



# COVID-19 Cases in Central Java in 2021: A Map Based on K-Means Cluster

Lucky Wiratama<sup>1</sup> and Evina Widianawati<sup>2\*</sup>

<sup>1,2</sup> Medical Record and Health Information, Faculty of Health, Universitas Dian Nuswantoro, Semarang, 50131

Corresponding Author : [evina.widianawati@dsn.dinus.ac.id](mailto:evina.widianawati@dsn.dinus.ac.id)

**Abstract.** Central Java was of the ten provinces with the highest number of COVID-19 cases in Indonesia, with 613,744 people infected by COVID-19 at the end of 2021. This study observed the COVID-19 distribution area in Central Java. The color was determined by the K-means cluster to see group categories and shows a graph of the number of COVID-19 cases trend in Central Java. This study was descriptive through observation of the Internal Report of COVID-19 Cases in Central Java in 2021. Based on the results, the color for low clusters was green, medium clusters were yellow, and high clusters were red. Banyumas district was in the high group of COVID-19, Semarang city was in the high group of COVID-19 recoveries and deaths. Karanganyar District was the area with the highest number of COVID-19 cases. This research can assist the Central Java Provincial Health Office to evaluate and observing COVID-19 distribution, and helping to facilitate the discovery of areas that require special handling through a case distribution map.

**Keywords:** COVID-19, Mapping, K-Means Cluster

## 1 Introduction

The Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) in Wuhan City, Hubei Province, China (1), which causes severe acute respiratory syndrome, shocked the world in 2020. The Covid-19 virus is what the World Health Organization, or WHO, labels it (2). When it is recognized that this Covid 19 virus spreads so quickly from person to person, it poses a threat of a pandemic and causes mild respiratory issues, serious lung infections, and death(3). Since the majority of the Covid-19 virus is conveyed via droplets (droplets) expelled when coughing or sneezing, the number of Covid-19 infections is rising daily. The national and provincial governments have enacted legislation regulating limits and the application of health procedures to prevent the spread of Covid-19. Covid-19 is reported to have entered Indonesia as of March 2020. Both in the form of Imposition of Restrictions on Community Activities its called PPKM and Large-Scale Social Restrictions its called PSBB(4). However, many people continue to disregard PPKM, PSBB, and health guidelines set forth by the government. The community still has a low degree of comprehension, knowledge,

and compliance. For holiday purposes, people continue to congregate in front of their homes without using physical barriers or masks.

Central Java is one of Indonesia's top 10 provinces in terms of the number of Covid-19 cases; as of December 9, 2021, there were 32,484 fatalities, 451,994 recoveries, and the remaining cases are currently being treated (5). The use of Geographic Information Systems, or GIS, a system used to manage data with specific information that manages data with spatial information and presents information in graphical form using maps as an interface, is one example of how technology is currently advancing very quickly and improving human lives in various fields. The health sector(6) is one of the many areas where GIS may be applied. It can help with policy development for bettering health services, in the context of combating certain epidemics or diseases, and it can also be used to track the spread of Covid-19 instances in Central Java. Making a map that depicts the spatial distribution of Covid-19 occurrences in Central Java is an example of using GIS. GIS and data mining are frequently integrated. One of the procedures of data mining is clustering, which is a technique of grouping records of things, observations, and groups that have the same object. Data mining is an investigation of data to identify clear links and conclusions that have never been known before (7)(8).

According to the preliminary survey findings, there were 613,744 cases in Central Java as of December 19, 2021, of which 39,709 deaths occurred, 573,894 were deemed cured, and the remaining cases are still being treated. There is a map showing the spread of Covid-19 and a map showing the risk of Covid-19 for each province in Indonesia on the website [covid19.go.id](https://covid19.go.id), whereas on the website [corona.jatengprov.go.id](https://corona.jatengprov.go.id) there is simply a map showing the distribution of the Covid-19 risk zones for each city or region in Central Java. The goal of this study is to provide information about the spread of Covid-19, including confirmed cases, those who have recovered, died, and those who are still receiving treatment, as well as to analyze the trend of the number of Covid-19 cases in Central Java, in order to help decision-makers act swiftly and accurately when handling Covid-19 cases.

