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# Implementation of Improved Apriori Algorithm for Drug Planograms in XYZ Pharmacies and Analysis of Medicinal Procurement Planning Using ABC Critical Index Methods

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**Abstract.** In conducting transactions in the present era where people no longer carry out transactions manually, where now there is modern technology, so that it can make it easier to conduct transactions, such as pharmacies. Pharmacy owners can now put their medicines in a position that matches the combination of goods sold and can also conduct an analysis of drug procurement planning. Improved Apriori Algorithm Method is one of the methods to assist in finding the combination of goods most often purchased by transforming data into a matrix and then cutting columns and rows according to the minimum amount of support specified and the iteration values that are ongoing, then displaying the results of the combination that is in accordance with the specified minimum confidence and the ABC Critical Index Method to analyze the critical stock procurement planning using the use value, investment value and VEN value to calculate the critical index value for each drug, after which each drug will be included in each class vary based on the level of drug sales. The results of testing manual calculations and programs obtained on 101 drug data and 64 transaction data in the Improved Apriori method are 4 drugs that can be combined with a predetermined minimum confidence value of 100%. Then in the Critical Index ABC method there is a percentage of drugs that go to group A is 17.82%, Group B is 66.34% and Group C is 15.84%.

## 1. Background

In this modern era of globalization, science and technology are advancing and developing rapidly. With the advancement in technology, it makes it easier for everyone to work with little risk. One technology that is increasingly developing is information technology. Information technology is a technology used to process data, including processing, obtaining, compiling, storing, manipulating data in various ways to produce quality information, namely information that is relevant, accurate and timely. The human need for information is also increasing. Humans want information that is relevant, fast, accurate and can be accessed wherever and whenever they want. This information applies to anything, such as shops, companies, supermarkets, and pharmacies. Today many companies, stores, supermarkets, pharmacies and others use an information system. The information system was created to make it easier to manage information in a company and others. There are information systems that are website based and desktop based. The current information system management within a company and others will be very easy and very fast. And no longer use the system manually, and sometimes difficult to manage.

The information system needed is in the form of an application that handles transaction patterns and planograms in sales transaction data and then also needs an information system regarding drug procurement planning. The number of drugs in the pharmacy makes it difficult for cashiers to take drugs from one another that are far from each other that has a tendency to purchase with a combination of set items. And the number of drugs also makes it difficult for cashiers to memorize the laying of drugs that are usually bought in combination sets of items, so this application is expected to help in the problem of a drug planogram at the pharmacy. Besides this application there is also an information system for drug procurement planning to facilitate the leadership of the pharmacy in managing drug procurement planning. Then the method used for this application is the Improved Apriori Algorithm



and the Critical Index ABC. Improved Apriori Algorithm to find out the transaction patterns for the drug planogram at the pharmacy. And the Activity Based Costing (ABC) Critical Index method for planning drug procurement. Matrix-based improved priori was proposed by several researchers, but with a different technique when searching for frequent item sets. By using database transformation techniques in the form of a matrix. To describe relationships in a database. Then the matrix is calculated to find the support value of the frequent item set candidates who meet the criteria to produce frequent item sets without re-scanning the database. ABC critical index method is an analysis used to sort, then group the types of goods in an effort to control the inventory of the amount of goods.

## 2. Literatur Study

The designed application is the application of the Improved Apriori Algorithm application for the drug planogram and the analysis of drug procurement planning using the Activity Based Costing method.

In arranging product layouts and display facilities, the term planogram is known. Planogram is the science and art of the layout of goods and displays. The purpose of a planogram is to optimize the use of space and display facilities so as to produce maximum productivity and probability.

The method used in this application is Improved Apriori and ABC Critical Index. Apriori matrix based proposed by several researchers, but with different techniques when searching often. By using basic data transformation techniques in the form of a matrix. To describe relationships in a database. Then the matrix is calculated to look for support values from frequently determined candidate items that meet the criteria for getting frequent items without re-scanning the baseline. Improved Apriori is one of the algorithm of the rules of association. Improved Apriori presents the database in the form of a matrix to describe the relationships in the database. Then the matrix is calculated to find the support value of the frequent itemset candidates without re-scanning the database by using the "AND" operation of the matrix row corresponding to the items in the frequent itemset candidate and adding the results of AND, with the result being support. ABC Critical Index is a very useful method for selecting, providing, managing distribution, and promoting rational use of drugs [1], [2], [3].

