

INFECTION CONTROL MEASURES OF COVID-19 IN THAILAND: ONE YEAR EXPERIENCE

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Abstract. Coronavirus disease 2019 (COVID-19) is a recent disease cause by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection. COVID-19 epidemic first appeared in Wuhan, China in December 2019 and has since become a global pandemic by the first half of 2020. The first local transmission in Thailand began in late January 2020, four weeks after discovering the first case of COVID-19 in a Chinese traveler from Wuhan, with the first wave of the epidemic occurring from March to April of the same year. Here, we summarize data on number of COVID-19 cases within the country, including those placed under a mandatory two-week state quarantine. We discuss how Thailand overcame the first COVID-19 pandemic, which employed preventive measures, public health policies, travel restrictions, and planning for eventual vaccination. A key factor was strict COVID-19 prevention measures, which included mask wearing, social distancing, state quarantine, working from home policy, smartphone tracking applications, nationwide curfew, lockdown, and restricted entry into the country. However, these measures came with social and economic costs, *viz* mental (stress) and social health problems (job loss, financial problem and suicide) among people with or suspected of COVID-19. Although Thailand successfully ended the first wave of COVID-19 outbreak by mid-2020, a new epidemic wave originating from Samut Sakhon Province in late December 2020 has posed a new challenge. The experiences from the previous outbreak was an informative result to adapt it for encounter the new wave outbreak in the future.

Keywords: COVID-19, preventive measures, public health, SARS-CoV-2, Thailand

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INTRODUCTION

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is the latest emerging viral pathogen spreading worldwide. In December 2019, a novel coronavirus emerged in Wuhan (Hubei Province), China and was officially named SARS-CoV-2 by the International Committee on Taxonomy of Viruses (ICTV) (Li *et al*, 2020; Zhou *et al*, 2020). The outbreak began with infection of individuals at or from a single seafood wholesale market (index cases) and rapidly spread to their close relatives and contacts, with the first mortality from SARS-CoV-2 infection documented on 11 January 2020 in China (WHO, 2020e). In early 2020, governments throughout the world became aware of the global spread of this virus and mounted large country-wide responses to SARS-CoV-2 outbreak, which World Health Organization (WHO) declared on 11 March 2020 as a “pandemic” (WHO, 2020a). By 11 April 2020, the virus had spread by human-to-human transmission to 167 countries with over 1 million confirmed cases of SARS-CoV-2 (WHO, 2020b).

The first SARS-CoV-2 introduction from China into another country that resulted in sustained transmission is believed to have occurred in mid-January 2020 in Bangkok, Thailand (WHO, 2020d). From mid-March to April 2020, the first wave of the epidemic started from a boxing stadium and entertainment venues in Bangkok and rapidly spread across the country (WHO Thailand, 2020a). The Thai government rapidly enacted strict containment policies and the outbreak was

significantly reduced by early May 2020 (Sirilak, 2020). Subsequent new cases were limited to imported cases in State Quarantine (SQ) Centers. From May to July, the government implemented a series of measures to ease containment policies, including reopening shopping centers, service business, canceled alcohol sale, schools/universities, fitness. (Limsawart *et al*, 2020).

However, on 17 December 2020, a new wave of SARS-CoV-2 infection occurred in Samut Sakhon Province, originating from a confirmed case of a 67-year-old stall owner who worked at Central Shrimp Market and had no history of travel outside Thailand. The vendor’s close relatives (mother, sister and sister-in-law) subsequently tested positive for the virus. The presumed index case was a fisherman from Myanmar. As of 19 December 2020, more than 500 confirmed cases were reported among Myanmar migrant workers at the same location (WHO Thailand, 2020b). While the outbreak is still continuing, some 1,000 individuals have contracted SARS-CoV-2 in over 60 provinces with Samut Sakhon Province accounting for over half of all new cases reported by late December 2020 (DDC, unpublished data). This latest wave of outbreak appears to be more extensive than the first event.

