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The Effect Of Social Contacts On The Spreads Of Covid-19 In Indonesia

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ABSTRACT

Introduction: Covid-19 is an infectious disease. Matrix that is often used to identify transmission of infectious diseases dynamics is Basic Reproduction Number (R_0). R_0 is influenced by 3 parameters there are transmissibility (τ), average contact (c) and duration of infectiousness (d). Transmissibility and duration of infectiousness are constant values. The value of R_0 will fluctuate if the rate of human interaction varies. The value of social contact different in every country. In Indonesia, there are no studies that discuss the value of social contact. Therefore researchers aims to find out these values and determine their effect on the spread of Covid-19.

Method: This research was a descriptive observational study. Aims of the study is evaluate the pattern of social contact associated with the spread of covid-19. Data was collected using POLYMOD questionnaire that distributed via google form. The research sample was Indonesian people who were reached by distributing questionnaires. The data obtained then analyzed using the SPSS program to find the frequency distribution, mean of social contact and logistic regression analysis.

Results: From this study, 6464 contacts were obtained from 1032 respondents with average number of contacts 6.26 and R_0 2.191.

Conclusion: The higher of contact value the higher risk of transmission. The R_0 value obtained is 2.191, so one infected person might be able to transmit it to two other people around them. Individuals who are most at risk for transmission is male with low education levels and students.

Keywords: Social Contact, Covid-19, Basic Reproduction Number, Covid-19 Transmission

INTRODUCTION

Coronavirus disease (COVID-19) is an infectious disease caused by a virus recently discovered, SARS-CoV-2. The clinical features of this disease varies, from asymptomatic to acute respiratory

distress syndrome and multi-organ dysfunction. The most common clinical features are fever, dry cough, sore throat, headache, fatigue, headache, diarrhea, nausea, myalgia and shortness of breath.[1] COVID-19 infection is transmitted through droplets produced during coughing and sneezing from symptomatic or asymptomatic individuals. Someone who is in close contact at a distance of 1-2 meters for more than 15 minutes with an infected person can be at risk for transmission. Infected droplets can spread and settle on the surface. COVID-19 can also be transmitted indirectly by touching the contaminated surface and then touching the nose, mouth and eyes. The incubation period for this disease varies from 2 to 14 days.[1] The protective way we can take to avoid the risk of transmission is by washing hands, not touching the face and limiting contact.[2]

Basic Reproduction Number (R_0) is one of matrix most often used to identify transmission of dynamics infectious diseases. This model provides an illustration how fast the outbreak will grow and transmit.[3] Basic Reproduction Number is defined as a number that indicates the average of new individuals that can be infected due to infected individuals entering vulnerable individual populations.[4] R_0 is affected by 3 parameters, there are transmissibility/the magnitude of risk of transmission (τ), average contact (c) and the duration of infectiousness (d).[5]

The infectious rate of the pathogen and duration of infectiousness are constant values. The value of R_0 will fluctuate if the rate of human-human or human-vector interaction varies.[4,5] The value of social contact varies in many country, for example Germany 7.95; United Kingdom 26.97; Taiwan 12.5; Japan 15.3 and Italy 19,77.[6,7] This difference of the value will affect covid incidence in each country. In Indonesia there are no studies that discuss the number of social contacts. Because of that, the researcher aims to know this value and find out its effect on the spread of COVID 19.

METHODS

This research is an observational descriptive study with a quantitative approach. Aim of this study to evaluate the characteristics of social contact patterns associated with the spread of COVID-19. Conducted in April - May 2020. The population is all Indonesian people and the research sample is the Indonesian people that is reached by distributing questionnaires via Google Form and fulfilling the research criteria. The research criteria in this study is individuals who understand and know how to fills questionnaires using Google Form. The number of research samples that participated in this study were 1032 respondents.

This study uses primary data obtained through an online questionnaire distributed via Google forms. The questionnaire used was the POLYMOD questionnaire, that is questionnaire from a large-scale study that discussed contact patterns related to the spread of infectious diseases. Contact in this study is defined as skin-to-skin touch (such as a handshake/other physical contact) or two-way face-to-face conversation at least three words at a certain distance so that one does not need to raise their voice within the duration of 15 minutes. Data collected in this study are sociodemographic data, number of contacts in a day and contact characteristics.

