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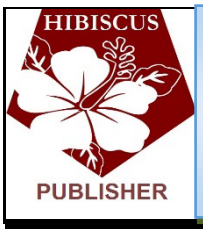

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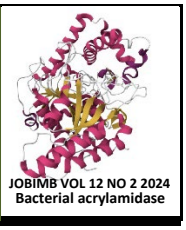

Takeaways From the COVID-19 Epidemic Progression and Combating Strategies in Southeast Asia

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ABSTRACT

Southeast Asia grappled with an early wave of COVID-19 cases, witnessing a spike in 2021 and early 2022 before vaccination efforts led to a decline. Governments in the region adopted diverse strategies, including lockdowns and public health measures, tailored to each country's cultural and socioeconomic landscape. This article delves into the COVID-19 outbreak across the 11 member countries, encompassing all ASEAN nations and Timor-Leste. It highlights the region's progression from low infection rates in 2020 to heightened mortality in 2021, followed by a drop in cases as vaccination coverage increased. Despite shared challenges, disparities in culture, wealth, and political context influenced the implementation and effectiveness of containment measures.

INTRODUCTION

Over the past two decades, the world has experienced a series of coronavirus waves that have triggered pandemics with global health implications [1]. The first, known as the Severe Acute Respiratory Syndrome, Coronavirus (SARS-CoV), had its most recent outbreak in September 2003 and infected more than 8000 people, including 774 deaths with a mortality rate of almost 10 percent [2]. The Middle East Respiratory Syndrome Coronavirus (MERS-CoV) triggered the second wave of respiratory coronavirus disease in the Middle East in 2012. MERS-CoV still exists but causes fewer cases and its mortality rate is much higher than that of SARS-CoV, at about 35 per cent [1,3,4]. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) causes coronavirus disease 2019 (COVID -19). The genome of SARS-CoV-2 differs by at least 20% from that of SARS-CoV and 50% from that of MERS-CoV and has spread to human populations worldwide [1]. Similarly, SARS-CoV-2 caused the COVID-19 pandemic, which infected nearly 700 million people worldwide by 1 January 2023 (Table 1) [5]. At some point, the base reproduction number (R0 value) was calculated to be 2 to 3.5, meaning that one infected person can infect two or three other people with a mortality rate of 2 to 3% [6]. SARS-CoV-2 infection resulted in many more deaths than its coronaviral siblings, but MERS-CoV infections result in a much higher mortality rate. The low R0 value of about 1 indicates that each person transmits MERS-CoV to only one person, which is the most critical characteristic for managing MERS-CoV. In contrast, the R0 value of SARS-CoV was about 4 [7].

Many countries were hit hard by the COVID-19 pandemic. The outbreak, which began in China, resulted in numerous health and economic losses and the isolation of countries around the globe and within countries [6]. However, to control and manage the epidemic, China has considered the functionality of surveillance. These principles include charting the natural history of the pathogen, detecting the spread of cases, and initiating disease control measures [2]. However, it is crucial to identify the various COVID-19 impacts of infection in different countries and their strategies to contain the virus. This is particularly true for countries in the Southeast Asian region, which have many diplomatic, social, and commercial ties with China. In addition, the proximity and existing social and commercial ties between China and Southeast Asia have led to the region being the first to report COVID-19 cases outside of China [2]. However, each country within the region develops and implements its COVID-

19 control strategies along a historical and context-specific pathway that includes multiple stages of development, learning from past outbreaks, negotiating with other countries, and sharing ideas between governments. In addition, contextual variables influence the key actors who inform, plan, and assess policies, such as the institutional landscape, cultural orientations, economic situation, and political style. The characteristics of such an environment in times like the COVID-19 crisis include high levels of uncertainty, sensitivity to the political situation, debates about stringent policies, and doubts about the duration and termination of special measures. Another hallmark of pandemics is the likely lethality of government inaction and decisions.

Against this background, this review article examines Southeast Asia's plans to combat the COVID-19 pandemic and the lessons that can be learned from these strategies. The aim was to analyze the COVID-19 prevention policies of Southeast Asian countries, to provide a fact-based insight into the case country scenario, and to assess and understand the strengths and weaknesses of the containment and mitigation strategies.

