

# Comparative Covid-19 Vaccine roll out study

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**Abstract:** Background: Covid-19 has been around for a year and does not seem to stop. Different types of vaccines have been rolled out in many countries and showed different outcomes. Objective: The purpose of the study is to compare outcomes of different vaccines from infected, death, and vaccination rates of each country. Materials and Methods: This study had an analysis for The US, Brazil, The UK, France, Thailand, Israel, Chile and Indonesia using the Our World Data research and statistics website. Data of the number of COVID-19 infected cases, death and COVID-19 vaccinations on dates including 31st December 2020, 31st January, 28th February, 31st March, 31st March, 30th April, 31st May, 30th June, 31st July 2021 were collected. Percent change of COVID-19 infected cases and death were calculated. Data were presented in tables comparing each period. Results: Comparison shows that vaccines can slow down viral infections at a certain point but not completely because there are new variants mutating. Conclusion: Vaccines should be constantly upgraded. Moreover, vaccine policy should support different groups of people, risk diversification and mass customization. Despite vaccination, fully self protection should still remain. There still should be intervention in health behaviors to create herd immunity.

**Keywords:** Covid-19 vaccines, Coronavirus, Covid-19 variants.

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## 1. INTRODUCTION

COVID-19 has been spreading since December 2019 when it was discovered in China and seems to never end. In order to prevent further transmission, countries have been locked down and state quarantined. It is crucial to attempt to break the chain of infection. According to the CDC, infection prevention includes staying 6 feet apart, avoiding crowded places, wearing a mask, washing hands, covering when coughing or sneezing, disinfecting materials, and self diagnoses like taking temperatures. (1) Although, there have been the withdrawal of protocols and lowering restrictions in some areas when cases are significantly low which results in the arrival of new variants.

One of the most important factors in ending this pandemic is to find a vaccine. Scientists from many countries have developed many types of vaccines. Vaccines could protect only an individual but also everyone from a spreading disease like COVID-19 because it strengthens the immunity of the community. (2) In order to create herd immunity, 70% of the world population should be vaccinated. Although, there are still groups that are not willing and hesitating to be vaccinated. Because this virus is still very new and new vaccine technologies like the mRNA vaccine have just been discovered, there is still continuing testing and research. Moreover, vaccines are still not distributed throughout many undeveloped countries.

Each vaccine has a different origin and efficiency. Different types of vaccines have been distributed at different times. In addition, new variants are occurring and spreading all over the world. In the current situation, developed countries that had a serious amount of cases before like the United States and the United Kingdom have lower rates because of the vaccination. While other countries like Mexico, Pakistan, Malaysia, Bolivia, Kazakhstan, and Thailand, still have a lot of active cases and fluctuation in rates even with vaccination in certain populations. (3) These countries received different types of vaccines and might be the reasons for the declined cases, ongoing number of cases and fluctuation in different countries. Currently, new outbreaks have been occurring everyday, despite a high percentage of the population being vaccinated. It is a controversial topic whether a certain type of vaccine could protect the new form of the virus or be effective enough. In order to lower the infection rate, it is important to know if certain vaccines are suitable for situations in each country. This study aims to compare different vaccines that are rolled out in countries and analyse the resistance to new variants of vaccines by using statistics of types of vaccines used, number of cases, death rates, and vaccination rate in different timelines.

## 2. MATERIALS AND METHODS

This study had an analysis for The US, Brazil, The UK, France, Thailand, Israel, Chile and Indonesia using the Our World Data research and statistics website. Data of the number of COVID-19 infected cases, death and COVID-19 vaccinations on dates including 31st December 2020, 31st January, 28th February, 31st March, 31st March, 30th April, 31st May, 30th June, 31st July 2021 were collected. Percent change of COVID-19 infected cases and death were calculated. Data were presented in tables comparing each period.