The data obtained then Analyzed using the Statistical Package for Social Science (SPSS) program. Univariate analysis of sociodemographic data was performed to determine the frequency distribution of each variable. Meanwhile, social contact variable data were analyzed to find the mean value of each sociodemographic group. The mean value of social contact then entered into the

Basic Reproduction Number formula equation to determine the effect of social contact of each group on the spread of COVID-19.

$$R_0 = t \times d \times c$$

R_0	:	The average new individual who can become infected due to an infected individual entering the vulnerable individual population
t	:	Transmissibility (t = 1,4-2,5)
d	:	Duration of infectiousness(d = 2-14)
c	:	Average rate of contact

Data in this study also performed logistic regression analysis. This aims to determine the factors that have the greatest influence on the spread of covid if the factors are analyzed simultaneously. In addition, the probability value for each variable in the logistic regression analysis is also calculated to find percentage risk of covid spread. The probability values are calculated using the following formula:

$$P(X) = \frac{1}{1+e^{-\alpha+\beta 1KAT}}$$

P	:	Probability
e	:	e natural number = 2,718
α	:	Regression constant
B	:	Regression coefficient

RESULTS

Distribution Frequency of Respondents Sociodemographic Factors

Table 1, presents the distribution frequency of respondents based on sociodemographic factors. Based on the table, it is known that the majority of respondents aged is 21-40 years (63.2%). Female is the most gender in this study (75.3%). Based on the level of education the majority of respondents is high education (60.2%). College students is the most occupational groups in this study (45.3%). Whereas based on the level of income obtained majority respondents with a low income (72.6%). For the household size, it was obtained if most respondents lived with three other people in the house (28.2%).

Tabel 1. Distribution Frequency of Respondents Sociodemographic Factors

Sociodemographic factors	Respondents	
	N	%
Age		
11 - 20	335	32,5
21 - 40	652	63,2
41 - 65	43	4,2
> 65	2	,2
Gender		
Male	255	24,7
Female	777	75,3
Education		
Low education	34	3,3
Moderate education	377	36,5
High education	621	60,2
Occupation		
Unemployment	98	9,5
Student	101	9,8
Collage student	467	45,3
Housewives	46	4,5
Entrepreneur	52	5,0
Private employee	199	19,3
Civil Servant	66	6,4
Retired	3	0,3
Income		
Low income	749	72,6
Moderate income	177	17,2
High income	106	10,3
Household size		
1	92	8,9
2	133	12,9
3	291	28,2
4	254	24,6
5	128	12,4
>5	134	13,0

The Value of Social Contact and R_0 for Sociodemographic Factor.

In Table 2 there is data of the value social contact and R_0 for each sociodemographic factor. Based on the table, it is known from 1032 respondents who participated in the study, the number of social contacts was 6464 with an average value of social contact 6.26 and R_0 2.191. So it can be concluded that one person infected with covid can transmit it to two other people who are nearby them.

Table 2.The Value of Social Contact and R0 for Sociodemographic Factor

Sum=6464	Mean	Median	Std. Deviation	CI 95%	R_0
All Respondents	6,26	4,00	9,105	5,71-6,82	2,191
Gender					
Male	8,25	5,00	12,794	6,68-9,83	2,887
Female	5,61	4,00	7,405	5,09-6,13	1,9635
Age					
11 - 20	5,01	4,00	6,037	4,36-5,66	1,7535
21 - 40	6,89	4,00	10,451	6,09-7,69	2,4115
41 - 65	6,60	5,00	5,786	4,82-8,39	2,31
> 65	4,50	4,50	0, ,707	-1,85-10,85	1,575
Education					
Low education	7,15	4,00	16,595	1,36-12,94	2,5025
Moderate education	5,89	4,00	9,764	4,90-6,88	2,0615
High education	6,44	4,00	8,077	5,81-7,08	2,254
Occupation					
Unemployment	6,55	4,00	11,036	4,34-8,76	2,2925
Student	4,81	4,02	5,60	4,02-5,60	1,6835
Collage student	4,38	4,00	2,969	4,11-4,65	1,533
Housewives	4,00	3,50	2,813	3,16-4,84	1,4
Enterpreneur	6,52	5,00	4,341	5,31-7,73	2,282
Private employee	10,99	6,00	15,675	8,80-13,19	3,8465
Civil Servant	8,59	5,00	13,031	5,39-11,79	3,0065
Retired	3,67	4,00	2,333	-0,13-7,46	1,2845
Income					
Low income	5,24	4,00	8,142	4,66-5,82	1,834
Moderate income	9,14	5,00	10,555	7,58-10,71	3,199
High income	8,69	5,00	11,300	6,51-10,86	3,0415
Household size					
1	7,24	3,00	12,741	4,60-9,88	2,534
2	4,40	2,00	5,942	3,38-5,42	1,54
3	5,69	3,00	10,662	4,46-6,92	1,9915
4	6,21	4,00	7,973	5,23-7,20	2,1735
5	7,48	5,00	7,782	6,12-8,84	2,618
>5	7,62	6,00	7,863	6,28-8,96	2,667

