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COMPARISON OF STUNTING CLUSTERS FOR EACH PROVINCE IN INDONESIA IN 2019 AND 2020 WITH 2021 AND 2022 USING THE K-MEANS METHOD

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ABSTRACT

Stunting is a condition in the development of toddlers due to malnutrition characterised by a height below average, and the consequence if a toddler is affected by stunting is that it hurts the child's cognitive development and causes generative diseases in adulthood. Presidential Decree No. 72 of 2021 concerning the acceleration of reducing stunting is a form of the government's seriousness in dealing with stunted toddlers. This research uses the K-Means algorithm method, which calculates data using RapidMiner software, looking for differences in the number of stunting data cluster members in 2019-2020 and 2021-2022. There are changes in provincial data in each cluster after comparison. The high cluster, initially three provinces, became nine, and the low cluster, initially 10, became 7. The average percentage of each high cluster in 2019-2020 compared to 2021-2022 experienced a decrease of 9.264%, and for the medium cluster, it experienced a decrease of 5.13%, and for the low cluster, there was a decrease of 3.736%.

Introduction

According to WHO, stunting is a disorder of growth and development in children due to chronic malnutrition and recurrent infections characterised by a height below normal or an incurable condition due to malnutrition and recurrent/chronic infections that occur within 1000 HPK, based on length/height at the age of less than -2 standard deviations of the WHO growth curve resulting in short or very short stature (Chandra & Susanti, 2023).

Stunting hurts children's cognitive abilities, such as low IQ and poor academic performance; stunting has biological implications for brain and nerve development, causing a decline in cognitive scores that impact poor academic achievement (Daracantika, Ainin, & Besral, 2021).

Growth failure can occur when the fetus is still in the mother's womb and only appears when the child is two years old; if not balanced with a catch-up growth rate, which will cause a decrease in growth rate, stunted growth problems arise, which is a public health problem associated with an increased risk of disease, death, and impaired motor and mental development, and stunting caused by failure to grow and develop which reflects the inability to achieve optimal growth (Mandu & Mulyanti, 2023).

The condition of stunted infants and toddlers is a considerable concern for the Indonesian government, and the Indonesian government has made various efforts and efforts to prevent the condition of stunting toddlers. Strategic Plan The Ministry of Health of the Republic of Indonesia 2020-2024 mandates a reduction in stunting in 2020 by

24.1% and 2024 by 14% (Anwar, Winarti, & Sunardi, 2022). Figure 1 shows that the incidence of stunting in Indonesia from the survey in 2007 to 2022 continues to decline, and the Indonesian Ministry of Health has a target of stunting toddlers in 2024 of 14%. The record of this survey is that, in 2020, no survey was carried out, but it is a prediction number due to the incidence of COVID-19, and in 2023, it is also a prediction because official data at the time of this writing has not been released.

Figure 1 Percentage of Stunting Incidence in Indonesia (Health Development Policy Agency, 2023)

The Indonesian government continues to strive for various efforts such as improving the nutrition of pregnant women, increasing human resources in the health sector, and increasing counselling so that stunting babies or toddlers do not occur so that the Indonesia Emas 2045 program can be achieved.

Clustering is necessary so that an area or province with a high percentage of stunting can be known, making it easier for the government to make maximum efforts in handling stunting.

Research on K-Means Optimization with Particle Swarm Optimization in Grouping Stunting Areas has concluded that it can do good clustering in grouping stunting areas in Kediri Regency (Harliana, Bhakti, Bachri, & Efendi, 2021).

The study entitled Grouping Districts/Cities in Indonesia Based on Factors Causing Stunting in Toddlers Using the K-Means Algorithm has concluded that cluster 1 is a cluster with high stunting-causing factors consisting of 324 districts/cities, and cluster 2 is a cluster with low stunting-causing factors consisting of 49 districts/cities (Fadilah, Pangestu, Lumbanbatu, & Defiyanti, 2022).

The study entitled Identification of Risk Factors for Stunting in Children with the K Means Clustering Method has concluded with the clustering method, children can be grouped into several groups based on selected attributes so that this allows for the

identification of risk groups that are vulnerable to stunting and provides a deeper understanding of patterns and relationships between risk factors that contribute to stunting (Setiawan & Fadila, 2023).