## 2 Method

This study was a descriptive observational study with a cross-sectional design. The type of research used is quantitative research with the research location at the Central Java Provincial Health Office and the research was conducted in March 2022 at the Central Java Provincial Health Office. The population used in this study was cases confirmed, died, recover and under treatment of Covid-19 in 2021 per city/district in Central Java. Samples were taken by using the total population sampling technique. Data was collected using observation sheets in the form of a recapitulation of the number of cases of Covid-19 in 2021. Clustering processing is carried out using the k-means cluster method on the Rapidminer software (9). The value of k chosen is 3 so that it will produce low, medium and high clusters (10). Data display becomes more efficient and informative with 3 (three) clusters, and in prior experiments, 3 clusters had a low sum of square error (SSE) (11)(12).

Data in the form of the number of Covid-19 per district/city is entered in the rapidminer then the k-means cluster feature is added to produce a centroid or cluster center point where the point close to the centroid will form a cluster (13). An area's

placement in the low, middle, or high cluster is determined by the centroid value. Furthermore, the attributes of the city/district name, the number of cases of Covid-19 in 2021, as well as the results of the clustering of low, medium and high risk locations were entered into the shp map of the province of Central Java so as to produce a Covid-19 mapping. There are 4 maps of the results of data processing cases of cases confirmed, died, recover and under treatment in 2021 which are processed using QGIS software.

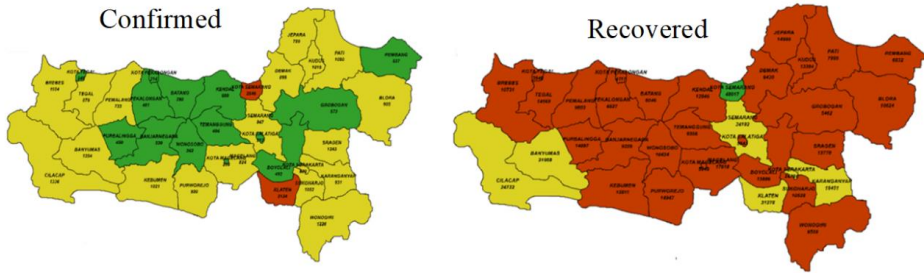
### 3 Result and Discussion

There was a COVID-19 cases spread in 35 city/district in Central Java and K-means cluster applied to get centroid number for clustering the risk of COVID-19 cases which is low, medium and high risk. Table 1 shows the result of centroid for each cluster.

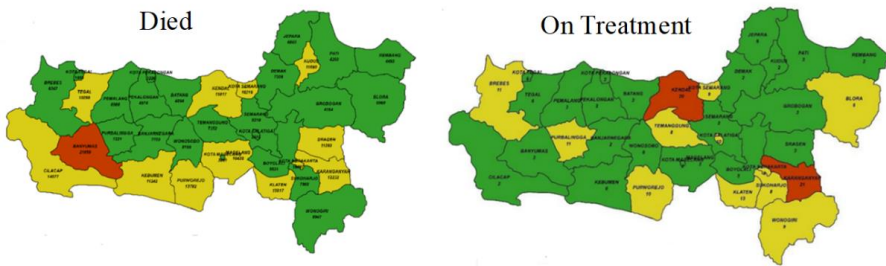
**Table 1.** Centroid of COVID-19 cases in Central Java 2021

| Cluster | Confirm  | Recover  | Died      | On Treatment |
|---------|----------|----------|-----------|--------------|
| 0       | 5927.63  | 10215.82 | 415.21    | 3.36         |
| 1       | 21859    | 26059.16 | 2491.5    | 20.5         |
| 2       | 12791.58 | 48017    | 997.01.00 | 0,41875      |

