

## Controlling COVID-19 with limited resources: The case of Viet Nam

### Kiểm soát thành công dịch COVID-19 với nguồn lực hạn chế: Trường hợp của Việt Nam

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### Abstract

This study focuses on the disease's epidemiology, the government's responses, and possible cultural factors that may be helping to restrain the COVID-19 pandemic in Viet Nam. This report covers the period from Jan. 23rd to Nov. 26<sup>th</sup>, 2020 and draws on data publicly available on "https://ncov.moh.gov.vn/" provided by the Vietnamese Ministry of Health (MOH). Since the first reported case in Viet Nam on Jan. 23<sup>rd</sup> 2020 until Nov. 26<sup>th</sup> 2020, only 1321 cases of COVID-19 were reported, with 35 deaths. Appropriate quarantining, tracing contacts, testing, social distancing and public health messaging were important to contain COVID-19 outbreaks and reduce spreading in the country. Additionally, hygiene behaviors in daily activities also helped to restrain the pandemic. Lessons learnt in Viet Nam provide details and additional choices for further improvements in controlling the pandemic in countries with similar

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circumstances. The lessons may help in tackling the COVID-19 threat and saving resources during the pandemic in other countries and regions.

*Keywords:* SARS-CoV-2; restraining COVID-19; Government's response; social distancing.

## Tóm tắt

Nghiên cứu này tập trung vào các yếu tố dịch tễ học của bệnh, phản ứng của chính phủ và các yếu tố văn hóa có thể giúp hạn chế đại dịch COVID-19 ở Việt Nam. Báo cáo này thực hiện trong khoảng thời gian từ ngày 23 tháng 1 đến ngày 26 tháng 11 năm 2020 và dựa trên dữ liệu công khai do Bộ Y tế Việt Nam cung cấp. Kể từ trường hợp đầu tiên được ghi nhận tại Việt Nam vào ngày 23 tháng 1, chỉ có 1321 trường hợp nhiễm COVID-19, với 35 trường hợp tử vong cho đến ngày 26 tháng 11. Việc cách ly thích hợp, truy vết các trường hợp tiếp xúc F0, xét nghiệm trên diện rộng, giãn cách xã hội và khai báo y tế là rất quan trọng để ngăn chặn sự bùng phát COVID-19 và giảm sự lây lan trong nước. Ngoài ra, các thói quen vệ sinh trong sinh hoạt hàng ngày cũng giúp hạn chế đại dịch. Các bài học từ Việt Nam cung cấp thông tin chi tiết và các lựa chọn bổ sung để cải thiện hơn nữa trong việc kiểm soát đại dịch ở các nước có hoàn cảnh tương tự. Các bài học từ Việt Nam có thể giúp giải quyết mối đe dọa COVID-19 và tiết kiệm tài nguyên trong thời kỳ đại dịch đang lan rộng ở các quốc gia và khu vực khác.

*Từ khóa:* Kiểm soát COVID-19; SARS-CoV-2; phản ứng của Chính phủ; giãn cách xã hội.

## 1. Introduction

The novel coronavirus disease 2019 (COVID-19), caused by the severe acute respiratory syndrome (SARS) coronavirus 2 (SARS-CoV-2), was initially reported on Dec. 31<sup>st</sup>, 2019 [1]. Viet Nam was considered highly vulnerable to an outbreak for three reasons. Firstly, Viet Nam has high volumes of trade with countries which have been facing difficulties in controlling the outbreaks, and therefore the possibility of significant cross-border virus traffic [2]. Secondly, tourism is an increasingly important industry in Viet Nam, with 18 million international visitors in 2019 [3]. Tourism therefore also posed a significant risk of spreading COVID-19 in Viet Nam. The third risk factor involved the migration of Vietnamese citizens and descents “back home” from areas affected by COVID-19, which included approximately 10,000 people in the first three months of the pandemic [4].