Epidemic Progression of SARS-CoV-2 Infection in Southeast Asia

The emergence of SARS-CoV-2 led to the infection of over 650 million people and killed nearly 7 million people worldwide by 27 December 2022 [8,9]. The pandemic poses a significant threat to global public health causing major socioeconomic problems [10]. About 20-30% of infected patients have needed hospitalization, with about 4% becoming extremely unwell and the disease fatal for some of them [11]. SARS-CoV-2 is a new virus that no one has been exposed to before, so the entire human population is susceptible to infection. The infection leads to rapid respiratory illness that is usually mild in children and healthy adults but can be fatal in the elderly and people with underlying diseases [12,13].

The virus began spreading from Wuhan to several countries at different rates and to varying degrees [14,15]. The virus spread rapidly to neighbouring countries in Southeast Asia and other Asian regions, as well as to southern and central parts of Europe and the United States [10,12,16]. However, when information spread in early 2020 that a worrisome new virus was circulating in Wuhan, experts feared that infections would spread rapidly throughout Southeast Asia and overwhelm the region's healthcare systems [16,17]. The first case outside China was reported on 13 January 2020 in Thailand, a popular destination for Chinese visitors [11,16,18]. The Philippines was the first country outside China to report a death from COVID-19 [19]. A Chinese traveller from Wuhan who visited Indonesia tested positive on his return, suggesting he had brought the virus on vacation [17].

However, after China, the first global hotspots for COVID-19 were Iran and Italy [20–22]. The pandemic quickly spread to Brazil, Europe, and the Americas [12]. In February 2020, Italy ranked third in the world for the number of reported cases [23,24]. In the second half of March 2020, the situation in the United States continued to deteriorate as the number of confirmed cases in the states began to rise [12]. In many European countries, the situation became more problematic at this time, especially in Spain, and a significant increase in confirmed cases was observed in France and Germany [22,25,26]. In the second half of 2020, the situation in the United States continued to deteriorate significantly [12]. In April and May 2020, the virus spread and spread across all continents [27]. Many countries began to prepare for a return to normalcy in May-June 2020, despite the looming threat of a second wave of the pandemic.

Nevertheless, Southeast Asia was relatively resilient and less affected throughout 2020 and early 2021. However, by the end of 2020, the most affected countries in the region were Indonesia and the Philippines, which reported over 700 and nearly 500 thousand cases respectively (**Fig. 1**) [28]. On the contrary, countries such as the Lao People's Democratic Republic, Timor-Leste, Brunei, and Cambodia reported fewer than 1000 cases (**Fig. 1**) [29]. By mid-June 2021, the pandemic had claimed the lives of fewer than 77,000 people in Southeast Asia's 668 million population (**Table 1**) [6,30]. By contrast, in the UK, which accounts for only one-tenth of the region's population, it killed nearly 128,000 people [31]. The Region seemed to have escaped the worst of the pandemic, but eventually, the narrative changed and before the end of August 2021, the region had recorded over 217,000 deaths from COVID-19, about 2.6 times the number just three months earlier (**Fig. 2**) [32,33]. However, as vaccination uptake reached an advanced stage and the most vulnerable populations were fully vaccinated, transmission rates and deaths declined [34].

Table 1. Cumulative Confirmed Cases, Deaths, and Vaccination Administered Relative to the Population as of Jan. 1, 2023 [5].

Country	Total confirmed cases	Total confirmed deaths	Case fatality rate	Confirmed cases per 1M Popn	Confirmed deaths per 1M Popn	Total vaccine doses administered per 100 Popn	Person Fully vaccinated Per 100 Popn	Person who received Booster dose per 100 Popn	Total number of tests	Total Popn
Brunei	276,067	225	0.8	619,775	505	294.26	102.02	77.65	717,784	445,431
Cambodia	138,963	3,056	2.2	8,078	178	272.82	87.45	62.67	3,019,420	17,168,639
Indonesia	6,730,289	160,817	2.4	24,111	576	162.44	63.14	24.84	114,158,919	279,134,505
Laos	217,973	758	0.3	29,137	101	206.9	77.64	32.43	1,233,207	7,481,023
Malaysia	5,036,918	36,942	0.7	151,801	1,113	224	85.08	50.35	67,677,441	33,181,072
Myanmar	633,833	19,490	3.1	11,477	353	118.64	50.63	4.09	9,945,354	55,227,143
Philippines	4,073,454	65,802	1.6	36,206	585	155.15	67.49	19.55	34,343,332	112,508,994
Singapore	2,217,575	1,722	0.08	373,106	290	254.28	87.5	78.56	24,756,666	5,943,546
Thailand	4,726,984	33,865	0.7	67,453	483	198.92	77.47	38.98	17,270,775	70,078,203
Timor-Leste	23,415	138	0.6	17,098	101	152.33	60.48	24.92	278,529	1,369,429
Vietnam	11,526,508	43,186	0.4	116,484	436	272.93	88.22	59.08	85,826,548	98,953,541
Southeast Asia	35,601,979	366,001	1.0							
World	675,465,538	6,764,827	1.0	86,655.9	867.9	168.95	64.85	30.61		

