Risk factors of COVID-19 incidence in Bantul Regency, Indonesia

Siska Wardani, Fardhiasih Dwi Astuti
Faculty of Public Health, Universitas Ahmad Dahlan, Yogyakarta, Indonesia

Article Info	ABSTRACT
	Coronavirus disease 2019 (COVID-19) was a public health problem in Indonesia. The highest number of COVID-19 cases in Special Region of Yogyakarta in 2021 was in Bantul Regency. The epidemiological description based on the person, place, time, and risk factors for COVID-19 in Bantul Regency in 2021 has yet to be described. This study aimed to determine risk factors, person, place, and time characteristics associated with the incidence of COVID-19 in the Bantul Regency in 2021. This study employed a cross-sectional design with secondary data on COVID-19 cases in Bantul Regency in 2021. Furthermore, 80,322 samples were analyzed and confirmed COVID-19 was 53,506 cases (66.61%). The case fatality rate was 2.72%. The highest age positive for COVID-19 is <65 years (92.31%), 53.83% of cases were female, and the district of Banguntapan with the highest rate of COVID-19 (15.11%). The peak of cases occurred in July, 2021. There is a relationship between close contact, travel history, age, and gender with the incidence of COVID-19 (p<0.001). The most significant risk factors were close contact (OR=8.657), travel history (OR=3.034), gender (OR=1.147), and age (OR=0.889). Close contact has the most significant association with the incidence of COVID-19, followed by travel history and gender. *This is an open access article under the [CC BY-SA](#) license.*

Corresponding Author:

Fardhiasih Dwi Astuti
Faculty of Public Health, Universitas Ahmad Dahlan
Yogyakarta, Indonesia
Email: fardhiasih.dwiastuti@ikm.uad.ac.id

1. INTRODUCTION

Coronavirus is a new type of virus, referred to as severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), and cause disease COVID-19 [1]. World Health Organization (WHO) announced coronavirus disease 2019 (COVID-19) as a pandemic, with cases increasing spread in 204 countries and 151 affected community countries with 449 deaths case fatality rate (CFR): 2.0% [2], [3]. The Government of the Republic of Indonesia, announced that as many as 5,923 positive cases of COVID-19. Indonesia has the highest number of positive cases of COVID-19 19 in Southeast Asia. While in the case of death, as many as 520 cases [4]. Based on data from the D.I. Yogyakarta Provincial Government, the number of COVID-19 cases was 30,027 with 722 deaths. Bantul District there was the most of case COVID-19 in D.I. Yogyakarta [5]. Moreover, based on a preliminary study, it is known that the total number of confirmed COVID-19 cases in the Bantul Regency in 2021 was 54,253 cases. In contrast, the total number of close contacts was 66,162 cases [6].

The risk factors infected with COVID-19 are age, gender, history of close contact with people with COVID-19/Probable COVID-19, travel history, history of comorbid illnesses or diseases, knowledge, COVID-19 prevention behavior -19, as well as other risk factors such as a history of smoking, obesity, and

dyslipidemia [7]. The most critical risk factors in COVID-19 are close contact with people with COVID-19 or having a history of travel to pandemic areas. In addition, other risk factors that affect the incidence of COVID-19 are age and gender [8]. WHO stated that people aged >65 years are at higher risk for infection with COVID-19 because the elderly tend to have long-term health problems [9]. Men are more susceptible to Covid because they pay less attention to personal hygiene and are less involved in health promotion [10]. The epidemiological findings reported higher morbidity and mortality covid 19 in males than females [11].

Time, place, and personal characteristics are essential to know because they describe the distribution of the state of a health problem, estimate the magnitude of health problems in various groups and regions and can provide initial clues to formulate a hypothesis that risk factor for disease [12]. The application of epidemiology findings to improve public health must become the highest priority for health policy [13]. The epidemiological picture in Indonesia based on data from the COVID-19 six-month of the outbreak on gender characteristics, the most confirmed COVID-19 is men (50.52%). The age characteristic confirmed by COVID-19 is 31-45 (29.73%). Then, based on the place category, it shows that East Java occupies Indonesia's province with the highest COVID-19 cases [14]. Research results in Jakarta show that high positive cases occurred at the beginning of the pandemic, experienced a decrease in May 2020, but then there was another increase until January 2021 [15]. Risk factors, person, place, and time characteristics for COVID-19 in Bantul Regency in 2021 are unknown. This study aimed to determine risk factors, person, place, and time characteristics associated with the incidence of COVID-19 in the Bantul Regency in 2021.

