

# Increasing Incidence and Risk Factors for Transmission of COVID-19 in Brebes Community Health Center, Indonesia

## Peningkatan Insiden dan Faktor Risiko Penularan COVID-19 di Puskesmas Brebes, Indonesia

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### Article Info

Received Mey 6, 2023

Revised Mey 26, 2023

Accepted June 20, 2023

### Keyword:

COVID-19 prevention; health protocols; mask use; public health centres; risk factors.

### Kata kunci:

Faktor risiko; pencegahan COVID-19; penggunaan masker; protokol kesehatan; pusat kesehatan masyarakat.

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### Abstract

**Introduction:** Coronavirus Disease 2019 (COVID-19) is an infectious disease caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). Now, COVID-19 is still a problem in Central Java. COVID-19 cases in Central Java rank third highest in Indonesia, one of which is Brebes Regency, where there have been confirmed cases leading to death, with the highest cases at the Brebes Community Health Center. **Purpose:** The purpose of the study was to determine the risk factors for the occurrence of COVID-19 in the work area of the Brebes CHC, Central Java. **Method:** This quantitative study uses an analytical observational design and a cross-sectional approach. The data is carried out using exclusion and inclusion criteria so that it is based on the desired research focus. The sample in this study amounted to 78 respondents using purposive sampling. Univariate, bivariate (Chi-square test), and multivariate data analysis were performed. **Results:** The results of this study were that gender, occupation, contact history, and habit of wearing masks had a significant relationship with COVID-19 cases, with a p-value of 0.046, 0.035, 0.0191, and 0.026, respectively. Meanwhile, education has no relationship with the incidence of COVID-19 (p-value = 0.379). **Conclusion:** Risk factors that increase the incidence of COVID-19 in the Brebes district Public Health Centre area are consistent with other studies, namely gender, occupation, contact history, and habit of wearing masks. Prevention and control of COVID-19 cases by paying attention to these risk factors and other health protocols, washing hands using soap, maintaining distance and implementing a One- Health approach through cross-sector collaboration.

### Abstrak

**Latar Belakang:** Penyakit Coronavirus 2019 (COVID-19) adalah penyakit menular yang disebabkan oleh Sindrom Pernafasan Akut Parah Coronavirus 2 (SARS-CoV-2). Hingga saat ini, COVID-19 masih menjadi masalah di Jawa Tengah. Kasus COVID-19 di Jawa Tengah menduduki peringkat ketiga tertinggi di Indonesia salah satunya Kabupaten Brebes yang telah terkonfirmasi kasus meninggal dunia dengan kasus tertinggi di Puskesmas Brebes. **Tujuan:** Mengetahui faktor risiko terjadinya COVID-19 di wilayah kerja Puskesmas Brebes Jawa Tengah. **Metode:** Penelitian ini merupakan penelitian kuantitatif dengan desain observasional analitik dengan pendekatan Cross-Sectional. Sampel dalam penelitian ini berjumlah 78 responden dengan menggunakan random sampling. Analisis data dilakukan secara univariat, bivariat (uji Chi-square), dan multivariat. **Hasil:** Hasil penelitian ini adalah jenis kelamin, pekerjaan, riwayat kontak, dan kebiasaan memakai masker memiliki hubungan yang bermakna dengan kasus COVID-19, dengan p-value 0,046; 0,035; 0,0191; dan 0,026, masing-masing. Sedangkan pendidikan tidak ada hubungan dengan kejadian COVID-19 (p-value = 0,379). **Simpulan:** Faktor risiko yang meningkatkan insiden COVID-19 di wilayah Pusat Kesehatan Masyarakat kabupaten Brebes konsisten dengan studi lain, yaitu jenis kelamin, pekerjaan, riwayat kontak, dan kebiasaan memakai masker. Pencegahan dan pengendalian kasus COVID-19 dengan memperhatikan factor risiko tersebut, selain protocol Kesehatan lain, cuci tangan menggunakan sabun, jaga jarak dan menerapkan pendekatan One-Health melalui kolaborasi lintas sektor.



