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RESEARCH ARTICLE

THE RELATIONSHIP BETWEEN THE NUMBER OF PEOPLE WITH IMMUNITY AGAINST COVID-19 AND ACHIEVING HERD IMMUNITY IN BANGKOK AND THE VICINITIESAREAOF THAILAND

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Abstract

The COVID-19 pandemic has caused major impacts all around the world, with its characteristics being highly contagious. The first case of COVID-19 was diagnosed in Wuhan, China in December 2019. Until July 2021 the situation in Thailand has only escalated with new daily cases being over 10,000 and is predicted to increase every day.Contrastingly, vaccines needto be imported to Thailand,causing multiple shortages and delaying the vaccination further. The aim of this research is to investigate the relationship between the number of people who have immunity against the coronavirus SARS-CoV-2 and achieving herd immunity in Bangkok and vicinities areas of Thailand. The research question of this investigation is " How is herd immunity in Thailand affected by the number of people who have had immunity against COVID-19 (either by vaccinated or has been infected by the coronavirus SARS-CoV-2) by surveying 300 people living in Bangkok and vicinities area and age between 17 and 90 years old?" The method used to gather data in this investigation is via internet survey by google form. The survey contains three to five questions and is sent out randomly to 300 people. After receiving the data, it is analyzed into graphs, charts, etc. by using Google form. The result from this survey illustrates that 73.4% from 300 people are immune to the coronavirus SARS-CoV-2. To conclude, by assuming that the survey group represent the whole Bangkok and vicinity population, by January 2022 Bangkok and the vicinity area will achieve herd immunity successfully.

Introduction:-

Coronavirus SARS-CoV-2 is an infectious disease, with the epicenter at Wuhan Province of the People's Republic of China. The disease is assumed to originate from an animal such as bats followed by human-to-human transmission. Although there are many species of Coronavirus SARS-CoV-2, the most common symptoms are fever, dry cough, and tiredness.If these symptoms are not taken care of, it could lead to further complications and become fatal.When compared to other emerging viruses, this COVID-19 has low pathogenicity and moderate transmissibility, as the incubation period of SARS-CoV-2 is 3 to 7 days.

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Illustrated in Fig 1 and 2 (as of 22nd July 2021) there have been 190,597,409 confirmed cases of COVID-19 globally, including 4,093,145 deaths caused by the current coronavirus SARS-CoV-2 outbreak.

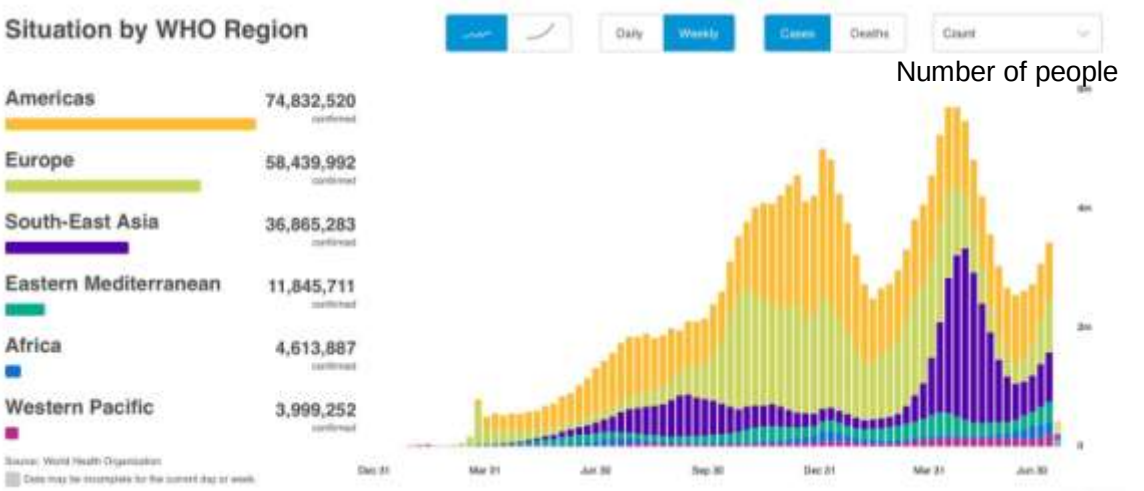


Fig 1:-The number of the confirmed cases of COVID-19 globally.