The program is intended for users in the form of cashiers and pharmacy owners. The application program will be created using the Improved Apriori method and ABC Critical Index. Cashier users can only make transactions with this program and access drug data. while for lead users, they can do calculations for financial statements, use the improved a priori method to determine the results of the combination of goods based on predetermined transaction data by cutting columns that are less than the specified support count and cutting rows that are less than the current iteration value, then the final result is in the form of an item set combination that matches the specified minimum confidence value. Then you can use the ABC Critical Index method to analyze the procurement plan using the use value, investment value and VEN value to calculate the Critical Index Value for each drug to determine the grade for each drug. In this program will be used 64 transaction data and 101 drug data with use value, investment value, and VEN value. Here is a sample table for the drugs data with use value, investment value, VEN value.

## 3. Method and materials

The methods used are 2 namely Improvement Apriori Algorithm and ABC Critical Index, Improved Apriori is one of the algoritma of the rules of association.

### 3.1. Improved Apriori Algorithm

Improved Apriori presents the database in the form of a matrix to describe the relationships in the database. Then the matrix is calculated to find the support value of the frequent itemset candidates without re-scanning the database by using the "AND" operation of the matrix row corresponding to the items in the frequent itemset candidate and adding the results of AND, with the result being support. This algorithm does not re-scan the database to look for relationships, so computing time and searching for frequent itemset candidates is faster [4], [5]. Difference between Improved Apriori Algorithm and Apriori Algorithm, Improved Apriori, converts data into a matrix to determine frequent

itemset and then reduces the number of frequent itemset candidates in Ck itemset candidates. While the Apriori Algorithm only calculates the amount of data and then selects data that is in accordance with support and confidence, then makes a combination regardless of the number of rows and columns. The stages of this algorithm run as follows:

Step 1: Converting database into matrix.

a. Database conversion containing items (In) and Transactions (Tm) in matrix form. The row of the matrix represents the transaction and the column of the matrix represents the item. If there is an item in a transaction, the value is 1 and value 0 if vice versa.

b. The sum of the values from the column is the value of the support count and the sum of the values from the row is the number of items in a transaction or count.

Step 2: Check the number of columns and the number of rows.

a. Remove columns that have fewer than the minimum support.

b. Delete rows where the number of rows is less than or equal to the value of k-frequent itemset (k).

Step 3: Combine each column using cross products to find the frequent 2-itemset combination and use the AND operation to get the value.

Step 4: Check the number of columns and the number of rows

a. Delete columns whose number of columns is less than the minimum value of support.

b. Delete rows where the number of rows is less than equal to the value of k-frequent itemset (k).

Step 5: Likewise to search for the Item-set item. Merge each column and delete columns that are less than the minimum support and delete rows where the number of rows is less than equal to k.

### 3.2 ABC Critical Index

Activity Based Costing (ABC) Analysis of the Critical Index is a very useful method for selecting, supplying, managing distribution, and promoting rational use of drugs. In the ABC Critical Index method to analyze data there are steps as follows:

Step 1: Calculate usage value

a. Calculate the value of drug use

b. Drug use data are grouped based on the amount of use. Sort from the largest usage to the smallest (the percentage of usage has become stipulated in the formula).

c. Group A with 80% use of all drug use.

d. Group B with the use of 15% of the total drug use.

e. Group C with 5% usage of all drug use.

The formula used in usage value:

$$Y = X / (\sum X) \times 100 \quad (1)$$

Description:

Y: % usage

X: number of uses / preparations

$\sum X$ : total number of preparations used

Step 2: Determine the investment value

a. Calculate the total investment for each type of drug.

b. Grouped by the investment value of the drug. Sorted from the largest investment value to the smallest one.

c. Group A with an investment value of 70% of the total drug investment

d. Group B with an investment value of 20% of the total drug investment

e. Group C with an investment of 10% of the total drug investment

The formula used in investment amount:

$$X = n \times hp \quad (2)$$

Description:

X: investment amount

$$N = \text{number of uses / preparations} \quad (3)$$

$$HP: \text{purchase price} + \text{VAT per unit preparation} \quad (4)$$

The formula used in investment value:

$$Y = X / (\sum X) \times 100 \quad (5)$$

Description:

Y: % investment

X: total investment / stock

$\sum X$ : total investment amount

Step 3: Determine the critical value of drugs

a. Develop critical value criteria.

b. The critical value of the drug is determined by the Pharmacy Management Pharmacy which influences prescribing and drug use.