Since the first COVID-19 case was reported in Viet Nam on Jan. 23<sup>th</sup>, until Nov. 26<sup>th</sup>, there have been, according to the Vietnamese Ministry of Health, 1321 reported cases and 35 deaths in the country [5]. Assuming these reports are accurate, these figures are astoundingly low. How can Viet Nam have

gained such an impressive early result in restraining the COVID-19 pandemic, when many other countries and regions have struggled? Several factors have likely contributed, including swift action by the authorities and widespread public compliance to health decrees among citizens. Government actions include various levels of quarantine, testing, public health messaging, and historically and culturally rooted public compliance. Previous infectious disease outbreaks, including SARS, have sensitized the Vietnamese public to protocols for disease prevention in pandemic. This report describes and discusses the COVID-19 situation in Viet Nam, focusing on the disease's epidemiology, the government's responses, and possible cultural factors that may be helping to restrain the pandemic in Viet Nam. The paper hopes to contribute to the growing literature on public health responses to the COVID-19 pandemic, particularly from the perspective of regions where there is evidence of early success in managing the disease.

## 2. Materials and methods

This report covers the period from Jan. 23<sup>rd</sup> to Nov. 26<sup>th</sup>, 2020 and draws on data publicly available on “<https://ncov.moh.gov.vn/>”

provided by the Vietnamese Ministry of Health (MOH) [5]. Patient data were derived from “https://ncov.moh.gov.vn/dong-thoi-gian” and the website of the Vietnamese Center for Disease Control, “https://ncov.vncdc.gov.vn”. By Nov. 26<sup>th</sup>, Viet Nam had reported 1321 cases in total [5], and no new cases in communities from Sep. 5<sup>th</sup> to Nov. 26<sup>th</sup>.

The infections inside the country were divided in two groups: cases in communities and hospital-related cases. Therein, the infections in communities happened in the first two waves before Apr. 16<sup>th</sup>. Whereas the third wave happened in hospitals, from Jul. 25<sup>th</sup> to Sept. 4<sup>th</sup>, mostly among patients who had been hospitalized and treated for other severe conditions and their caregivers and family members. Data on the first two waves were analysed for epidemiology of the diseases. The third wave, due to its specific group of patients and the information insufficiency, was analysed separately for the death cases.

Due to a lack of data on 499 “back-home” and non-citizen, imported cases after May 4<sup>th</sup>, these also were subtracted from the analysis.

Data were managed in Microsoft Office Version 2016, including illustrative announcements from the National Steering Committee and local authorities collected from newspaper websites.

Publicly available representations of COVID-19, including narratives of the disease’s origins and spread, were collected from online sources and the print media to illustrate key attitudes and perceptions toward the control of the disease in this country.

Based on personal information of patients and outbreaks, several individuals who were quarantined in citizen blocks or centers and relative health veterans were contacted. Information from “inside” served as a parallel source of information and for independently evaluating the confidence of the published data.