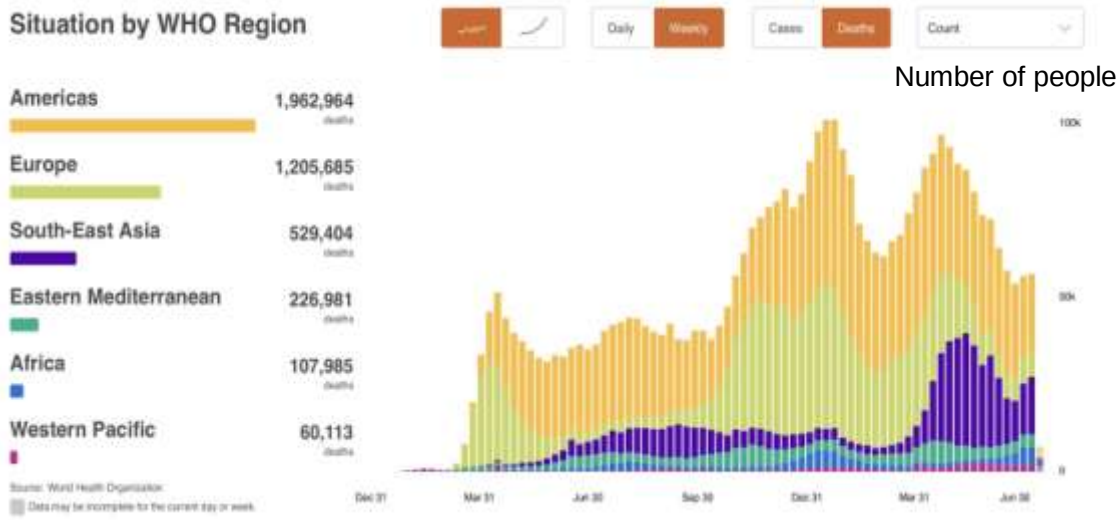


Fig 2:- The number of people who died from COVID-19 globally.

Currently in Thailand, the COVID-19 situation is in critical condition, due to the significant increase in new cases every day. As of 20th July, 2021 the number of new cases exceeds 10,000 cases per day with the total accumulated confirmed cases being approximately 415,170 and over 3,400 deaths as shown in Fig 3 and 4. This number is expected to increase rapidly in the future.

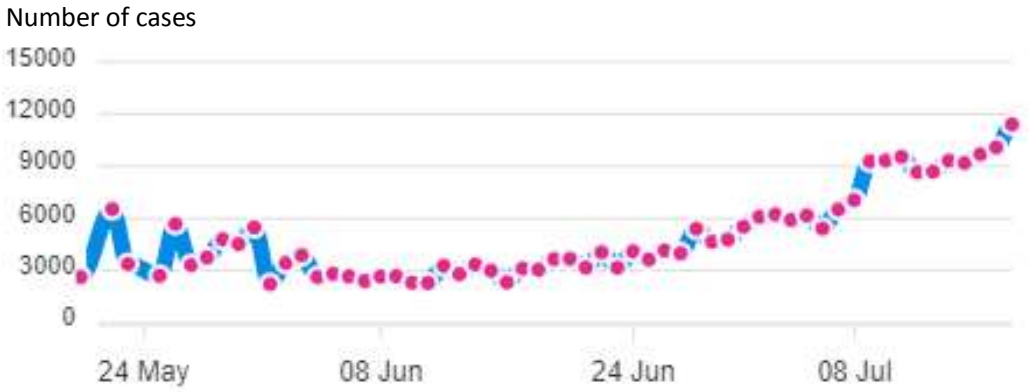


Fig 3:-The number of new confirmed cases of COVID-19 daily in Thailand.

