

RESULT OF POLYMERASE CHAIN REACTION (PCR) TEST POSITIVITY AND VACCINATION ASSOCIATED WITH INCIDENCE RATE OF COVID-19 IN JEPARA REGENCY

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ABSTRAK

COVID-19 merupakan penyakit menular disebabkan oleh virus SARS-CoV-2. Kabupaten Jepara menjadi salah satu wilayah tersebarnya COVID-19 dan telah menerapkan strategi testing serta vaksinasi sebagai upaya penanganan pandemi. Penelitian ini bertujuan untuk mengkaji hubungan tingkat tes positif PCR dan tingkat vaksinasi terhadap laju insidensi COVID-19 di Kabupaten Jepara. Penelitian ini menggunakan pendekatan kuantitatif dengan desain cross-sectional. Unit analisis penelitian ini merupakan periode waktu dalam satuan minggu. Populasi dan sampel berupa data sekunder angka kasus COVID-19, hasil tes PCR, dan vaksinasi COVID-19 yang tercatat di Dinas Kesehatan Kabupaten Jepara pada 1 Juni 2020 sampai 30 Juni 2022, dengan menggunakan teknik total sampling. Instrumen penelitian berupa lembar pencatatan. Hasil uji korelasi Spearman diperoleh adanya korelasi positif yang sangat kuat antara tingkat tes positif PCR dengan laju insidensi COVID-19 ($r=0,810$). Terdapat hubungan antara tingkat vaksinasi dengan laju insidensi COVID-19 di Kabupaten Jepara dengan arah korelasi negatif yaitu dosis pertama ($r=-0,603$) berkorelasi kuat, dosis kedua berkorelasi sedang ($r=-0,591$), dosis ketiga ($r=-0,311$) berkorelasi lemah. Simpulan penelitian ini adalah terdapat hubungan antara tingkat tes positif PCR dan tingkat vaksinasi dengan laju insidensi COVID-19 di Kabupaten Jepara.

Kata kunci : Covid 19, vaksinasi

ABSTRACT

COVID-19 is an infectious disease caused by the SARS-CoV-2 virus. Jepara Regency is one of the areas where COVID-19 has spread and has implemented a testing and vaccination strategy as an effort to deal with the pandemic. This study aims to examine the relationship between PCR test positivity rates and vaccination rates with the incidence rate of COVID-19 in Jepara Regency. This study uses a quantitative approach with a cross-sectional design. The unit of analysis for this research is the time period in weeks. Population and sample are in the form of secondary data on number of COVID-19 cases, PCR testing result, and COVID-19 vaccinations recorded at the Jepara Regency Health Office on June 1, 2020 - June 30, 2022 by using the total sampling technique. The research instrument was in the form of a recording sheet. The results of the Spearman correlation test showed a very strong positive correlation between the PCR test positivity rates and incidence rate of COVID-19 ($r = 0.810$). There is a relationship between the vaccination rate and the incidence rate of COVID-19 in Jepara Regency with a negative correlation direction, namely the first dose ($r=-0.603$) is strongly correlated, the second dose is moderately correlated ($r=-0.591$), the third dose ($r=-0.311$) is correlated weak. The conclusion of this study is that there is a relationship between the PCR test positivity rates and vaccination rates with the incidence rate of COVID-19 in Jepara Regency.

Keywords : COVID-19, testing, vaccination

INTRODUCTION

Coronavirus disease 2019 or COVID-19 is an infectious disease caused by the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) which was first discovered in Wuhan City, China at the end of 2019. COVID-19 can be transmitted through small droplets from the nose or mouth when coughing and sneezing, then infected people will generally experience fever, cough and shortness of breath. The World Health Organizations (WHO) have

designated the incident as a Public Health Emergency of International Concern (PHEIC) and also as a Global Pandemic since March 11, 2020 (Sohrabi et al., 2020).