## Introduction

Coronavirus Disease 2019 (COVID-19) is an infectious disease caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). The increase in the number of COVID-19 cases took place

How to cite:

(APA)



Sutaip, S., Sutningsih, D., Adi, M. S., Diyana, S., Azzahra, N. A., Banilal, P. A. S., & Giyantolin, G. (2023). Increasing Incidence and Risk Factors for Transmission of COVID-19 in Brebes Community Health Center, Indonesia. *Jurnal Kesehatan Metro Sai Wawai*. 16(1), 22-31. DOI: <http://dx.doi.org/10.26630/jkm.v14i1.3861>

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quite quickly and spread to various countries in a short time. As of June 18, 2021, the Ministry of Health of the Republic of Indonesia reported 177,108,695 confirmed cases, with 3,840,223 deaths worldwide. Case Fatality Rate (CFR) is 4.6%. Meanwhile, in Indonesia, as of June 2021, the Ministry of Health reported 1,963,266 confirmed cases with 54,043 deaths (CFR 2.8%), 1,779,127 patients had recovered, and 111,635 suspected cases (Kemenkes RI., 2021). Based on the Central Java Provincial Health Office, on June 30, 2021, there were 253,939 confirmed cases of COVID-19, with 10,429 deaths (CFR 4.1%) (Dinkes Provinsi Jawa Tengah, 2021).

In Brebes Regency, In March, there were 3,005 confirmed cases. Three hundred fifteen people died (CFR 10.4%); in April, there were 3,523 confirmed cases with 378 people dying (CFR 10.7%); in May, there were 4,127 confirmed cases with 448 people dying (CFR 10.8%), and in In June, there were 5,101 confirmed cases with 559 deaths (CFR 10.9%) (Dinkes Kabupaten Brebes, 2022). Meanwhile, based on preliminary studies, the highest Community Health Centers (CHCs) with COVID-19 cases, namely the Brebes Health Center with 129 confirmed people, followed by the Banjorharjo Health Center with 98 confirmed people, then the Bulakamba Health Center with 82 people.

According to experts from the World Health Organization (WHO) and The Centers for Disease Control and Prevention (CDC), several risk factors can cause COVID-19 and lead to a worsening of infection in humans, namely age, contact history, comorbidities, or disease: participants and gender. Related to age risk factors, those who are vulnerable or very at risk are the elderly. Contact history is divided into three, namely people with a history of travel from countries/regions infected with COVID-19, people with a history of travel from countries/regions with local transmission of COVID-19, and people who have a history of close contact with positive COVID-9 patients (Morfi, 2020).

In a study by Permatasari et al. (2020), the pediatric age group is the group with the fewest infected cases, while cases of the geriatric age group infected with COVID-19 are relatively high and have a high risk of death. In addition, risk factors that are significantly associated with an increased incidence of COVID-19 cases in adult patients are patients with complications of hypertension, diabetes mellitus, and coronary heart disease. Male age and gender significantly impact the risk of severe COVID-19 (Gvozdanovi et al., 2021; Meister et al., 2022).

Thus, several risk factors can influence the COVID-19 case in Brebes Regency. For this reason, a study is needed regarding this matter, so it is hoped that it can prevent and become an overview of the COVID-19 handling program in the future. Because of the importance of studying the risk factors for COVID-19, it is necessary to conduct an in-depth study of "Risk Factors for the Incidence of COVID-19 in the Work Area of the Brebes Health Center in Indonesia".

## Methods

This quantitative study uses an analytic observational design and a cross-sectional approach. The data used are secondary data from medical records and isolation rooms in several hospitals that were reported to the Brebes Community Health Center from January 1, 2021, to June 30, 2021, with a total of 5,101 confirmed cases of COVID-19.

From this data, filtering was done by filling in complete data according to exclusion criteria. Inclusion criteria: (1) Confirmed, (2) Not Confirmed; (1) Men, (2) Women; (1) >60 years (advanced age), (2) 45 – 59 years (pre-advanced age); (3) 19 – 44 Years (Adult); (4) 10 – 18 Years (Teenagers); (1) School, (2) No School; (1) Working, (2) Not Working; (1) Wearing a Mask, (2) Not Wearing a Mask. The sample in this study amounted to 78 respondents using purposive sampling.

