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Mapping patterns of the spread of covid-19 in medan city in efforts to improve health service actions to communities exposed to the covid-19 virus Using the apriori algorithm method

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ABSTRACT

Corona Virus Disease, also known as COVID-19, is an infectious disease caused by the recently discovered corona virus. Most people who contract COVID-19 will experience mild to moderate symptoms, and will recover without special treatment. The virus that causes COVID-19 is mainly transmitted through the droplets (saliva splashes) that are produced when an infected person coughs, sneezes, or exhales. These droplets are too heavy and cannot stay in the air, so they quickly fall and stick to the floor or other surface.
It is easy to get infected so that many people are infected with COVID-19 so that there is an increase in service efforts in implementing the COVID-19 prokes in every sub-district in PemKO Medan.
The Medan City Government seeks to cooperate with local health centers to tackle the spread of COVID-19 in Medan City by preparing COVID-19 alerts in every puskesmas in every sub-district

1.Introduction

Coronavirus disease 2019 (Covid-19) is caused by a virus from the Corona virus family, SARS-CoV-2 where this virus emerged from the city of Wuhan, China in 2019. and has since spread throughout the world (plos one), with more than 100,000 increasing number of cases and deaths due to exposure to this virus.(Ribeiro et al. 2020).The spread of Covid-19 has a broad impact on the economy, both in the micro and macro economic sectors as well as the lower social and cultural level (Spicer 2020) owned by the community so that community activities are delayed, this is what will cause a prolonged negative impact for the government, especially the city. Medan.(Supriatna 2020)

The increase in the number of cases of Covid-19 disease starts from the knowledge of Covid 19 patients. This virus is transmitted through droplets (splashes of saliva) that are produced when an infected person coughs, sneezes, or exhales. can be infected. If you touch a contaminated surface and then touch your eyes, nose or mouth, protect yourself from other people around you.(Muhammad, Aditia Mahardika, and Rizka Amalia 2020)

Knowing the facts related to this virus and taking appropriate preventive steps according to local health authorities can be interpreted as a result of knowing from the patient about his illness, understanding the

disease, how to prevent it, treatment and complications (Devi Pramita Sari and Nabila Sholihah 'Atiqoh 2020)This knowledge is possessed by maintaining a healthy lifestyle at home. Maintain a healthy diet, adequate sleep has an important role in determining a complete behavior because knowledge will form beliefs which then in perceiving reality, provide a basis for decision making and determine healthy living behavior (Yunus et al. 2020)

Acceleration of Handling Corona Virus Disease 2019 (Covid 2019), Presidential Decree no. 11 of 2020 concerning the Determination of a Public Health Emergency of Corona Virus Disease 2019 (Covid 2019). Presidential Decree Number 12 of 2020 concerning the Determination of Covid 19 as a National Disaster. Minister of Health Regulation 9 of 2020 concerning Guidelines for Large-Scale Social Restrictions in the Context of Accelerating the Handling of Corona Virus Disease 2019. (Pratiwi 2021)this is the basis of the government's efforts in accelerating the spread of COVID-19 in the city of Medan.

The Medan city government's policy in order to improve health services for people exposed to COVID-19 is very important and needs to be considered to avoid the spread of the virus which is rapidly advancing to the adult community, especially for the elderly who have a history of illness, because these are very vulnerable to being exposed and infected. even take a life.This study aims to be used as a basic reference in government actions in responding to the density of the spread of COVID-19 in every sub-district of the city of Medan. (Huynh et al. 2020)

2. Literature Review And Hypothesis Development

Apriory Algorithm

Apriori algorithm is one of the algorithms in data mining to find frequent items/itemsets intransactional databases. The a priori algorithm was first introduced (Zhou 2020) to find the highest frequent in a database. Use of an iterative bottom-up approach. To determine the rule mining association of a database transaction, it takes time to process the frequent itemset, resulting in quite a lot of data combinations, t. This process is carried out to find the minimum support value and minimum confidence value.The a priori algorithm is very easy to understand, but there are some drawbacks to it:

1. Database Scanning: The transaction database needs to be scanned repeatedly to find the frequent itemset. If there are n items in the database, it requires a minimum of n times to scan the database.
2. Setting the minimum frequent item/itemset to determine the minimum support value.
3. Association rule mining rule in getting the minimum confidence value

The apriori algorithm steps are as follows:

1. Join (merger).
   In this process, each item is combined with other items until no more combinations are formed.
2. Prunes (pruning).
   In this process, the results of the combined items are then trimmed using a predetermined minimum support.

