Story Map Visualization of the Population Affected by COVID-19 in Jepara Regency

Finda Andayani, Jumadi(✉), and Choirul Amin

Faculty of Geography, Universitas Muhammadiyah Surakarta, Surakarta, Central Java 57162, Indonesia
jumadi@ums.ac.id

Abstract. Information related to the population affected by COVID-19 in Jepara Regency can be visualized using a Story Maps. Interactive maps, photos, videos, audio, and text can all be used to display the results. This study sought to compare the number of residents before and after COVID-19 and visualize the most recent COVID-19 data in Jepara Regency using Story Maps. The method in this study involved the analysis of secondary data from related organizations and literature reviews. According to the findings, Karimunjawa Subdistrict had the lowest number of COVID-19 cases in the Jepara Regency, while Jepara Subdistrict had the highest number. Given the number of deaths from COVID-19, a comparison of the number of residents before and after that year reveals that, from 2019 to 2022, 2020 had the fewest residents overall. In 2021, Jepara Regency's population started to rise as a result of a higher birth rate, fewer COVID-19 cases, and better COVID-19 case management than in previous years. As a result, fewer mortality cases occurred in the region. Six hospitals in the Jepara Regency are COVID-19 referral hospitals, and they have the necessary infrastructure to help lower these cases. The Jepara Regency government and the public can access information easily through the link to the story map, which can be updated according to the latest situation.

Keywords: Population · COVID-19 · Story Map

1 Introduction

COVID-19 is an infectious disease caused by the Coronavirus discovered in Wuhan, China, in December 2019. COVID-19 is now an ongoing pandemic in many countries across the globe (WHO, 2019). The infected patient has mild symptoms such as fever, cough, and difficulty breathing, and these symptoms can progress to severe pneumonia (Ministry of Health RI, 2020). COVID-19 has had a devastating impact on people around the world. Then, every action that was once done in person is now conducted online. Social distancing rules and large-scale social restrictions were implemented to prevent an increase in COVID-19 cases. These limitations include those pertaining to work and school holidays, religious events, public gatherings, socio-cultural activities, travel, and others, particularly those pertaining to defense and security (Ministry of Communication

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and Informatics, 2020). The implementation of the restriction takes the form of prohibiting human societies that engage in socio-cultural activities; this ban also applies to all associations, or associations, regardless of whether they engage in political, academic, sporting, or cultural activities (Fahriyani et al., 2021).

Changes in population due to COVID-19 occur in every region. In addition to the pandemic's growing number of victims, COVID-19 deaths are also rising in number globally. The truth about the COVID-19-affected population should be taken into account once more. This is due to the fact that some information still causes confusion or unrest in the community (Yunus & Rezeki, 2020). Spatial analysis using the integration of spatial and non-spatial data offers different perspectives on the pattern and direction of the COVID-19 spread. Demographic parameters have a lower correlation than temperature, humidity, and residential areas with the number of confirmed COVID-19 cases, including age and population (Ghazali et al., 2021), because the application of large-scale social restrictions, or LSSR, is more focused and does not infect according to administrative boundaries but according to spatial linkages.

Jepara Regency is one of the regencies in Indonesia, situated in the Central Java province and located in the northernmost part. This regency is one of the areas affected by COVID-19 and is the second-highest in Central Java out of 35 cities or regencies in August 2020 (Ramadhan and Siwiendrayanti, 2021). Results of monitoring in Jepara Regency reveal that there were 102 active cases of patients, 20,931 recovered patients, and 1,074 deaths. The data is based on the update on November 19, 2022 (Jepara Regency, 2022). The provincial government of Central Java needs to pay more attention to Jepara Regency because there are still a lot of active cases there. This must be done to prevent an increase in fatalities, active cases, or the spread of active cases outside of the Jepara Regency area (Mahmudullah, 2020). Changes in the number of residents before and after COVID-19 in Jepara Regency certainly entail a different impact than other regions. The increasing number of deaths from COVID-19 will affect demographic changes in the future despite the changes are not too extreme. Overall, the COVID-19 pandemic will not massively change the population structure.