The statistical test used is to calculate the p-value of each Chi-square test variable. All variables with  $p < 0.25$  were then analyzed in the logistic regression test. In logistic regression analysis, the Hosmer-Lemeshow and Omnibus tests are used to validate the model fit assumptions. This analysis uses Microsoft Excel and SPSS v.24 for univariate, bivariate, and multivariate analysis. The confidence level using ( $\alpha$ ) 0.05 and the magnitude of association used odds ratio (OR). The study was conducted after obtaining research permission from the Health Service, Brebes Regency, and Central Java Province, and each respondent had agreed to informed consent as long as the research complies with health protocols to prevent transmission of COVID-19. This research protocol was based on the ethical review of the Ethics Commission of Diponegoro University, Indonesia. The research was conducted after providing information about research ethics and obtaining consent from respondents. Health protocols were implemented during the study to prevent transmission of COVID-19.

## Results

### Respondents Characteristics

**Table 1** shows that most COVID-19 patients are male, as many as 61 people (78.2%), while women are as many as 32 (41.0%). Age at most 45-59 years old (Pre-elderly), as many as 36 people (46.2%), more than 60 years (elderly), as many as 27 people (34.6%), 19-44 years (Adults), as many as 14 people (17.9%) and 10-18 Years (Teenagers) as many as one people. In this study, 22 people (28.2%) had undergraduate education at most, 18 people (23.1%) did not graduate from elementary school, 16 people (20.5%), 11 elementary school students (14.1%), seven junior high school students (9.0%), and Diploma as many as four people (5.1%).

Most occupations were Private Employees as many as 14 people (17.9%), Businessman as many as 13 people (16.7%), Farmers as many as 10 people (12.8%), Civil servants as many as nine people (11.5%), Traders as many as nine people (11.5%), State-Owned Enterprises employees were two people (2.6%). While not working as homemakers, as many as ten people (12.8%) retired, as many as seven people (9.0%), and students as many as four people (5.1%). Contact history with confirmed COVID-19 was 38 (48.7%), and no contact was 40 (51.3%). The habit of wearing masks was 41 people (52.6%) wore masks, and 37 (47.4%) did not wear masks (**Table 1**).

### Statistical Analysis Results

#### Bivariate Analysis

Based on the data in **Table 2**, the results obtained for the gender variable p-value of 0.046, where the p-value was less than  $< 0.05$ , statistically show a relationship between gender and the incidence of COVID-19 in the work area of the Brebes Public Health Center. The age variable p-value was 0.379, where the p-value was  $> 0.05$ , so statistically, it shows no relationship between age and the incidence of COVID-19 in the working area of the Brebes Public Health Center. The education variable p-value was 0.728, where the p-value was  $> 0.05$ , so statistically, it shows no relationship between education and the incidence of COVID-19 in the working area of the Brebes Public Health Center. The work status variable p value = 0.035, where the p-value was  $< 0.05$ ; statistically, it shows a relationship between work status and the incidence of COVID-19 in the work area of the Brebes Public Health Center. The contact history variable p value = 0.019, where the p-value was less than  $< 0.05$ , statistically shows a relationship between contact history and the incidence of COVID-19 in the work area of the Brebes Public Health Center. The variable habit of wearing masks p value = 0.026, where

the p-value was less than  $< 0.05$ , then statistically shows a relationship between wearing masks and the incidence of COVID-19 in the Brebes Public Health Center working area.

### Multivariate Analysis

Based on the data in [Table 3](#), it can be seen that the variable wearing a mask compared to the variables gender, occupation, and contact history, the variable wearing a mask has the highest Odd ratio (OR) value of 1.338, the odds ratio value for sex is 0.370, the odds ratio for work is 0.222, the odds ratio for contact history is 0.474, so that the variable wearing a mask is included in the multivariate modelling II. The multivariate modelling II can be seen in the table below. Based on the data in [Table 4](#), it can be seen that the variable most related to the incidence of COVID-19 is wearing a mask, which is indicated by the value (OR 3,830), which means that the habit of wearing a mask has the opportunity to cause the occurrence of COVID-19 by 3,830 times, with a significant p-value of  $0.026 < 0.05$  with a value of 95% CI 1.121 – 13.086. In the logistic regression test of the variables above, it can be concluded that the habit of wearing a mask is the variable most related to the incidence of COVID-19 in the work area of the Brebes Health Center.