2. METHOD

This research was a descriptive and observational analytic study with a cross-sectional design. The population is COVID-19 cases contained in the surveillance information system data and extraordinary events (SISKLB) of the Bantul District Health Office in 2021 is 100,822. Sample was selected with inclusion criteria and exclusion criteria. The inclusion criteria: all COVID-19 cases recorded in Bantul Regency in 2021 that carried out transcription polymerase chain reaction (RT-PCR)/antigen laboratory examinations at the Bantul Regency Health Office. Hence the exclusion criteria was incomplete data on COVID-19 cases recorded.

Based on the inclusion and exclusion criteria, the sample size in this study was 80,322. The dependent variable was COVID-19 cases that confirm by RT-PCR or antigen test. Moreover, independent variables were close contact, travel history, age, and sex. Epidemiology characteristics present by person, time, and place. Data was analyzed descriptive, correlated bivariate with Chi-square test statistic, and multivariable analysis with logistic regression.

3. RESULTS AND DISCUSSION

Based on the surveillance information SISKLB of the Bantul District Health Office in 2021, there were 80,322 data. Case positive confirmed COVID-19 was 53,506 cases (66.61%). Figure 1 demonstrates that most of the confirmed cases of COVID-19 are under 65 years old. Case confirmation COVID-19 proportion of females more than males as shown in Figure 2. The patient status shows the condition after passing the isolation period will recover or die-case fatality rate of COVID-19 in Bantul Regency 2.72% (Figure 3). The sub-district area in Bantul Regency with the most cases of COVID-19 is Banguntapan District as shown in Figure 4. The peak of COVID-19 cases in 2021 occurred in July as shown in Figure 5.
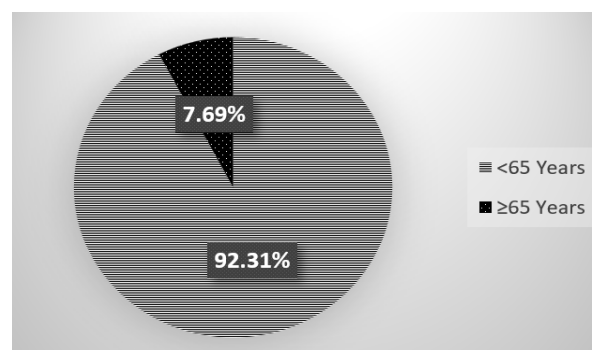

Figure 1. Description of characteristics age of confirmed cases of COVID-19 in Bantul Regency
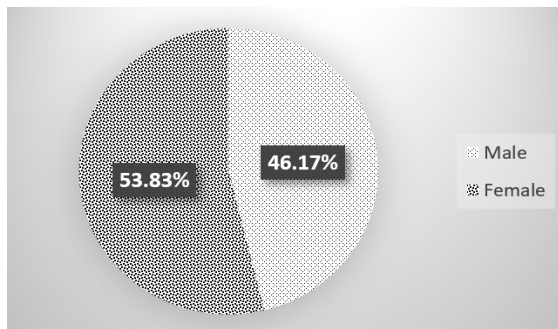
Figure 2. Description of characteristics sex of confirmed COVID-19 cases in Bantul Regency
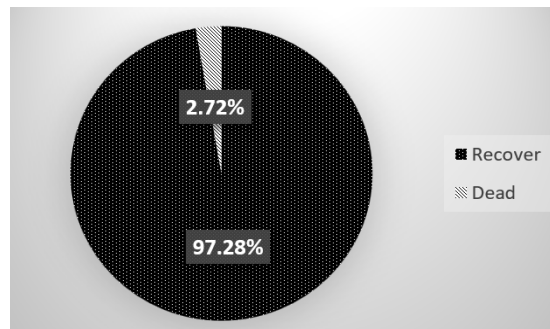