The study entitled The Implementation of the K-Means Algorithm in the Clustering of Tegalwagi Toddler Stunting Cases has concluded that cluster 0 has 392 toddlers, namely Shanum, Rizka, Nurjanah, and others. Cluster 1 has three toddlers, namely Ezra, M Abidza, and Abd Mahmud, and the number of toddlers with Normal status is 287. The number of toddlers with Stunting status is 108, based on the Anthropometric Standard of the ideal toddler standard (Apriyani, Dikananda, & Ali, 2023).

The study entitled Clustering Puskesmas with K-Means Based on Data on the Quality of Family Health and Community Nutrition has concluded that the results of this puskesmas clustering can be used as a reference for the Jember Regency Office in making policies, especially on policies related to the quality of family health and community nutrition (Prakoso, Rachmawati, Mudiono, Vestine, & Suyoso, 2023).

This study used the K-Means algorithm with the clustering method to solve problems, and the calculation process used the RapidMiner application. The data used in this study is on the percentage of stunting cases in each province in Indonesia from 2019-2022. This 4-year data was then separated for 2019-2020 and 2021-2021. This data discrepancy is because, in 2021, there was Presidential Regulation No. 72 of 2021 concerning the Acceleration of Stunting Reduction (Daniel Tunggono Saputro & Sucihermayanti, 2021).

Research Methods

The research method of Comparison of Stunting Clusters for Each Province in Indonesia in 2019 and 2020 with 2021 and 2022 with the K-Means Method uses the flow as shown in Figure 2 below.

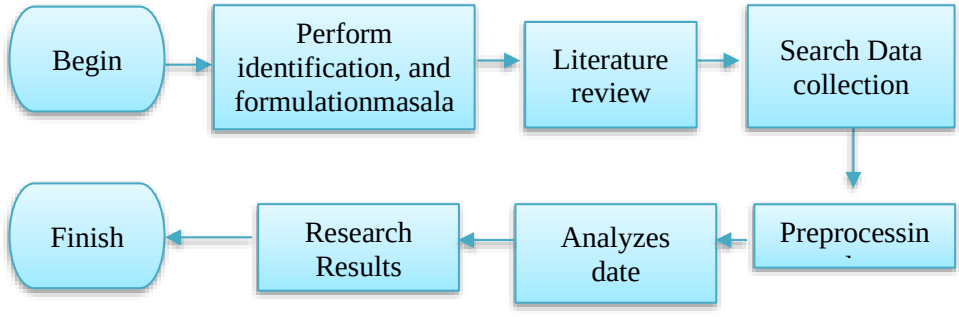

Figure 2 Research Writing Flow

Identifying and Formulating Problems

Comparing the results of provincial data for each cluster before Presidential Regulation No. 72 of 2021 was issued by the government, namely data for 2019 and 2020, with data for 2021 and 2022 after being released.

The research results may be used for decision-making if, after the issuance of the Presidential Regulation, the results of each cluster have no difference, then related parties may conduct further evaluation.

K-Means

The three steps to determine the K-Means algorithm are as follows (Daniel Saputro & Swanjaya, 2023):

1. Specifies the number of clusters to be formed. The authors in this study will establish 3 clusters, and the results of these 3 clusters will form low, medium, and high stunting percentage rates.
2. Centroid data is randomly selected from the three clusters that have been selected.
3. Define the cluster with Euclidean distance. To obtain the corresponding result, determine the closest distance to the selected centroid.

RapidMiner Studio

RapidMiner is a data science software platform that provides an integrated environment for data preparation, machine learning, text mining, and predictive analytics.

Search and Data Collection

The data used in this study is data taken from the Indonesian Nutritional Status Study (SSGI), which is a national-scale survey to determine the development of the nutritional status of toddlers (stunting, wasting, and underweight) with survey coverage, namely national, provincial, and city/district. This survey was conducted by the Balitbangkes Agency of the Ministry of Health in collaboration with the Central Bureau of Statistics (BPS) and supported by the Secretariat of the Vice President of the Republic of Indonesia.

Praposes Data

Data on the percentage of stunting rates by province will be processed using RapidMiner software; before processing, the data must be processed to make it easier to understand the data, choose the correct data mining method, and improve the quality so that the results of the data process become excellent and appropriate (Ujianto & Ramdhan, 2022).

Results and Discussion

The research data (data set) in Table 1 has been processed to find the average so that data is obtained in Table 3, which then table 3 will be processed using RapidMiner software shown in Figure 3.