Based on the WHO report at the end of July 2022, there were more than 567 million confirmed cases of COVID-19, with a death rate of 6.3 million people (WHO, 2022). In Indonesia, the first cases of COVID-19 was identified on March 2, 2020 in Depok (Nugraha et al., 2020). According to data from the Ministry of Health of the Republic Indonesia, as of July 31, 2022, there were 6,207,098 confirmed cases of COVID-19 in Indonesia and 156,993 deaths. Central Java province occupies the third position after DKI Jakarta and West Java with a total of 630,424 confirmed cases. Meanwhile, Jepara Regency as of October 25, 2020 ranks fourth with the highest incidence rate in Central Java Province, which is as many as 164.26 cases per 100,000 population then on June 21, 2021 first rank with 2,595 active cases of COVID (Pemprov Jateng, 2022). The number of confirmed cases of COVID-19 continues to increase in Jepara Regency, it was recorded that until July 31, 2022, the number of confirmed cases reached 21,622 with details of 24 active cases, 20,541 recovered, and 1,057 deaths (Dinkes Jepara, 2022).

Various kinds of public health interventions and social actions have been implemented in Indonesia through the formulation of various policies ranging from Large-Scale Social Restrictions (PSBB), Transitional PSBB, new normal, Enforcement of Community Activity Restrictions (PPKM) with levels according to the highest cases of COVID-19 and death rates in each region (Satuan Tugas Penanganan COVID-19, 2021). Strategies in dealing with the COVID-19 pandemic need to be carried out by individuals and communities through discipline in the implementation of wearing masks, maintaining distance, washing hands, avoiding crowds, limiting mobilization and being equipped with COVID-19 vaccinations, while efforts by the government are by implementing and optimizing 3T strategies (Test, Trace, Treatment) (WHO, 2020). This 3T approach is carried out by identifying confirmed cases of COVID-19, through several types of tests, followed by tracing the history of close contact with those who may be infected, then conduct self-isolation, so that if someone is infected they can prevent transmission to others (Furuse et al., 2021).

The testing strategy has a major role in identifying people infected with COVID-19 in order to avoid further transmission. Based on previous research, test positivity rate can be used as indicator to measures and monitoring spread of COVID-19 (Obi et al., 2021). Test positivity rate also can explain the differences in testing between various areas, which can be used to evaluate the test strategy that has been applied (Al Dallal et al., 2021). COVID-19 patients can be detected using some type of test. In most COVID-19 diagnostic tests accuracy studies, the gold standard for the detection of SARS-CoV-2 is nucleic acid amplification by Polymerase Chain Reaction (PCR) test (Porte et al., 2020).

Vaccination against COVID-19 is an effort to prevent and control the disease COVID-19. Vaccination can provide immediate protection for vaccinated individuals against viral attacks. In addition, the acceleration of COVID-19 vaccination needs to be carried out aimed at reducing the spread of COVID-19, reducing morbidity and mortality due to COVID-19, and achieving herd immunity so that people can be protected from COVID-19 (Ophinni et al., 2020). Based on previous research, it was found that vaccination had a major impact in reducing incidence rates of COVID-19 in several countries. Countries with higher vaccination rates resulted in lower incidence rates of COVID-19 during the study period (Chen, 2021).

Based on observations with the Jepara Regency Health Office. The first COVID-19 vaccination was carried out in Jepara Regency on January 25, 2021. The vaccine targets were 1,032,455 targets including health workers, public services, the elderly, vulnerable and general communities, adolescents, pregnant women, persons with disabilities and children. Data on COVID-19 vaccine coverage in Jepara as of June 30, 2022 had reached 83.4% for the first dose

or 861,190 people, then for the second dose it reached 66.46% or 686,256 people and the third dose reached 14.25% or 147,164 people. Then the implementation of the COVID-19 test strategy in Jepara Regency can be carried out in health facilities, including 22 health centers, 6 hospitals and 6 laboratories, 14 clinics with a daily testing target of 1,834 people per day. Jepara Regency has implemented both strategies, both testing and vaccination, but for several times Jepara Regency was designated as a red zone with the highest daily COVID-19 cases in June 2021 as many as 466 cases (Dinkes Jepara, 2022). This is the basis for research to examine the influence and relationship of PCR test positivity rates and vaccination rates with COVID-19 incidence rates whether the test and vaccination strategy shows a meaningful and measurable impact on the COVID-19 pandemic in Jepara Regency.