### COVID-19 Variants

Throughout the pandemic, new SARS-CoV-2 had been developing and spreading in many countries. These changes affect the virus's characteristics, such as how readily it spreads, the severity of the sickness it causes. It could also disturb the performance of vaccinations, therapeutic medications, diagnosis, and other public health and social measures. The WHO recommends utilizing Greek Alphabet letters, such as Alpha, Beta, Gamma, and Delta to avoid discrimination and make it more practical. (4)

SARS-CoV-2 Interagency Group categorized the variants into 3 groups including Variant of Interest, Variant of Concern and Variant of High Consequence.

Variants of interest include Epsilon, Eta, and Kappa. These variants have specific binders that reduce the efficiency of antibodies, treatment, diagnosis or immune escape. Epsilon (20C/S:452R), originated in the United States, California, increases 20% transmission. Eta (20A/S:484K), originated in the UK and Nigeria, was first found in December 2020. Kappa (20A/S:154K), originated in India since December 2020 was first found in December 2020. Both Eta and Kappa have the possibility of lowering neutralization of post-vaccination serum and reducing neutralization of antibodies. (5)

Another variant in this category is the Iota (20C/S:484K) which was found in the United States, New York in November 2020. The Variant of concern group could have a higher transmission and fatality rate. It was found to significantly lower the antibody's neutralization, vaccine and diagnosis. This group consists of Alpha, Delta Beta and Gamma. Alpha (20I/501Y.V1) was found in the United Kingdom and could raise transmission rate by 50%. Beta (20H/501.V2) was found in South Africa and could also raise transmission rate by 50%. Delta (21A/S:478K) was identified in India. It lowers neutralization in post-vaccination serum and reduces neutralization of antibodies. Gamma (20J/501Y.V3) was found in Japan and Brazil and decreased susceptibility to monoclonal antibody immunotherapy with bamlanivimab and etesevimab. (5)

In comparison to previously circulating variants, a variant of high concern's preventative efforts or medical countermeasures (MCMs) are much less effective. There are currently no SARS-CoV-2 variations that are considered to be of high concern. (5)

Current COVID-19 vaccines were developed by studying the Wuhan-SARS-CoV-2 hu-1's spike protein, which binds and infect host cells. However, the new "variants of concern" appear to be more transmissible or deadly than the wild-type SARS-CoV-2 had changes in the spike protein, raising worries about vaccination efficacy. (6)

### Chain of infection

The model of the chain of infection consists of agent, host, and environment. When an agent leaves its reservoir or host by an exit portal, is transported by some means of transmission, and enters through a suitable portal of entry to infect a susceptible host. Humans, animals, and the environment all have reservoirs. The reservoir might be the source of an agent's transmission to a host or it could not. Sexually transmitted illnesses, measles, mumps, streptococcal infection, and numerous respiratory infections are examples of diseases that are transmitted from person to person without the use of mediators. The path via which a pathogen departs its host is known as the portal of exit. The pathogen's localization site usually correlates to the exit portal.

According to the CDC, modes of transmission include direct and indirect. Direct transmission included direct contact and droplet spread. Skin-to-skin contact, kissing, and sexual contact are all examples of effective touch. Spray with fairly large, short-range aerosols produced by sneezing, coughing, and talking is referred to as droplet spread. Indirect transmission is transfer of an infectious agent from a reservoir to a host via dispersed air particles, objects (vehicles), or animate facilitators (vectors). Infectious pathogens are spread via the air by dust or droplet nuclei floating in the air. Food, water, biologic fluids (blood), and pathogenic organisms are all vehicles that can passively carry an infectious agent (personal objects).

The way a virus enters a vulnerable host is known as the portal of entry. Access to tissues where the infection can grow or a toxin can function is required. Lastly, a host's susceptibility is determined by genetic or structural characteristics, adaptive immunity, and unspecified factors that impact a person's strength to fight infection. (7)

### **Covid-19**

Interventions are made in order to limit or discard the agent at the point of transmission, protecting entry points and strengthening the host's defenses. (1)

According to the WHO, Covid-19 can spread within 1 meter. When virus-containing aerosols or droplets are breathed or come into direct contact with the eyes, nose, or mouth, a person can get infected. According to laboratory findings, people infected are most infectious shortly before they acquire symptoms (two days before symptoms) and early in their illness. The conditions that make it easier for the COVID-19 virus to spread were close-contact environments, especially where individuals are interacting extremely close to each other; crowded areas; and poor ventilation in confined and enclosed areas.