**Table 1.**  
 Distribution of Respondents Characteristics (n=78)

Variable	N	Frequency (%)
Case category		
Confirmed	61	78.2
Not Confirmed	17	21.8
Gender		
Male	48	61.5
Female	30	38.5
Age		
> 60 Years (Elderly)	27	34.6
45 – 59 Years (Pre-Elderly)	36	46.2
19 – 44 Years (Adult)	14	17.9
10-18 Years (Teenagers)	1	1.3
Education		
School	62	79.5
Elementary school	11	14.1
Junior high school	7	9.0
Senior high school	18	23.1
Diploma	4	5.1
Bachelor	22	28.2
Without school	16	20.5
Work		
Working	57	74.4
Civil servant	9	11.5
Farmer	10	12.8
Trader	9	11.5
SOEs employees	2	2.6
Private sector employee	14	17.9
Businessman	13	16.7
Unemployed	21	25.6
Retired	7	9.0
Housewife	10	12.8
Student	4	5.1
Contact History		
Yes	38	48.7
No	40	51.3
Wearing a Mask		
Use	41	52.6
Do not use	37	47.4
Total	78	100

**Table 2.**

The results of the analysis of the relationship between gender, age, latest education, occupation, contact history, comorbid hypertension, diabetes mellitus, and mask-wearing with the incidence of COVID-19 cases.

Variable	Status		P-		COR	95% CI	
	Confirmed	Not Confirmed	value			Lower	Upper
	N	%	n	%			
Gender							
Male	34	37.5	14	10.5	0.046		
Female	27	23.5	3	6.5			
Age						1,673	0.528 5.298
< 60	46	44.6	11	12.4	0.379		
> 60	15	16.4	6	4.6			
Last education						1.256	0.347 4,547
School	49	48.5	13	13.5	0.728		
Without school	12	12.5	4	3.5			
Work						1.38	0.017 1.119
Working	42	45.4	16	12.6	0.035		
Does not work	19	15.6	1	4.4			
Contact History						0.244	0.071 0.835
Yes	27	31.3	13	8.7	0.019		
No	34	29.7	4	8.3			
Wearing a Mask						3,830	1.121 13.086
Yes	28	32.1	13	8.9	0.026		
No	33	28.9	4	8.1			

**Table 3.**

Multivariate Modeling I

Variable	B value	AOR	95% CI		P value
			Lower	Upper	
Gender	- 0.995	0.370	0.091	1.505	0.046
Work	- 1,504	0.222	0.026	1,927	0.035
Contact History	- 0.748	0.474	0.033	6,848	0.019
Wearing a Mask	0.291	1.338	0.092	19,513-	0.026
Constant	2,309	4.224			

**Table 4.**

Multivariate Modeling II

Variable	B value	AOR	95% CI		P value
			Lower	Upper	
Wearing a Mask	1.343	3,830	1.121	13.086	0.026
Constant	- 3,453	1.111			

## Discussion

### Gender and incidence of COVID-19

This study shows a relationship between gender and the incidence of COVID-19. This was concluded by research by Hua Cai from China in 2020, which concluded that there is a relationship between the sexes and the incidence of COVID-19. In Hua Cai's research, gender is said to be related to the incidence of COVID-19 related to lifestyles, such as the tendency to smoke (Cai, 2020). Research by Satria et al. (2020) also says that gender is a risk factor for COVID-19. The study stated that gender was a risk factor for mortality in COVID-19 patients due to fundamental differences in the immune system in men and women and differences in lifestyle, and was also associated with smoking prevalence. In this study, most patients were male, and as many as 34 were confirmed from 78 patients. Bwire (2020) stated that men are more at risk of COVID-19 due to chromosomal and hormonal factors. Women are more protected from COVID-19 than men because they have an X

chromosome, and sex hormones such as progesterone play an essential role in innate and adaptive immunity (Maragakis, 2020).