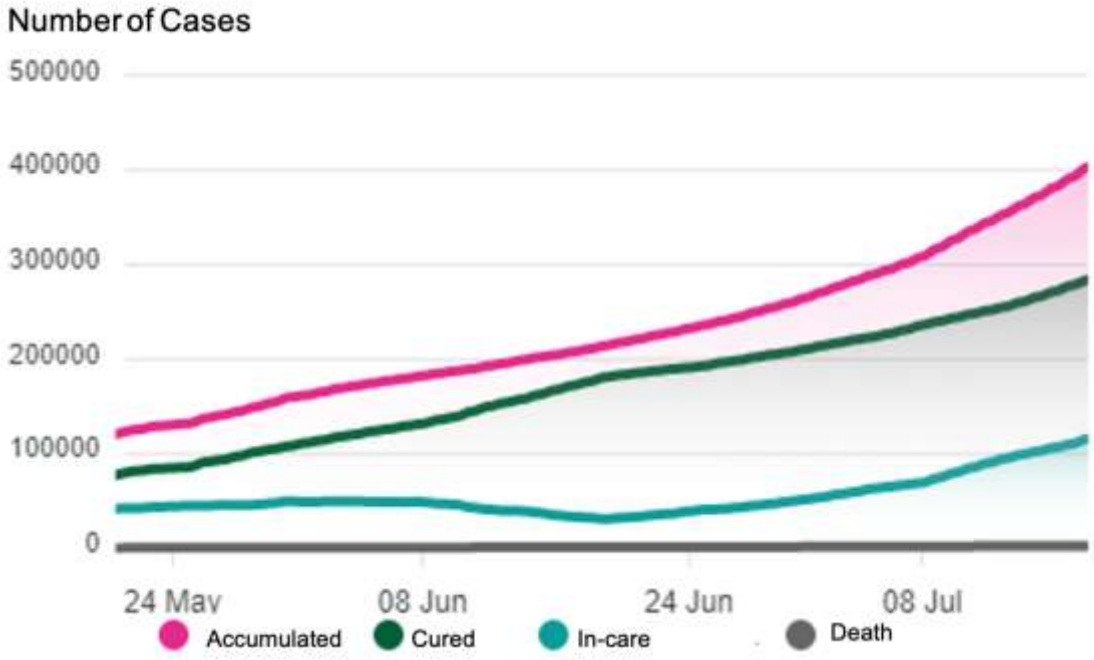


Fig 4:-The number of COVID-19 cases in Thailand.

As of July 2021, several vaccines that are currently provided in Thailand are Sinovac, AstraZeneca, Sinopharm, Pfizer, and Moderna. These vaccines can be classified into 3 types, whole virus, viral vector, and nucleic acid (RNA and DNA). Firstly, the whole virus vaccineis an inactivated virus which means that they are weakened versions of the virus. When injected into our body, it triggers the immune responses to produce T-cells and creates immunity against the virus such as the coronavirus SARS-CoV-2, which are Sinovac and Sinopharm. The second type of vaccine is the viral vector vaccine. For instance, AstraZeneca vaccine; its mechanism works by injecting genetic codes of an antigen into a harmless virus, which this virus then delivers the code into the cell without causing any diseases. Even though viral vector vaccines are complex to develop, it triggers strong immune responses. Lastly, the nucleic acid vaccine works by inserting genetic code (DNA and mRNA) directly into the cell to produce an antigen, this technology is used in Moderna and Pfizer vaccine. Furthermore, all of these vaccines require both first and second doses, as the first dose of the vaccine prepares the immune system to respond to the foreign virus, then the second dose will develop a protective immune response against it.

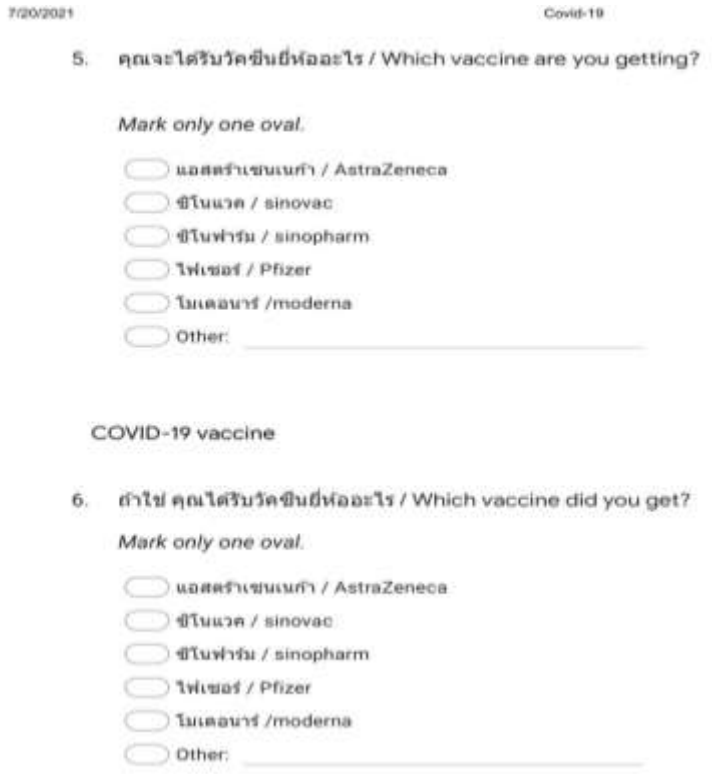
Herd immunity is when most of a population is immune to an infectious disease. This provides indirect protection to those who are not immune to the disease. For example, if 80 percent of a population is immune to a virus, the