Figure 3. Description of characteristics condition status of confirmed cases of COVID-19 in Bantul Regency in 2021
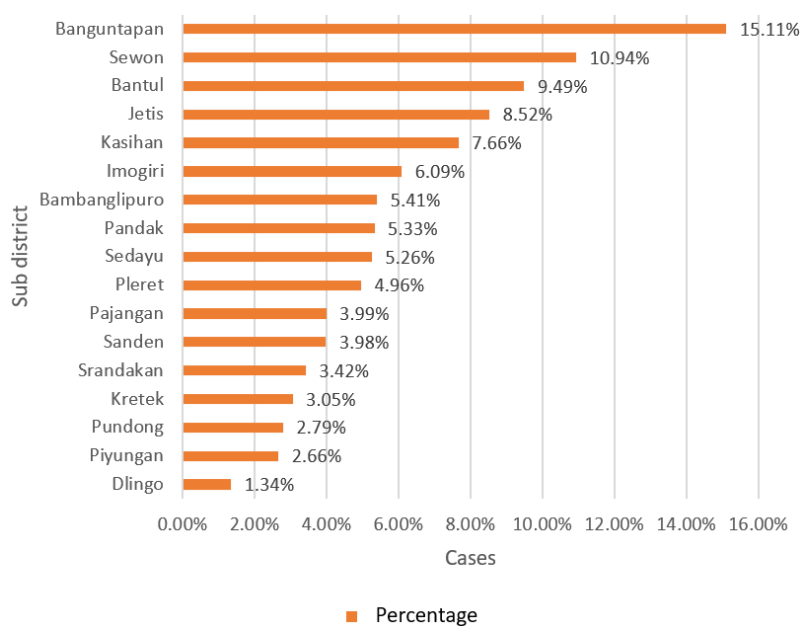

Figure 4. Description of frequency of confirmed cases of COVID-19 by the sub district in Bantul Regency

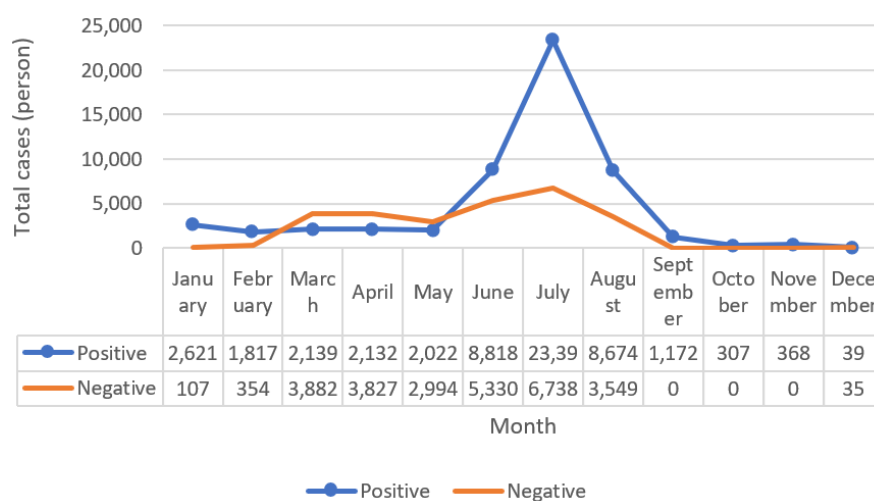| Month	January	February	March	April	May	June	July	August	September	October	November	December
Positive	2,621	1,817	2,139	2,132	2,022	8,818	23,39	8,674	1,172	307	368	39
Negative	107	354	3,882	3,827	2,994	5,330	6,738	3,549	0	0	0	35

Figure 5. Description of frequency of confirmed COVID-19 cases by time in Bantul Regency

Table 1 presents a bivariate analysis association of close contacts, travel history, gender and age with COVID-19 case confirmation. All independent variables have a significant association with COVID-19 case confirmation. Multivariable analysis in Table 2 presents close contact as having the most considerable correlation with confirmation of COVID-19 than travel history, gender, and age.