### 3. Results

#### 3.1. Epidemiology of COVID-19 in Viet Nam

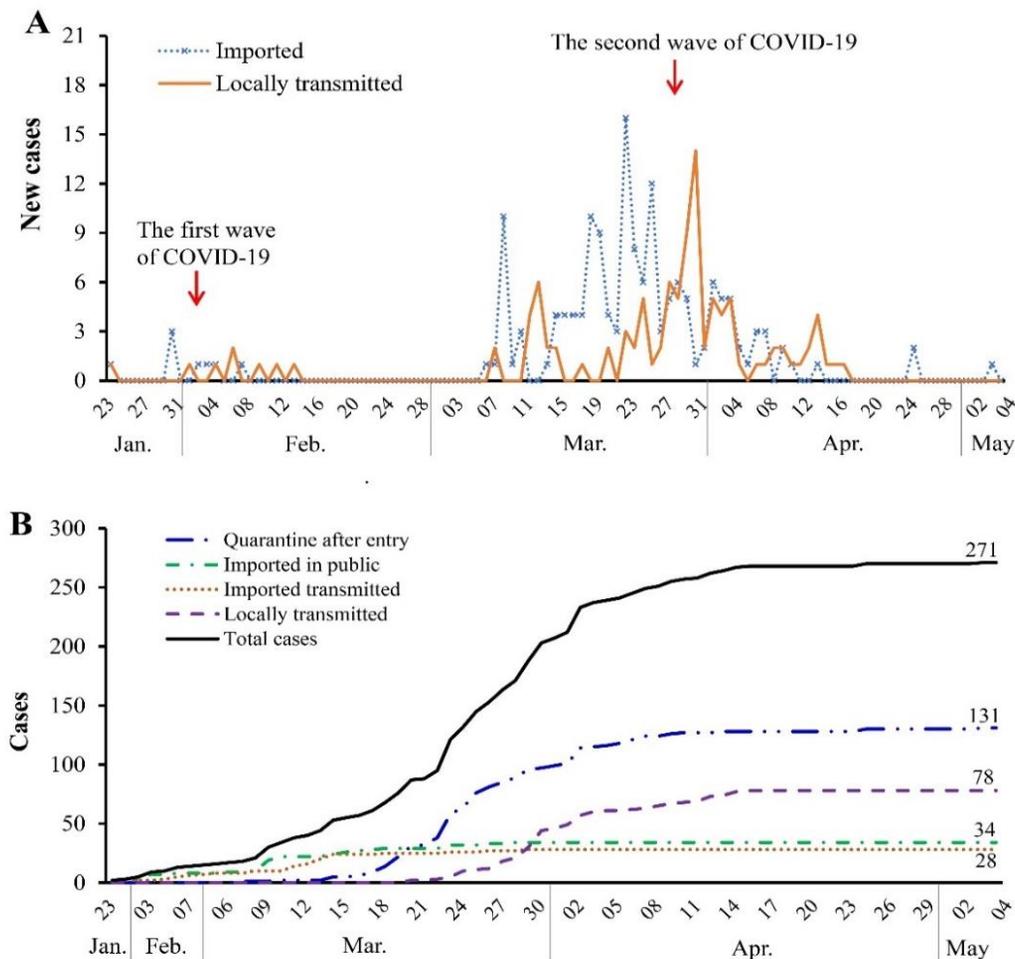
##### 3.1.1. Waves, infection sources

Effects of COVID-19 in Viet Nam can be characterized by five main phases (Table 1) and three “waves”. The first outbreak with two waves spread Covid-19 (Fig. 1). In the first “wave”, from Jan. 23<sup>rd</sup> to Mar. 3<sup>rd</sup>, 16 cases were confirmed in Viet Nam (Table 1). In the second wave, from Mar. 4<sup>th</sup> to May 4<sup>th</sup>, 255 cases were reported (Table 1 and Fig. 1). No new cases in communities were reported from Apr. 16<sup>th</sup> to Jul. 24<sup>th</sup>. There were 551 confirmed cases inside the country in the third wave from Jul. 25<sup>th</sup> to Sept. 4<sup>th</sup> (Table 1). There were also 388 imported cases (back-home and non-citizens) since Jul. 25<sup>th</sup> (Table 1).

**Table 1.** Six phases of COVID-19 in Viet Nam.

Phase	Period	New cases	Description
Phase 0	To Jan. 23 <sup>rd</sup>	0	No cases in Viet Nam. The virus spread in China.
Phase 1	Jan. 23 <sup>rd</sup> to Mar. 3 <sup>rd</sup>	16	Cases reported in Viet Nam were typically people with a travel history to China.
Phase 2	Mar. 4 <sup>th</sup> to Mar. 19 <sup>th</sup>	69	The virus started spreading globally; it was still traceable and quarantine suspected cases.
Phase 3	Mar. 20 <sup>th</sup> to Apr. 16 <sup>th</sup>	183	Community-level infection occurred and several outbreaks appeared. The original sources of the infections were not traceable.

Phase 4	Apr. 17 <sup>th</sup> to Jul. 24 <sup>th</sup>	145	No new cases in communities. The pandemic is restrained, “new normal” stage is applied with high alert.
Phase 5	Jul. 25 <sup>th</sup> to Sep. 4 <sup>th</sup>	634	Discovering new infections spreading from hospitals in Da Nang city (551 cases). Re-launching social isolation measures in localities is epidemic
Phase 6	Sep. 5 <sup>th</sup> to present	274	No new cases in communities The pandemic is restrained again, anti-epidemic "longer and more muscle tension", and along with social-economic development



**Figure 1.** Positive cases in Viet Nam: (A) New case daily; (B) Characteristic of transmission; (C) Total cases. Total imported = Quarantine after entry + Imported in public; Total locally transmitted = Locally transmitted + Imported transmitted.