METHOD

This study uses analytical descriptive research with a quantitative approach. The research design used was a cross-sectional design. The unit of analysis in this study is the time period in units of weeks, observations starting from June 1, 2020 to June 30, 2022. The population and sample in this study, namely number of COVID-19 cases, PCR testing result, and COVID-19 vaccination were recorded at the Jepara Regency Health Office by using total sampling as a sampling technique. The variables in this study consisted of independent variables and dependent variables. The independent variable is the PCR test positivity rate and vaccination rate of COVID-19. The dependent variable in this study, namely the incidence rate of COVID-19 per 100,000 population.

The type of data used is secondary data obtained from the Jepara Regency Health Office. The data were then processed and analyzed by univariate and bivariate. The correlation test was used to analyze the relationship between the PCR test positivity rate and vaccination rate with the incidence rate of COVID-19 in Jepara Regency from 2020 to 2022. The results of the univariate and bivariate analysis were then displayed in the form of narratives, tables and chart.

RESULT

In terms of monitoring and dealing with the dynamics of the COVID-19 pandemic, there are several indicators that can influence the level of COVID-19 cases, including the PCR test positivity rate, vaccination rates, and the incidence rate of COVID-19. From the results of the univariate test, the results are shown in table 1.

Table 1. Result of Univariate Analysis

Research Variables	N	Mean	Standard Deviation	Minimum-Maximum	95% CI
Incidence rate of COVID-19	109	16.59	30.18	0-189.57	10.86-22.32
PCR test positivity rate of COVID-19	109	19.45	19.15	0-84.62	15.82-23.09
Vaccination rate of COVID-19					
First Dose	75	39.60	32.93	0.28-83.40	32.03-47.18
Second Dose	73	27.50	25.07	0.27-66.46	21.65-33.35
Third Dose (Booster)	47	3.65	4.48	0.06-14.25	2.33-4.96

Table 1 shows the frequency distribution of the research variables. It can be seen that from June 1, 2020 to June 30, 2022, the average weekly incidence rate of COVID-19 was 16.59 cases per 100,000 population with a standard deviation of 30.18. The lowest incidence rate from 2020 to 2022 is 0 and the highest is 189.57 cases per 100,000 population. The estimated

95% confidence interval for the incidence rate of COVID-19 is 10.86-22.32 cases per 100,000 population.

Then the average weekly PCR test positivity rate of COVID-19 was 16.59% with a standard deviation of 30.18%. The lowest PCR test positivity rate of 2020 to 2022 is 0% and the highest is 84.62%. An estimated 95% confidence interval was obtained, on the PCR test positivity rate of COVID-19 of 15.82%-23.09%.

It is also known the average of COVID-19 vaccination rate for first dose in Jepara Regency was 39.60% with a standard deviation of 32.93%. The vaccination rate of first dose reached 83.40% and an estimated 95% confidence interval for the vaccination rate of first dose of COVID-19 in Jepara COVID-19 was 32.03%-47.18%. The second dose of COVID-19 vaccination rate until June 30, 2022 has an average of 27.50% with a standard deviation of 25.07%. The vaccination rate of second dose reached 66.46% and the estimated 95% confidence interval was 21.65%-33.35%. Meanwhile, for the third dose of COVID-19 vaccination, an average of 3.65% was obtained with a standard deviation of 4.48%. The coverage of the third dose of COVID-19 vaccination has only reached 14.25% and has an estimated 95% confidence interval of 2.33%-4.96%.