spread of infectious diseases will be under control which is depended on how rapid the spread of an infection is. Usually, 50 to 90 percent of a population needs to have immunity before infection rates start to drop. But,several factors such as viral evolution or how people interact with each other, can alter the percentage of immunity. However, immunity from vaccination in the population still has a positive effect, the higher the level of immunity, the lower the infected rate. Therefore, it is important to get as many people as possible vaccinated.There are two ways to achieve herd immunity, the first being getting vaccinated and second being getting infected by the disease. However, getting infected has more disadvantages than benefits, as the disease can take more life or make permanent damage to the lungs. For COVID-19, the suggested percentage is that at least 70% of the population be immune to achieve herd immunity without restrictions on activities meaning that we can go back to a pre-pandemic lifestyle.

Method:-

1. Research from journal and publication listed in the references on the COVID-19 disease, current situation globally, the current situation in Thailand, and COVID-19 vaccines available in Thailand.
2. Create a google form to survey and collect data about the COVID-19 vaccine in a random group of people aged between seventeen to ninety years old who are currently living in Bangkok and vicinity areas of Thailand.
3. Conduct surveyin a 3-day period (between 20th to 22nd July 2021) for 300 responses.
4. Perform dataanalysis by using Google form and Microsoft Excel.
5. Summarize and interprete overall results with conclusion.

Fig 5:-QR code for the survey in Google form.


7/20/2021 Covid-19

5. คุณจะได้รับวัคซีนยี่ห้ออะไร / Which vaccine are you getting?

Mark only one oval.

- แอสตร้าเซนเนก้า / AstraZeneca
- ซิโนแวค / sinovac
- ซิโนฟาร์ม / sinopharm
- ไฟเซอร์ / Pfizer
- โมเดอนาร์ /moderna
- Other:

COVID-19 vaccine

6. ถ้าใช่ คุณได้รับวัคซีนยี่ห้ออะไร / Which vaccine did you get?

Mark only one oval.

- แอสตร้าเซนเนก้า / AstraZeneca
- ซิโนแวค / sinovac
- ซิโนฟาร์ม / sinopharm
- ไฟเซอร์ / Pfizer
- โมเดอนาร์ /moderna
- Other:

Fig 6:- The survey form.

Results:-

Percentage of people previously infected by COVID-19: 4.7% or 14 people have been infected from the sample of 300 people as shown in Fig 7 because the survey period was conducted between 20th to 22nd July 2021 which COVID-19 pandemic in Thailand started to escalate.

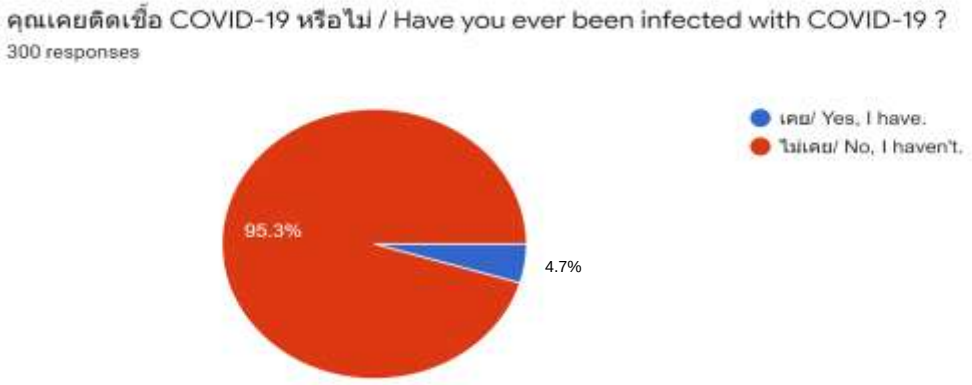


Fig 7:- The number of people who have been infected with COVID-19.