### **Age and incidence of COVID-19**

The age variable shows no significant relationship between age and COVID-19 cases ( $p = 0.379$ ). The same thing was also stated in a study, which showed no significant difference in age (Maragakis, 2020). Another study revealed that one of the risk factors for COVID-19 was age over 50 years (Cen et al., 2019). In this study, more COVID-19 patients were aged 45-59 years (Pre-elderly). Several studies related to COVID-19 stated that older adults (elderly) are more susceptible to infection. Based on research conducted by Maragakis (2020) suggests that the elderly are twice as likely to be at risk of COVID-19 than the young. Another study found that older people had a higher attack rate, with the highest being in the 60-69 year age group, and logistic regression showed a statistically significant relationship (ECDC, 2020).

Furthermore, Tiruneh et al. (2021) reported from systematic reviews and meta-analyses that COVID-19 density is related to age and complications that occur. An increase in age by an average of 1 year was significantly associated with the incidence of syndromes, the dominant of which was acute respiratory distress by almost a third (30.93%), and the rest (69.17%) included acute kidney and heart injury, as well as an increased incidence of shock. The older population is a high-risk community for developing complications of disease syndromes, compared to younger age. Health professionals should endeavour to give primary attention to individuals in these risk groups.

### **Education and incidence of COVID-19**

The education variable shows no significant relationship between education and COVID-19 cases ( $p = 0.728$ ). In this study, the patients with the most education had the most undergraduate education, as many as 22 people (28.2%), and high school students, as many as 18 people (23.1%). This is because the knowledge gained by the community affects the level of education, with education regarding the transmission of COVID-19 not only obtained from formal education but also from personal experience and the social environment (Gennaro et al., 2020).

Education level is a risk factor for the incidence of Covid-19 transmission (Sonyorini & Sulastri, 2021; Rahman et al., 2022). In addition, the level of education is a factor that predisposes behaviour among the community to live a healthy life (Green & Kreuter, 2005). The study's results reported that the incidence of COVID-19 was significantly related to knowledge and behaviour of COVID-19 prevention among the community (Desty et al., 2021; Olapegba et al., 2020). Furthermore, a systematic review study found that knowledge, attitudes, and behaviours are associated with the incidence of COVID-19 in the Americas (Sarria-Guzmán et al., 2021). It is important to pay attention to the community level according to education and knowledge to campaign for awareness and prevention of the spread of COVID-19, especially for community groups with low education levels.

### **Work status and incidence of COVID-19**

The work status variable showed a significant relationship between work status and COVID-19 cases with  $p = 0.035 < 0.05$ . Workers who interact with potentially infectious individuals are also at risk of transmission (e.g., workers in shops and supermarkets, banks, schools, delivery services, restaurants, sports, and tourist facilities, and so on), as well as those who work in high densities, given their proximity to other workers in semi-restricted settings (e.g., factories, service centres, open space



offices and so on). In this study, more patients with confirmed COVID-19 status worked. The business world and the working community significantly contribute to breaking the chain of transmission due to a large working population and the significant mobility and interaction of the population, generally due to work activities. The workplace as a locus of interaction and gathering of people is a risk factor that needs to be anticipated for transmission (Muslima et al., 2012).

Another study showed that the transmission route of 39 cases was through contact with co-workers. The transmission of COVID-19 started from animal-to-human infection, but this virus has evolved into a form that can cause rapid human-to-human transmission (Shereen et al., 2020). According to Tellier et al. (2019) the transmission of COVID-19 is through aerosol, droplets, and direct contact. Transmission via aerosol is the main mode of transmission. Aerosols are particles with a diameter below 100 m. Airborne transmission contributes to the incidence of COVID-19. The findings suggest that airborne transmission of COVID-19 is in line with reports of past SARS events (Shen et al., 2020).

Furthermore, from the Scoping Review by Upshaw et al. (2021), among the four studies that clinically described the occupations of COVID-19 survivors, two did not assess differences by occupation, and two did not find statistically significant differences in symptom severity by occupation. Whereas, in Wuhan, China, Chu et al. (2020) reported that among 54 medical staff hospitalised with COVID-19, severe illness tended to be more common in non-emergency or non-clinical clinical environments. Wang X. et al. found that 16 out of 80 frontline medical workers hospitalised in Wuhan were 'other' non-medical healthcare workers compared to doctors and nurses (Chen et al., 2021). The importance of identifying the employment status of COVID-19 survivors for clinical characteristics and the need to provide professional care so that the impact of death can be minimised and prevented.