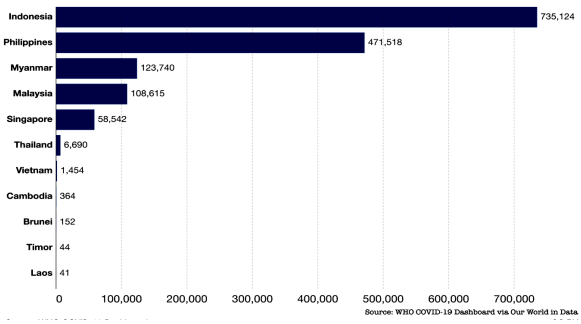

Fig. 1. Shows cumulative Confirmed COVID-19 Cases as of Dec. 30, 2020 [35].

Nevertheless, 2021 was a challenging year for many Southeast Asian countries. In the remaining six months of the year and the first quarter of 2022, the region worked extremely hard and fast to contain rogue virus outbreaks, delivering vaccines to every corner and crevice of urban and rural areas [36] and fighting to return to anything near normalcy. However, when the Omicron variant emerged and began to spread, especially in Africa, governments in the region feared how the mutated variant would affect Southeast Asian countries in the long term, based on their experience with the Delta variant. More frightening were the findings of researchers from South Africa, who found that Omicron has more than thirty mutations on its spike gene, giving the virus a very high transmission potential compared to previous variants [37,38].

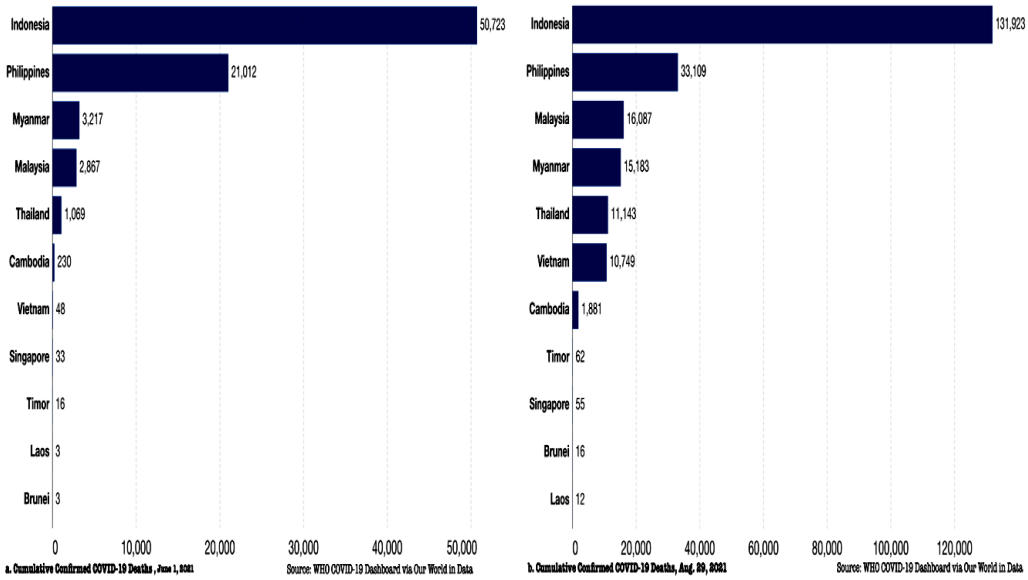

Fig. 2. Cumulative Confirmed COVID-19 Death. **Fig.** 2a shows the cumulative number of confirmed COVID-19 deaths as of June 1, 2021. **Fig.** 2b shows the cumulative number of confirmed COVID-19 deaths as of August 29, 2021 [35].