Percentage of people who have received 2 doses of COVID-19 vaccine: Fig 8 portrays that 27.5% or 82 people from 298 responses have received both doses. However, from the number of people who received 2 doses of vaccine, there are 5 people who are infected with COVID-19. It is equivalent to 35.7% of people who are infected with COVID-19 or 6% of people who have already received 2 doses of vaccine. Even thoughpeople get vaccinated, there isstilla possibility to be infected by the Coronavirus SARS-CoV-2 because Sinovac vaccine takes up to 4 weeks to gain the immunity. And,Sinovac vaccine was the dominant vaccine available at that time. Nonetheless, in

that period of time if a person is exposed to the Coronavirus SARS-CoV-2, the chance of them getting infected is still relatively high, as they are vulnerable. Furthermore, careless behavior after receiving vaccinecould also increase the possibility of getting infected as well.

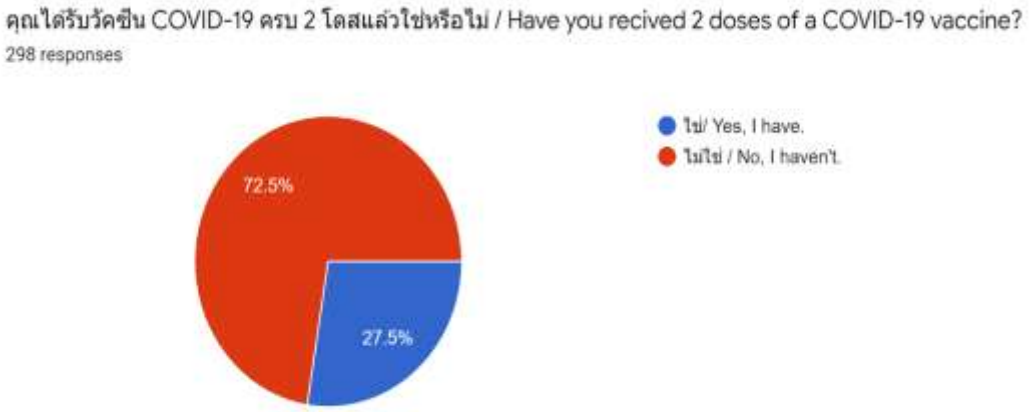


Fig 8:-The number of people who received 2 doses of COVID-19 vaccine.

Percentage of people who have reserved COVID-19 vaccine

Fig 9 illustrates that 38.4% has booked their COVID-19 vaccinationand 61.6% has not received nor booked their COVID-19 vaccination. The reason for the low numbers of registration for COVID-19 vaccine is that Thailand uses an internet booking system which might be a limitation to some, as not all of Thailand's population can access to the internet. Furthermore, due to the large gap in Thailand's population between low-income and high-income society has caused inequality to access the vaccine. This results in high-income society being able to access the vaccine much faster, while low-income society has the technological limitation making it difficult for them to access. In addition, concerns about side effects of thevaccines and their effectiveness arise, some of the population are afraid of getting vaccinated.

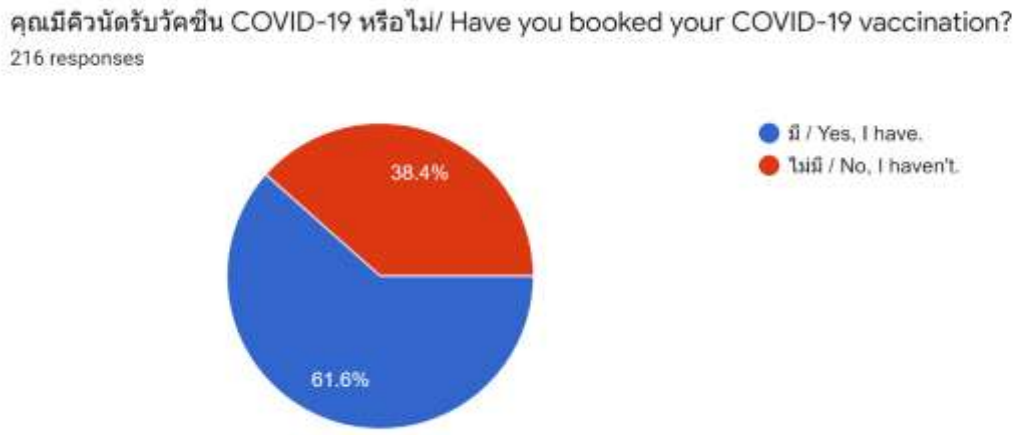


Fig 9:-The number of people who booked their COVID-19 vaccine.