Up to 1 March 2021, globally at least 113 million confirmed cases and 2.5 million deaths have been attributed to SARS-CoV-2 infection (WHO, 2020f). The highest preliminary percent population of confirmed cases is 23% in USA, followed by 13% in India and

9% in Brazil (WHO, 2020f). As there are no promising treatments for COVID-19 infection, vaccine is the only current effective solution for prevention. At present, the arsenal of SARS-CoV-2 vaccines comprises formulation containing mRNA, viral-like particle carrier, protein subunit, or inactivated virus (Krammer, 2020; Poland *et al*, 2020). As of February 2021 more than 70 vaccine candidates have been tested on various numbers of participants in Phase I-III clinical trials (WHO, 2021c), among which at least 32 candidates are about to or in Phase III clinical trials, and 11 (BBIBP-CorV, Convidicea, CoronaVac, Covaxin, CoviVac, EpiVacCorona, Johnson & Johnson, Moderna, Oxford-AstraZeneca, Pfizer-BioNtech, and Sputnik V) have been approved for emergency or full use worldwide (Rawat *et al*, 2020; Izda *et al*, 2021) and show more than 70% effectiveness in protecting against mild and serious COVID-19 (Polack *et al*, 2020; Logunov *et al*, 2021; Torjesen, 2021).

In response to the first wave of SARS-CoV-2 epidemic in 2020, the Thai Government introduced control measures comprising universal wearing of mouth and nose mask, hand washing with disinfectants, social distancing, and avoidance of unnecessary out-door gathering (Limsawart *et al*, 2020). In addition, travel outside provincial boundaries and large family/public gatherings during the Thai New Year (Songkran) holidays (April 13-15) were prohibited, allowing successful control of COVID-19 epidemic. Here, we present data on one year of clinical and

health-related experiences, including infection prevention and control measures, of COVID-19 in Thailand.

MATERIAL AND METHODS

Data sources

Data used in the study were primarily obtained from the official database of the Department of Disease Control (DDC), Ministry of Public Health (MoPH), Thailand. Additional information was obtained from websites, including those of WHO and the Administration of the Situation Due to the Outbreak of the Communicable Disease Coronavirus 2019, Office of the Prime Minister, Thailand. All COVID-19 confirmed cases identified before 14 January 2021 were included.

Ethical consideration

Approval from the Institutional Review Board Ethics committee was not required as this was a retrospective descriptive study of databases on COVID-19 situation in Thailand.

RESULTS

Incidences of COVID-19 in Thailand, 13 January 2020 - 13 January 2021

On 3 January 2020, MoPH Thailand formed an Emergency Operations Centre (EOC) and instructed authorities at Suvarnabhumi International Airport to establish a special screening procedure to detect suspected COVID-19 cases entering the country. The first confirmed case of COVID-19 in Thailand was a 61-year-old Chinese female resident of Wuhan, China who was identified using a thermal surveillance

camera upon arrival at Suvarnabhumi International Airport on 12 January 2020 (Okada *et al*, 2020). Then another 19 confirmed cases, mostly individuals from China, were identified on 31 January 2020 at Suvarnabhumi International Airport. The first case of local transmission in Thailand was reported in a taxi driver in Bangkok on 31 January 2020 following contact with Chinese tourist passengers with frequent coughing but who wore masks; the taxi driver had no history of travel to China (Pongpirul *et al*, 2020). MoPH, on 30 January 2020, began tracing contacts to control SARS-CoV-2 transmission. A state of emergency was announced on 26 March 2020 of a nationwide lockdown and curfew (22:00 - 04:00 h) resulting in a drop of new indigenous COVID-19 cases from 1,181 cases in April to 41 cases in May. This allowed the Thai government to introduce on 3 May the first of six phases towards return to a normal situation, whereby restaurants, markets, supermarkets, outdoor sports avenues, salons, barbershop, and pet grooming clinics were permitted to re-open. On 3 May 2020, the second phase included medical clinics and fitness centers located outside shopping malls, and limited curfew to 22.00 - 04.00 h. The third phase introduced on 1 June consisted of three control measures, namely, installation at all indoor public places a check-in and check-out "Thai Cha Na app" and a body temperature sensor, reduction of curfew to 23.00 - 04.00 h and unrestricted travel across province borders. The fourth phase, announced on 15 June 2020, abolished the curfew and allowed

work-from-home, but urged the public to continue with hand washing with disinfectants, wearing face masks and social distancing. In the fifth phase, introduced on 1 July, schools were allowed to open, and on 22 July final (sixth) phase foreign visitors and migrant workers were permitted to enter/work in the country but must be registered with the appropriate governmental agency.