From table 2 its known that for confirmation cluster 0 is the lowes cluster, cluster 1 is the highest cluster and cluster 2 is the medium cluster. For recover, cluster 0 is the lowes cluster, cluster 1 is the highest cluster and cluster 2 is the medium cluster. For died, cluster 0 is the lowes cluster, cluster 1 is the highest cluster and cluster 2 is the medium cluster. For on treatment, cluster 0 is the lowes cluster, cluster 1 is the highest cluster and cluster 2 is the medium cluster. From the centroid result, each district/ city in Central Java will be mapping and clustered by low, medium and high risk using QGIS. The result of the mapping COVID-19 cases 2021 in Central Java for confirmation, recover, died and on treatment was shown in Figure 1-2 below.



**Fig. 1.** Mapping COVID-19 confirmed and recovered in Central Java 2021



**Fig. 2.** Mapping COVID-19 died and on treatment in Central Java 2021

On the map of the distribution of recovered from Covid-19, the highest area is in Semarang City, which is marked with a description on the green map and included in cluster 2 or the high category. Finally, on the map of the distribution of deaths caused by Covid-19, the highest area is in Banyumas Regency, which is marked with a description on the red map and is included in cluster 1 or the high category. Kendal Regency and Karanganyar Regency, which are highlighted with information on the map in red and are included in cluster 1 or high category, are the highest places, according to the distribution of Covid-19 care map. According to the study's findings, Banyumas Regency in Central Java had the most confirmed instances of Covid-19 in 2021 at 21859 cases, while Tegal City had the fewest confirmed cases at 1959, given the study's findings.

According to Lidia Gayatri's research (2021), Semarang is one of the Central Java province's most vulnerable districts/cities, whereas other districts/cities in the province experience a low level of vulnerability (14). which is in line with the study's findings, Semarang City had the highest number of deaths attributable to Covid-19 in Central Java, Comorbidities, or circumstances where two or more diseases exist concurrently, regardless of whether the sickness is continuous or not, are one of the factors that contribute to death from Covid 19. The most frequent co-morbidities suffered by individuals with confirmed Covid-19 are heart disease, chronic obstructive pulmonary disease

(COPD), hypertension, and diabetes mellitus, according to research by Dwi Agus Setiawan (2020) (15). This study is consistent with other studies that have shown that patients with co-morbid diabetes mellitus and heart disease are three times more likely to die from Covid-19 infection (16). Additionally, patients with a history of cardiovascular disease or pulmonary disease have a higher propensity to die from acute inflammation, and decreased organ function can also increase the risk of death from Covid-19 infection.

Karanganyar Regency had the greatest number of patients receiving Covid-19 treatment in Central Java, at 21. Health professionals only treat symptoms, such as headaches, fever, nausea, diarrhea, and joint pain, due to the high treatment rate and lack of an approved antiviral treatment for Covid-19. Additionally, the initial step in treating respiratory issues is to administer oxygen therapy(17). The patient will be quarantined in the hospital during the course of his treatment and recovery until the doctor declares him to be entirely cured if the patient requires particular care, such as having comorbidities.

## 4 Conclusion

Areas that fall into the high category or that are given red color information on the map are Banyumas with the highest number of confirmed Covid-19 cases, Semarang City with the highest number of recoveries and the highest number of deaths due to Covid19, and Karanganyar Regency with the highest number of cases still under Covid-19 treatment. It is hoped that the mapping of the distribution of Covid-19 can help the Central Java Provincial Health Office in evaluating and monitoring the development of Covid-19 cases in Central Java. And help make it easier to find areas that need special handling and it is hoped that future researchers can help perfect this Covid-19 mapping by collaborating with the official Covid-19 website.