Along with the widespread use of Geographic Information Systems (GIS) and technological developments in the acquisition, storage, and collection of spatial data, this subsequently affects the development of the increasingly widespread use of spatial data (Nahdhiyatul Fikriyah et al., 2022). Story Maps is a web application that combines creator-generated visual media into an online template with narrative accounts that support multimedia content (Hunter et al., 2021). Story Maps is also a collection of digital maps that can visualize spatial, location, or geographic information. In order to make the information presented on Story Maps more engaging, the presentation of the map can be displayed by combining different multimedia content, such as text or stories, images, video-audio, and others. (Son & Aditya, 2021). To support information on the population impacted by COVID-19 cases in Jepara Regency, interactive, educational, practical maps that the general public can understand must be created.

Various methods have been used in the past to visualize COVID-19 data, such as Tableau and Orange programming. Visualization is the process of transforming rigid tabular data into graphs, charts, geo-mapping, and other representations that can more clearly show changes and differences in the data (Ten, 2020). Data analysis with Python

scripts and software results in the advantage of visually visualizing data by simply connecting the desired widget and setting the necessary variables and parameters (Juliansyah, 2020). The way visualization uses the geo-mapping concept which can indicate the location of a region. The presentation of geographic data, however, is not as comprehensible, entertaining, or educational as story maps. Based on the aforementioned problems and background, this study aimed to visualize COVID-19 data using Story Maps as well as analyze the comparison of the number of residents before and after COVID-19, so that the number of populations affected by the COVID-19 pandemic in Jepara Regency could be found. The local government can monitor, analyze, and assess ongoing COVID-19 cases in Jepara Regency using the visualization results. In addition, the general public can access information easily and quickly using the visualization link.

2 Method

2.1 Research Area

The research area covers Jepara regency, Central Java province. Jepara Regency's administrative boundaries are defined as the area between latitudes 5°43′20.67" and 6°47′25.83" south and longitudes 110°9′48.02" and 110°58′37.40" east. According to its location, Jepara Regency shares borders with Demak Regency to the south, Kudus and Pati regencies to the east, and the Java Sea to the west and north (Silitonga & Hartoko, 2014). The closest distance from the district capital is Tahunan Subsdistrict which is 7 km and the farthest distance is Karimunjawa Subsdistrict which is 90 km. Viewed from the height of the land surface from sea level, Jepara Regency is located from 0 m to 1,301 m. The visualization of the research area is presented in Fig. 1.

2.2 Data Collection and Processing

This study used secondary data sourced from the Jepara District Health Office, the Statistics Indonesia of Jepara Regency, and Google Earth. Details of the data are shown in Table 1.

2.3 Making of the Distribution Map of COVID-19 Cases in Jepara Regency

The latest data on COVID-19 cases in Jepara Regency was mapped. The mapping was made based on 16 subdistricts in the district, including Bangsri, Batealit, Donorojo, Jepara, Kalinyamatan, Karimunjawa, Kedung, Keling, Kembang, Mayong, Mlongo, Nalumsari, Pakis Aji, Pecangaan, annuals, and Welahan. COVID-19 confirmed data consist of current confirmed, treated, and deaths. Total COVID-19 cases are classified into five types: very high, high, medium, low, and very low. In addition to the distribution map of COVID-19 cases, it also requires an administrative boundary map and the distribution of COVID-19 referral hospitals for variation and data analysis.