Table 2. Result of Bivariate Analysis

Independent Variables	Incidence rate of COVID-19			Total (n)	Description
	Correlation Coefficient (r)	Signification (p)			
PCR test positivity rate of COVID-19	0.810	0.000	109		Positive, very strong, correlated
Vaccination rate of COVID-19					
First Dose	-0.603	0.000	75		Negative, strong, correlated
Second Dose	-0.591	0.000	73		Negative, moderate, correlated
Third Dose (<i>Booster</i>)	-0.311	0.034	47		Negative, weak, correlated

Table 2. is the result of bivariate analysis using the Spearman correlation test. It is known that there is a relationship between the PCR test positivity rate and the incidence rate of COVID-19 in Jepara Regency ($p < 0.05$), the correlation coefficient value (r) is 0.810, indicating that there is a very strong relationship strength and a positive correlation direction or in the same direction, which means that if the PCR test positivity rate of COVID-19 increases, the incidence rate of COVID-19 in Jepara Regency will also increase. Vice versa.

Based on the results of the Spearman correlation test in table 2. showing a relationship between vaccination rate and incidence rate of COVID-19 in Jepara Regency ($p < 0.05$), the correlation coefficient value (r) of vaccination rate of the first dose was -0.603 with the strength of the correlation is strong. The second dose has a moderate correlation of -0.591, and the third dose (booster) has a weak correlation of -0.311. It is also known that the direction of the correlation between the vaccination rate and the incidence rate of COVID-19 is negative or opposite, which means that if the vaccination rate of COVID-19 increases, the incidence rate of COVID-19 in Jepara Regency will decrease.

The pattern of the relationship between the level of PCR test positivity rate and the incidence rate of COVID-19 in Jepara Regency from June 1, 2020 to June 30, 2022 is presented use a comparison chart in Figure 1.