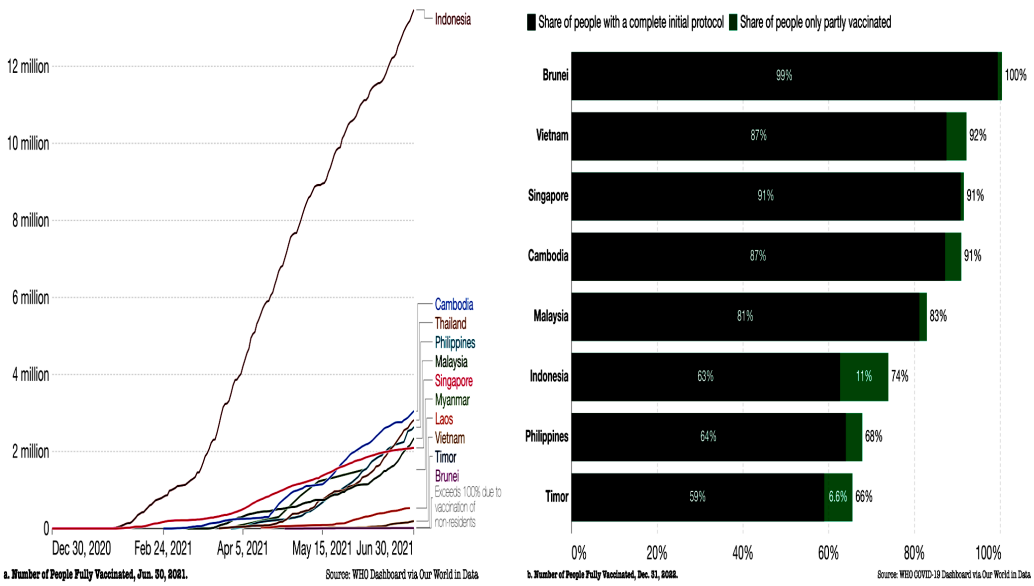

Fig. 3. (a) Share of People (in numbers) with a complete primary series of Vaccinations Against COVID-19 by individual Southeast Asian countries as of June 30th, 2021. (b) Share of people (in percentage) with a complete primary series of vaccinations and that of those with only one dose of vaccination against COVID-19 by individual countries in Southeast Asia, as of Dec. 31st, 2022 [50].

Nonetheless, the various member countries of the region have wisely and with prompt preventive response tightened their travel restrictions to contain the spread of the variant across their borders [6]. Travellers from various countries, most of them in Africa, who have confirmed the presence of Omicron in their countries have been temporarily prevented from entering Indonesia, Singapore, the Philippines, Malaysia, Thailand, Cambodia, and Vietnam [39]. They have also enhanced COVID-19 testing and strict quarantine regimes for visitors and returning citizens [39].

Although most members of the region have vaccinated more than 60% of their at-risk population [34], they have also intensified their vaccination campaigns to mitigate the impact of the new variant [40,41]. Moreover, when the Omicron variant was rampant in the region, it appeared to be highly transmissible, leading to an increase in the number of infections. However, its virulence was curbed by the increased vaccination rollout in many countries, where more than 60% of the adult population had already been vaccinated [34]. The virus later became somewhat endemic, causing fewer irregular epidemics within the region, from one country to another [42]. By December 2022, almost all vulnerable populations in most member countries had received their second dose of the vaccine, and many had received a booster dose (**Fig. 3b**). Despite the frequent mutations and the emergence of numerous Omicrons subvariants, the vaccine was still effective in reducing the virulence of the virus and significantly lowering the mortality rate of the disease [43].

The Emergence and Distribution of SARS-CoV-2 Variants in Southeast Asia

Variants B.1.1.7 (alpha), B.1.351 (beta), P.1 (gamma), and B.1.617.2 (delta), as well as the Omicrons subvariants, were the variants of concern (VOCs) and variants under monitoring (VUMs) that have circulated in the Southeast Asian region (**Fig. 4**) [44,45]. Migration of workers between countries, often through illegal and uncontrolled channels, combined with limited early introduction of vaccines, has put the entire region at risk from highly transmissible and immune invasive variants. Southeast Asia served as a model for COVID-19 control strategies in 2020 [45]. The increase in case numbers changed the picture in mid-2021. The average number of confirmed daily new cases increased from almost 13,000 in March 2021 to more than 28,000 in June (**Fig. 5**), with a median time-varying reproductive number of 1.09, indicating that daily new cases are increasing exponentially [41,46,47]. Due to limited testing capacity in some countries, data are likely to be incomplete [45,48].