The two main processes are the steps that will be taken to get the frequent itemset in the Apriori algorithm. A priori goal to find frequent itemsets that often appear in every transaction that is executed on a set of data. A priori is also used to find a pattern of association rules that are good and have the highest accurate value, can be used to process millions of data, select data that are eligible for further processing so that they become several rules.

This a priori type of association rule in data mining is applied in solving many problems.

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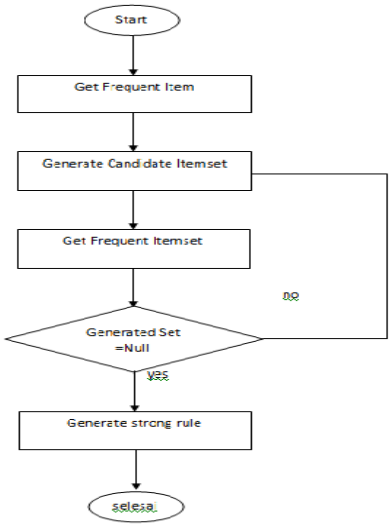

Figure 2. Description of the Apriori Algorithm

Pseudocode algoritma aprirori:
Input:
D,a database of transaction;Min_Supp, the minimum support count threshold
Out put:L, frequent itemsets in D
Method:
L1 = find_frequent_1_itemsets(D);
For (k=2;LK-1 ≠Φ,k I i){
Ck=apriori_gen(L1-1);
For each transaction t ⊂ D{//scan D for counts
Ct = subset (Ck,t); ; // get the subsets for each candidate c € Ct
c.count | |;
}
Lk={c ⊂ ck | c.counts≥ min sup}
}
Return L = ∪k Lk;

Rule Mining Association Analysis

Association rules are in data mining that find frequent itemsets in the database. Association of data mining rules is a mechanism in data mining in association rules, the implication expression of the form X → Y where X is Y. The antecedent and consequent are specified domain items I. antecedent and consequent are a set of items from domain I. Thus X∩Y = . The support of the item set is defined as the ratio of the number of transactions containing the item set to the total number of transactions. The trust of association rule X → Y is the probability that Y transaction contains association rule mining algorithm X, (Lismardiana and Nababan 2015)The formula to find the support and confidence values is:

$$\text{Support (A)} = \frac{\text{Number of transaction in which A appears}}{\text{Total number of transactions}}$$

$$\text{Confidence (A}\rightarrow\text{B)} = \frac{\text{Support(AUB)}}{\text{Support(A)}}$$

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Association analysis is defined as a process to find all association rules that meet the minimum requirements for support (minimum support) and minimum requirements for confidence (minimum confidence).

1. Generation Phase conditional pattern base Conditional Pattern Base is a subdatabase containing prefix path (prefix path) and suffix pattern (suffix pattern). Generating conditional pattern base is obtained through the FP-tree that has been built previously.
3. Conditional FP-tree Generation Stage At this stage, the support count of each item in each conditional pattern base is added up, then each item that has a support count greater than the minimum support count will be generated with a conditional FP-tree.
4. Frequent itemset search stage if the conditional FP-tree is a single path, then the frequent itemset is obtained

3. Research Methods

Technique of Using Apriori Algorithm In this research, several steps were carried out as follows:

1. This research starts from data collection and data filtering process using Weka Explorer.
2. The next stage is the k-1 frequent item process on the a priori algorithm
3. The results of the process at stage k-1 frequent items a priori, to minimize frequent items/itemsets and shorten the workings of forming rule mining associations to generate support values and confidence values.

Data Collection Technique

In conducting this research, the data sources used are: https://covid19.pemkomedan.go.id/index.php?page=stat_kec with an update date of 09 November 2020 which contains data on the Medan city sub-district. The attributes used in the formation of the mining rule mining association are: status, local number and activity. The number of records sampled is 21 records.