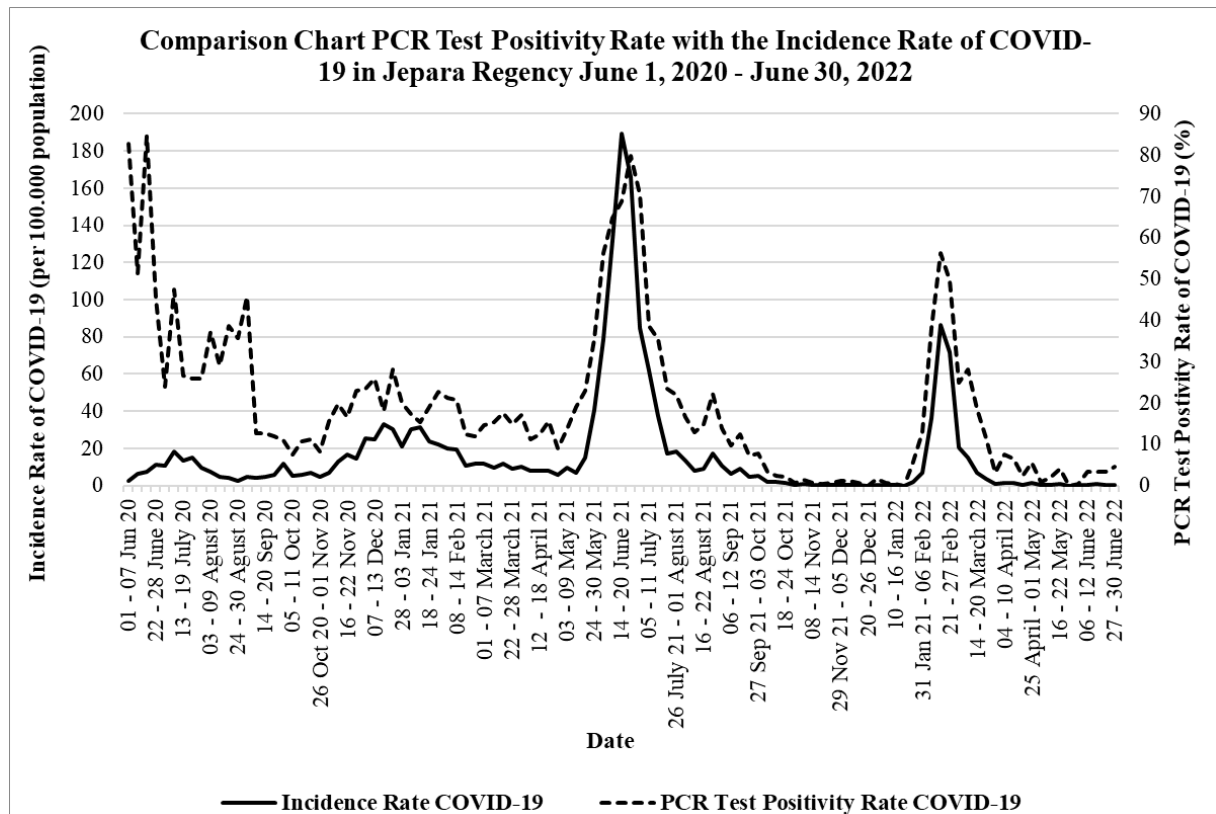


Figure 1. Comparison Chart PCR Test Positivity Rate with the Incidence Rate of COVID-19 in Jepara Regency June 1, 2020 - June 30, 2022