COVID-19 epidemic first wave

The first wave of COVID-19 outbreak in Thailand occurred from March to April 2020 originating from several transmission clusters: a Muay Thai (kick-boxing) stadium and several nightclubs, restaurants and entertainment venues located in Thonglor area of Bangkok. In the first epidemic wave, more than 100 new cases of COVID-19 were reported daily, leading to the Government's immediate re-instatement of stringent precautionary measures: nationwide curfews, lockdown measures, closing of entertainment venues and crowded gatherings, together with a campaign to "stay home, stop virus, save nation". Both domestic and international flights were suspended in early April, and individuals entering the country from regions with COVID-19 epidemic were required to remain in a state quarantine (SQ) facility for 14 days (CCSA, 2020b). The DDC, MoPH introduced a smartphone "Thai Chana app" using a QR code to record time of check-in and check-out crowded areas, such department stores, restaurants and supermarkets, which has now become a normal practice.

The number of confirmed new cases began to decline in April and by early May new cases were mostly confined to travelers in SQ facilities. Eventually, the DDC, MoPH announced that for a period of 100 days (from early June to September) the country was free of local COVID-19 cases and that the first epidemic wave had come to an end.

New wave of COVID-19 epidemic

In December 2020, a COVID-19 outbreak was detected in Samut Sakhon Province, the majority of cases being migrant workers from Myanmar working at the Central Shrimp Market and, in the beginning, transmitted among local residents who frequented the market. However, COVID-19 rapidly spread out to other regions of the country, including Bangkok, Chonburi Rayong, and Samut Prakarn Provinces. In this new epidemic wave, clusters of significant transmissions were illegal gambling venues. As the numbers of confirmed new COVID-19 cases dramatically increased daily, the Administration of the Situation Due to the Outbreak of the Communicable Disease Coronavirus 2019 launched measures to control local transmission during the New Year holiday period. These measures differed from regulations enacted in the first wave in that they did not include nationwide curfew or lockdown but divided areas of COVID-19 outbreaks into four zones, namely red, orange, yellow, and green, with red having the highest rate and green absence of new COVID-19 cases (CCSA, 2020a).

Timelines

The timelines of new COVID-19 cases and of government preventive measures are shown in Fig 1. The first COVID-19 case in Thailand was reported on 13 January 2020 and by the end of January there were 19 confirmed cases in the country. Several transmission clusters were identified beginning in March and the number of confirmed new cases arose to 89 cases on 21 March (week 10 after report of the first case) and was the highest number of the first epidemic wave (Fig 2). New COVID-19 cases rose quickly during week 10 to week 14, followed by a significant decline during week 15 to week 18 after the Government preventive measures were launched, and remained stable from week 18 to week 49.

COVID-19 situation has worsened because of the second wave of the pandemic, with a steep rise at week 50, when the number of infected people dramatically increased within 2 days (Fig 2). On 20 December, 576 cases were confirmed in one day, a new high. However, the number of new cases fluctuated between week 50 and week 53. Numbers of confirmed hospitalized patients increased from week 49, although rate of recovery slightly increased.

State quarantine (SQ)

The first compulsory SQ was initiated with Thai citizens ($n = 138$) who returned from Wuhan, China during 4 - 18 February 2020. Subsequently, many Thai citizens requested permission to travel home or were smuggled into Thailand. Thus, the