### **Covid 19 Vaccines**

Vaccines create antibodies that could fight diseases. Not only vaccines could protect only an individual but also everyone from a spreading disease like COVID-19 because it strengthens the immunity of the community. Before being approved for use, any licensed vaccination requires extensive testing in multiple phases of trials, yet it is regularly reviewed once it is in use.

(8) Its effectiveness and side effects differ in certain age, gender and status groups.

According to the CDC, there are 3 major types of vaccines including, mRNA vaccines, protein subunit vaccines and vector vaccines. mRNA vaccines include material from the virus that causes COVID-19, which instructs our cells on how to create a harmless virus-specific protein. Instead of the whole germ, protein subunit vaccinations include harmless fragments (proteins) of the virus that causes COVID-19. Vector vaccines are made out of a modified form of a virus which are components from the virus that causes COVID-19 inside the modified virus's envelope. (8)

Pfizer, an mRNA vaccine, developed in the United States or BioNTech in Germany, is approved in the remaining 79 countries. Two injections should be given three weeks apart. At 36–46°F, undiluted storage lasts up to 1 month. 159 million doses have been delivered in the United States. Effectiveness was estimated to be 95% after 7 days following the second dosage, and 97.0 percent effective in a real-world research in Israel. The most prevalent side effects were tiredness and headache, which were severe enough after the second dosage in less than 4% of patients. In clinical testing with 12- to 15-year-olds, there was 100 percent effectiveness.

Moderna is an mRNA vaccination that has been approved in the United States and 50 other countries. Two injections, four weeks apart, are recommended. Refrigerated storage lasts up to 30 days. As of May 23, 125 million doses had been administered in the United States. In clinical trials, efficacy was estimated to be 94.1 percent, 14 days following the second dose. In a clinical experiment, 100% efficacy after the second dosage. The minimum age is 18 for vaccination.

Johnson & Johnson is manufactured from DNA in adenoviral vector. It is used in the United States and 41 other countries. There is only one dosage necessary. At 36–46°F, it can be stored for up to three months. Since May 23, 11 million doses have been delivered in the United States. In clinical studies, its efficiency was 72 percent in the United States, 64 percent in South Africa, and 61 percent in South America 28 days after vaccination. In a real-world research in the United States, the effectiveness was 76.7 percent. Adverse In 1% of receivers, there are abnormalities. The FDA examined 15 cases of uncommon, serious blood clots, most of which occurred in women aged 18 to 59, and determined that the vaccine's advantages outweigh the risks. Vaccination requires to be at least 18 years old.

Oxford (UK) and AstraZeneca (UK-Sweden) is produced by DNA in adenoviral vector vaccine. It is approved in 103 countries but not the United States. Two injections, four weeks apart, are recommended. Refrigerated storage lasts up to 6 months. In a clinical experiment conducted in the United States, Peru, and Chile, its efficiency was found to be 76 percent after 4 weeks. In the case of a serious infection, 100% efficacy is guaranteed. Soreness, headaches, tiredness, and muscular discomfort were among the mild to severe responses. Unusual blood clotting problem is indicated as an adverse effect. Vaccination requires at least 18 years old.

Sputnik V (Russia) is a DNA-based vaccination with two adenoviral vectors that has been approved in 68 countries but not in the United States. Three weeks apart, the first dosage of rAD26 adenovirus was given, followed by the second dose of rAd5 adenovirus. Temperatures should be kept between 36 and 46 degrees Fahrenheit. In clinical studies, efficiency was 91.6 percent on day 21 following the first dosage. Flu-like sickness, injection-site responses, headache, and asthenia were the most frequent adverse effects (fatigue). Serious side effects were not reported. Vaccination requires at least 18 years old.