## References

1. Susilo A, Olivia C, Jasirwan M, Wafa S, Maria S, Rajabto W, et al. Review of Current Literatures Mutasi dan Varian Coronavirus Disease 2019 ( COVID-19 ): Tinjauan Literatur Terkini. *J Penyakit Dalam Indones*. 2022;9(1):59–81.
2. P V, Wicaksono TY. Karakteristik dan Persebaran Covid-19 di Indonesia: Temuan Awal. *CSIS Comment*. 2020;2507(February):1–9.
3. E T. Sistem Informasi Geografis Peta Sebaran Data Penyembuhan Covid-19 Daerah Kecamatan Ciampea. *J Pengabdian Kpd Masyarakat MAJU*. 2020;2507(February):1–9.
4. L F. Evaluasi Kebijakan Penanganan Covid-19 Pemerintah Provinsi Jawa Barat. *J Public Sect Innov* [Internet]. 2021;3(1):1689–99. Available from: <http://journal.unilak.ac.id/index.php/JIEB/article/view/3845%0Ahttp://dspace.uc.ac.id/handle/123456789/1288>
5. Lilik NIS BI. Perilaku Pencegahan Penularan Covid-19 Pada Ibu Hamil. *Indones J Public Heal Nutr* [Internet]. 2021;3(1):1689–99. Available from: <http://journal.unilak.ac.id/index.php/JIEB/article/view/3845%0Ahttp://dspace.uc.ac.id/handle/123456789/1288>

6. Mulyani A, Kurniadi D FN. Perancangan Sistem Informasi Geografis Pemetaan Sebaran Kasus Covid-19 di Kabupaten Garut. *J Algoritma*. 2021;2021.
7. Sindi S, Ratnasari W, Ningse O SI. Analisis algoritma k-medoids clustering dalam pengelompokan penyebaran covid-19 di indonesia. *J Teknol Inf [Internet]*. 2020;21(1):1–9. Available from: <http://journal.um-surabaya.ac.id/index.php/JKM/article/view/2203%0Ahttp://mpoc.org.my/malaysian-palm-oil-industry/>
8. Mahmudan A. Clustering of District or City in Central Java Based COVID-19 Case Using K-Means Clustering. *J Mat Stat dan Komputasi*. 2020;17(1):1–13.
9. Fatmawati K, Windarto AP. Data Mining: Penerapan Rapidminer Dengan K-Means Cluster Pada Daerah Terjangkit Demam Berdarah Dengue (Dbd) Berdasarkan Provinsi. *Comput Eng Sci Syst J*. 2018;3(2):173.
10. Windarto AP. Penerapan Datamining Pada Ekspor Buah-Buahan Menurut Negara Tujuan Menggunakan K-Means Clustering Method. *TechnoCom*. 2017;16(4):348–57.
11. Winarta A, Kurniawan WJ. Optimasi cluster k-means menggunakan metode elbow pada data pengguna narkoba dengan pemrograman python. *J Tek Inform Kaputama*. 2021;5(1):113–9.
12. Solichin A, Khairunnisa K. Klasterisasi Persebaran Virus Corona (Covid-19) Di DKI Jakarta Menggunakan Metode K-Means. *Fountain Informatics J*. 2020;5(2):52.
13. Mirantika N. Penerapan Algoritma K-Means Clustering Untuk Pengelompokan Penyebaran Covid-19 di Provinsi Jawa Barat. *Nuansa Inform*. 2021;15(2):92–8.
14. L G, H. H. Pemetaan Penyebaran Covid-19 Pada Tingkat Kabupaten/Kota Di Pulau Jawa Menggunakan Algoritma K-Means Clustering. *J Sebatik*. 2021;10(2):6.
15. Setiawan DA. PANDEMI COVID-19 DALAM PERSPEKTIF DEMOGRAFI. *Semin Nas Off Stat 2020 Stat New Norm A Chall Big Data Off Stat*. 2020;
16. Carrollina Ratna Fatika, Widianawati E. CASE STUDY: KEJADIAN PASIEN COVID-19 LANSIA DI RS X JAWA TENGAH. *J Kesehat*. 2022;20(2).
17. Rosyanti L HI. Dampak Psikologis dalam Memberikan Perawatan dan Layanan Kesehatan Pasien COVID-19 pada Tenaga Profesional Kesehatan. *Heal Inf J Penelit*. 2020;2020.

**Open Access** This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