Table 1. Bivariate analysis for COVID-19 in Bantul Regency 2021

| Variables | COVID-19 | | | | Total | | p-value | RP (95% CI) |
| | Confirm | | No confirm | | | | | |
	n	(%)	n	(%)	n	(%)		
Close contact								
Yes	31,323	39.0	21,568	26.9	52,891	65.8		
No	22,183	27.6	5,248	6.5	27,431	34.2	<0.001	0.732 (0.726-0.739)
Total	53,506	66.6	26,816	33.4	80,322	100		
Travel history								
Yes	21,530	26.8	5,196	6.5	26,726	33.3		
No	31,976	38.8	21,620	26.9	53,596	66.7	<0.001	1.350 (1.338-1.363)
Total	53,506	66.6	26,816	33.4	80,322	100		
Age								
≥65 Tahun	4,117	5.1	1,799	2.2	5,916	7.4		
<65 tahun	49,389	61.5	25,017	31.1	74,406	92.6	<0.001	1.048 (1.030-1.067)
Total	53,506	66.6	26,816	33.4	80,322	100		
Sex								
Male	24,703	30.8	13,241	16.5	37,944	47.2		
Female	28,803	35.9	13,575	16.9	42,378	52.8	<0.001	0.958 (0.948-0.967)
Total	53,506	66.6	26,816	33.4	80,322	100		

Table 2. Multivariable analysis risk factors for COVID-19 in Bantul Regency 2021

| Variables | B | S.E | Sig. | OR | 95% C.I.for EXP (B) | |
					Lower	Upper
Close contact	2.158	0.144	<0.001	8.657	6.523	11.489
Travel history	1.110	0.145	<0.001	3.034	2.284	4.031
Age	-0.117	0.030	<0.001	0.889	0.838	0.943
Sex	0.137	0.015	<0.001	1.147	1.113	1.182
Constant	-0.700	0.148	<0.001	0.497		

Most COVID-19 sufferers are aged <65 (92.31%) because, at that age of productivity, a person tends to have high mobility and activities outside the home. Productive period tends to be at risk of being infected with COVID-19. The data COVID-19 in Indonesia during the first six months of the outbreak, patients that the age range of 19-30 years and 31-45 years were the two largest age categories for the highest number of positive patients in Indonesia [14]. At productive age, people tend to be often involved in social activities and have high mobility, making it easier for COVID-19 transmission. In addition, in the young adult age group, symptoms are mild or asymptomatic so they can contribute to the transmission process. Asymptomatic people infect people close to them, including people at risk of severe disease [16].

Based on gender characteristics, the results showed that the female sex contained 28,803 cases (53.83%) positive confirmed cases of COVID-19. National data on COVID-19 patients as of December 26, 2021, in Indonesia also states that female is the most common sex in Indonesia that positively COVID-19 [17]. The study in Kotamobagu in 2020 noted that the distribution of COVID-19 sufferers most women with a percentage of 56.1% [18]. Data from the central statistics agency (BPS) of Bantul Regency in 2020 shows the percentage of the population aged 15 years and over in Bantul Regency by gender women who work 97.20%, and those who do not work only 2.80%. At the same time, the gender of women who take care of the household is 70.17% [19]. Housewife activities included social gatherings and recitation, thus causing crowds that can risk COVID-19 transmission. The public is always advised to implement health protocols, namely washing hands, wearing masks, and social distancing to prevent the spread of COVID-19 [20].

Regarding COVID-19 morbidity in Europe, women appear slightly more likely to be diagnosed with COVID-19. For example, up to June 1, 2020, in Germany, confirmed cases of women accounted for 52% and men 48%. This may be because the majority of health workers with high exposure to the SARS-CoV-2 virus. Europe and globally have reported COVID-19 outbreaks in many long-term care sector (LTC) facilities, with high rates of morbidity and case fatality in residents and high rates of staff absenteeism. Confirmed cases among healthcare workers show that women are being infected in higher numbers than men: in Italy, 68% of infected are women; in the USA, 73%, Spain 75%, Germany 72% [21].

The condition of the patient after isolation, the patient recovered healthy as many as 52,048 cases (97.28%). Most people infected with COVID-19 of productive age have milder symptoms compared to the period of children and the elderly. In the younger, not many have comorbid diseases. Older people tend to have comorbid illnesses that can cause severe infections when infected with COVID-19 and even cause death. COVID-19 causes more severe conditions and death in older people than children and adults [22]. The elderly may represent a specific cluster of high-risk patients for developing COVID-19 with rapidly progressive clinical deterioration. In older individuals, immunosenescence and comorbid disorders are more likely to promote viral-induced cytokine storms resulting in life-threatening respiratory failure and multisystemic involvement [23].