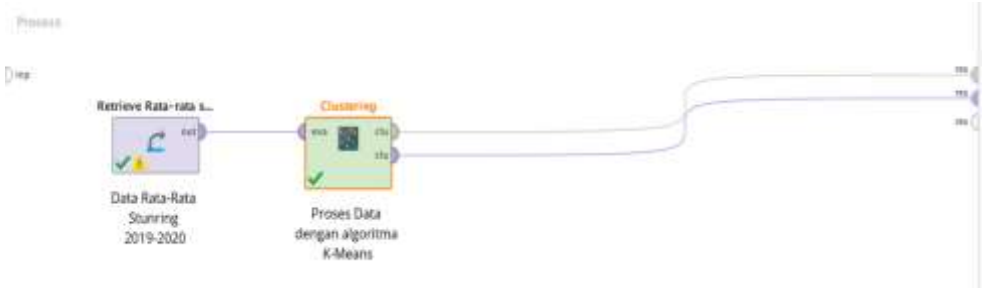

Figure 3 Process of stunting average data 2019-2020 with K-Means algorithm using RapidMiner

The next step is to determine the k used in the K-Means algorithm. The selected K value is 3, divided into 3 clusters: the percentage of sizeable, medium, and low stunting rates. The K value is determined by substituting/inputting the K value in the parameter "K," as shown in Figure 4.

Figure 4
Determination of the value of "k", which is 3

After the calculation process with RapidMiner, the average value of each cluster is as follows:

Table 5
Results of Calculating the Average Value of Stunting Percentage 2019 -2020 in Each Cluster

Cluster Name	Average rating	Stunting Rate
Cluster 0	28,966	Keep
Cluster 1	40,603	Tall
Cluster 2	20,072	rendang

The results of cluster modelling with Rapipminer can be seen in Figure 5

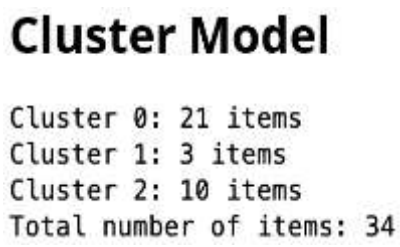

Figure 5
Cluster Model Results of stunting average in 2019-2020

Cluster 0, with a medium stunting percentage rate, consists of 21 provinces; Cluster 1, with a high stunting rate, consists of 3 provinces; and Cluster 2, with a low stunting rate, consists of 10 provinces, for a list of each province can be seen in table 6.

Table 6
List of Provinces in each cluster for stunting data 2019-2020

No	*Cluster* 0 (Medium)	*Cluster* 1 (High)	*Cluster* 2 (Low)
1	Aceh	Nusa Southeast West	Riau
2	Sumatra Utara	East Nusa Southeast	Jambi
3	West Sumatra	West Sulawesi	The world is in the
4	South Sumatra		Riau Islands
5	Bengkulu		Jakarta
6	Lampung		DIY
7	West Java		Banten
8	Jawa Tengah		Bali
9	Jawa Timur		South Sulawesi
10	West Kalimantan		Papua
11	Central Kalimantan		
12	South Kalimantan		
13	East Kalimantan		
14	North Kalimantan		
15	Central Sulawesi		
16	North Sulawesi		
17	Southeast Sulawesi		
18	Gorontalo		
19	Maluku		
20	North Maluku		
21	Papua Barat		

The data visualisation in Table 6 is presented below (figure 6).

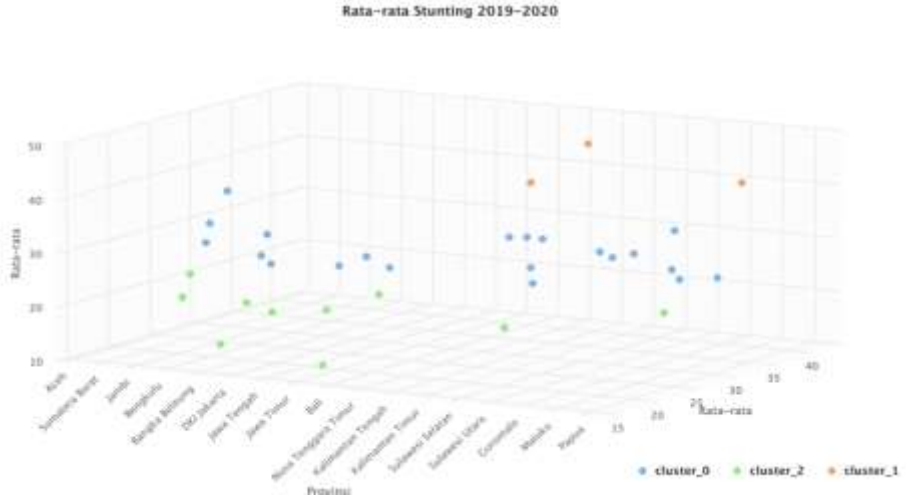

Figure 6 Data visualisation of each data cluster 2019-2020 Average

The next step is to process the average stunting percentage data for 2021-2022 (table 4) using RapidMiner. The steps are the same as the steps above.
The average of each cluster is as follows:

Table 7
Results of Calculating the Average Value of Stunting Percentage 2021 -2022 in Each Cluster

Cluster Name	Average rating	Stunting Rate
Cluster 0	16.336	Low
Cluster 1	31, 339	Tall
Cluster 2	23, 836	Keep

The results of cluster modelling with Rapip Minernya can be seen in Figure 7

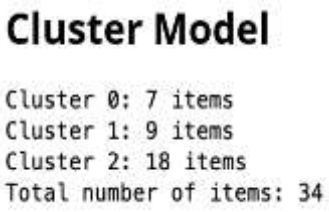

Figure 7
Cluster Model Results of stunting average in 2021-2022

Cluster 0, with a low stunting percentage rate, consists of 7 provinces; Cluster 1, with a high stunting rate, consists of 9 provinces; and Cluster 2, with a medium stunting rate, consists of 18 provinces, for a list of each province can be seen in table 8.

Table 8
List of Provinces in each cluster for stunting data 2021-2022

No	*Cluster* 0 (Low)	*Cluster* 1 (High)	*Cluster* 2 (Medium)
1	Riau	Aceh	Sumatra Utara
2	Lampung	Nusa Southeast West	West Sumatra
3	The world is in the	East Nusa Southeast	Jambi
4	Riau Islands	West Kalimantan	South Sumatra
5	Jakarta	Central Sulawesi	Bengkulu
6	DIY	Southeast Sulawesi	West Java
7	Bali	West Sulawesi	Jawa Tengah
8		Papua	Jawa Timur
9		Papua Barat	Banten
10			Central Kalimantan
11			South Kalimantan
12			East Kalimantan
13			North Kalimantan
14			South Sulawesi
15			North Sulawesi
16			Gorontalo
17			Maluku
18			North Maluku

The data visualisation in Table 8 is presented below (figure 8).

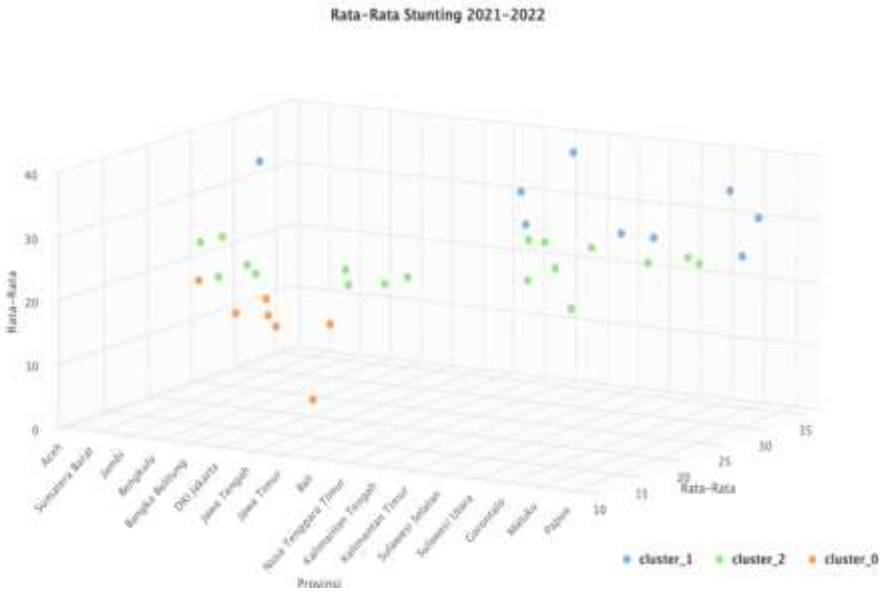

Figure 8
Data visualisation of each data cluster 2021-2022 Average

Conclusion

After comparison and calculation using RapidMiner software, the conclusion was obtained that the average percentage of each cluster experienced a significant decrease between 2019-2020 and 2021-2022, showing the seriousness of the Government of Indonesia in handling stunting very well, supported by the issuance of Presidential Regulation No. 72 of 2021. In addition, there was a change in provincial data in each cluster, where the number of provinces in high clusters increased from 3 to 9, while in low clusters decreased from 10 to 7.

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