Sinopharm or BIBP-CorV (China) is an inactivated coronavirus (SARS-CoV-2 strain) vaccination that is approved in 43 countries, except the U. S.. Two dosages, three to four weeks apart, are required. It should be kept at a temperature of 36°–46°F. Clinical studies have a 78.1 percent efficiency rate. Only 1% of the adverse responses were serious. Vaccination age requires at least 18 years old. (9)

Sinovac-CoronaVac is an inactivated whole virus vaccination with aluminum hydroxide adjuvant. A phase iii trial in Brazil found that two doses, given 14 days apart, had a 51 percent efficacy against symptomatic SARS-CoV-2 infection, 100 percent against severe COVID-19 infection, and 100 percent against hospitalization starting 14 days after the second vaccination (95 percent confidence interval. It is recommended for people above 18. (10)

The ChAdOx1 nCoV-19 vaccine (AZD1222) was invented at Oxford University. It contains the SARS-CoV-2 structural surface glycoprotein antigen (spike protein; nCoV-19) gene, which is stored in a replication-deficient chimpanzee adenoviral vector ChAdOx1. Vaccine effectiveness was 62.1 percent in people who got two standard doses, and 90 percent in participants who received a low dose after. Not only the ChAdOx1 nCoV-19 is 70.4% effective and could improve disease control throughout this outbreak but it could be distributed worldwide because the vaccine is usable at 2-8 degrees celsius. (11)

COVID-19 vaccination uptake rates have been studied in 33 different countries. Ecuador (97.0 percent), Malaysia (94.3 percent), Indonesia (93.3 percent), and China (91.3 percent ) had the greatest COVID-19 vaccination acceptance rates among adults representing the general population. On the other hand, in the Middle East, Russia, Africa, and numerous European nations, low rates of COVID-19 vaccine uptake have been observed. This might be a serious issue in the current COVID-19 pandemic's worldwide control efforts. Kuwait (23.6 percent), Jordan (28.4 percent), Italy (53.7 percent), Russia (54.9 percent), Poland (56.3 percent), the United States (56.9%), and France (56.9%) had the lowest COVID-19 vaccination acceptance percentages (58.9 percent ).

For health care givers (doctors and nurses), only eight studies of healthcare personnel were identified, with vaccination acceptance percentages ranging from 27.7% in the DRC to 78.1 percent in Israel. (12)

Vaccine efficiency is usually expressed as a percentage reduction in risk (RRR). According to RRR, the Pfizer–BioNTech vaccine decreases relative risk by 95%, the Moderna–NIH vaccine by 94%, the Gamaleya vaccine by 91%, the J&J vaccine by 67%, and the AstraZeneca–Oxford vaccine by 67%. (13)

A potential vaccine for SARS-CoV-2 that may protect against infection, illness, or transmission of any of these factors could help control the disease. CHIM or Controlled human infection model research might aid in the discovery of a protective vaccine. However, in phase 3 clinical trials, the effectiveness objective, protection against severe illness and mortality, is difficult to assess.

It's unlikely that a single vaccination would be considered as the one; multiple platforms and technologies might have varied capabilities and be relevant in different epidemiological settings. Furthermore, there will most likely be insufficient supply of a single vaccination. (14) Thus, there is no universal vaccine for all people.

### 3. RESULTS

#### Comparative analysis by country

This study aims to compare and analyse data of countries including the US, the UK, France, Israel, Brazil, Chile, Indonesia and Thailand. This study had an analysis for the number of COVID-19 infected cases, death and COVID-19 vaccinations using the Our world Data research and statistics website. Data of the number of COVID-19 infected cases, death and COVID-19 vaccinations on dates including 31st December 2020, 31st January, 28th February, 31st March, 31st March, 30 April, 31 May, 30 June, 31 July 2021 were collected. Percent change of COVID-19 infected cases and death were calculated.

**Vaccine roll out**

This table distributes the number of COVID-19 infected cases, death and COVID-19 vaccinations by period in The US, The UK, France, Israel, Brazil, Chile, Indonesia and Thailand on July 12 of 2021. It also shows different variants in each country.

