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Review Article

Herd immunity and COVID-19 in Indonesia

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HIGHLIGHTS

- Herd immunity in the case of Indonesia is still controversial to be applied in Indonesia because until now no vaccine has been found as a substitute for the formation of partial immunity due to the formation of natural antibodies in patients.

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ABSTRACT

Herd immunity or herd effect is a phenomenon that occurs in groups of people who are resistant to disease. The purpose of conducting this research is to predict the number of cumulative cases of COVID-19 in Indonesia. Covid-19 cases in Indonesia on April 6, 2020, were 2235 cases spread in 34 Provinces. As many as 2491 cases in Indonesia, there were 192 patients recovered (including those treated, so they have natural antibodies in the end) while the total who died was 209 people. It is assumed that around 13% of the total cases have natural antibodies. This is also the case with SARS-CoV-2 and may explain why some individuals (perhaps those most recently able to recover from seasonal coronavirus infections) have asymptomatic infections. Finally, the theoretical concept of increasing herd immunity in pandemic and epidemic cases in Indonesia which aims to control COVID-19 still needs to be reviewed because it is seen from the mortality data that CFR COVID-19 is predicted to be around 8.39% of the population in Indonesia where the risk of death still available. The best alternative is to do a healthy lifestyle, social distancing, and waiting for the vaccine to be found.

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1. INTRODUCTION

The main principle of the immune system against microbes is divided into two types, namely innate systems and adaptive systems. Innate immune response to microbes is rapidly and non-specific, whereas adaptive immunity is specific to microbes and has memory cells used when microbes re-infect.[1] Herd immunity or herd effect is a phenomenon that happens of the group people resistance of disease such people without a fully working immune system,

including those without a working spleen, people on chemotherapy treatment whose immune system is weakened, people with HIV, newborn babies who are too young to be vaccinated, elderly people and many of those who are very ill in hospital. Herd immunity, also known as not everyone in a population needs to be immunized to eliminate the disease.[2,3] Vaccines are one of the most cost-effective measures in health care, but this benefit is eroded as the cost per dose rises. Another advantage of an effective vaccination program is the 'herd immunity' that it confers on the general population. By lowering the number of susceptible members of a population, vaccination decreases the natural reservoir of infected individuals in that population and so reduces the probability of transmission of infection. Thus, even unvaccinated members will be protected because their chance of encountering the pathogen is decreased.[4]

Herd immunity is an important concept of the epidemic that concerns immunity to prevent transmission of pathogens through vaccination programs. Herd immunity can be obtained in a limited way such as the pathogens are fairly species-specific, the pathogens are spread contagiously by fairly direct means and host exposure or vaccination confers fairly strong immunity.[5] Herd immunity also is known as the totality of naturally acquired and vaccine-based immunity to a given infectious agent like a virus, bacteria, fungi as the proportion of the whole population so can reduce the risk of infection for the individual. Herd immunity also obviously dynamic because will disappear over time through the reduced immune response system so the memory of infectious agents like bacteria, fungi, and the virus will be decreased or can be the death of individual and do vaccination for the mechanism of this herd immunity.[6] The indirect effect of vaccination can be increased the level of herd immunity is important in the disease elimination program.[7] Herd immunity is the indirect protection from infection conferred to susceptible individuals when a sufficiently large proportion of immune individuals exist in a population. Herd immunity threshold: the point at which the proportion of susceptible individuals in a population falls below the threshold needed for transmission.[8]

Mechanism of herd immunity from before and after vaccination is when infectious agents like viruses, bacteria, and fungi into the body, many infected cells because of lack of immunity was to fight the disease yourself. When an infectious agent into a vaccinated body, the spread of the disease becomes limited. The indirect effect protects individuals who not immunized, including those who cannot be vaccinated and those who have vaccinated but not successful, which is the principle of herd immunity. Succesful herd immunity will increase if the body is vaccinated around 40% but depends on the disease.[3,7]

The mechanism of action of herd immunity in people before and after being vaccinated through the picture below is taken from various sources[2,5] :

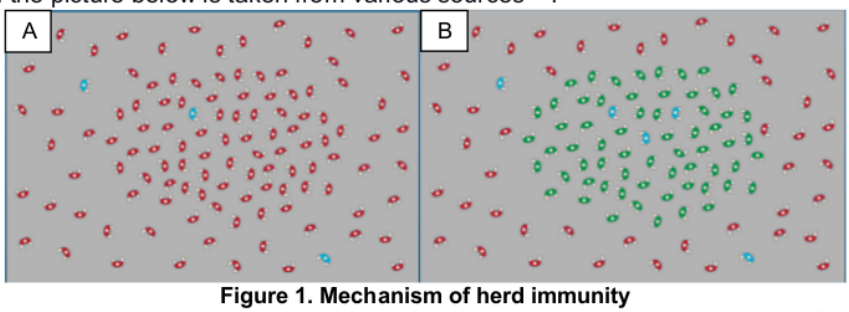

Figure 1. Mechanism of herd immunity

Picture A, infectious agents such as bacterial and fungal viruses enter the body; many infected cells due to lack of immunity will fight the disease themselves. Picture B, when an infectious agent comes a vaccinated body, the spread of the disease becomes limited. The indirect effect will protect individuals who are not immunized, including those who cannot be vaccinated and those who have vaccinated but are not successful, which is the principle of herd immunity. Successful herd immunity will increase if the body is vaccinated around 40% but also depends on the disease.