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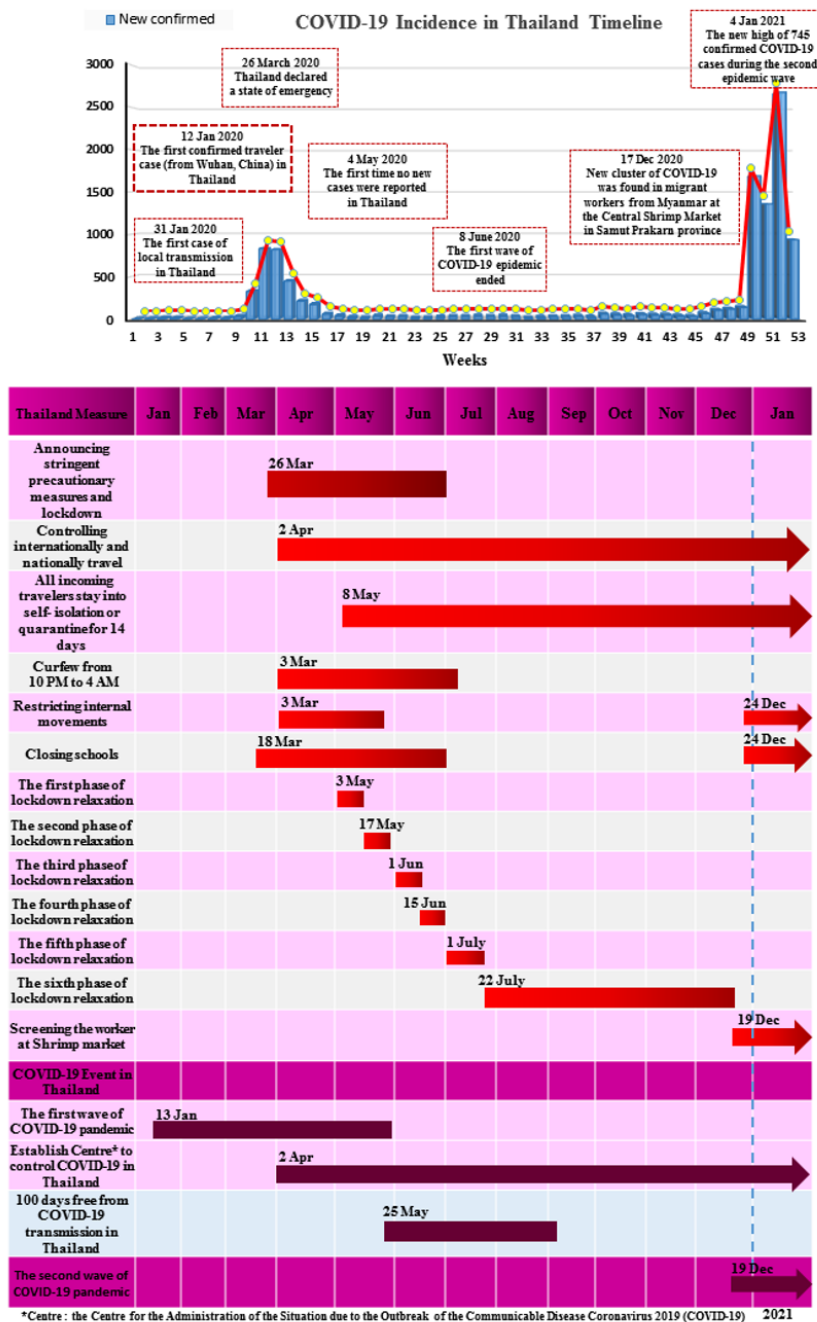


Fig 1 - Timeline of new COVID-19 cases and of government preventive measures in Thailand (13 January 2020 – 13 January 2021).

Note: Information derived from CCSA, 2020a; Limsawart *et al*, 2020; and DDC's unpublished source