**U.S.A.**

As of 31 December, 2020, the United states had more than 19,630,000 COVID-19 infected cases, 384,554 deaths. Number of infected cases increased by 34% from December to January 2021 and increased by 3.92% from June to July 2021. This showed a decline in infected rates. But since then, President Biden announced that he wanted 100 shots of vaccination in his first 100 days in office according to NBC news. COVID-19 vaccines including Pfizer, Moderna, and AstraZeneca were rolled out from December 2020 until 56.79% of the population were vaccinated on July 31, 2021. Infected rate had substantially decreased but started to increase a little on 31 July, 2021 due to the Delta variant occurring in most of the cases. Moderna, AstraZeneca, and Pfizer could not resist the Delta variant from spreading. (Table 1.)

**Table 1: Comparative No. of COVID-19 infected, Death and COVID-19 Vaccinated by Period U.S.A.**

As of	31Dec20	31Jan21	28Feb21	31Mar21	30Apr21	31May21	30Jun21	31Jul21
No. of Infected (x1000) (%change)	19,630	26,250 (34%)	28,650 (9%)	30,470 (6%)	32,350 (6.17%)	33,270 (2.84%)	33,660 (1.17%)	34,980 (3.92%)
No. of Death (x1000) (%change)	384	449 (17%)	514 (15%)	552 (7%)	576 (4.31%)	594 (3.15%)	604 (1.74%)	613 (1.43%)
% Population Vaccinated (x1000) (%Population)	2,790 (0.83%)	25,200 (7.49%)	49,770 (14.80%)	97,590 (29.02%)	144,890 (43.08%)	167,730 (49.87%)	180,670 (53.72%)	190,980 (56.79%)

**U.K.**

As of 31 December 2020, the United Kingdom had more than 2,390,000 COVID-19 infected cases, about 726,000 deaths. Number of infected cases increased by 60% from December to January 2021 and increased by 5.99% from June to July 2021. This showed a decline in infected rates. COVID-19 vaccines including Moderna, AstraZeneca, Pfizer/BioNTech were rolled out from December 2020 until 68.64% of the population were vaccinated on July 31, 2021. Infected rate had substantially decreased but started to increase a little on 30 April and, 2021 continued to show little fluctuation due to the Delta variant occurring in most of the cases. Moderna, AstraZeneca, and Pfizer could not resist the Delta variant from spreading. (Table 2.)

**Table 2: Comparative No. of COVID-19 infected, Death and COVID-19 Vaccinated by Period in U.K.**

As of	31Dec20	31Jan21	28Feb21	31Mar21	30Apr21	31May21	30Jun21	31Jul21
No. of Infected (x1000) (%change)	2,390	3,830 (60%)	4,190 (9%)	4,710 (11%)	5,680 (20.59%)	5,730 (0.88%)	5,840 (1.92%)	6,190 (5.99%)
No. of Death (x1000) (%change)	726	106 (46%)	123 (16%)	126 (3%)	127 (0.65%)	128 (0.21%)	128 (0.28%)	129 (1.20%)
% Population Vaccinated (x1000) (%Population)	1,010 (1.47%)	9,300 (13.63%)	20,280 (29.73%)	31,150 (45.67%)	34,360 (50.38%)	39,480 (57.88%)	44,860 (65.77%)	46,820 (68.64%)

**France**

As of 31 December 2020, France had more than 2,630,000 COVID-19 infected cases, about 64,000 deaths. Number of infected cases increased by 24% from December to January 2021 and increased by 21.99% from June to July 2021. This showed a decline in infected rates. COVID-19 vaccines including AstraZeneca were rolled out from December 2020 until 21.99% of the population were vaccinated on July 31, 2021. Infected rate had substantially decreased but continued to increase a little on 31 July, 2021 due to the Alpha variant occurring in most of the cases. AstraZeneca could not resist the Alpha variant from spreading. (Table 3.)