Step 4: ABC Critical Index Analysis

a. To classify drugs, the data is then entered into the following formula:

The formula used in critical index value:

$$NIK = \text{use value} + \text{investment value} + (2 \times \text{critical value}) \quad (6)$$

Description:

Use value, investment value and critical value range from 1 to 3

For NIK 9.5 - 12, the drug is included in the Aik group

For NIK 6.5 - 9.4 the drug is included in the Bik group

For NIK <6.5, the drug is included in the Cik group

#### 4. Results and discussion

Based on point number 2 above, the final result of the Improved Apriori Algorithm method and ABC Critical Index method based on the formula previously described, then obtained as follows:

**Table 1.** Final Result for Improved Apriori Algorithm method

Combination	Confidence (%)
PRCT 500 ^ CTM 4 → DMCL	100
DMCL ^ AMXCL 500 → PRCT 500	100
DMCL ^ AMXCL 500 → CTM 4	100
DMCL ^ CTM 4 → AMXCL 500	100
DMCL ^ CTM 4 → PRCT 500	100
CTM 4 ^ PRCT 500 → AMXCL 500	100
CTM 4 ^ PRCT 500 → DMCL	100
CTM 4 ^ DMCL → AMXCL 500	100
CTM 4 ^ DMCL → PRCT 500	100

**Table 2.** Final Result for ABC Critical Index method

Drugs Group A	Drugs Group B	Drugs Group C
AMXCL 500	DXMTS 0.5	APR TAB
PRCT 500	SIR THI	CK
AM 500	AD 400	KD 25
DMCL	FG T	NRG
VTD 50	CTP 12.5	CPFX 500
MCH	C L 500	P V B16 10
VTCM	TMZ Tab	CND 0.15
PDNS 5	Vi B1 100	G g 100

**Table 2 (Advanced)**

<b>Drugs Group A</b>	<b>Drugs Group B</b>	<b>Drugs Group C</b>
CT 4	Tos	PNBB
T A	GBCMD 5	Vi C 1000
DCG	MND 5	AMNP 200
SP	CT 4	BTD plester
LMS 16	MCHX s	GSV MC 125
JCO	SPCTT	PM TAB
CRPN 250	IBPF 400	DCS
PRTS TAB	ERTM 500	SNB kaps
AMX 500mg	SM	
LD	MTM	
	PT 500	
	KTCN 200	
	PTC sach	
	PMD forte	
	KMTH	
	ACC400	
	APC 500	
	ALPR 100	
	ICD Od	
	NUD	
	DXCC100	
	DMP 15	
	HMVT jreng	
	GSOFU 125	
	CDMC 300	
	NFDP 10	
	LRTD 10	
	ANTG 500	
	ICD OD	
	DXN	
	RNTD 150	
	EZP	
	NT-E	
	CCS 30s	
	DTM	
	NURPV	
	BXD	
	NV 5mg	
	PNR	
	CDI 20mg	
	CMTD 200	

HSP 10s		
<b>Table 2 (Advanced)</b>		
<b>Drugs Group A</b>	<b>Drugs Group B</b>	<b>Drugs Group C</b>
	LCD	
	ENV-C	
	OMPZ20	
	DGR	
	SMN	
	FS 300mg	
	VP-G	
	WO I Mint	
	SVTT 10mg	
	CTRZ 10mg	
	CTMX 480	
	VOSEA TAB	
	MFN 500mg	
	GFGZ 300	
	PPR 5	
	NOZ forte	
	VSN 6ml	

## 5. Conclusion

Following are the conclusions that can be drawn in this calculation:

1. Pharmacy sales application system based on desktop applications provides the results of a combination of drug set items for drug layout based on specified transaction data and provide the results of drug procurement planning based on transaction data and drug data.
2. The results of testing the data on the method of Apriori Improved Algorithm obtained the results of 4 kinds of drugs that can be combined based on the predetermined transactions, namely AMXCL 500, PRCT 500, DMCL, CT 4. Because these 4 drugs can form a combination then for the placement of drugs in Pharmacies can be brought in parallel.
3. The results of testing the data on the Critical Index ABC method obtained the results of the names of drugs that fall into groups A, B, and C. Percentage values for each group are Group A 17.82%, Group B 66.34%, Group C 15.84%. Where the drugs that belong to groups A and B, it needs a review of the stock and the stock must not be empty within 48 hours. Provision of stock in Group C needs to be reduced and can be replaced with Group A from here the profit will be maximal if using existing stock.

## 6. References

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