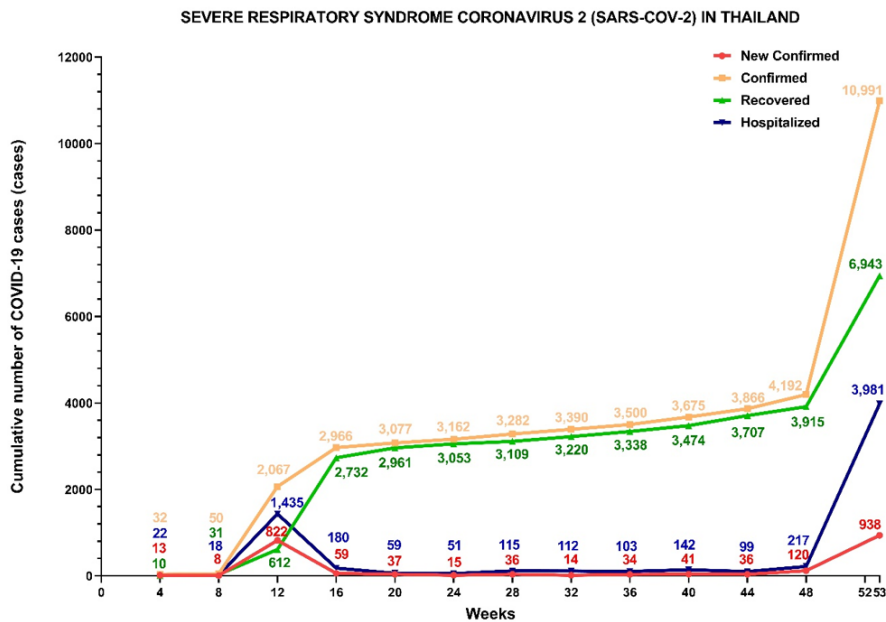


Fig 2 - Trends in patients with severe respiratory syndrome coronavirus 2 (SARS-CoV-2) infection in Thailand (13 January 2020 - 13 January 2021)

Note: Data derived from DDC's unpublished source

Thai government established the “State quarantine policy” on 4 March 2020, which mandated isolation of persons entering the country who might have previously been exposed to COVID-19 (Limsawart *et al*, 2020). The government identified locations suitable for establishing quarantine centres and also described for certain visitors from COVID-19-affected countries a “self-quarantine” category consisting of minimizing social contact and wearing of mask if traveling in crowded public areas.

As part of its quarantine policy, the Thai government placed restrictions on

foreigners entering Thailand, requiring mandatory 14-day quarantine upon entry, even though they may have a medical certificate of SARS-CoV-2-free status from their own countries. Two types of quarantine options were authorized for Thai nationals returning by air, namely, SQ or local SQ. Those arriving via land and sea were required to be quarantine at a facility specified by the Thai government (*ie* MoPH, Ministry of Defence and Ministry of Interior) for that entry point. Cost of quarantine for Thai citizens was subsidized by the state. During the quarantine period, individuals observed with presentation of COVID-19

signs or symptoms were examined for presence of SARS-CoV-2 by RT-PCR assay of nasal swabs. A virus-positive subject (Patient under Investigation) was admitted to the hospital. Alternative state quarantine (ASQ), hotels and private hospitals certified by MoPH and the Ministry of Defence, were available for foreign visitors or Thai people who preferred to pay for their quarantine costs. Currently, Relative Risk Country Guidelines issued by The DDC, MoPH set out the SQ requirement criteria for visitors from each country.

Key criteria for ASQ certification are (i) building structure safe for occupancy, with each room having a separate air conditioning system and a telemedicine system; (ii) presence of nurses on premise 24 hours, with physicians available for consultation through the telemedicine system; (iii) adequate facilities for live-in occupants throughout the 14-day quarantine period; (iv) adequate emergency and first-aid medical supplies and personal protective equipment, *eg* alcohol gel, face mask and body temperature sensing device; (v) state certified infectious waste management and wastewater treatment system; and (vi) collaborating hospitals providing medical and supportive facilities.

From the time the Thai Government announced SQ policies on 4 March 2020, total number of foreign visitors tested positive for SARS-CoV-2 is 14.8% (563/3,807), highest from Myanmar 77.0% (2,930 persons), followed by Cambodia 3.4% (129 persons) then India 2.2% (84 persons) (DDC, unpublished data).