**Table 3: Comparative No. of COVID-19 infected, Death and COVID-19 Vaccinated by Period in France**

As of	31Dec20	31Jan21	28Feb21	31Mar21	30Apr21	31May21	30Jun21	31Jul21
No. of Infected (x1000) (%change)	2,630	3260 (24%)	3820 (17%)	4360 (12%)	4430 (1.61%)	4500 (1.58%)	109 (7.11%)	5880 (21.99%)
No. of Death (x1000) (%change)	64	76 (18%)	86 (14%)	86 (0%)	104 (20.60%)	109 (4.79%)	111 (1.42%)	112 (0.73%)
% Population Vaccinated (x1000) (%Population)	1.248 (0%)	1,660 (2.46%)	3,110 (4.61%)	8,790 (13.02%)	15,930 (23.58%)	25,840 (38.77%)	34,270 (50.73%)	42,660 (63.14%)

**Israel**

As of 31 December 2020, Israel had more than 412,000 COVID-19 infected cases, about 330,000 deaths. Number of infected cases increased by 56% from December to January 2020 and increased by 3.83% from June to July 2021. This showed a decline in infected rates. COVID-19 vaccines including AstraZeneca were rolled out from December 2020 until 65.83% of the population were vaccinated on July 31, 2021. Infected rate had substantially decreased but started to increase a little on 31 July, 2021 due to the Delta variant occurring in most of the cases. Astrazeneca could not resist the Delta variant spreading. (Table 4.)

**Table 4: Comparative No. of COVID-19 infected, Death and COVID-19 Vaccinated by Period in Israel**

As of	31Dec20	31Jan21	28Feb21	31Mar21	30Apr21	31May21	30Jun21	31Jul21
No. of Infected (x1000) (%change)	412	643 (56%)	479 (21%)	833 (7%)	838 (0.65%)	636 (0.12%)	841 (0.27%)	874 (3.83%)
No. of Death (x1000) (%change)	330	479 (45%)	575 (20%)	620 (7%)	636 (2.48%)	641 (0.77%)	642 (0.27%)	647 (0.68%)
% Population Vaccinated (x1000) (%Population)	990 (11.27%)	3,100 (35.31%)	4,720 (53.70%)	5,250 (59.63%)	5,400 (61.47%)	5,450 (62.05%)	5,600 (63.73%)	5,790 (65.83%)

**Brazil**

As of 31 December 2020, Brazil had more than 7,680,000 COVID-19 infected cases, about 194,000 deaths. Number of infected cases increased by 20% from December to January 2020 and increased by 7.33% from June to July 2021. During April and May, infected rates increased more than a thousand percent. In contrast, infected rates decreased 89% and 88.79% respectively. This showed massive fluctuation in infected rates. COVID-19 vaccines including AstraZeneca and Sinovac were rolled out from December 2020 until 49.09% of the population were vaccinated on July 31, 2021. Astrazeneca and Sinovac could not resist the Gamma variant spreading and could not control infection to become stable (Table 5.)

**Table 5: Comparative No. of COVID-19 infected, Death and COVID-19 Vaccinated by Period in Brazil**

As of	31Dec20	31Jan21	28Feb21	31Mar21	30Apr21	31May21	30Jun21	31Jul21
No. of Infected (x1000) (%change)	7,680	9,200 (20%)	1,055 (-89%)	1,275 (17%)	14,660 (1049.80%)	165,500 (1028.92%)	18,560 (-88.79%)	19,920 (7.33%)
No. of Death (x1000) (%change)	194	224 (15%)	254 (14%)	321 (21%)	403 (25.59%)	462 (14.61%)	518 (11.94%)	556 (7.39%)
% Population Vaccinated (x1000) (%Population)	0 (0%)	2,050 (0.96%)	6,520 (3.05%)	14,920 (6.97%)	29,150 (13.62%)	45,380 (21.20%)	72,720 (33.98%)	105,060 (49.09%)

**Chile**

As of 31 December 2020, France had more than 743,000 COVID-19 infected cases, about 194,000 deaths. Number of infected cases decreased by 2% from December to January 2020 and continued to fluctuate a little. Number of infected

increased by 3.85% at the end of July. COVID-19 vaccines including Sinovac and Pfizer were rolled out from December 2020 until 72% of the population were vaccinated on July 31, 2021. Infected rate has fluctuated due to the Lambda and Gamma variant but started to decrease on 31 July, 2021. Pfizer and Sinovac could not resist the Lambda and Gamma variant but could lower rates during July, 2021. (Table 6.)

