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Demographic influence on COVID-19 reinfection at the Integrated Laboratory of Syarif Hidayatullah State Islamic University Jakarta

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ABSTRACT

Background: COVID-19 can reinfect the same person, or it can be called reinfection. Reinfection that occurs has a slightly higher severity level, characterised by the need for ventilation and intensive care in the ICU, than the first infection. This study aimed to determine the influence of demographics on COVID-19 reinfection cases in the Integrated Laboratory of the Faculty of Medicine, Syarif Hidayatullah State Islamic University Jakarta, in 2020-2022.
Methods: The study was an observational analytical study using a cross-sectional design conducted on patients in the Integrated Laboratory of the Faculty of Medicine, Syarif Hidayatullah State Islamic University Jakarta, who were selected by consecutive sampling.
Results: The study aims to understand the relationship between gender, age, occupation, blood type, and source of sample with cases of COVID-19 reinfection. This study collected 396 samples. It was found that the majority of samples had the characteristics of women (57.8%), young adults (35.9%), unknown occupation (45.7%), unknown blood type (39.4%), hospital patients (90.2%), and experienced reinfection (31.8%). The results of the bivariate analysis showed a significant relationship between gender and age with cases of COVID-19 reinfection.
Conclusions: A significant relationship was found between gender and age with cases of COVID-19 reinfection at the Integrated Laboratory of the Faculty of Medicine, Syarif Hidayatullah State Islamic University Jakarta.

Keywords: demographics, gender, reinfection, COVID-19.
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INTRODUCTION

Coronavirus disease 19 (COVID-19) infection is caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus and has clinical effects on its sufferers. The clinical symptoms in COVID-19 patients may vary, including dyspnea, fatigue, myalgia, cough, headache, sore throat, fever, and diarrhoea.[1] COVID-19 itself has spread to 196 countries. The World Health Organisation (WHO) has included this infection in the pandemic category. On a global scale, this disease has caused more than 700 million cases of infection and more than 6 million deaths according to WHO data.[2]

COVID-19 can reinfect the same person. Based on research collected from 22 countries, there were 577 cases of COVID-19 reinfection with a slightly higher severity, characterised by the need for ventilation and intensive care in the ICU compared to the first infection.[1] Reinfection might happen because, within a non-specific and unequal period, immune components, such as immunoglobulin (Ig) G, IgA, IgM, B cells, T cells, and neutralising antibodies against SARS-CoV-2, will decrease.[3] Antibody levels against SARS-CoV-2 decrease around 60-90 days after initial infection.[4] There is research on the serum antibody profile in patients with COVID-19 reinfection cases showing that the IgG response is stronger while IgM is lower in the second infection.[5,6] This titer profile is evidence that the patient experienced reinfection rather than COVID-19 reactivation.[5]

Other than antibody profile, COVID-19 reinfection also can be affected by other factors, such as elderly age with decreased immune function and possible comorbidities, productive worker age due to high social interaction compared to other age groups, comorbidities such as diabetes and hypertension, immunosuppressive factors either from immunodeficiency diseases or obtained from drugs that prevent viral clearance, decreased antibody profile (immune decay), and vaccination status.[7–9]

Recent research demonstrates that COVID-19 reinfection substantially increases the risk of long-term adverse health outcomes. Individuals who experience reinfection show significantly higher odds of developing chronic physical symptoms than those who were never infected, with risk estimates exceeding those observed in both Omicron and original variant infections. Reinfection also confers the greatest likelihood of chronic mental health symptoms, suggesting that repeated exposure to SARS-CoV-2 may amplify neuropsychological vulnerability.[10] Additional cohort data further indicate that reinfection is associated with

heightened risks of various pulmonary disorders, including asthma, chronic obstructive pulmonary disease, interstitial lung disease, and even lung cancer. These findings underscore that repeated infections may not only prolong symptom burden but also contribute to progressive structural and functional damage within the respiratory system.[11] Therefore, this study aimed to determine the influence of demographics on COVID-19 reinfection cases in the Integrated Laboratory of the Faculty of Medicine, Syarif Hidayatullah State Islamic University Jakarta, in 2020-2022.