COVID-19 prevalence, mortality and associated comorbidities

From 13 January 2020 to 13 January 2021, data of all confirmed COVID-19 cases recorded by MoPH showed 10,991 cases of SARS-CoV-2 infection, 4,505 (40.99%) males and 4,875 (44.35%) females, with gender not reported in 1,611 (14.66%) cases. Total confirmed cases, including in SQ, outside SQ, local transmission, and the active case finding are 1,618, 582, 5,785, and 3,006, respectively, among whom 6,943 (63.2%) recovered, 3,981 (36.2%) undergoing treatment and 69 (0.6%) died (DDC, unpublished data). Distribution of COVID-19 patients according to age are as follows: ≤ 10 years old, $n = 191$, 1.74%; 11-20 years old, $n = 471$, 4.29%; 31-40 years old, $n = 1,935$, 17.61%; 41-50 years old, $n = 1,527$, 13.89%; 51-60 years old, $n = 1,079$, 9.82%; 61-70 years old, $n = 522$, 4.75%; 71-80 years old, $n = 160$, 1.46%; 81-90 years of age, $n = 33$, 0.30%; and 91-100 years old, $n = 4$, 0.04%. Average patients' age is 38 years old, majority being 21-30 years old (20.08%), and youngest and oldest being 0.1 and 97 years old respectively. The majority of COVID-19 cases are localized to central Thailand, especially Samut Sakhon Province and Bangkok ($n = 6,154$) and distributed outwards throughout the country: central ($n = 9,746$), southern ($n = 781$), northern ($n = 307$), and northeastern (Isan) ($n = 157$) regions (Fig 3) (DDC, unpublished data).

The first confirmed COVID-19 death in Thailand was reported on 1 March 2020. In late January of the same year, the patient was initially diagnosed with

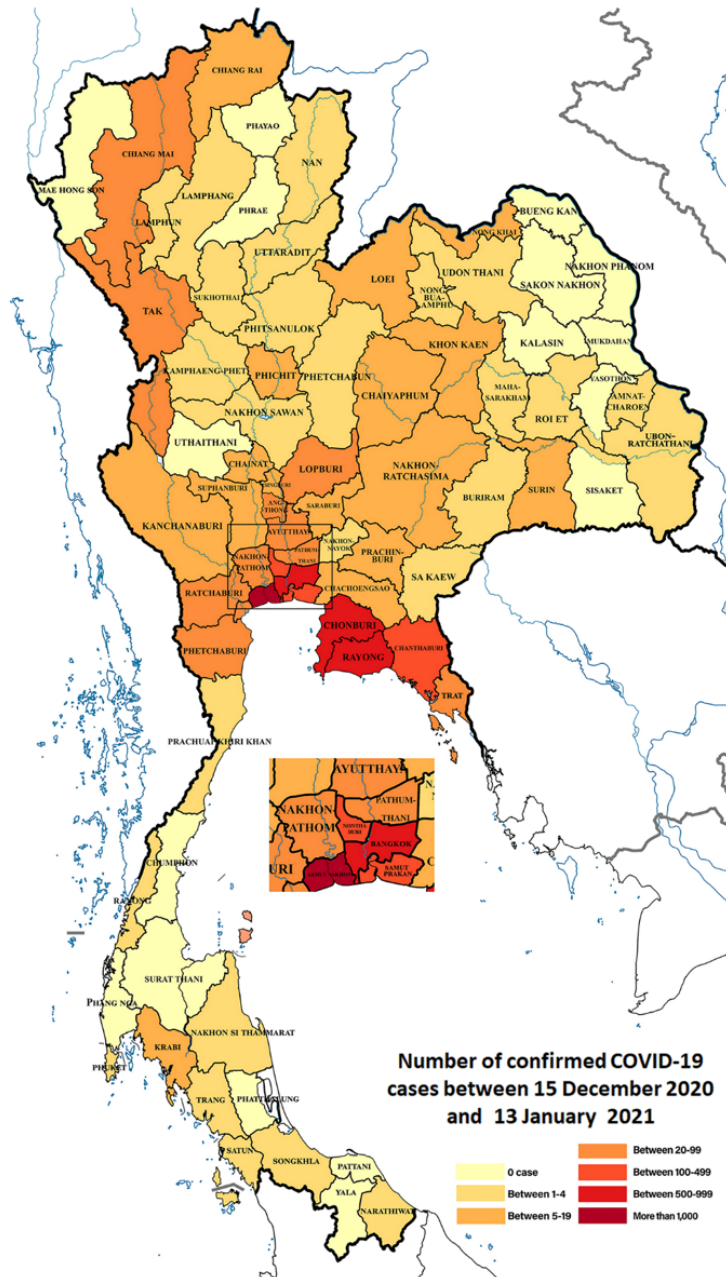


Fig 3 - Distribution of SARS-CoV-2 positive cases in Thailand (15 December 2020 - 13 January 2021)