TABLE1.
DATA SET USED

No	Kecamatan	Sembuh	Meninggal	Rawat	No	Kecamatan	Sembuh	Meninggal	Rawat
1	Medan Selayang	539	22	77	11	Medan Area	250	24	60
2	Medan Johor	444	19	105	12	Medan Perjuangan	227	14	72
3	Medan Helvetia	443	20	81	13	Medan Tembung	212	14	78
4	Medan Sunggal	399	22	77	14	Medan Petisah	207	11	40
5	Medan Denai	359	25	74	15	Medan Barat	173	11	58
6	Medan Timur	317	28	95	16	Medan Deli	148	10	44
7	Medan Amplas	327	19	68	17	Medan Marelan	164	3	28
8	Medan Tuntungan	336	10	43	18	Medan Maimun	151	9	29
9	Medan Kota	278	21	59	19	Medan Polonia	93	3	19
10	Medan Baru	257	9	80	20	Medan Labuhan	82	3	30
					21	Medan Belawan	62	8	24

connection

In table 1 above is the data record of Healing, Died and being treated in each sub-district of Medan City divided by a comparison of the observations from the data so as to produce several comparison model items from the Heal, Died, and Treated items per sub-district producing comparative data values on records:
{Heal <=200 (A1), Heal <=300(A2), Heal<=400 (A3), and healed >=400 (A4)}, {Died<=10 (B1), Died <=20 (B2), Died <=30 (B3), Treated <=50 (C1), Treated <=60 (C2), Treated <=70 (C3), Treated <=80 (C4), Treated <=90 (C5) , Treat >=90 (C6). From the results of the comparison value of recovered, died and hospitalized, the dataset is as follows:

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1. {A1,A2,A3,A4}
2. {B1,B2,B3,B4}
3. {C1,C2,C3,C4,C5,C6}

TABLE 2.
FREQUENT ITEMSET DATA OF 21 RECORDS

No Records	Item Set
T1-T5	A4,A3,B2,B3,C4,C5,C6
T6-T10	A2,A3,B2,B3,C1,C2,C3,C5,C6
T11-T15	A1,A2,B2,B3,C1,C2,C3,C4
T16-T21	A1,B1,B2,C1

Table 2 above shows the results of data item filters from each field record in a collection of data sources that are already available, the data that is considered quality and potential for further data processing is Frequent ItemSet which often appears in Records T1 – T5= {a4,a3,b2 ,b3,c4,c5,c6}, on Records T6-T10= {a2,a3,b2,b3,c1,c2,c3,c5,c6} and Records T11-T15=a1,a2,b2,b3,c1 ,c2,c3,c4,Records T16-T21= a1,b1,b2,c1. Followed by the process of performing candidate generation and frequent itemset combinations in table 2 above as shown in table 3 below:

TABLE 3.
K-1 ITEM SET

K-1 Item Set	Frequent Itemset
A1	2
A2	2
A3	2
B1	1
B2	4
B3	3
C1	3
C2	2
C3	2
C4	2
C5	2
C6	2

In Table 4 above, the results of data processing from candidate generation and frequent itemset combinations that often appear after processing data are {(a1=2,a2=2,a3=2,b2=4,b3=3,c1=2,c2 =2,c3=3,c4=2,c5=2,c6=2)} from the frequent itemset in table 4 above, it can be interpreted that the most densely populated areas exposed to covid-19 frequent itemset area b2 followed by area b3, c3. A frequent itemset area with a value of 2 is an area with a low population exposed to COVID-19. After that, proceed with the K-3 Frequent Itemset process as shown in table 5 below:

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TABLE 4.
K-2 FREQUENT ITEMSET

K2-Itemset	Frequent Itemset	K2-Itemset	Frequent Itemset	K2-Itemset	Frequent Itemset
A1,A2	1	A3,B3	2	C1,C2	2
A1,A3	0	A3,C1	1	C1,C3	2
A1,B2	1	A3,C2	1	C1,C4	1
A1,B3	1	A3,C3	1	C1,C5	1
A1,C1	2	A3,C4	0	C1,C5	1
A1,C2	1	A3,C5	2	C2,C3	2
A1,C3	1	A3,C6	2	C2,C4	1
A1,C4	1	B2,B3	3	C2,C5	1
A1,C5	1	B2,C1	3	C2,C6	1
A1,C6	0	B2,C2	2	C3,C4	1
A2,A3	1	B2,C3	2	C3,C5	1
A2,B2	2	B2,C4	2	C3,C6	1
A2,B3	2	B2,C5	2	C4,C5	1
A2,C1	2	B2,C6	2	C4,C6	1
A2,C2	2	B3,C1	2	C5,C6	2
A2,C3	2	B3,C2	2		
A2,C4	1	B3,C3	2		
A2,C5	1	B3,C4	2		
A2,C6	1	B3,C5	2		
A3,B2	2	B3,C6	2		