Based on the sub-district area, the most positive confirmed cases of COVID-19 in Bantul Regency in 2021 were in the Banguntapan sub-district, with 8,086 cases (15.11%). Banguntapan sub-district is densely populated, with 3,978 people per km^2. Population density is one of the risk factors for the transmission of COVID-19. The disease can spread quickly if the transmission mode is through droplets and occurs in areas with high population density. The frequency of interaction between individuals will increase at a high population density. Interactions between close individuals will increase the risk of transmission [24].

Time-based analysis on the incidence of COVID-19 in Bantul Regency throughout 2021, the peak of the increase in cases occurred in July. The number of nationally active cases of COVID-19 as of December 26, 2021, shows that the rise of COVID-19 cases in Indonesia in 2021 will occur in July [25]. The delta variant has a transmission rate five times faster than the alpha variant. WHO also mentioned that this delta variant spreads faster than previous variants and is responsible for more cases and deaths worldwide [26]. To combat the delta variant, strategies vaccination, and tracking is mandatory to implement. Tracking by finding the positives, identifying the contacts, and isolating them quickly allows for interrupting the transmission chains of SARS-CoV-2. this strategy prevented the delta variant spread in the population before the complete vaccination cycle [27].

Our findings indicate that the number of respondents with a history of close contact is more than that of respondents with no history of close contact, 52,891 cases (65.8%). Multivariate analysis showed a close contact relationship with the incidence of COVID-19, an odd ratio value of 8.657 (CI: 6.523-11.489) as shown in Table 2 that there was a significant relationship between close contact with the incidence of COVID-19 in Bantul Regency in 2021. COVID-19 transmission occurs mainly in household contacts. A study in China showed a secondary attack rate of 10.3%. The high transmission at home is because people spend an amount of time at home with family, and the masks, when at home, are often not used [28]. Person perception will infect COVID-19 associated with compliance with wearing a mask [29].

COVID-19 from symptomatic patients is transmitted through droplets from coughing or sneezing that infect nearby individuals. A droplet is a water particle whose diameter is >5-10 μm. Transmission through droplets is when there is close contact with symptomatic people, with a distance of about 1 meter [30]. Efforts to stop the transmission of COVID-19 are carried out with social/physical distancing regulations by not shaking hands, maintaining a minimum distance of one meter from other people, and delaying big events, such as music concerts, community gatherings, sports, and business. Social distancing regulations reduce the contact of symptomatic people with healthy people [24]. The government has also tried to prevent the spread of COVID-19 by testing, tracing, and treatment. Testing is an early examination that aims to determine whether a person with COVID-19 or not. The test was conducted on people with close or direct contact with COVID-19 patients. Tracing is an epidemiological investigation by identifying people who have been in contact with people who have confirmed COVID-19; after that, close contacts are required to isolate or quarantine. Treatment is treating people who are confirmed to have COVID-19. There are two ways to treat COVID-19 patients: isolation at the hospital or home under the supervision of public health officers for people who have confirmed COVID-19 asymptomatic [31].

The relationship between travel history and the incidence of COVID-19 in Bantul Regency in 2021 obtained a prevalence ratio value of 1.350, and multivariate analysis got an odd ratio value=3.034 (CI: 2.284-4.031). People who come to areas with a high spread of COVID-19 cases have an infected risk of COVID-19 [32]. Our study shows that people with a travel history to areas of high COVID-19 transmission are at risk of 3,034 (CI: 2,284-4,031). The findings among Wuhan travelers showed the risk of COVID-19 infection higher, with an approximate infection rate of up to 1.3% [32]. In 2021 Bantul Regency was categorized as a red zone which causes the transmission rate of SARS-CoV-2 to increase, and someone who travels in the area is more at risk of being infected with SARS-CoV-2. The government takes policy prevention are large-scale area restrictions. Traveling is one of the mechanisms by which the virus spreads globally. In particular, long-distance travel (e.g., by airplane) can help spread the virus over long distances, whereas local travel (e.g., by public transportation) can help speed up the spread of the virus in a smaller geographic area. Alternatively, where the COVID-19 virus is circulating, there is a high risk of infection.

Restrictions on leaving the house by working at home and lockdown policies had a significant effect on reducing the COVID-19 spread [33].