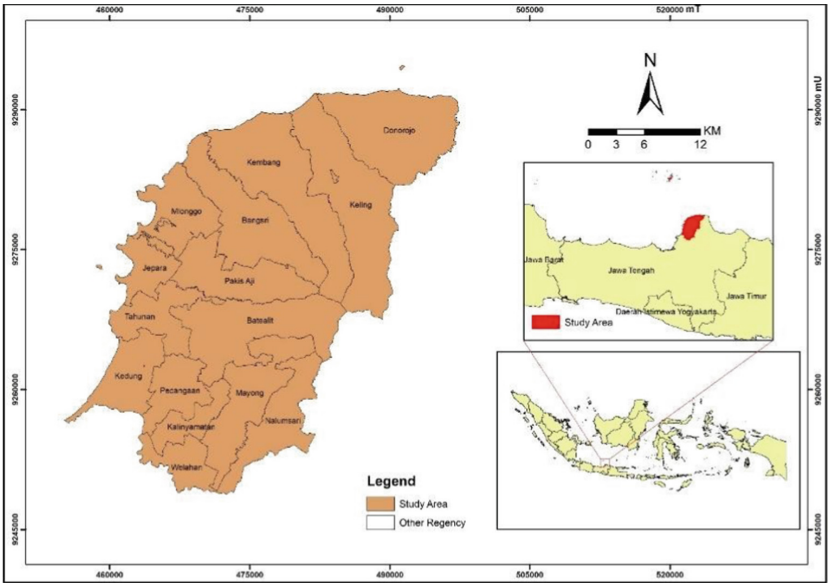

Fig. 1. Study Area

Table 1. Research Data

Data	Source	Utility
Jepara Regency COVID-19 Case Data Data from the Jepara Regency Covid-19 Referral Hospital Total Population of Jepara Regency Shapefile data of Jepara Regency Administrative Boundary	Jepara Subdistrict Health Office (Jepara Regency Health Office, 2022). Google Earth Jepara Regency in Figures (Statistics Indonesia of Jepara Regency, 2020). Website page: http://tanahair.ind onesia.go.id/	to make a map of the spread of COVID-19 cases. to make a map of the distribution of COVID-19 referral hospitals. to make a comparison graph of the population before and after COVID-19. to make a map of the administrative boundaries of Jepara Regency.

2.4 Creating COVID-19 Data Visualization Using Story Map

Story maps can be made based on the outline, which is the core framework of a story. Then, open web Story Maps and Login ArcGIS account, subsequently, create interactive maps online using ArcGIS Online. The making of maps was obtained from the results of SHP administrative boundary data, confirmed cases of COVID-19, and COVID-19 referral hospitals in Jepara Regency and is then zipped to be inserted into Story Map. In addition, maps are also inserted in a text to clarify and describe maps, tables, and graphs. The layout of Story Map was made with variations of Slideshow and Slidecar for the

display to be interactive. Following that, a Story Map was also inserted with additional images that support the visualization concept. After the visualization was complete, Story Map could proceed to publish.

2.5 Analysis of COVID-19 Cases in Jepara Regency

COVID-19 cases in Jepara Regency were taken using the latest data from 2020 to 2022. The results of the case mapping were then analyzed based on their distribution in the districts of Jepara Regency. Next, the number of existing COVID-19 cases is linked to the existing COVID-19 Referral Hospital. After that, the number of residents before and after COVID-19 was made into a graph and compared to whether there was a decrease or increase due to the pandemic.

2.6 Framework

To make it simpler for local governments and the general public to access this information with a communicative and appealing appearance, the COVID-19 data visualization study in Jepara Regency was carried out. The stages of research are presented in detail in Fig. 2.