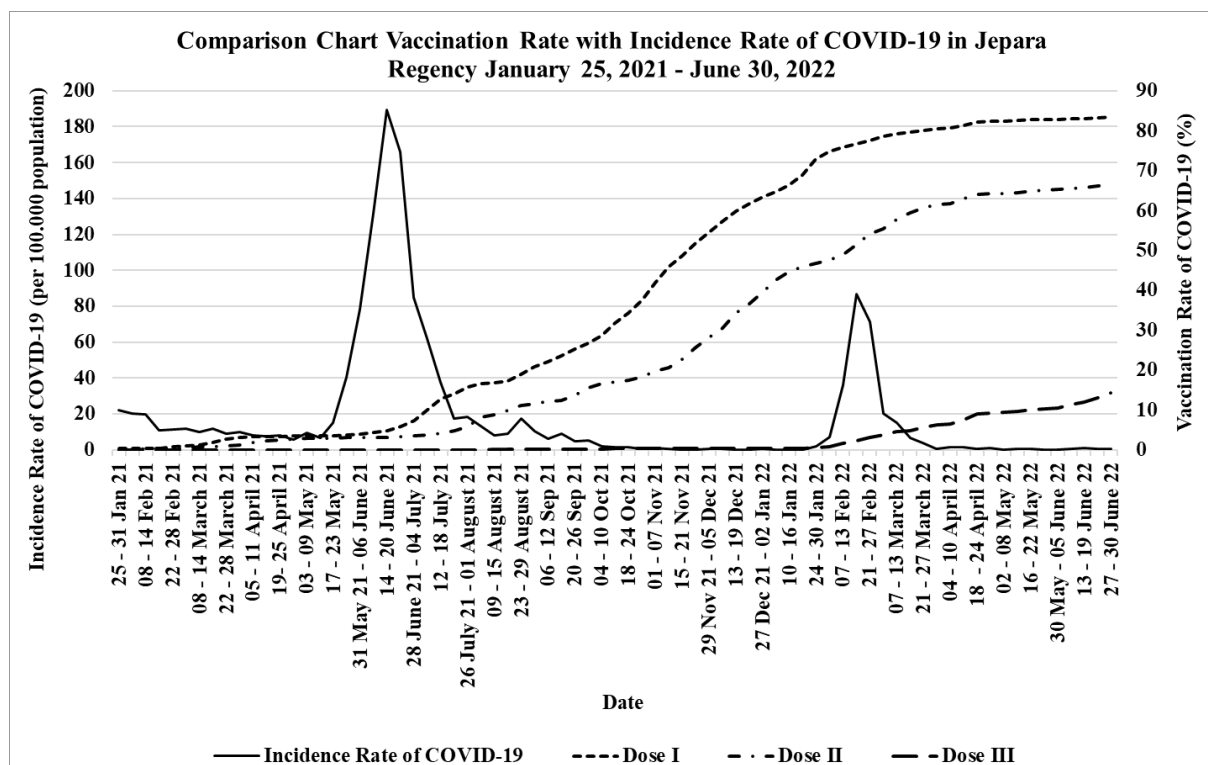


Figure 2. Comparison Chart Vaccination Rate with Incidence Rate of COVID-19 in Jepara Regency January 25, 2021 - June 30, 2022

Based on the comparison chart of the relationship in Figure 1. PCR test positivity rate and the incidence rate of COVID-19 fluctuated throughout 2020 to 2022 the highest incidence rate of COVID-19, namely 189.57 cases per 100,000 population on June 14 to 20, 2021.

The pattern of the relationship between the vaccination rate and the incidence rate of COVID-19 in Jepara Regency from January 25, 2021 to June 30, 2022 is presented in comparison chart in Figure 2.

Based on the comparison chart above, it can be seen that the COVID-19 vaccination in Jepara Regency has been carried out as an effort to prevent COVID-19 which was first implemented on January 25, 2021, the second vaccination dose of COVID-19 began to be given on February 8, 2021, while the third dose (booster) was given on August 12, 2021. Vaccination rate of COVID-19 until June 30, 2022 for the first dose reached 83.4%, the second dose was 66.46%, the third dose was 14.25% with an incidence rate of COVID-19 as many as 0.32 cases per 100,000 population.

DISCUSSION

A similar study by (Obi et al., 2021) state that test positivity rate is useful indicator for monitoring the quality of outbreak response in Edo State. The significant positive correlation ($r=0.569$) between sampled tested and COVID-19 positive cases in Edo State, Nigeria. Another study by (Al Dallal et al., 2021) also showed that the test positivity rate is a better indicator to measures the spread of COVID-19. The correlation coefficients reported have positive correlation between confirmed cases and performed tests for the selected countries with range from Canada ($r=0.496$) to South Africa ($r=0.936$). The study was also conducted by (Pilecco et al., 2021) which showed a high test positivity rate associated with a higher incidence of COVID-19 in several countries such as Egypt, Mexico, and Bolivia shown a high test positivity rate indicating a potential need to expanding testing strategies by allowing PCR test to be performed for people with low suspicion of COVID-19, which indicates that the more tests carried out, the more will be diagnosed with COVID-19 that need to be treated immediately so it cannot transmit COVID-19 to others.

The highest incidence rate of COVID-19 in Jepara Regency, namely 189.57 cases per 100,000 population, occurred when the PCR test positivity rate of COVID-19 by 68.65% on June 14 to 20 2021 which coincided with the Eid al-Fitr celebration period, the government has issued a policy of prohibiting travel or mudik (homecoming tradition ahead of Eid al-Fitr), but in fact there is still an increase positive cases of COVID-19 in Jepara Regency. Based on research (Mehta et al., 2021) in the United States, it is explained that the procurement of long holidays can have an impact on accelerating the spread of COVID-19 and increasing the test positivity rate of COVID-19 due to the high flow of population and crowd mobility when celebrating holidays.

Meanwhile, the highest PCR test positivity rate of COVID-19 occurred at the beginning of the pandemic, which was June 15-21, 2020 with a positive rate of 84.62% for COVID-19 with an incidence rate of 7.43 cases per 100,000 population. This could be due to the lack of proper preparation in the beginning of the COVID-19 pandemic (Firmansyah et al., 2020). The challenges faced are the lack of number and capacity of laboratories, examination tools and PCR reagents that are not yet available, then the lack of health workers due to many being infected with COVID-19 (Sukanya, 2020).