Percentage of vaccine brands on vaccinated people

Fig 10 shows that people received Sinovac vaccine 82.7%, AstraZeneca 12.3%, Sinopharm 2.5%, combination of first dose Sinovac and second dose AstraZeneca 2.5%,Pfizer and Moderna at 0%. The majority of vaccinated people received Sinovac vaccine because it is the only one available at the initial stage since the 24th of February 2021,

while AstraZeneca vaccine has been delivered 4 months later causing the Sinovac vaccine to dominate the vaccinated population. These vaccines are provided by the government as a public health provider, free of charge. On the other hand, there are other vaccines including Sinopharm, Pfizer, and Moderna also known as alternative vaccines which are provided by private providers with their own expenses, meaning the high-income population will be able to access more choices for their own health.

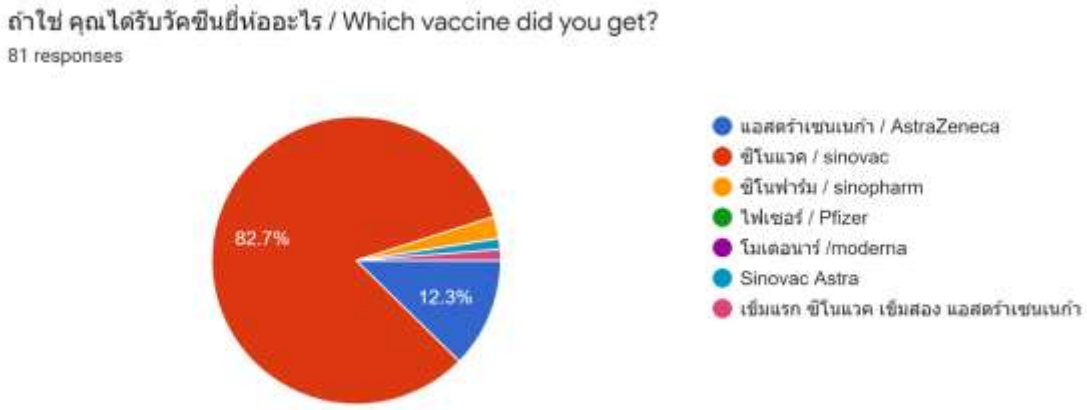


Fig 10:- The number of people who have received different brands of vaccine.

Data analysis:-

Overall percentage of people who are immune to the coronavirus SARS-CoV-2

Fig 11 displays that 73% have immunity against the coronavirus SARS-CoV-2, whilst only 27% do not. From the 73% who have immunity against the coronavirus SARS-CoV-2, they can be further divided into 3 categories:

1. 5% have been infected with the COVID-19.
2. 26% have received both doses of COVID-19 vaccine.
3. 43% will receive the vaccine by January 2022.

The reason that 27% do not have immunity against coronavirus SARS-CoV-2 is because the vaccines are currently available in Thailand, can not be used in under 18 years old as it may cause complications. Thus, all of Thailand's youth population does not have immunity against corosnavirus SARS-CoV-2.