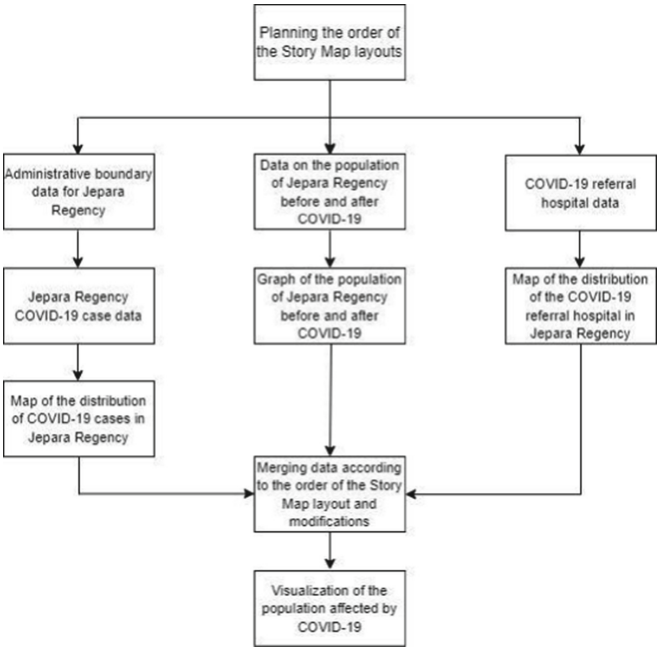

Fig. 2. Research Framework

3 Results and Discussion

3.1 Visualization of COVID-19 Data in Jepara Regency

The results showed a visualization of COVID-19 data in Jepara. The Web page that has been designed can be accessed at: https://arcg.is/1rq5Xz. At the beginning of the story map, there was a title and then a description of the research site with a description of the administrative boundary map of Jepara Regency as shown in Fig. 3 and 4. Users can interact by scrolling and selecting the location of the selected district. Users can zoom in and out of the map as needed. The map shows 16 subdistricts in Jepara Regency. Story Map has advantages such as an attractive appearance, display of photos/videos and text, then updates are easy to do as it does not require coding. However, story maps entail the disadvantage that the use of the map depends on the user's network connection (Friday and Saturday, 2022). The description of the research site shows astronomical information and the administrative boundaries of the Jepara Regency. After that, the next interface contains information related to COVID-19 cases in Jepara Regency, as shown in Fig. 3, Fig. 4 and Fig. 5.

The COVID-19 information is described in general, then it displays the distribution map of the latest COVID-19 cases in Jepara. The map shows that Jepara Regency has 22,107 cases of COVID-19. The total number includes active, recovered, and death cases. The results of the distribution classification of COVID-19 in every subdistrict in the Jepara Regency are classified into five classes. A very high class can be found in the Jepara subdistrict, ranging from 2,029 to 3,154 cases. With a value range of 1,601 to 2,029 cases, the high class is located in the Bangsri, Tahunan, and Pecangan subdistricts. The medium category is located in the Mlonggo, Keling, Kedung, Mayong, Nalumsari, and Welahan subdistricts, with cases ranging from 1,160 to 1,601 cases. The low class

Fig. 3. COVID-19 Information

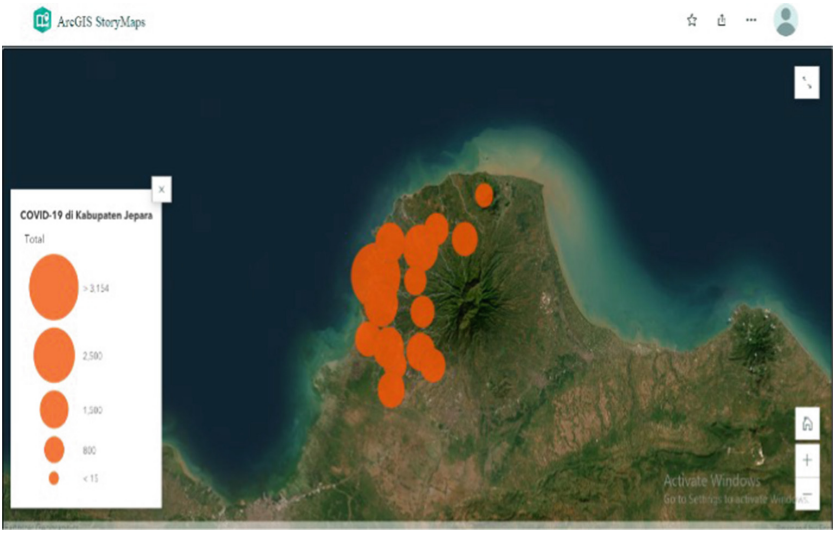

Fig. 4. Distribution of COVID-19 Cases in Jepara Regency

Fig. 5. Description of COVID-19 in Jepara Regency

is in the Donorojo, Kembang, Pakis Aji, Batealit, and Kalinyamatan with a value range of 15 to 1,160 cases. Then the last is the low class in Karimunjawa subdistrict with a value range of less than 15 cases.