Data derived from DDC's unpublished source

dengue fever and received treatment for COVID-19 after testing positive on 21 February 2020, and succumbed from multiple organ failures on 29 February 2020. Of COVID-19 deaths, 54 were males and 15 females, with mean age of 60 years old and most in middle age group and none below 28 years of age (Fig 4). Number of mortalities with one comorbidity, >1 comorbidity and severe symptoms without comorbidity was 10, 28 and 24, respectively (DDC, unpublished data). The two most common comorbidities among COVID-19 mortalities were diabetes (26 cases, 38%) and hypertension (17 cases, 25%) (Fig 5).

Associated negative impacts of COVID-19 on societal health were significant. Lockdowns and loss of foreign tourists affected people in the hospitality industry, which in turn affected those who catered to hospitality workers, and the domino effects resulted in job loss, financial problems, mental stress, and suicidal tendencies. The Department of Mental Health (DMH), MoPH reported the national suicide rate increases from 6/100,000 population in 2016 to 7.3/100,000 in 2020 (DMH, 2021).

DISCUSSION

From the start of COVID-19 pandemic in Wuhan, China at the end of 2019, in the Southeast Asian region, Indonesia was initially the most affected with 869,600 positive cases and 25,246 deaths by mid-January 2021, followed by the Philippines (494,605 cases, 9,739 deaths) (WHO, 2021b) and Malaysia (147,855 cases, 578 deaths) (WHO, 2021a).

Thailand was the first country to report transmission of COVID-19 outside of the Peoples Republic of China (Okada, 2020). In the first epidemic wave type T viral genotypes were found at the boxing stadium cluster and types GH, GR, and T at entertainment venue clusters and among foreign visitors entering the country (Puenpa *et al*, 2020). Although local COVID-19 transmission had risen continuously to some 3,000 cases in late April 2020, Thailand responded immediately to the outbreak and was successful in controlling the epidemic resulting in no new cases after 25 May 2020 (until the second epidemic wave in December of the same year).

There are five key lessons from Thailand's management of COVID-19 (first wave) epidemic. Firstly, more than 1,000 public hospitals, 10,000 primary healthcare workers and 1 million village health volunteers provided prompt supportive services to patients with COVID-19. Secondly, Thailand has a strong health care system, providing universal health coverage since 2002 for all Thais. During the COVID-19 pandemic, foreign visitors were treated gratis. Thirdly, village health volunteers working in their local areas visited villagers to determine active cases and performed disease surveillance and assisted in maintaining quarantine facilities. Fourthly, the Thai government was rapid to recognize the potential severity of the epidemic and established the Center for COVID-19 Situation Administration (CCSA) under the Prime Minister to facilitate disease control (CCSA, 2020a). Personal protection and enhanced hygiene practices, such as

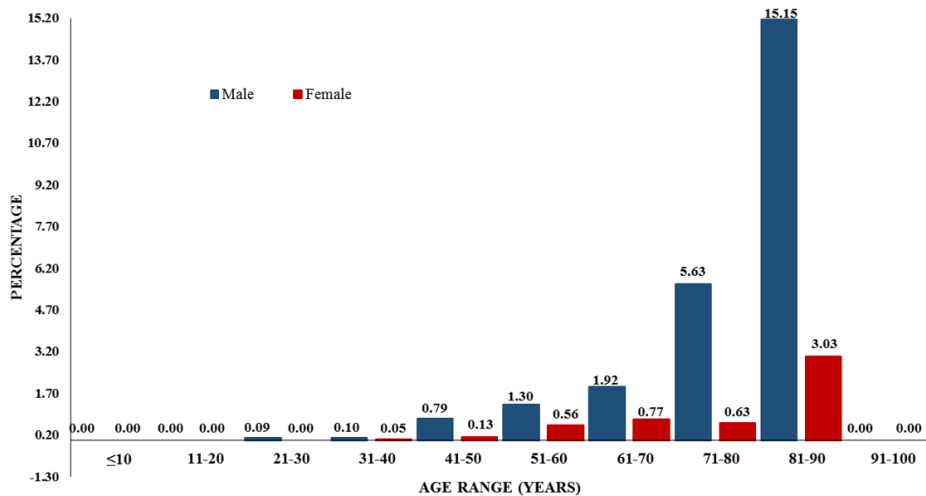


Fig 4 - Percent COVID-19 mortality among age groups and gender in Thailand (13 January 2020 - 13 January 2021)