Note:

There are seven COVs known to cause humans which are divided low pathogenic and highly pathogenic COVs. Four corona-viruses (HCOVs, namely HCOVs 229E, NL63, OC43, and HKU1) are known as non-severe acute respiratory syndrome (SARS) like COVs. The disease caused by SARS-CoV-2 is named Corona-virus Diseases-2019 (COVID-19). COVID-19 arises through transmission from humans to a human pathogen which causes a broad spectrum of clinical patients with COVID-19. Clinical symptoms that appear in the form of no symptoms at all (being asymptomatic) to having fever, cough, sore throat, general weakness, fatigue, and muscular pain, for case severe such as severe pneumonia, acute respiratory distress syndrome, sepsis, and septic shock, additional some countries such as South Korea, China, and Italy that patients with confirmed SARS-COV-2 infection have developed anosmia/hyposmia/loss of smell.[11,12]

In general, innate and adaptive immune systems play a direct role in eliminating viruses. Besides, an immune response will fight HLA class-I and class-II-restricted viral epitopes mediated by CD8+ and CD4+ T lymphocytes. Clinically T lymphocyte responsible has an opportunity to be antiviral in the body. When analogous with another COVs. SARS-COV-2 may induce lymphocyte-mediated by an immune response, and this is evidenced by the presence of patients treated at the hospital often showing signs of lymphopenia so cellular immune can be suppressed by the presence of SARS-COV-2 infection will quickly clear SARS-COV-2 without a mild clinical sign of infection or virus causing excessive immunosuppression and the defence of the human body.[10,12]

Innate herd immunity is a type of herd immunity that genetically determined physiological changes with respect to antibody production or other defence mechanisms in a herd. It does not depend on the previous exposure of herd with infection, or it may arise in a herd through prolonged exposure to an infection or natural selection. Acquired herd immunity is a type of herd immunity where a sufficient number of its members have actually been exposed naturally or artificially to infectious agents during their lifespan.[13,14]

There are many opinions about the relationship of herd immunity and COVID-19 that are still being debated by scientists. Scientists said that herd immunity would appear in people who have the flu and people from abroad have gotten flu vaccines that can protect individuals who are not immunized. The problem with flu strains is still unknown from the flu about variations in strains in certain races; that's why the flu vaccine isn't always 100% effective. But the biggest problem now with coronavirus, which is a novel virus that has never spread before, which means everyone is at risk of infection. Herd immunity can only be achieved if vaccinating but until now there has been no vaccine, and it still takes a long time to make an effective vaccine for coronavirus or individuals who fall ill and then recover it will develop natural immunity against viruses such as influenza viruses. Herd immunity against Covid-19 will be achieved if it is infected with Covid-19 first, but currently, there is no vaccine, so it is quite dangerous if it has to be infected first and then recovered. Social distancing is currently ridden by the government to manage and build herd immunity so that it is more effective against Covid-19. Besides, herd immunity will make it more difficult to spread to the person to person because it has been vaccinated.[3,6,7]

Numerous clinical trials to evaluate novel vaccine candidates and drug repurposing strategies for the prevention and treatment of SARS-CoV-2 infection are currently ongoing. However, it is unknown whether these trials will produce effective interventions, and it is unclear how long these studies will take to establish efficacy and safety, although an optimistic estimate for any vaccine trial is at least 12–18 months.[15,16], Particularly in the context of attaining herd immunity to SARS-CoV-2, regard for finite healthcare resources, cannot be overstated, as this policy inherently relies on allowing a large fraction of the population to become infected. The ability to establish herd immunity against SARS-CoV-2 hinges on the assumption that infection with the virus generates sufficient, protective immunity. At present, the extent to which humans are able to generate sterilizing immunity to SARS-CoV-2 is unclear.[17] In a cohort of 175 recovered COVID-19 patients, SARS-CoV-2-specific serum neutralizing antibodies (NAbs) were detected at considerable, albeit variable, titers in most (n = 165) individuals. Even if reinfection can occur after sterilizing immunity wanes, enduring memory cells of the adaptive immune system would likely facilitate immune control of the virus

and limit disease pathology, which would hopefully decrease the clinical severity of subsequent infections.[18, 19]