Jepara subdistrict is the area with the highest cases among other districts with a total of 3,154 confirmed people. This happens because the Jepara subdistrict is the center of

activity for the Jepara Regency. This means many activities trigger the spread of COVID-19 cases such as government activities, trade, education, health, and so on. Then, for the region that has the lowest number of COVID-19 cases, it is the Karimunjawa subdistrict with 15 confirmed cases. Karimunjawa subdistrict is located in the middle of the Java Sea, so there are no activities or interactions in the subdistrict, which causes the spread of COVID-19 cases to be higher. In addition, although Karimunjawa Subdistrict is famous for its tourist destinations, It does not affect the low number of COVID-19 cases in the area because, at that time, all tourist activities were not allowed to operate as long as the case remained.

3.2 Comparison of Population Before and After COVID-19 in Jepara Regency

A visualization of the comparison of the number of residents before and after COVID-19 in Jepara Regency is illustrated with tables and graphs. Swipe is a feature that is used to view tables and graphs, making it possible to compare and contrast how many residents there are in different areas. After that, there is a text that contains a general description of the tables and graphs as shown in Table 2, Fig. 6 and Fig. 7.

Table 2. Total Population Before and After Covid-19

No.	Year	Total of Population (Person)	Description
1.	2019	1252090	Before COVID-19
2.	2020	1184947	Early days of COVID-19
3.	2021	1188510	The New Normal COVID-19
4.	2022	Data not available yet	Transition to New Normal

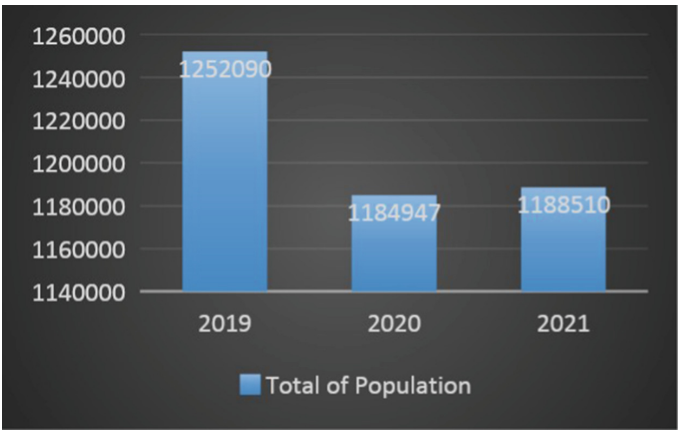

Fig. 6. Graph of Population Before and After COVID-19

Fig. 7. Description Comparison of Total Population

Indonesia has experienced at least three waves of increased cases. The first wave began in December 2020 and had the highest number of cases on January 30, 2021. The second wave was particularly damaging due to the Delta variant on June 15, 2021, then the deaths were up to more than 2,000 people per day on July 27, 2021. The third wave is mainly caused by the Omicron variant, with the highest daily cases on February 17, 2022, after which, on April 6, 2022, the number of cases decreased again (Aditama, 2022). The number of residents before and after COVID-19 showed different information. In 2019, there were no COVID-19 cases and at the end of the year, it became the beginning of the spread of COVID-19 cases. After that, in 2020 and 2021, COVID-19 cases increased significantly, and all regions of the world had cases without exception. Then, in 2022 the case is not over but slowly the rate of spread was not as alarming as in previous years. Activities began to return to normal as usual, accompanied by the implementation of social restrictions and health protocols.