METHODS

Design of the study

A cross-sectional study with secondary data was carried out using the medical records obtained from the Integrated Laboratory of the Faculty of Medicine, Syarif Hidayatullah State Islamic University Jakarta, in 2020-2022. An observational analytic study was used to inquire about the relevance of sex and reinfection cases. Populations used in this study are positive COVID-19 patients confirmed with a real-time PCR assay.

Data sampling

The data used in this study were consecutively selected until the required number of 126 subjects was met by both groups. Patients confirmed to have COVID-19 reinfection cases and patients confirmed to have COVID-19 cases without reinfection at the Integrated Laboratory of the Faculty of Medicine, Syarif Hidayatullah State Islamic University Jakarta, in 2020-2022 are both included in this study. Patients with HIV or without gender information were excluded. Patients are confirmed to have COVID-19 reinfection if experiencing a relapse as evidenced by a positive RT-PCR ≥90 days after primary infection or ≥1 negative RT-PCR in between.

Statistical analysis

Characterisations of the subjects used in this study are directly described in numbers and percentages. Further bivariate analysis was performed using chi-square. A probability value of less than 0.05 ($p < 0.05$) was considered significant.

RESULTS

General characteristics of the data

In this study, a total of 1,396 data records were obtained from the Integrated Laboratory of FK UIN Jakarta for analysis. Less than half of the subjects were identified as reinfection cases (31.8%). The proportion of confirmed positive cases was higher among females compared with males. Based on age distribution, the largest group of participants consisted of young adults aged 17–30 years (35.9%). Regarding occupation, nearly half of the subjects had undocumented or

Table 1. General characteristics of patients' demographic data (n=396)

Characteristics	Number	Percentage
Age Group		
Baby (0-2)	3	0.8
Child (3-16)	6	1.5
Young adult (17-30)	142	35.9
Middle-aged (31-45)	113	28.5
Older adult (>45)	132	33.3
Sex		
Males	167	42.2
Females	229	57.8
Occupation		
Unemployed	1	0.3
Midwife	3	0.8
Laborer	1	0.3
Health worker	41	10.4
Lecturer	1	0.3
Housewife	21	5.3
Employee	110	27.8
Student	14	3.5
Civil servant	14	3.5
Police	1	0.3
Entrepreneur	8	2.0
Unknown	181	45.7
Blood Type		
A	171	43.2
AB	6	1.5
B	27	6.8
O	36	9.1
Unknown	156	39.4
Source of samples		
Clinic	16	4.0
Laboratory	23	5.8
Hospital	357	90.2

unspecified employment status (45.7%), followed by those working as employees (27.8%). Blood type A was the most prevalent among the study population (43.2%). Additionally, most samples were collected from hospital settings (90.2%) (Table 1).

According to the total sample of 396 samples, there were 126 (31.8%) samples that were reinfected by COVID-19, and 68.2% had no reinfected.

The distribution of reinfection differed significantly by sex (p = 0.000). Female subjects exhibited a substantially higher proportion of reinfection (22.7%) compared with males (9.1%). In contrast, the proportions in the non-reinfection group were relatively similar between males (33.1%) and females (35.1%). These findings suggest that female patients may have an increased likelihood of experiencing reinfection compared with their male counterparts. Age also demonstrated a significant association with reinfection (p < 0.001). Reinfection was most frequently observed among young adults aged 17–30 years (17.9%), followed by middle-aged adults aged 31–45 years (9.1%) and older adults above 45 years (4.3%). Cases were rare among children (0.5%) and absent among infants. Conversely, in the non-reinfection group, older adults (>45 years) represented the largest proportion (29.0%), followed by middle-aged individuals (19.4%). This pattern indicates that younger age groups, particularly young adults, have a relatively higher likelihood of reinfection compared with older populations. The source of sample collection did not show a significant association with reinfection status (p = 0.682). Most reinfection samples were obtained from hospitals (29.3%), with smaller numbers from clinics (1.0%) and laboratories (1.5%). A comparable distribution was observed in the non-reinfection group, where hospital-derived samples also predominated (60.9%). These findings indicate that the place of sample collection did not meaningfully influence the likelihood of detecting reinfection.