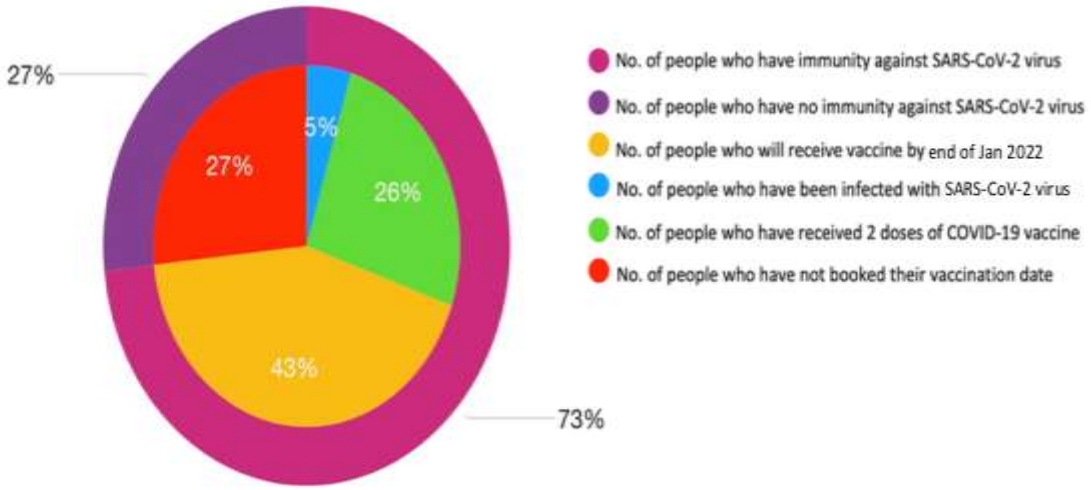


Fig 11:- The number of people who have immunity against coronavirus.

Conclusion:-

In conclusion, the research from 300 people living in Bangkok and vicinities of Thailand surveywas conducted between 20th to 22nd July 2021 which is the starting point of escalation of the COVID-19 pandemic in Thailand. The result shows that 30.4% are immune to the coronavirus SARS-CoV-2, which can be categorized into 2 groups from prior infection4.7% and vaccination 25.7%. By January 2022, the other unvaccinated129 people have reserved and will receive vaccine which will increase the herd immunity percentage up to 73.4%. In order to achieve herd immunity, over 70% of the population has to be immune. Hypothetically applyingthis research result and theory to a larger scale by representing as the whole Bangkok and the vicinity population, 13 million people, this assumption would conclude that by January 2022 Bangkok and the vicinity areas will be able to achieve herd immunity as more people will be immune to COVID-19 at around 73.4% or 9.53 million people.

Furthermore, owing to the fact that reservation of vaccines in Thailandis required to register via internet platform which causes difficulty for elderly, uneducated, and low-income populations who do not have the technological advances or skills to register. Hence,this causes low percentage of population who have immunity against coronavirus SARS-CoV-2. The reservation system should allow access in several different method such as call-center, walk-in, invitation letter, etc.In addition, Thai government only brought Sinovac vaccine for the first phase of the pandemic resulting in the youth population (under 18 years old) not receiving any vaccine, thus having no immunity against coronavirus SARS-CoV-2. Furthermore, the anti-vaxxer causes low reservation percentagedue to the health concernsor misunderstandings. Therefore, Thai government should promote, educate and provide information about the coronavirus SARS-CoV-2 and vaccines to refute the confusion. Nevertheless, the uncertainty of effective beginning period and duration is questionable especially in high risk jobs or careless behavior.

Since pandemic situation becomes severe, people pay more attention to protect themselves and prevent the risk of infection by reserving vaccine, which reflect into a significant increasenumber of potential vaccinations.In addition,by the end of year 2021 more choices of vaccines will be imported by private providers. This couldspeed up the vaccinated population,but it is expensive and requires own expense which creates inequality in accessibility of healthcaredue to the affordable gap between high-income and low-income.

In summary, vaccines are the solution to prevent pandemic issues. Hypothetically by January 2022 Bangkok and the vicinity area of Thailand will be able to achieve herd immunity with more than 70%.

Evaluation:-

The aim of this research is to predict when Bangkok and vicinity area of Thailand will achieve herd immunity by analysis of sampled group who are immune to COVID-19 either from the infection or the vaccination. Since this pandemic has taken over a year now and it seems endless, and the situation is even getting worse, this research shows that if vaccination goes according as planned, Bangkok and vicinity areas of Thailand will be able to achieve herd immunity by January 2022.

The accuracy of this research result could be improved by increasing the sample numberto represent the characteristics accurately for the whole population. For example, increasing number of sample group to 2,500 people instead of 300 people from 13 million people, as it is only 23 ppm. Secondly, survey content should be able to categorize human characteristics such as age, career, house-hold income, technological skills and level of educationto further identify other specific issues. Lastly, determining each district separately with pandemic level of severityto clarify and analyze the results more precisely.

Additional research could be further expanded into investigation of each brand of COVID-19 vaccine and how its mechanism allows it to keep each person immune to the coronavirus SAR-CoV-2 in a period of time.

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