Characteristics of Social Contacts

From Table 3 we can see the characteristics of social contact data in this study. Based on the table, it is known that respondents mainly made contact with contact opponents from the age group 21-40 years and 41-65 years (35.8% and 41-65%). While based on the duration of contact. The majority of contacts were obtained within 5-15 minutes (27.4%) and <5 minutes (22.9%). For contact locations, homes and workplaces were found to be the places where most respondents made contact, which were 72.8% and 17.9%

Table 3.Characteristics of Social Contacts

Characteristics of Social Contacts		%
Age of contact	< 11	10,5
	11-20	19,0
	21-40	35,8
	41-65	30,3
	> 65	4,4
Duration of contact	< 5 minutes	22,9
	5 - 15 minutes	27,4
	15 - 60 minutes	16,0
	1 - 4 hours	11,8
	> 4 hours	21,8
Location of contact	Home	72,8
	Office	17,9
	School	0,9
	Transportation / public facilities	8,4

Logistic Regression Analysis

Table 4 contains data on the results of logistic regression analysis and probability values. After logistic regression analysis, it was found 3 factors that most influenced the contact, there are education (low, moderate), gender (male), and occupation (unemployment, students, collage students. Then the three variables are calculated the probability value to determine to risk percentage of covid spread (can be seen in Table 4).

Based on the probability values in the table, obtained male sex, low education, and students who have the highest risk of COVID spread compared to other factors. Then the probability values of these three factors are entered and recalculated using the equation formula so that the probability values can be determined if the three factors are combined:

$$P(X) = \frac{1}{1+e^{(-0,705+(-1,1)+(-0,567)}}$$

$$P(X) = \frac{1}{1+0,09}$$

$$P(X) = 91\%$$

So from the above calculation it can be concluded that individuals with male gender, primary education and student have a risk of 91% on the spread of COVID. (housewives, entrepreneurs, private employees, and civil servants).

Table 4.Logistic Regression Analysis and Probability Value

Variables	Regression coefficient (B)	Df	*P value*	Exp(B)	Probability (%)
Education				0,011	
Low education	0,037	1	0,929	1,038	75
Moderate education	0,452	1	0,004	1,572	26
Gender					
Male	0,432	1	0,006	1,540	67
Occupation				0,000	
Unemployment	0,922	1	0,461	2,515	55
Student	0,285	1	0,820	1,330	63,8
Collage student	0,431	1	0,729	1,539	46,2
Housewives	0,352	1	0,783	1,422	46
Enterpreneur	1,125	1	0,374	3,080	1,12
Private employee	1,516	1	0,224	4,553	0,03
Civil Servant	1,232	1	0,329	3,428	0,05
Constant	**-1,137**	**1**	**0,360**	**0,321**	

DISCUSSION

Value of Social Contacts

From this study, 6464 contacts were obtained from 1032 respondents with an average number of contacts is 6.26. This value is almost similar as the average contact value in Korea 6.6 and Hong Kong 6.93. But this value is smaller compared to Italy 19.77 and the United Kingdom 26,97.[7,8,9] This might explain why the incidence of COVID in Indonesia is not as high as in these countries. This is because one that affects the incidence of a disease is the level of transmission. One that affects the transmission is the value of contact. So that the higher the contact value, the incidence of a disease will also be higher.[4]

Based on gender, male have more contact than female. These results are the same as those obtained in a study conducted by Leung et al in 2017. This is because male carry out more activities outside the home, so the number of contacts also increases.[9]