2. REVIEW METHOD

The purpose of conducting this research is to predict the number of cumulative cases of COVID-19 in Indonesia. The research data was taken from secondary data sourced from the Indonesian Ministry of Health's website portal and data from the government portal that monitors the COVID-19 case data. Using journal calculation method from a journal reference used by the Chinese government in reviewing COVID-19 cases. In this case, what we are analyzing is that the situation occurs COVID-19 so that it can be used as a reference for Indonesian data. And then we specify data and processing data.[20,21] Data processing procedures have several stages, including:

a. Secondary data is obtained from data information from valid national and regional sources of each province, including the number of cases, the number of healing, and the number of dead.
b. Data tabulation is secondary data that has been obtained is processed using Microsoft Excel.
c. Before conducting a strategy to measure distribution modelling, it is necessary to estimate the reproductive number (R0) and simulate the real effective data (Rt) of a population. R0 is the number of secondary cases produced by the presence of one infected person in a full population that has the potential or susceptibility to infection and mingling. Whereas Rt is a simulated version of life in the field using secondary data of cases found to estimate the number of epidemics that are taking place so that this research simulation uses the exponential growth method using data on the latest COVID-19 case numbers in Indonesia as of March 6, 2020. While the serial intervals include the mean (π = 4.7 days), the standard deviation (dv = 2.9 days) and the significant level (R = 0.05). Using Rt values, we can calculate the (critical) minimized (Pkris) level of a population of immunity obtained through medical treatment or natural induction after recovery from COVID-19. So to stop the spread of infection in the population used the formula: (Pkris) = 1-(1/Rt). After being calculated the data obtained are analyzed .[21]

3. RESULTS AND DISCUSSION

Covid-19 cases in Indonesia on April 6, 2020, were 2235 cases spread in 34 Provinces. The three provinces with the highest number of infections are DKI Jakarta (n = 1151), West Java (n = 252), East Java (n = 187). We know the provinces above are densely populated cities and large cities in Indonesia with many activities so that the spread of infection virus through aerosol.

As of March 13 2020, there were 32 countries outside China with over 100 COVID-19 cases. The seven countries with the highest number of infections were: the United States (n = 2294), France (n = 3671), Germany (n = 3675), Spain (n = 5232), Korea (n = 8086), Iran (n = 11,364) and Italy (n = 17,660).[2] Herd Immunity and SARS-CoV-2. The ongoing SARS-CoV-2 pandemic has caused over 3.5 million clinically confirmed cases of COVID-19 and has claimed more than 250,000 lives worldwide (as of May 4, 2020). Numerous clinical trials to evaluate novel vaccine candidates and drug repurposing strategies for the prevention and treatment of SARS-CoV-2 infection are currently ongoing. However, it is unknown whether these trials will produce effective interventions, and it is unclear how long these studies will take to establish efficacy and safety, although an optimistic estimate for any vaccine trial is at least 12–18 months. In the absence of a vaccine, building up SARS-CoV-2 herd immunity through natural infection is theoretically possible. However, there is no straightforward, ethical path to reach this goal, as the societal consequences of achieving it are devastating.[2,9] The number of confirmed cases in the other 25 countries were less than 1200 in 2003, the Chinese population was infected with a virus that caused Severe Acute Respiratory Syndrome (SARS) in Guangdong province. This virus that infects patients shows symptoms of pneumonia with an alveolar spreading injury which causes acute respiratory distress syndrome. Whereas in

udi Arabia, it was also detected as confirmed as a member of the coronavirus and named as the Middle East Respiratory Coronavirus (MERS-CoV). MERS-CoV infection starts with mild upper respiratory injury while its development leads to severe respiratory illness. Similar to SARS coronavirus, patients infected with MERS-coronavirus suffer from pneumonia, followed by symptoms of acute respiratory distress syndrome and kidney failure. Latest at the end of 2019, WHO was notified by the Chinese government of several cases of pneumonia with the known etiology COVID-19 spread from human to human spread of the virus occurred because of close contact with infected people, coughing, sneezing, respiratory droplets or aerosols. This aerosol can penetrate the human body (lungs) through inhalation through the nose or mouth.[20]