The relationship between age and the incidence of COVID-19 in Bantul Regency in 2021 found a prevalence ratio of 1,050 people aged 65 with a 1,050 times greater risk of being exposed to the incidence of COVID-19 compared to people aged <65 years. Multivariate analysis showed the risk factor age was odd ratio=0.889. There are correlations between age and incidence of COVID-19 with the proportion of COVID-19 hospitality patients aged 60-69 years (68%), being male (66%) [34]. More elderly hospitalized patients can be due to comorbidities in the elderly. COVID-19 patients aged >50 has predicted to experience excess ACE2 expression due to decreased immunity, decreased organ function, comorbidities, and other causes that increase the risk of death [35].

The results showed that most respondents were of non-risk age (≤65 years), most of whom were productive and tended to have a high lifestyle, mobility, and social interaction. These activities risk exposure to SARS-CoV-2 [36]. A survey by the central statistics agency (BPS) revealed that people of a younger age always do not comply with health protocols more than older generations. Noncompliance with health protocols has an impact on increasing the incidence of COVID-19 [18]. Adolescents have mild symptoms than adults; adults-adolescents, and youth had 1.94 times the risk of contracting COVID-19 compared with older adults [16].

The incidence of COVID-19 based on gender, the proportion of women, was more than men, 42,878 (52.78%). The bivariate analysis showed that the prevalence ratio was 0.958 (CI: 0.948-0.967), and multivariate analysis of gender was the third risk factor with OR=1.147 (CI: 1.113-1.182). Risk ratio for hospitalization comparing males to females was 1.2 (95% CI, 1.1-1.3) [37]. Men are more at risk for exposure to COVID-19 than women. The high risk of COVID-19 in men is due to the presence of the D allele responding to ACE1 more expression. In SARS-CoV-2 infection, ACE2 receptor suppression occurs, resulting in an imbalance between ACE1/ACE2 in males. Another is that in women, ACE2 repression induced by SARS-CoV-2 might correlate with high basal levels of ACE2 caused by higher levels of sex hormones so that women are more protected against infection of SARS-CoV-2 [35].

The government's effort to reduce COVID-19 cases was vaccination. The vaccination achievement in Batul Regency until December 2, 2021, dose 1 was 83.64%, and dose 2 was 75.70% [38]. The Ministry of health issues circular number HK.02.02//II/252/2022 regarding the advanced dose of COVID-19 vaccination (booster). A booster vaccination is a COVID-19 vaccination after the individual has received a total dose of primary vaccination. This booster vaccination is critical because it helps increase immunity or protection in a person, especially in susceptible groups. The study results revealed a decrease in antibodies six months after the total dose of primary vaccination [39]. The previous study shows that no participant required hospitalization following immunization. Vaccination can avoid severe COVID-19 infection [40] even though vaccine efficacy may decrease along with the emerging new variants [41].

4. CONCLUSION

This study revealed that most COVID-19 cases were aged <65, with a higher proportion of women. The highest area of COVID-19 incidence was in Banguntapan, while the peak of COVID-19 incidence was July, 2021. Close contact has the most significant association with the incidence of COVID-19, followed by travel history and gender. The government's effort to reduce COVID-19 cases was vaccination and continued to implement health protocols. Continuing healt promotion strategy is needed to improve the health quality among community.

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BIOGRAPHIES OF AUTHORS

Siska Wardani ⓘ 🔢 SC ↻ graduated from of Public Health with a concentration in Epidemiology at Univesitas Ahmad Dahlan. He was once an active member of the Community Health Extension Corps and also had an internship at the Bantul District Health Office in the field of disease prevention and control services. She can be contacted at email: siskawardani21@gmail.com.

Fardhiasih Dwi Astuti ⓘ 🔢 SC ↻ has been a lecturer in the Faculty of Public Health at Universitas Ahmad Dahlan since 2011. She completed Bachelor of Public Helath at the Faculty of Public Health, Universitas Ahmad Dahlan and Master in Tropical Medicine at Faculty of Medicine, Public Health and Nursing, Gadjah Mada University. The author is a candidate doctorof public health science at Sebelas Maret University, Surakarta. The author has an experience in the fields of epidemiology and entomology, especially in vector-borne disease. She can be contacted at email: fardhiasih.dwiastuti@ikm.uad.ac.id.