The extent of genetic heterogeneity in the SARS-CoV-2 genomes available in Thailand indicates that the virus has been spreading undetected for months [49]. The spread of the alpha and delta variants occurred throughout the region from March to June 2021 (**Fig. 4a**), leading to health system overload. The alpha variant began spreading in Cambodia and Thailand in March 2021 [45]. Successful public health strategies during the first and second waves in 2020 were ineffective in combating the new variant. In some Thai clusters, the SARS-CoV-2 positivity rate was as high as 60–90 per cent [11,45]. The COVID-19 infection spread to Laos, where there had previously been essentially no local transmission. The beta variant, which reportedly has lower vaccine efficacy, was detected in Indonesia and Malaysia, and eventually, the virus spread to the southern provinces of Thailand [51,52]. Since April 2021, the region has been plagued by competition between alpha and delta variants (**Fig. 4a**), with the proportion of delta variants increasing in Singapore, Indonesia, Malaysia, Thailand, and Vietnam (**Fig. 4b**) [53].

Based on the known genome sequences, the delta variant appears to have effectively overtaken the alpha variant (**Fig. 4b**) in Indonesia, Malaysia, Singapore, Laos, and Vietnam [45,54]. Most importantly, genomic data have revealed an uncontrolled flow of these variants between countries with constrained vaccine rollout, when less than 5% of the total population has been fully vaccinated as of 30 June 2021 (**Fig. 3a**), then Southeast Asia emerges as a new regional hotspot in the global fight against COVID -19 [45,55].

Myanmar is probably the least reported disaster in the region; case reporting and genetic data surveillance became limited following the political turmoil that began in February 2021 [45]. Genetic surveillance data of imported cases from Singapore and Thailand suggest that the alpha variant persists in Myanmar. Myanmar was exposed to alpha, beta, and delta variants from Thailand to the east and Bangladesh and India to the west [45]. As such, it could not escape their imports, especially considering how many people migrated in and out of the country due to political unrest [45,56,57].

While high-income countries around the world were recovering their livelihoods from the pandemic, emerging variants in Southeast Asia threatened the COVID-19 control efforts in the final stretch [45,58]. By the third quarter of 2021, the delta variant became the most prevalent variant in the region, displacing all other variants before the end of 2021 (**Fig. 4b**). By the end of 2021, only a few Omicron variants were reported in Southeast Asia. However, the variant quickly overtook the delta variant (**Fig. 4c**) [59]. The predominant circulating variants for most new COVID-19 cases in 2022 were the Omicron variants (**Figs. 4c** and **d**), which overtook the Delta (**Fig. 4d**) [52]. The list of VOCs was updated in March 2022 to exclude the alpha, beta, and gamma variants [59]. Similarly, the delta variant was removed in June 2022 [52,59]. The Southeast Asian members of GISAID, including Malaysia, are monitoring COVID-19 by sharing genomic data, collaborating on regional surveillance, researching variants, and supporting public health preparedness with early warning systems and evidence-based strategies (**Fig. 4**).

Delta Variant and the Unpleasant COVID-19 Experience in Southeast Asia

When the Delta variant arrived in the region (Southeast Asia), it encountered a population with weak immunity, complacent after a year of relatively few COVID-19 cases, and reliant on public health interventions developed for the milder wild type of the virus. For much of 2020, there were almost no cases in Vietnam. Normally, the country reported single-digit numbers until April 2021, when the number of cases reported daily rose to over 13,000 by early September 2021 [16,61,62]. Similarly, changes in government policy (in Vietnam) on COVID-19 preventive measures could explain the large increase in cases and deaths in the second half of 2021 [61].

According to David Heyman of the London School of Hygiene and Tropical Medicine (who led the WHO's response to SARS in the region in 2003), "As governments in the region came to terms with the likelihood that the virus would become endemic and that it was already wreaking havoc within their borders, they began to look for strategies to leave with the virus". This costly decision means accepting a certain number of infections and deaths. Thailand, for example, was the first country to remove many restrictions on free movement and trade, and other countries followed suit [61,62].