connection

connection

In Table 4 above, the results of candidate generation and frequent itemset combinations that often appear in the data processing process in the a priori algorithm are {(b2,b3),(b2,c1)}= 3 {(a1,c1),(a2,b2) ,(a2,b3),(a2,c1),(a2,c2),(a2,c3),(a3,b2),(a3,b3),(a3,a5),(b2,c2),(b2,c3),(b2,c4),(b2,c5),(b2,c5),(b2,c5),(b2,c6),(b3,c1),(b3,c2),(b3, c3),(b3,c4),(b3,c5),(b3,c6),(c1,c2),(c1,c3)}= 2. From frequent occurrences with a value of 2, it is stated that the exposed areas Covid-19, but it is unlikely that the area will not experience a lockdown by the local government due to the level of prevention of the implementation of the 5M program that is being driven by the government towards the community, which is very helpful in breaking the chain of the spread of COVID-19. (Gargiulo 2020)And we can also take a temporary analysis of frequent occurrences with a value of 3 which states that the most densely populated areas are exposed to Covid-19, but it is not dangerous because in this area the healing rate of those who have been exposed has increased and the local community is able to overcome it so that the local government do not do a lockdown around the area. After the results of the statement, it is continued with the k-3 frequent itemset process in the table below:

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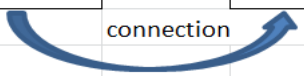
Table 5.K-3 Frequent ItemSet

K3-Itemset	Frequent ItemSet		K3-Itemset	Frequent ItemSet
A1,A2,A3	1		A3,B2,C6	2
A1,A2,B2	1		B2,B3,C1	2
A1,A2,B3	1		B2,B3,C2	2
A1,A2,C1	1		B2,B3,C3	2
A1,A2,C2	1		B2,B3,C4	2
A1,A2,C3	1		B2,B3,C5	2
A1,A2,C4	1		B2,B3,C6	2
A1,A2,C5	1		B3,C1,C2	2
A1,A2,C6	0		B3,C1,C3	2
A2,A3,B2	1		B3,C1,C4	2
A2,A3,B3	1		B3,C1,C5	1
A2,A3,C1	1		B3,C1,C6	1
A2,A3,C2	1		C1,C2,C3	2
A2,A3,C3	1		C1,C2,C4	1
A2,A3,C4	0		C1,C2,C5	2
A2,A3,C5	1		C1,C2,C6	1
A2,A3,C6	1		C2,C3,C4	1
A3,B2,B3	2		C2,C3,C5	1
A3,B2,C1	1		C2,C3,C6	1
A3,B2,C2	1		C3,C4,C5	0
A3,B2,C3	2		C3,C4,C6	0
A3,B2,C4	1		C4,C5,C6	0
A3,B2,C5	2			



In Table 5 above, the data processing results from the candidate generation process and the frequent itemset combinations that often appear are those listed in the areas: {(a2,b2,b3), (a2,b3,c3), (a3,b2,c5), (a3,b2,c6), (b2,b3,c1),(b2,b3,c2),(b2,b3,c3),(b2,b3,c4),(b2,b3,c5),(b2,b3,c6)(b3,c1,c2),(b3,c1,c3),(b3,c1,c4),(c1,c2,c4),(c 1,c2,c5)}=2, stating that the area This is for the recovery rate and the level of care for those exposed to COVID-19 can be overcome and increased seen from the frequent itemset which is only worth 2 times, even though the percentage is high, in this case the government is still improving health services and urges the public to continue implementing the 5M covid process. -19 so that the spread of the corona virus can be overcome by the government assisted by local people who have realized how important health is for families and the implementation of the lockdown for these areas is abolished so that the mobility of the local community can run well as well as other activities. the activities carried out every day are getting better and better, so as to be able to maintain economic stability in the city of Medan. Then proceed with the K-4 Frequent Itemset process as shown in table 6 below:

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TABLE 6.
K-4 FREQUENT ITEMSET

K4-Itemset	Frequent ItemSet		K4-Itemset	Frequent ItemSet
A1,A2,A3,B2	0		A3,B2,B3,C5	2
A1,A2,A3,B3	0		A3,B2,B3,C6	2
A1,A2,A3,C1	0		B2,B3,C1,C2	2
A1,A2,A3,C2	0		B2,B3,C1,C3	2
A1,A2,A3,C3	0		B2,B3,C1,C4	1
A1,A2,A3,C4	0		B2,B3,C1,C5	1
A1,A2,A3,C5	0		B2,B3,C1,C6	1
A1,A2,A3,C6	0		B3,C1,C2,C3	2
A2,A3,B2,B3	2		B3,C1,C2,C4	1
A2,A3,B2,C1	2		B3,C1,C2,C5	1
A2,A3,B2,C2	2		B3,C1,C2,C6	1
A2,A3,B2,C3	2		C1,C2,C3,C4	1
A2,A3,B2,C4	1		C1,C2,C3,C5	1
A2,A3,B2,C5	1		C1,C2,C3,C6	1
A2,A3,B2,C6	1		C2,C3,C4,C5	1
A3,B2,B3,C1	1		C2,C3,C4,C6	0
A3,B2,B3,C2	2		C3,C4,C5,C6	0
A3,B2,B3,C3	2			
A3,B2,B3,C4	1	connection		

In Table 6 above, the results of data processing from the candidate generation process and frequent itemset combinations that often appear are: {(a2,a3,b2,b3),(a2,a3,b2,c1),(a2,a3,b2,c2) ,(a2,a3,b2,c3),(a3,b2,c3,c2),(a3,b2,b3,c3),(a3,b2,b3,c5),(a3,b2,b3,c6) ,(b2,b3,c1,c2),(b2,b3,c1,c3),(b3,c1,c2,c3)}=2 itemset frequency that appears remains the same and the areas exposed to the corona virus are also in the same condition from the previous frequent itemset (found in table 5) which stated that the condition of the area was maintained from the spread of the corona virus, even activities related to the community's economy were not constrained by continuing to apply the 5M health protocol so that the community was also able to overcome the symptoms of covid-19 so as to reduce Patients who enter hospitals or health centers realize that they have been fighting the Covid-19 problem for so long so that the community is also very enthusiastic about helping in breaking the chain of Covid-19 spread, the central government and local governments can control the spread of this corona virus which has been a problem for the government since 2019.(Ghanem, Ahmad, and Aboualy 2021)

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TABLE 7.
ASSOCIATION OF RULE MINING APRIORI ALGORITHM

itemset	Support	Min. Support 60%	Min. Confidence 70%
A2,A3,B2,B3	2	11%	13%
A2,A3,B2,C1	2	11%	13%
A2,A3,B2,C2	2	11%	13%
A2,A3,B2,C3	2	11%	13%
A3,B2,B3,C2	2	11%	13%
A3,B2,B3,C3	2	11%	13%
A3,B2,B3,C5	2	11%	13%
A3,B2,B3,C6	2	11%	13%
B2,B3,C1,C2	2	11%	13%
B2,B3,C1,C3	2	11%	13%
B3,C1,C2,C3	2	11%	13%

Table 7 above is the result of forming rule mining associations on records 1-21. In table 8 the percentage of association rule mining minimum support & minimum confidence there are 2 parts: support value 11% and confidence value 13%, namely: (a2,a3,b2,b3),(a2,a3,b2,c1,),(a2,a3,b2,c2,) ,(a2,a3,b2,c3), (a3,b2,b3,c2),(a3,b2,b3,c3),(a3,b2,b3,c5), (a3,b2,b3,c6),(b2,b3,c1,c2),(b2,b3,c1,c3),(b3,c1,c2,c3) stated that the condition of the area was maintained from the spread of the corona virus, even activities related to the community's economy are not constrained by continuing to apply the 5M health protocol so that the community has also been able to overcome the symptoms of covid-19 so as to reduce patients entering hospitals or health centers, realizing that they have been fighting with the covid-19 problem for so long. The community is also very enthusiastic about helping in breaking the chain of the spread of Covid-19