The table and graph show the total population of Jepara Regency in 2019, namely 1,252,090 people. The year 2019 had residents with the highest value from 2019 to 2022. The population then dropped significantly from the year before in 2020, totaling 1,184,947 individuals. The difference between the population in 2019 and 2020 is 67,143 people. This is because COVID-19 cases soared so there were many cases of death due to infection with these cases. The infection is spread easily through splashes from the nose, mouth, and respiration of people infected with COVID-19. Droplets that fall on certain objects or places when touched and penetrate the eyes, nose, and mouth can cause COVID-19 (Fuadi, 2020). Additionally, many people who already have comorbidities such as pneumonia are more susceptible to COVID-19 cases and usually have very weak immunity. At that time, health services in terms of facilities and medicines had not been able to reduce the number of COVID-19 cases in a short time (Dedication & 2021–2021).

COVID-19 cases were extremely high in 2021, but the virus did not spread as quickly as it did in 2020. An increase in population to 1,188,510 people started that year. This

means that the population increased by 3,563 in 2021 compared to 2020. Besides many deaths, the year has been offset by the birth rate so that the number of residents started to return to what it was before the COVID-19 case. In addition, the handling of the hospital was also better than the previous year, with a variety of qualified facilities and drugs in high doses that help treat infected people. In 2022, population data was not yet available, but it can be assumed that the number of residents will increase. The year 2022 was a transition from the new normal to normal. For instance, online activities were gradually switched to offline, public transportation policies were no longer as strict as the previous year, and activities that involve many people started to be implemented again.

Social aspects play an important role in environmental impact assessment. The social aspects examined in environmental impact analysis embrace components consisting of variables such as demographics, economy, and culture (Hardjono, 2004). Then, the COVID-19 pandemic has led to unemployment and increased poverty in every country in the world (Arianto, 2020). During the pandemic, Jepara Regency had the highest average proportion of poor microentrepreneurs (12.53%) (Karnoto, 2021). Aside from the shift in the population, COVID-19 also changed Jepara Regency in terms of the rising unemployment rate brought on by the mass layoffs of numerous jobs. In 2020, the open unemployment rate in Jepara Regency obtained 6.70. Then in 2021 and 2022, it decreased by 4.23 and 4.10, respectively (Statistics Indonesia of Jepara Regency, 2022).

3.3 Distribution of COVID-19 Referral Hospitals in Jepara Regency

The distribution of COVID-19 referral hospitals in Jepara Regency is visualized with dots indicating the location of the hospital. Users can interact by selecting a point from the hospital so information will show existing referral hospitals. In addition, there is a description of the distribution map as in Fig. 8 and Fig. 9.