### **History of contact and incidence of COVID-19**

The contact history variable showed a significant relationship between contact history and the incidence of COVID-19 ( $p = 0.019$ ). According to the Ministry of Health (2020), close contact is when someone has physical contact, is in a room, or visits 1 meter with a patient under surveillance or confirms within two days before the case develops symptoms. Up to 14 days after the case develops symptoms. According to the World Health Organization (2021), the mode of transmission of COVID-19 can be through several mechanisms such as transmission of SARS-CoV-2 can occur through direct contact, indirect contact, or close contact with an infected person, transmission through the air, secretions such as saliva and respiratory secretions or respiratory droplets released when an infected person coughs, sneezes, and talks. Patients have more close contacts because close contacts travel from outside the city, such as Jakarta, and close contacts with confirmed family.

A person who, 14 days before the onset of symptoms, lives or travels from a country or local transmission area of COVID-19, has close contact, for example, with family members, co-workers, or medical personnel who treat patients who are not known to be infected with COVID-19, are very likely to be at risk of infection (Kemenkes RI, 2020). Based on research conducted by Banjarnahor (2021) shows that the transmission of COVID-19 to nurses occurs due to a history of contact with patients and hospital staff confirmed COVID-19, the habit of eating together with colleagues, caring for patients who have confirmed COVID-19 in the hospital—non-isolation rooms, and visiting crowded places such as markets.

### **The habit of wearing masks and the incidence of COVID-19**

This study shows a significant relationship between mask use and the incidence of COVID-19 ( $p = 0.026$ ). This study is consistent with a study in Wuhan, China, showing that the behavioural factor of wearing a mask was significantly associated with the COVID-19 epidemic (Chen et al., 2020). Likewise, the behaviour of wearing masks is a factor associated with the COVID-19 pandemic in Turkey (Ayrhan et al., 2022), in South Africa (Burger et al., 2022), among students (Prastyawati et al., 2021). Among students, in addition to using masks, the prevention of COVID-19 is also significantly related to the behaviour of washing hands with soap and hand sanitisers, implementing cough etiquette, and physical distancing.

In South Africa, the prevalence of mask use has increased significantly along with the increase in COVID-19 cases and the relaxation of social restrictions. However, it was found that despite having a higher risk of mortality, the elderly had a significantly lower chance of wearing a mask (Burger et al., 2022). The study by Zhang et al. (2023) showed that China's education level, age, and income increased mask-wearing. In addition, the population living in rural areas is lower than in urban areas. Masks are an effective measure to prevent and control the spread of COVID-19. After the Chinese government made wearing masks mandatory in public places, most of the population in China has developed the habit of wearing masks, which contributes to the high rate of mask-wearing. However, people in rural areas must raise their awareness of wearing masks. Wearing masks is important in preventing and controlling the COVID-19 pandemic by people of all groups so that the prevalence of COVID-19 incidence can be prevented and the pandemic will end soon.

### **Conclusion**

Risk factors that have a significant relationship to COVID-19 are the habit of wearing masks, gender, history of work status, and contact history. The risk factor for the habitual status of wearing a mask is the factor most related to the incidence of COVID-19. Meanwhile, age, last education, comorbid hypertension, and diabetes mellitus have no relationship with the incidence of COVID-19. In controlling COVID-19, applying the One-Health approach through cross-sector collaborations is essential. It is recommended that increased awareness in preventing COVID-19 and the need for continuous research to support factors related to the incidence of COVID-19. This research requires further research related to the presence of risk factors that can cause death and comorbidities.

### **Acknowledgment**

The authors want to reveal gratitude to the health workers, the COVID-19 Task Force, Brebes Health Office staff, and others who have contributed to collecting COVID-19 data in Brebes. The authors thank our funder, Southeast Asia One Health University Network (SEAOHUN), and the United States Agency for International Development (USAID).

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