In addition, the high of test positivity rate could be due to examinations that are only carried out on symptomatic patients who come to the hospital and close contacts (Ponnaiah et al., 2021) (Reno et al., 2020). WHO states that asymptomatic cases of COVID-19 have been found, so individuals who do not have symptoms also need to be considered for testing, including individuals who are at risk of contracting COVID-19 such as health workers,

inpatients, and travelers (WHO,2020). According to (Rannan-Eliya et al., 2021) it is necessary to expand the target of COVID-19 testing, as has been done by several countries that have successfully eliminated COVID-19 such as China, New Zealand, and Cambodia.

Policies in handling COVID-19 can also affect the high and low test positivity rate and incidence rate of COVID-19. It can be seen that there was an increase in the test positivity rate and incidence rate of COVID-19 in Jepara Regency in the first phase, namely June 2020 which is when the new normal era was implemented which was marked by an reducing of economic activity in places of business and buildings, houses of worship, and offices with health protocols must be implemented (Andriani, 2020). Then a significant decrease occurred in the second phase at the end of June 2021 after the implementation of the PPKM micro policy by setting it to the smallest unit level, namely neighborhood. After that, it was continued with Emergency PPKM which was originally only implemented in Java - Bali, then similar policies were also implemented in a number of other areas. Emergency PPKM ending on July 25, 2021 was replaced with PPKM level 3-4 which was issued taking into account the high number of COVID-19 cases in an area (Toharudin et al., 2021).

According to a similar study conducted by (Chen, 2021) regarding the correlation between COVID-19 vaccination and the number of new cases of COVID-19 in 6 countries, it shows that there are 2 countries, namely the UK ($r=-0.7916$) and America ($r=-0.7315$). which has a negative correlation where the higher vaccination rate of a country can reduce the incidence rate of COVID-19. The same study conducted by (Cuadros et al., 2022) showed that there was a relationship between vaccination rate and incidence rate of COVID-19. There is also different result from a recent study by (Subramanian & Kumar, 2021) found no correlation between vaccination rates and COVID-19 cases. The study concluded that the surge in COVID-19 cases is not driven by areas with low vaccination rates because the COVID-19 virus constantly changes through a natural ongoing process of mutation.

The first dose of vaccination aims to trigger an initial immune response. The first dose is the prime dose or the main dose that can introduce the attenuated or dead COVID-19 virus into the recipient's body to stimulate the immune system to produce antibodies (Ophinni et al., 2020). Based on a study conducted (Alharbi et al., 2022), the first dose of COVID-19 has a high level of protection reaching 92% at the start of the pandemic. A similar study carried out in Turkey showed negative correlation means that the rise in first dose vaccination rates for COVID-19 is associated with a decrease in the incidence of COVID-19 disease (Erdal & Şaşmaz, 2022). Another study showed that the first dose of COVID-19 was also 70-80% effective in reducing the death rate from COVID-19 (Vasileiou et al., 2021).

The second dose of vaccination has an effect on the low incidence rate of COVID-19 where the second dose is intended to re-expose antigen molecules to viral pathogens so as to trigger the immune system and can increase the strength of the previously formed immune response (Li et al., 2021). It can be seen that there was a decrease in the incidence rate of COVID-19 in Jepara Regency in a few weeks starting from February to May 2021, besides that at the end of June 2021 a significant decrease in COVID-19 was seen after passing the peak of the incidence rate of COVID-19 due to the discovery of mutations. The Delta variant of COVID-19 that originated in India and is able to spread more quickly. The decrease in the incidence rate of COVID-19 can be influenced by the vaccination rate of the second dose which continues to be carried out almost every day in Jepara Regency.