Table 2. Proportion of COVID-19 reinfection (n=396)

Characteristic	Description	n	%
COVID-19	Reinfection	126	31.8
	No reinfection	270	68.2

Table 3. General characteristics of data from reinfected patients (n=126)

Characteristics	Number	Percentage
Age Group		
Baby (0-2)	0	0
Child (3-16)	2	1.6
Young adult (17-30)	71	56.3
Middle-aged (31-45)	36	28.6
Older adult (>45)	17	13.5
Occupation		
Unemployed	0	0
Midwife	3	2.4
Laborer	0	0
Health worker	26	20.6
Lecturer	1	0.8
Housewife	3	2.4
Employee	57	45.2
Student	6	4.8
Civil servant	3	2.4
Police	0	0
Entrepreneur	1	0.8
Unknown	26	20.6
Blood Type		
A	20	15.9
AB	4	3.2
B	16	12.7
O	19	15.1
Unknown	67	53.2
Source of samples		
Clinic	4	3.2
Laboratory	6	4.8
Hospital	116	92.1

DISCUSSION

The significant findings of this study indicate that COVID-19 reinfection cases occurred far less frequently than non-reinfection cases. Positive COVID-19 results were more commonly observed in females compared with males. Patients who experienced reinfection were most likely to be young adults, employed individuals, those with blood type A, and those whose samples were submitted from hospital settings. Furthermore, the analysis demonstrated a significant association between sex and reinfection status, as well as a significant relationship between age group and the likelihood of

COVID-19 reinfection.

The effects of COVID-19 infection differ in males and females. Theoretically, males are known to be more susceptible to COVID-19 infection because the ratio of angiotensin-converting enzyme 2 (ACE2) receptors, the attachment site for the causal virus, and transmembrane protease serine 2 (TMPRSS2), a protease that helps the viral entry, is both higher than in females.[12,13] On the other hand, females have two X chromosomes, which are responsible for the expression of specific genes for innate immunity, such as toll-like receptor (TLR) 4, TLR7 and TLR8, which are linked to the X chromosome.[12] So when transcriptional inactivation of the chromosome occurs, females can compensate for immune system dysregulation, so they are better at overcoming infections than males.[14,15] These factors have an impact on the number of infections, the severity of symptoms, and the higher incidence of mortality in male COVID-19 patients. The mortality rate in infected males compared to females is 2.8% compared to 1.7%.[12,13] Contradicted to this research study, that obtained results of positive COVID-19 cases are higher in females (57.8%) than in males (42.2%). This result is suspected to be related to women's awareness of health checks, which may cause more cases to be recorded in women than in men.[16] In addition, women also provide more care to sick people, either as health workers or as family members. This increases the risk of exposure in the female group.[17,18]

In this study, the reinfected group consisted of 126 people (31.8%), and the control group consisted of 270 people (68.2%). This means that the number of COVID-19 reinfection cases is lower than non-reinfection cases. This is related to the finding that in the population that has been infected with COVID-19, the risk of being reinfected decreases significantly.[19] Reinfection is also related to the "immune decay" term, where antibodies against SARS-CoV-2 decrease naturally.[20]

Several studies have found that cases of COVID-19 reinfection are also closely related to age and occupation. The highest cases of reinfection are in the working-age group, ranging from 20 to 39 years.[9] This is quite in line with this study, where the highest cases of reinfection were found in the young adult age group, ranging from 17 to 30 years old, as many as 71 people (17.9%). Meanwhile, in this study, the highest cases of COVID-19 reinfection were experienced by subjects with jobs as employees, as many as 57 people (45.2%). These results are also quite in line with the characteristics of higher cases of reinfection in health workers and employees.[21] The high cases of reinfection in this age and workgroup are because individuals in these groups have greater exposure to social interaction.[9] Meanwhile, the low cases of reinfection in children and workers in the education sector are assumed to be due to school closures during the pandemic.[22,23] In the reinfection group in this study, as many as 67 people (53.2%) had unknown blood types. Then followed by blood type A as the second largest, with a total of 20 people (15.9%). This finding is in line with reports of increased susceptibility to COVID-19 reinfection in individuals with blood type A.[18,24] This is related to anti-A antibodies that can block the interaction between SARS-CoV and its receptor, while blood type A does not have these anti-A antibodies.[18] However, the majority of blood types in this group are unknown. This may affect the conclusion of the distribution of blood types of research subjects based on gender in this study. Moreover, consider that the majority of the Indonesian population has blood type O, around 17 million, which is almost twice the number of blood types A and B, which are 8.25 million. In this study, 116 people (92.06%) in the reinfection group were sampled from hospitals. Unfortunately, no references were found regarding the relationship between the number of COVID-19 reinfection cases based on their health facilities. This may be related to hospital-acquired infections (HAIs) and laboratory-acquired infections (LAIs). Concurrently, there