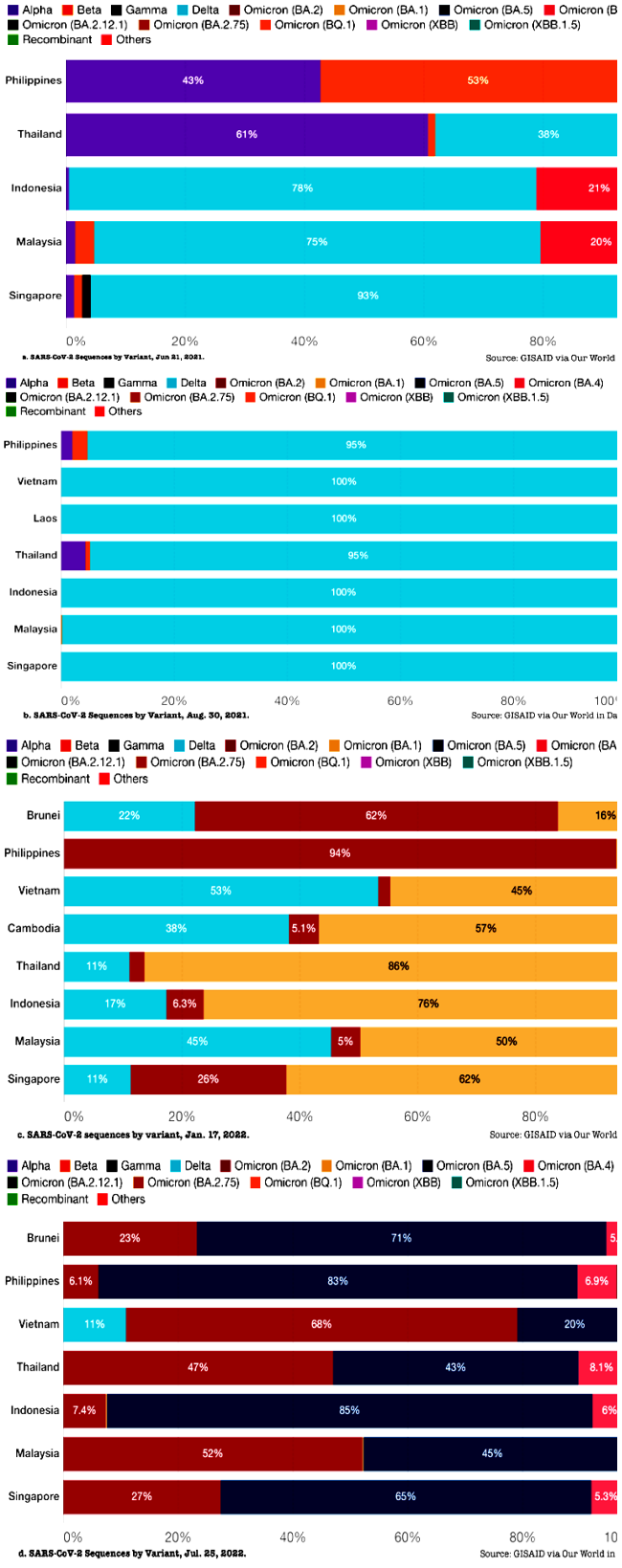

Fig. 4. SARS-CoV-2 variant sequence distributions at various stages of the Pandemic by Southeast Asian countries (based on data availability at GISAID). a. Sequence distribution for 5 countries, as of June 21st, 2021. b. Sequence distribution for 7 countries, as of Aug. 30th, 2021. c. Sequence distribution for 8 countries, as of Jan. 17th, 2022. d. Sequence distribution for 7 countries, as of July 25th, 2022 [60].

Multifaceted Government Perspective for Disease Prevention

Governments implement public health policies in different ways. However, recognizing that COVID-19 is a unique and insecure virus in multiple ways is an important strategy for containing the virus. Similarly, the information provided by WHO on COVID-19 prevention is an important source of policy references and benchmarks that all countries should follow as a guide. Singapore and Malaysia are two regional members that have put into practice the WHO recommendation to track and trace every incident [55]. Each member country has implemented the COVID-19 guidance on contact tracing at different stages of the pandemic. Many cases were reported in Thailand and the Philippines as of January 2020. However, other countries, like Indonesia and Myanmar, took longer to report any case; they did not report their first confirmed cases until March 2020 [55,63].

As the pandemic spread, countries in the region began to change their policies and adopt more stringent measures, implementing lockdowns and widespread quarantine. They also learned from other nations that successfully dealt with the pandemic. Countries such as Malaysia, Singapore, the Lao People's Democratic Republic, and Indonesia mitigated the impact of the pandemic by partially closing their borders [29]. In almost all Southeast Asian countries, the adoption of stimulus packages has been announced [35]. However, the agreement among Southeast Asian countries to establish the COVID-19 Response Fund in April 2020 is an example of a negotiated agreement. Similarly, the spread and exchange of ideas between governments show that each nation has unique characteristics, values, and cultures [64].