**Table 6: Comparative No. of COVID-19 infected, Death and COVID-19 Vaccinated by Period in Chile**

As of	31Dec20	31Jan21	28Feb21	31Mar21	30Apr21	31May21	30Jun21	31Jul21
No. of Infected (x1000) (%change)	743	727 (-2%)	824 (13%)	995 (17%)	1,200 (15%)	1380 (13.04%)	1560 (15.00%)	1620 (3.85%)
No. of Death (x1000) (%change)	16	184 (11%)	205 (11%)	231 (11%)	26 (11.18%)	29 (11.08%)	32 (11.18%)	354 (8.92%)
% Population Vaccinated (x1000) (%Population)	0.865 (0.05%)	57 (0.3%)	3,320 (17.26%)	6,810 (35.47%)	8,170 (42.51%)	10,730 (55.84%)	12,720 (66.19%)	13,830 (72%)

#### Indonesia

As of 31 December 2020, Indonesia had more than 608,000 COVID-19 infected cases, about 1,080,000 deaths. Number of infected cases increased by 77% from December to January 2020. Infected rates began to decline. COVID-19 vaccines including Sinovac, AstraZeneca, and Sinopharm have been rolled out from January 2021. The Infection rate has declined but increased significantly during July again (56.42%) while vaccination rate is still low (17.09%) during that time. Death rates increased drastically from 15.65% to 60.91% at the end of July, 2021 because of the outbreak of the Delta variant and lack of efficient management with the pandemic. Sinovac could not resist the Delta variant. (Table 7.)

**Table 7: Comparative No. of COVID-19 infected, Death and COVID-19 Vaccinated by Period in Indonesia**

As of	31Dec20	31Jan21	28Feb21	31Mar21	30Apr21	31May21	30Jun21	31Jul21
No. of Infected (x1000) (%change)	608	1,080 (77%)	1,330 (23%)	1,510 (12%)	1,670 (10.60%)	1,820 (8.98%)	2,180 (19.78%)	3,410 (56.42%)
No. of Death (x1000) (%change)	22	29 (36%)	36 (21%)	40 (11%)	45 (12.16%)	50 (11.11%)	58 (15.65%)	94 (60.91%)
% Population Vaccinated (x1000) (%Population)	0 (0%)	493 (0.17%)	1,690 (0.61%)	8,010 (2.9%)	12,420 (4.49%)	16,410 (5.94%)	29,280 (10.59%)	47,230 (17.09%)

#### Thailand

As of 31 December 2020, Thailand had more than 7,000 COVID-19 infected cases, about 63,000 deaths. Number of infected cases increased by 174% from December to January 2020. Increased infected rates began to decline and peaked to 145.26% during May 2021. COVID-19 vaccines including Sinovac and AstraZeneca have been rolled out from March 2021 which was late compared to other countries. The Infection rate has declined but increased significantly during July again due to the new Alpha variant (96.22%) while vaccination rate was still low during that time (19.50%). Sinovac and AstraZeneca could not resist the Alpha variant. (Table 8.)