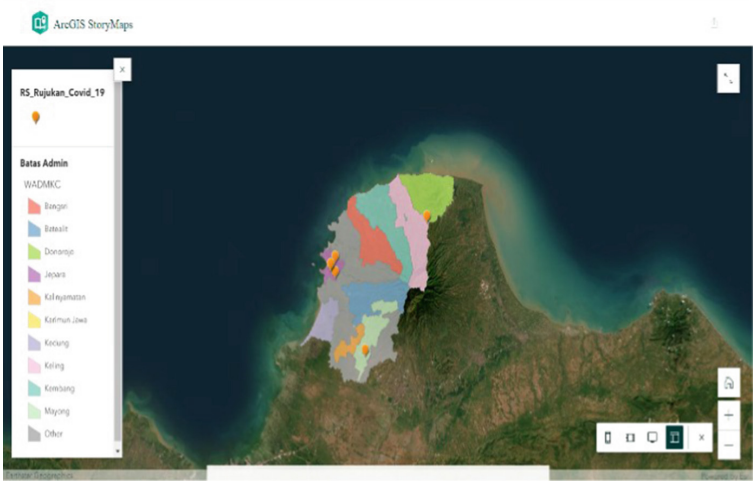

Fig. 8. Distribution Map of COVID-19 Referral Hospitals

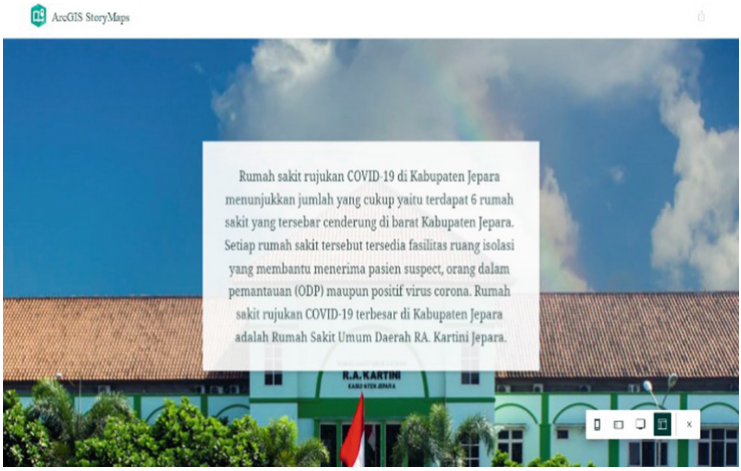

Fig. 9. Description of the COVID-19 Referral Hospitals

COVID-19 referral hospitals in Jepara Regency have six hospitals, including Raden Ajeng Kartini General Hospital, Rehatta General Hospital, Sultan Hadlirin Islamic Hospital, Graha Husada Hospital, PKU Aisyiyah Jepara Hospital, and PKU Muhammadiyah Mayong Hospital. Each hospital is provided with isolation room facilities that help those infected, whether they are under monitoring, treatment, or critical. Referral hospitals are located in the western part of Jepara Regency, precisely in Jepara Subdistrict, which is the central area with four hospitals and two other referral hospitals located in Keling and Mayong subdistricts. The location of the referral hospital is based on factors other than the facilities, such as the level of accessibility and the needs of the surrounding population.

During the COVID-19 pandemic, differences in mortality risk were evident for specific causes of death and individual characteristics. Important data on resource allocation for interventions to correct medical and socioeconomic status inequalities are also provided by the need to address disproportionate access to health care and health inequalities made worse by the pandemic (Oh et al., 2022). Maintaining health protocols during the pandemic is very important in the community because following a healthy lifestyle in daily activities can reduce the chances of COVID-19 virus infection (Yoanisaputri et al., 2022). The process of preventing COVID-19 cases can also be carried out in various ways, one of which is the provision of vaccines starting in 2021 to 2022. Sinovac, Moderna, AstraZeneca, and others. The process of administering the vaccine is carried out in stages to reduce the risk of contracting COVID-19. When the vaccine is injected into a person's body, it stimulates antibodies to learn and recognize the weakened virus. Thus, the body attacks the virus and reduces the risk of exposure (Health Service Unit Indonesian Ministry of Health, 2021).

4 Conclusions

Visualization of COVID-19 data in Jepara Regency is described using Story Map with various features such as Slide Show, Slide Car, Swipe, Map, and Text. The comparison of the number of residents before and after COVID-19 cases, the distribution of COVID-19 referral hospitals in Jepara Regency, and the visualization of COVID-19 data using the most recent data are some of the significant findings in the visualization results. According to the findings, Karimunjawa District had the lowest number of COVID-19 cases in the Jepara Regency, while Jepara Subdistrict had the highest number. After that, given the number of deaths from COVID-19, a comparison of the number of residents before and after that year reveals that, from 2019 to 2022, 2020 had the fewest residents overall. In addition, COVID-19 also has an impact on increasing population unemployment in Jepara Regency. The number of COVID-19 referral hospitals located in Jepara Regency is 6 hospitals with adequate facilities to help reduce these cases.

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