The regions' approach to managing and responding to crises in COVID-19 showed both parallels and contrasts. In Indonesia, for example, the president oversees strategic decision-making, while in some other countries, such as Malaysia and Singapore, the prime minister is in charge. While operational systems vary from country to country, some countries such as Indonesia and Lao PDR have task forces, others do not, and some countries use their armed forces and policies to force people to comply with quarantine. In contrast, other countries have not been as strict in implementing the strategy example, Thailand has not instituted a total lockdown in the country. Some countries have offered to provide medical assistance, while others have not. Vietnam, Lao People's Democratic Republic, Singapore, and Brunei were praised for their effective measures [55,64]. Despite a second wave of the virus in Singapore, especially in dormitories of migrant workers [55].

Southeast Asian countries, like many others, faced challenges in dealing with the pandemic. These included public disagreement and blame despite successes, especially in measures to save lives and sustain the economy, which were at odds with each other. People questioned whether the government had worked effectively and quickly enough to control the outbreak. Many leaders have difficulty dealing with such problems because of conflicts between different levels of government, such as in Indonesia, Cambodia, Myanmar, and other countries [29]. Indeed, ineffective mandates, political ideals and personalities, and misunderstandings can jeopardise attempts to develop a coordinated crisis response [65].

Political and Socio-Economic Factors Influencing COVID-19 Epidemic Progression in Southeast Asia

Various socio-economic factors have influenced the worsening situation of the COVID-19 pandemic in Southeast Asian countries.

The region's diversity in terms of political and socio-cultural differences plays an important role in how individual nations approach certain issues [66]. In many Southeast Asian countries, healthcare systems are underdeveloped and there are not enough hospital beds, ventilators, and medical staff [67]. In rural areas and poorer communities, access to healthcare services is limited, leading to higher mortality rates and slower recovery. While wealthier countries such as Singapore were able to obtain early supplies of vaccines, lower-income countries such as Myanmar, Laos and Timor-Leste struggled to procure enough vaccines due to cost and logistics issues, delaying herd immunity [29,67,68].

A large proportion of the labour force in Southeast Asian countries is employed in the informal sector, where there is often no social protection such as unemployment benefits or health insurance [69,70]. Lockdowns and mobility restrictions have disproportionately affected these workers, pushing many into poverty and leading to economic instability [71,72]. The migration of people from rural to urban areas for work has led to difficulties in enforcing lockdowns and managing health protocols, further complicating efforts to combat the pandemic. Tourism, hospitality, and manufacturing are key industries in countries such as Thailand, Indonesia and the Philippines that have been severely affected by the pandemic and where many jobs have been lost [73,74].

In Timor-Leste, economic dependence on agriculture and a small tourism sector has exacerbated the impact of the pandemic [75]. In many Southeast Asian countries, social safety nets were insufficient to support people during the lockdowns [13,75,76]. Governments did provide some financial assistance, but the scope and scale were often insufficient [29,74,76–82], meaning that many people did not receive enough support to survive the economic consequences. Large cities such as Jakarta, Manila, Yangon, and Bangkok have high population densities, making it difficult to implement and monitor social distancing measures [83,84]. Slums and low-income areas often lack adequate sanitation facilities, which contributes to the rapid spread of the virus [85,86]. High poverty rates in countries such as Cambodia, Laos, Myanmar, and Timor-Leste make it difficult for people to access essentials such as healthcare, nutritious food, and sanitation, which are crucial for disease prevention and recovery [77]. Poor nutrition weakens the immune system and makes people more vulnerable to severe consequences of COVID-19.

Southeast Asian governments have implemented various strategies to contain the pandemic, with varying degrees of success [13,29]. Countries such as Vietnam initially managed to contain the virus well [47], but others, such as Indonesia and the Philippines, struggled with inconsistent lockdown enforcement, misinformation, and limited health resources [68,87,88]. In countries with lower public trust in state institutions, such as Myanmar, where political instability exacerbated the crisis, there was resistance to lockdowns, mask-wearing, and vaccination campaigns [10,29]. This undermined efforts to control the pandemic.