Data derived from DDC's unpublished source

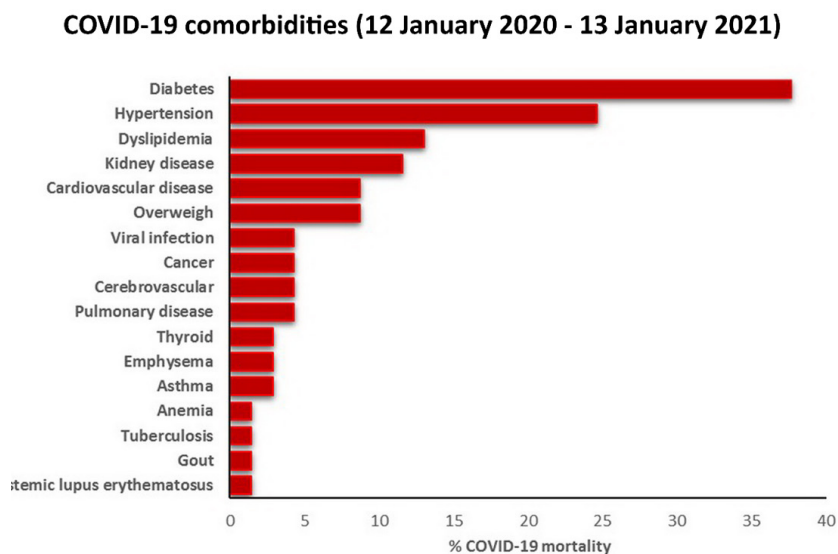


Fig 5 - Comorbidities among COVID-19 mortalities in Thailand (13 January 2020 - 13 January 2021)

Data derived from DDC's unpublished source

frequent hand washing, wearing nose and mouth mask and social distancing (≥ 1 m), contributed to lowering COVID-19 transmission risk levels (Doung-Ngern *et al*, 2020). A MoPH survey (from 15 May 2020 to 15 Jan 2021) found a significant increase in number of people wearing face masks, ~87% in the first COVID-19 epidemic wave. Fifthly, the Government maintained and updated daily records of COVID-19 cases and high-risk contact persons to enable rapid changes in control and prevention policies (MoPH, unpublished data).

Thailand launched a variety of preventive measures, such as lockdown, curfew, state and private quarantine facilities and different degrees of zoning restrictions. In addition, the Government took advantage of digital technology to introduce smartphone applications, such as “Mor Chana” and “Thai Chana”, to allow real-time identification of persons with potential risk of COVID-19 transmission and alert high-risk contacts to curtail possible transmission. This appeared to be a key factor in achieving effective control of transmission, as it allowed identification and isolation of SARS-CoV-2 positive individuals for prompt treatment should COVID-19 symptoms appear.

Nevertheless, Thailand is now facing a second COVID-19 epidemic wave beginning in December 2020 from clusters in Samut Sakhon Province, traced to illegal Myanmar migrant workers. Genotypes of the second wave SARS-CoV-2 were GH type, common in India and Myanmar (MoPH, 2020). Re-emergence of COVID-19 in Thailand

with new variants underscores how a lapse in good governance and social responsibility can quickly unravel all previous preventive measures won through hard work and diligence.

It is our hope that a new normal lifestyle, strong protective measures and an effective vaccine can sufficiently control the current (and possibly future) COVID-19 epidemic. However, the efficacy of vaccines applied to a large population and the length of time immunity persists after vaccination remain unknown. Thus, the results described in this study should provide lessons that could be successfully applied to control and prevent ongoing and future COVID-19 outbreaks while awaiting population-wide vaccination.

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