Table 4. Factors associated with COVID-19 reinfection

Factors		Number (%)	p
Reinfection	Males	36 (9.1)	0.000
	Females	90 (22.7)	
No reinfection	Males	131 (33.1)	
	Females	139 (35.1)	
Reinfection	Baby (0-2)	0	<0.001
	Child (3-16)	2 (0.5)	
	Young adult (17-30)	71 (17.9)	
	Middle-aged (31-45)	36 (9.1)	
	Older adult (>45)	17 (4.3)	
No reinfection	Baby (0-2)	3 (0.8)	
	Child (3-16)	4 (1.0)	
	Young adult (17-30)	71 (17.9)	
	Middle-aged (31-45)	77 (19.4)	
	Older adult (>45)	115 (29.0)	
Reinfection	Clinic	4 (1.0)	0.682
	Laboratory	6 (1.5)	
	Hospital	116 (29.3)	
No reinfection	Clinic	12 (3.0)	
	Laboratory	17 (4.3)	
	Hospital	241 (60.9)	

is no literature on infections obtained from clinics. In hospitals, only a few sections have strict safety regulations. Meanwhile, in the laboratory itself, where pathogen management regulations and protocols are stricter, they are supported by facilities designed for biosafety.[25] At the time of sampling in this study, namely 2020-2022, COVID-19 cases were mostly handled in hospitals. This is because the symptoms of COVID-19 are very diverse, making patients prefer hospitals.[26] This is what causes more samples of patients who experience COVID-19 reinfection to come from hospitals than from other health facilities.

Based on the results of the categorical comparative analysis using the chi-square test, the p-value obtained was 0.000 ($p < 0.05$). In this study, sex differences were found to be significantly associated with COVID-19 reinfection cases. This finding is in line with research conducted by Almadhi et al. (2022) on 1362 cases of reinfection in Bahrain, where the proportion of male reinfection was 60.3% compared to females, which was 39.7% ($p < 0.0001$).[9] On the other hand, in research conducted by Adrielle dos Santos et al. (2021), different results were obtained, namely a p-value of 0.350, which means there is no significant relationship between gender and cases of COVID-19 reinfection ($p > 0.05$).[24] The parameter for the strength of the relationship used was an OR of 0.42 with a 95% CI between 0.27 and 0.67. Epidemiologically, OR may not be significant considering the narrow CI value. This may be because there are research bias factors, such as higher awareness of women to check and sampling techniques with non-probability sampling, so that they cannot represent the population accurately.

Limitations of this study are that there is a lot of incomplete data regarding blood type and occupation, so associations between reinfection and both demographics cannot be made.

CONCLUSION

Results of this study indicate that some demographic factors, like gender and age, affect the COVID-19 reinfection case outcome.

DISCLOSURES

Conflict of interest

The authors affirmed that there were no conflicts of interest in this study.

Ethical approval

This research proposal was granted ethical approval by the Ethics Committee Faculty of Medicine, Syarif Hidayatullah State Islamic University, with the registry number B-010/F12/KEPK/TL.00/03/2024.

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Author contribution

All of the authors contributed equally to this study. The contribution matrix demonstrates that both contributors played substantial but distinct roles in the development of the manuscript. Contributor 1(FF) was primarily involved in the design of the study, defining the intellectual content, conducting the literature search, clinical work, data analysis, statistical analysis, manuscript preparation, editing, and review, and served as the guarantor of the manuscript. In contrast, Contributor 2 (EAS) contributed significantly to the conceptualisation of the study, data acquisition, and manuscript editing and review. Both contributors participated in clinical studies and manuscript review, although neither was involved in experimental studies.

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