In this study it was found, more contact occurred at the age of 21-40 years. This is also found in other studies conducted in the Netherlands.[10] Ages 21-40 years are included in the productive age of work.[11] During the covid pandemic as now, there are several private companies that do not allow their employees to work from home. So that there is still contact between them. While the lowest contact value is in individuals aged > 65 years. This is because, the older the age, the lower the contact value. It's related to physical conditions that are no longer supportive.[7,9]

From the results of the data collected, it is known that most contacts occur at the low education. The following results are the same as those obtained in research in Hong Kong.[9] Individuals with sufficient knowledge will be able to obey and implement government recommendations properly and optimally.[12] While for individuals with low education has insufficient knowledge about covid information, so they do not know what exactly needs to be done or not done during this pandemic.

Based on the work in this study, known that private employee has a higher contact value compared to other occupation. This is in line with research conducted by Oh. et al. (2020).[8] There is a high value of contact with private employee because during pandemics, they keep work as usual, so contact remains occur between them.

In this study it was found that moderate and high income levels had more contact than other groups. This is in line with previous research.[8,9] The reason is because the tendency of individual with high income have more time to social activities and recreation so as to allow more contact. While individuals with low income levels, spend more time on household commitments to fulfill their daily needs.[9]

For the household size, it is known that someone who stays at home with more people, tends to have a higher number of contacts as well. Similar results were obtained in previous studies.[7,8,9] But the difference in this study is found people who live with one other person also have high contact. This may be due to their level of boredom, so they seek and make even more contact when outside the house.

Characteristics of Social Contacts

In this study, it is known that the age group which is the most contact opponent of respondents in the study is 21-40 years old. This is because in large part, a person will be more in contact with people of their age.[7,8,9,13] As is known in this study, the 21-40 years age group is the largest age group participating in the study (63.2%). Mixing assortativity can have an effect on the spread of disease. If the individual has contact with other members of the same population group, then the disease will spread especially to that group

In this study it was found that most contacts occurred within a span of <15 minutes. Different research results obtained by Mossong who get about 70% of contacts made every day more than an hour (2008)[7.] The longer the duration of contact, the possibility of exposure is also greater so that the possibility for infection is also higher.[7]

In this study it was found, more contact occurred at home and in the office. The number of contacts that occur at home in line with previous research. In that study, it was found that almost two-thirds of the contacts occurred at home. [7, 9] Many home contact events showed that the majority of respondents in this study had followed the government's recommendation to stay at home. In addition, given the majority of respondents in this study are students who are currently learning activities from home, so that the time they spend more at home and existing contacts generally occur at home. But the number of contacts that occur at home can encourage a high incidence of infection in the household. This is like what was found in an investigation conducted in Wuhan. Due to extreme physical restrictions such as school closures, workplace closures and the prohibition of

holding meetings in public can encourage more transmission to occur in households which can ultimately lead to an increase in cases of infection in the household.[14]

The Factors that Most Influence Social Contact and Covid Spread

All factors collected in the study are then analyzed simultaneously to find out which factors are most influential when all factors are combined. From the results of logistic regression analysis, it was found that individuals with male sex, primary education, and students had the highest risk of covid spread by 91%.

Of the 1032 data collected, most of the respondents that were reached were students, amounting to 45.3%. Meanwhile, the proportion of students in the Indonesian population is relatively small, that is only 8,043,480 out of 268,369,114 inhabitants of Indonesia (2.9%).

While the acceleration of the spread of infection (R0) is determined from the transmission and incubation period of Covid-19 which until now has not been able to be controlled because until now Vaccine and Covid-19 standard drugs have not been found. and social contact in the local area, so that the acceleration of the spread (R0) of Covid-19 infection is largely determined by community activities. So they can understand the importance of limiting activities and contacts. The government can also make rules about lockdowns but also with due regard for logistics for the people while they are at home.

CONCLUSIONS

The conclusions obtained from this study are:

a. 6464 contacts from 1032 respondents were obtained from the study with an average number of contacts of 6.26. With a Contact Value of 6.26 the R0 is 2.191. Means it is known to every one infected person will be able to transmit Covid-19 to 2 other people who are around him.
b. In this study, Indonesian men in the age range of 20-40 years, low education level with RO 2,191, had a 91% risk of being infected with Covid-19 and also transmitting Covid-19 to the people they met, and this study has proven the role of Social Contact in spread of covid-19 infections.

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