Then in February 2022 the incidence rate of COVID-19 increased due to the emergence of a new COVID-19 virus mutation, the Omicron variant. WHO noted that the speed of Omicron infection exceeds the Delta variant and has a large effect on vaccine effectiveness, the second dose of Pfizer vaccine can only provide 33% protection against Omicron infection, even in South Africa its effectiveness has decreased to 80% (Torjesen, 2021). So, the third dose of COVID-19 vaccination with another designation, namely booster vaccine, needs to be given to

individuals who have received complete primary vaccines according to the policy regulated SE Number HK.02.02/II/252/2022 regarding COVID-19 Vaccination Advanced Doses (Booster). The third dose has begun to be implemented in Jepara Regency as a measure to anticipate the transmission of the Omicron variant of the COVID-19 virus.

Factors that can affect the vaccination rate of COVID-19, namely by expanding the target age group for vaccination, it is very necessary to do in terms of providing more comprehensive protection to the community. The recipients of the first stage of COVID-19 vaccination are given the age group of 18-59 years, which is a productive age group with high mobility and activities outside the home who are at high risk for infection and transmitting SARS-CoV-2 in the community (Krsamer et al., 2020). The productive age is a priority at the beginning of the vaccination implementation, namely health workers, then public workers for example, such as educators, market traders, soldier, police, public service officers, public transportation officers (Toharudin et al., 2021). In the next stage, vaccinations will begin to be given to the general public and the elderly aged 60 years and over who are susceptible to various diseases because their physiological functions will gradually decrease, including the body's immune system. The COVID-19 virus is seen more frequently causing severe infections and death in the elderly (Niu et al., 2020). Then the last stage is given to children aged 6-11 years and adolescents aged 12-17 years who are among the groups vulnerable to contracting COVID-19, especially in the case of family clusters (Goldwire & Leeds, 2022).

According to (Tunas et al., 2021) there are several factors from the delay in meeting the vaccination coverage target, including the availability of vaccines and public perception of vaccination. In Jepara Regency, it was noted that the vaccine stock was vacant due to the delay in distribution from the center to the regions and the lack of doses from the total requirement (Setiawan, 2022). In addition, there are several factors of willingness to vaccinate, namely age, occupation, area of residence, level of education, then lack of knowledge that gives rise to negative perceptions of COVID-19 vaccination (Utami, 2022). The influence of medical professionals, living arrangements, chronic illness, and access to medical services also play a role in vaccination uptake (Malesza, 2021). Concerns about vaccine safety and effectiveness, long-term side effects, illness, medication, pregnancy, and religious such as halal status of vaccination COVID-19 or ethical reasons are common reasons for declining vaccination of COVID-19 (Petros et al., 2021) (Adesta et al., 2021).

CONCLUSION

From this study, it can be concluded that there is a relationship between the PCR test positivity rate and vaccination rate of the incidence rate of COVID-19 in Jepara Regency where the higher of PCR test positivity rate, the higher incidence rate of COVID-19. The higher vaccination rate of COVID-19, the lower incidence rate of COVID-19. In implementing the testing strategy, it is necessary to pay attention to the test positivity rate of which is one of the important indicators in helping an area determine the number of positive cases every day in order to determine the direction or appropriate action to be taken to deal with the COVID-19 pandemic.

The right testing strategy certainly needs to be followed by contact tracing and treatment measures so that infected people both with symptoms and without symptoms can be detected immediately in order to reduce the number of cases of the spread of COVID-19. In addition, the public is expected to always be aware of COVID-19, with disciplined health protocols and receive full-dose vaccinations and additional doses (boosters) considering that the COVID-19 pandemic is not yet fully over.

The weakness in this study is that it uses secondary data whose validity may not be guaranteed because researchers do not have direct control over the initial data collection

process. Further researchers are expected to examine factors that can affect the PCR test positivity rate of and vaccination rate of COVID-19, such as population density, population mobility, and the application of health protocols. The results of this study are expected to be a reference for consideration for Jepara Regency Health Office in evaluating and planning programs to deal with the COVID-19 pandemic in Jepara Regency.

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