4. Results And Discussions

TABLE 8 .
DECISION TABLE

Code	Description	Min. Support 60%	Min. Confidence 70%
A2	healed <=200	11%	13%
A3	healed <=400	11%	13%
B2	dead<=20	11%	13%
B3	dead<-30	11%	13%
C1	treat<=50	11%	13%
C2	treat <=60	11%	13%
C3	treat <=70	11%	13%
C4	treat <=80	11%	13%
C5	treat <=90	11%	13%
C6	treat >=90	11%	13%

In table 8 above, the itemset a2,a3,b2,b3,c1,c2,c3,c4,c5,c6 are in accordance with the decision table above that the rate of cure and care for those exposed to covid 19 is increasing, that for people who are being treated at hospitals can recover completely, and the death rate for those exposed to COVID-19 can be reduced with the collaboration between the government and local communities who are able to protect their respective environments from the spread of this corona virus.(Liang et al. 2020)

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TABLE 9.
OUT PUT OF RULE MINING ASSOCIATION

Area 1		Area 2		Area 3		Area 4		Area 6	
B2 <dead=20	Medan Perjuangan	A2>healed =200	Medan Baru	C1	Medan Tuntungan	A3 healed > 400	Medan Sunggal	C4 treat <=80	Medan Selayang
	Medan Tembung		Medan Area		Medan Deli		Medan Denai		Medan Sunggal
	Medan Petisah		Medan Perjuangan		Medan Marelan		Medan Timur		Medan Denai
	Medan Barat		Medan Tembung		Medan Maimun		Medan Amplas		Medan Tembung
	Medan Deli		Medan Petisah		Medan Polonia		Medan Tuntungan		
	Medan Marelan		Medan Barat		Medan Labuhan	Area 5		Area 7	
	Medan Maimun		Medan Deli		Medan Belawan	B3 dead < 30	Medan Selayang	C2=treat <=60	Medan Area
	Medan Polonia		Medan Marelan		Medan Petisah		Medan Sunggal		Medan Kota
	Medan Helvetia		Medan Maimun				Medan Denai	C3=treat <=70	Medan Amplas
	Medan Labuhan		Medan Polonia				Medan Timur	C5 treat <=90	Medan Helvetia
	Medan Belawan		Medan Labuhan				Medan Area	C6 >=90	Medan Johor
	Medan Baru		Medan Belawan						Medan Timur
	Medan Amplas								
	Medan Johor								

The information in table 9 above is the output of the a priori algorithm records for the sub-district area within the Medan City Government which has a proportion of the spread of Covid-19. Information from table 9 that the potential for the spread of COVID-19 is low in terms of the death rate, the number of people who have recovered has increased from the proportion exposed to the corona virus. With this statement, it can be seen from the mapping in table 9 that the average community who every Covid-19 recovers and the community has been able to anticipate, cope with and break the chain of spread of Covid-19 in every sub-district in the Medan City Government.(Muhammad, Aditia Mahardika, and Rizka Amalia 2020)

This can be proven by looking at the graph below:

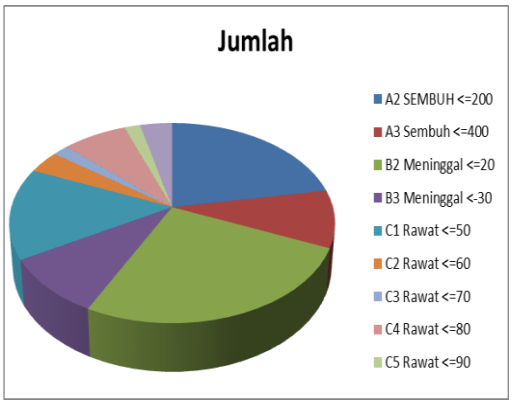

Figure 1. Covid-19 Mapping Graph in Medan City Government

5. Conclusion

Based on the results of the research above, the author concludes that the spread of Covid-19 in the Medan City Government, especially in each sub-district, stated that the community in each sub-district had been able to break the chain of the spread of Covid-19 and had been able to cope with the spread of the Covid-19 virus, with evidence that more people recovered than those who recovered. died of covid-19.

Accredited "Rank 4"(Sinta 4), DIKTI, No. 36/E/KPT/2019, December 13th 2019.

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