**Table 8: Comparative No. of COVID-19 infected, Death and COVID-19 Vaccinated by Period in Thailand**

As of	31Dec20	31Jan21	28Feb21	31Mar21	30Apr21	31May21	30Jun21	31Jul21
No. of Infected (x1000) (%change)	7	19 (174%)	26 (33%)	28 (10%)	65 (125.73%)	159 (145.26%)	259 (62.27%)	597 (96.22%)
No. of Death (x1000) (%change)	0.063	0.077 (22%)	0.083 (8%)	0.094 (12%)	0.203 (115.96%)	1 (407.88%)	2 (96.22%)	4 (140.09%)
% Population Vaccinated (x1000) (%Population)	0 (0%)	0 (0%)	0 (0%)	151 (0.22%)	1,100 (1.57%)	2,540 (3.63%)	7,110 (10.17%)	13,800 (19.50%)

#### 4. DISCUSSION

Developed countries like the United States, the United Kingdom, France and Israel had high infection rates during the beginning of the year. COVID-19 vaccines including AstraZeneca were rolled out from December 2020 and most of the population were vaccinated during July 2021 which made the infected rates substantially decreased. Although, cases started to increase a little on 31 July, 2021 due to the Delta variant occurring in most of the cases. Another developed country, Chile, had infected cases decreasing from December to January, 2020 and continued to fluctuate a little due to the Lambda and Gamma variant but started to decrease. In developing countries including Brazil, Indonesia and Thailand, infection rates were fluctuating highly, especially Indonesia and Brazil where COVID-19 vaccines including Sinovac, AstraZeneca, and Sinopharm have been rolled out from January 2021. Thailand rolled out the same type of vaccines but during March 2021 which was late compared to other countries. Death rates increased dramatically in Indonesia while all other countries had leveled death rates due to the poor management of the government and limitation of hospital beds. (15) Infection rates in these countries increased significantly during July again due to the new Alpha variant.

Data was from secondary sources such as statistics reports, scientific research, news, etc. This study is still an ongoing issue so some of the data were not available in research papers. Overall, this study was able to distribute a broad perspective of how vaccination of each country affects their productive rate.

Whether vaccines which were developed based on the virus during the first outbreaks could protect people from new variants was concerned. According to the BBC news, a study conducted by Public Health England stated that dosages of either the Pfizer or AstraZeneca vaccination showed more than 90% effectiveness in preventing Covid-19 infections caused by Delta while a single dosage. Experts said that vaccines could still lower severe conditions. (16) On the other hand, it was less effective in preventing Delta than Alpha variant. Compared to this study, it is true that vaccines could lower infection rates but at a certain point when new variants are emerging, the cases increase. Vaccines could prevent severe conditions but might not prevent infection.

From the results, Moderna, AstraZeneca, and Pfizer could not resist the Delta variant from spreading. Pfizer and Sinovac could not resist the Lambda and Gamma variant but could still lower rates. Sinovac and AstraZeneca could not resist the Alpha variant. Vaccines can reduce viral infection to some extent, but not completely. It may keep us from becoming infected, or at the very least from becoming unwell in severe cases, but it does not actually stop the pandemic. It has been demonstrated that conventional vaccines do not entirely protect novel variations such as Delta Gamma and Alpha.

#### 5. CONCLUSION

Vaccine could slow down viral infection at a certain point, but not completely. It could protect us from getting infected or at least become ill in severe conditions but it does not stop the pandemic directly. This is due to the fact that viruses could mutate by nature from a place and spread to many countries. From the study, it is shown that current vaccines do not protect new variants like Delta completely. New cases from the Delta variant are still rising despite getting vaccinated by efficient COVID-19 vaccines. Therefore, vaccines need to be constantly upgraded to combat the new form of the virus. Another point is that vaccine policy should support diverse groups of people, risk diversification, and mass customization. Despite having a vaccination, fully self protection and transmission prevention should still be done. Intervention Behavior should start from ourselves and the community. We should accept that the end of this pandemic is currently unpredictable. People should all develop habits to this new normal life.

#### 6. RECOMMENDATIONS

To lower risks, everyone should follow these guidelines which are staying informed from authorities. It is crucial for every pine to cooperate and create COVID-19 preventions as a habit. Protocols are practice social distancing (1 meter apart), wear well fitted 3 layered masks, washing hands with soap and water, use alcohol hand gels, avoid highly infection risked areas, increase airflow in buildings, avoid touching in public facilities, cover when coughing or sneezing, and get vaccinated.(17) People should stay informed with the latest updates about COVID-19 updates and follow COVID-19 prevention guidelines strictly.



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