Many Southeast Asian countries are highly dependent on migrant workers from neighbouring countries. These countries can be divided into sending countries (Laos, Indonesia, Cambodia, Philippines, and Myanmar) and receiving countries (Singapore, Malaysia, Thailand, and Brunei) [89]. The closure of borders and restrictions on freedom of movement have led to labour shortages, particularly in sectors such as agriculture and construction. An important issue is the impact of foreign labour and migration on the number of imported COVID-19 cases in the region, particularly in Singapore [90]. Migrant workers in Singapore, who often live in cramped accommodations (dormitories), have been vulnerable to COVID-19 outbreaks and their displacement has led to economic disruption.

The COVID-19 Vaccination Campaign and the Change in the Pandemic Narrative

Singapore was the first country in the region to start vaccinating its citizens and residents against COVID-19 as early as 30 December 2020 [91]. Similarly, Indonesia adopted a Chinese-produced vaccine from Beijing-based Sinovac Life Sciences on 13 January 2021 [92]. Since then, various sources have supplied vaccines in several stages to Southeast Asian countries such as Malaysia, Thailand, Laos, Myanmar, Cambodia, and Vietnam. Consequently, all Southeast Asian countries have started large-scale vaccination campaigns before the end of April 2021, with Timor-Leste being the last country in the region to receive vaccines [93].

This progress is commendable for the region's recovery efforts. However, disparities in access to vaccines between countries are a cause for concern for vaccine-dependent countries such as those in Southeast Asia. Nevertheless, in 2020, Southeast Asia proved that it could mitigate the severe impact of contagion through lockdowns, restrictions on movement and gatherings, the wearing of masks, and physical distancing [41]. However, with the emergence of highly infectious viral variants, these approaches proved insufficient to successfully control COVID-19. Extensive vaccination campaigns are needed in Southeast Asia to keep pace with emerging variants. Moreover, the region has been constrained by a lack of vaccines and other medical supplies. Low-income countries in the region have needed substantial assistance from foreign donors, not only for vaccines but also to accelerate vaccination.

Given these facts, the recent COVID-19 crisis is likely to influence how Southeast Asian nations and other vaccine-dependent countries will approach their future engagement with the emerging "vaccine giant" Southeast Asia and could develop a vaccine-dependent relationship with China, India, or Russia that will play a key role in influencing regional geopolitical relations. However, it is important to note that, Vietnam initially rejected the Chinese (Sinopharm) vaccine, however, it eventually did approve it although with limited usage compared to other vaccines [94,95]. On the other hand, the Chinese vaccine has been used in various COVID-19 vaccination campaigns in as many as seven Southeast Asian countries [96].

In addition, the region has struggled with the problem of vaccine hesitancy and related conspiracy theories that influence low public confidence in vaccination in many cultures worldwide [97]. This was particularly evident in two similar surveys in the Philippines (up to 84%) [98] and Malaysia (up to 83%) [99] of participants who felt uncertain about the safety and reliability of COVID-19 vaccines. The stated goal of vaccination campaigns, which is to promote herd immunity and ultimately transform COVID-19 into something significantly less lethal, could be hampered by such public doubts.

CONCLUSIONS

The region's experience with previous outbreaks of infectious diseases enabled it to swiftly develop a response plan that kept it resilient to the pandemic throughout the year 2020. The strategies included in this response were early detection, contact tracing, and isolation of infected people. The region's investment in medical technology and infrastructure also made a significant contribution to its capacity to properly manage the

pandemic. The complacency of the public health measures developed for the wild type of the virus somewhat put the region in confidence that they have overcome the worst of the pandemic. However, viral mutations that developed over time led to the break of resilience shown by the region before the arrival of the Delta variant. The political turmoil brought about by the national elections in some countries within the region, coupled with the porosity of their borders for immigrant workers, further aggravated the worsening situation of the pandemic in the region. The initial lagging vaccine rollout in the region, possibly due to myths and misconceptions that influence vaccine hesitancy coupled with the inequitable access to vaccines, retarded the progress of attaining herd immunity in good time. However, with individual countries' efforts in risk communication, use of media for information sharing, and robust vaccine access strategies at no distance time, most countries in the region vaccinated a higher percentage of their vulnerable population.

LIST OF ABBREVIATIONS

ASEAN: Association of Southeast Asian Nations
COVID-19: Coronavirus Disease 20219
PDR: People's Democratic Republic
Popn: Population
MERS-CoV: Middle East Respiratory Syndrome Coronavirus
SARS-CoV: Severe Acute Respiratory Syndrome Coronavirus
SARS-CoV 2: Severe Acute Respiratory Syndrome Coronavirus 2
VOCs: Variants of Concern
VUMs: Variants under Monitoring
WHO: World Health Organization

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this article.

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