The lowest case is Papua (n = 25), around 1.1% of the total cases in Indonesia. This does not mean there are no cases because the facilities in Papua have not been fulfilled, and data access is difficult. Most COVID cases have no symptoms, especially cases of teenagers and the elderly or elderly. The risk exposure ratio is based on the sex of the patient even the male sex in the COVID-19 study with the proportion of men ranging from 51.4% to 73.2% (Lai et al., 2020). Meanwhile, according to research, the ratio of exposure to 0-9 years of age is 0.00%. Age 10-19 years as much as 0. 04%. Age 20-29 years 1.04%. Age 30-39 years as much as 3.43%. Age 40-49 years as much as 4.25%. Age 50-59 years as much as 8.16%. Ages 60-69 years as much as 11.8%. Age 70-79 years as much as 16.6% and the highest ratio at the age of ≥80 years as much as 18.4% so that from the data above the highest death ratio is based on cases of age exposed at age ≥80 years.[21] At age> 65 years, the clinical manifestations of COVID-19 pneumonia were confirmed, and 1,399 (32.6%) with very severe cases. As noted above, the overall mortality rate for COVID-19 pneumonia is 4%. Whereas age <65 years, all mortality ratio (0.3%). This data shows that the majority of patients with COVID-19 pneumonia will recover from the disease, especially younger people. Our current data shows that patients in the deceased group are susceptible to multiple organ failure, especially heart failure and respiratory failure. One of the best laboratory parameters is cardiac injury inflection to predict COVID-19 pneumonia death is cardiac troponin I, and these parameters remain valid in the sex, age, and disease underlying the analysis of suitable controls.[22]

If secondary data parameters are observed, and the implication is further cases that the difference in Ro and Rt is related to the proportion of individuals who already have natural immunity (antibodies) and who are treated who are infected with pathogens in a population. Besides, the way to count for pathogens in a particular population is by transferring Ro to the proportion of the population that does not yet have natural immunity (antibodies) in the sense that they are susceptible to this pathogen infection. Therefore, Ro is the same as Rt when no individual with natural immunity (antibody) is found in a population (all susceptible to infection). It is said that partial immunity has already appeared before the transmission agent so that it has an impact on reducing the number of secondary expected to emerge. The obstacle SARS-CoV-2 is a new coronavirus, and pandemic cases first appeared. However, a possible source of partial immunity is because the mechanism of cross-reactivity antibodies results in partial immunity from previously common seasonal coronavirus infections that have infected in the human population for decades as noted for SARS-CoV. As many as 2491 cases in Indonesia, there were 192 patients recovered (including those treated so they have natural antibodies in the end) while the total who died was 209 people. It is assumed that around 13% of the total cases have natural antibodies. This is also the case with SARS-CoV-2 and may explain why some individuals (perhaps those most recently able to recover from seasonal coronavirus infections) have asymptomatic infections. Finally, the theoretical concept of increasing herd immunity in pandemic and epidemic cases in Indonesia which aims to control COVID-19 still needs to be reviewed because it is seen from the mortality data that CFR COVID-19 is predicted to be around 8.39% of the population in Indonesia where the risk of death still available. The best alternative is to do a healthy lifestyle, social distancing, and waiting for the vaccine to be found. When there are no immune individuals in the population (i.e. when all are susceptible), this means that any partial, pre-existing immunity to the infecting agent can reduce the number of expected secondary cases arising because of some possible antibody

cross-reactivity and partial immunity from previous infections with the common seasonal coronaviruses.[28] Social distancing is the practice of reducing the spread of viruses and limiting contact between individuals. When these conditions apply, methods to achieve herd immunity serve an important role in preventing disease epidemics and are an important component of programs for disease elimination or eradication. But Understanding herd immunity requires consideration of infection dynamics, modes of transmission, as well as the acquisition of immunity by individuals in the population.[23] Several countries have implemented, namely the USA, Italy, China now also applied in several pandemic countries. Besides, the benefits of Social Distancing also reduce the burden of the medical team to treat cases exposed to COVID-19 due to the lack of health facilities so that many patients will be treated. In conclusion, social distancing is a realistic solution to dealing with Covid-19 pandemic.[23]

Besides candidates for immunotherapy for COVID-19 including monoclonal antibody testing, plasma therapy, immunoglobulins for T-cell respondents, and angiotensin-converting enzyme 2 (ACE2) therapy for vaccine candidates still need to be tested at the in vivo stage. But a history of SARS is very effective using a monoclonal antibody test, so it recommends immunotherapy for 2019-nCoV on the grounds and evidence of previous research on two other coronaviruses SARS-CoV and MERS-CoV.[24.]

4. CONCLUSION

Herd immunity in the case of Indonesia is still controversial to be applied in Indonesia because until now no vaccine has been found as a substitute for the formation of partial immunity due to the formation of natural antibodies in patients. On the other hand, the risk of death in patients is very inappropriate if the concept of herd immunity is applied in Indonesia. The best solution at this time is still social distancing, eating a nutritious life, always maintaining immunity, and always adhering to a healthy lifestyle such as always washing hands and wearing a mask when an emergency when outside activities.

DISCLOSURE STATEMENT

The authors reported no potential conflict of interest.

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SHORT BIOGRAPHY

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