%

Source: (Afif & Wulandari, 2019)

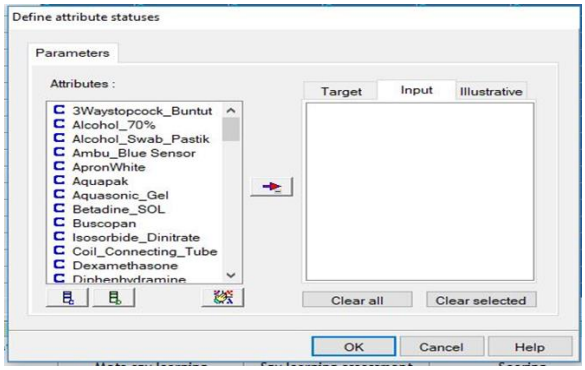
Based on the data in table 4, we get the association rules that meet the criteria of support and

confidence with a minimum support value of 33.3% and a confidence value of at least 85%, so it can be concluded that the three rules have a frequency and a strong interrelation between itemset.

D. Testing

The next step is to test data mining applications, using the Tanagra application version 1.4.50 as the testing application to test the suitability of manual calculations with calculations using the application. The following are the testing steps with Tanagra:

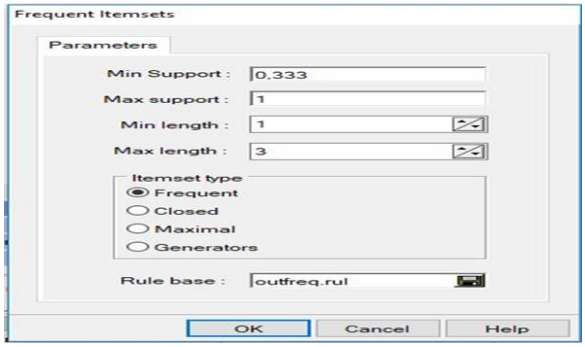
1. Input data into Tanagra, after the dataset is displayed, on the "Define Dataset" Tab then enter the input attribute on the itemset you want to do the calculation.



Source: (Afif & Wulandari, 2019)

Gambar 1. Tampilan input Atribut

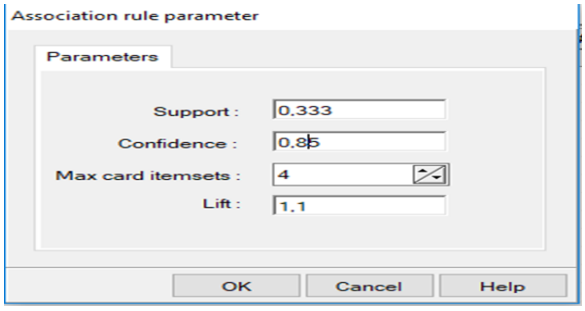
2. Determine the parameters for the minimum value of support to count the number of items that meet the minimum value of support following the minimum number of combinations to be produced



Source: (Afif & Wulandari, 2019)

Figure 2 Support Parameter Settings

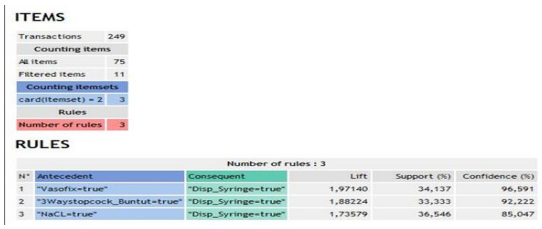
3. After frequent items and combinations of support that meet the standard are generated, the association rules will be formed. On the "Association" menu click then select "A Priori", then enter the minimum value of support and confidence in the parameter menu and the desired maximum combination



Sumber : (Afif & Wulandari, 2019)

Figure 3 Formation of the Association

4. After determining the value of support and confidence, the results of the association rules with the pattern of data indent data processing items and medical devices in the Mayapada Hospital South Jakarta department are obtained.



Source: (Afif & Wulandari, 2019)

Figure 3 Formation of the Association

After testing using the Tanagra 1.4.50 application, the resulting association rules are formed by three rules and prove the equation from the results of manual calculations. So it can be concluded that the items of minimum support and confidence that meet the criteria are the same and have been tested. So that these items can be used as management considerations, especially those involved in indent activities to pay attention to both the availability of stocks and their distribution in a guaranteed manner

CONCLUSION

This research is intended to look for combination patterns and items that most often appear as candidate items that will be used as references in each department to safeguard the availability of drugs and medical devices, assuming that items produced from the association pattern are the ones most often needed for patient action.

The method used to calculate frequency patterns and combinations is to use the Priori A Data Mining Algorithm technique as a data processing

method and use the Tanagra 1.4.05 Application as a test from manual calculations to calculations with applications. After doing various calculation patterns, both through support and confidence, we get a combination of rules that meet these two parameters, namely a combination of 3Waystopcock Tail and Disp Syringe with a support value of 33.3% and a confidence value of 92.2%, a combination of NaCL 0, 9% and Disp Syringe with a support value of 36.4% and a confidence value of 85.0%, as well as a combination of Vasofix and Disp Syringe with a support value of 34.0% and a confidence value of 96.5% as a combination that meets the minimum parameters which is determined. By finding the combination of these patterns, and the frequency of the dominant items in the last transaction period, it is expected that both the radiology department as the department in need can safely control the inventory in the department's deposit, and the pharmaceutical department as the provider to guarantee the availability of these items and ease of distribution.

For further research, it can be done with data that is updated to the needs of the current study, as well as using several different methods to prove the validity of the results of existing research.

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