Fig. 2 summarizes the known or suspected sources and chains of infection of COVID-19 in Viet Nam. Among 16 cases in Phase 1, nine cases were infected outside the country. In contrast to increasing COVID-19 outbreaks elsewhere in the world, no new infections were reported in the last two week of February. The

second wave of COVID-19 in Viet Nam started with “Patient 17”, who returned from London on Mar. 1st (Fig. 2, 017VN). Of particular note was a “superspreader”, Patient 34, who arrived from New York on Mar. 2nd and associated with 11 additional cases (Fig. 2, 034VN). The first concentrated outbreak at the community

level was associated with an entertainment venue, the Buddha Bar & Grill, in Ho Chi Minh City. Although the source of infection here was most likely someone who had recently arrived from abroad (Patient 91 or 158), authorities were unable to determine the identity of “patient zero” in this outbreak. Among confirmed cases, the 97<sup>th</sup> case was also associated with the Buddha Bar & Grill, while the 98<sup>th</sup> case was a traveller from Malaysia. Travel from the UK was associated with 59 confirmed cases, nearly four times higher than the number of cases coming from France, the second biggest infection source (Fig. 3).

An outbreak in Bach Mai Hospital, one of the biggest hospitals in Hanoi and the country, was associated with non-identification of a patient zero. Fortunately, it was rapidly contained (Fig. 2, Bach Mai hospital). More than 5000 health care workers, patients and food-supplying workers were tested and quarantined at the hospital. In addition, another 40,000 people who had been at the hospital were tracked down and asked to self-quarantine at home, without any surveillance means [6]. In total, there were 58 confirmed cases in the outbreak at Bach Mai Hospital, including 27 from food supply company (Fig. 2, Truong Sinh company) and 12 from Ha Loi community (Fig. 2, 243VN) [7].

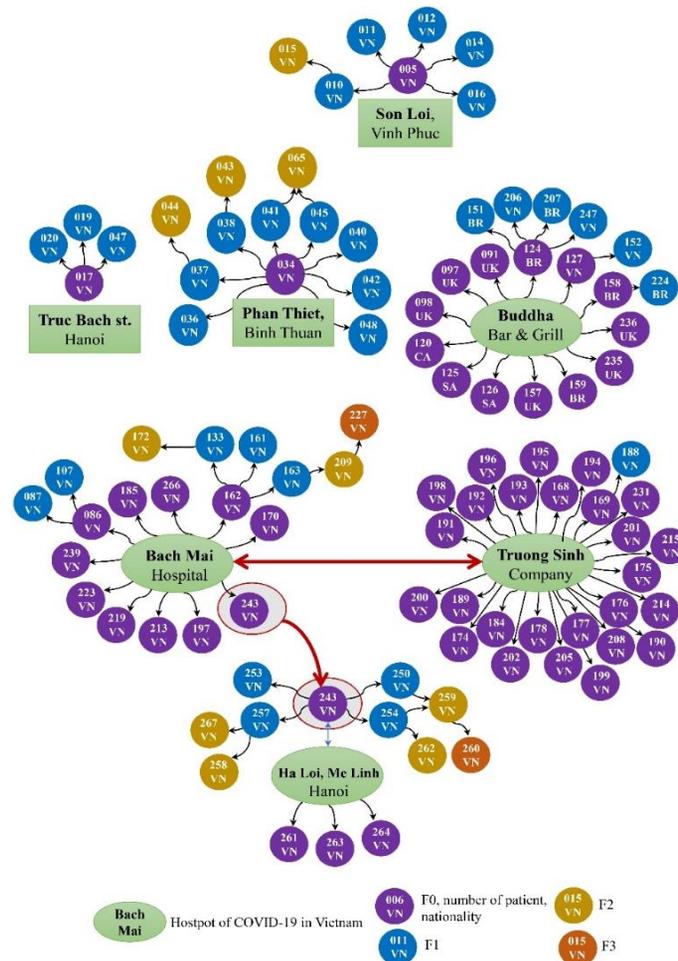
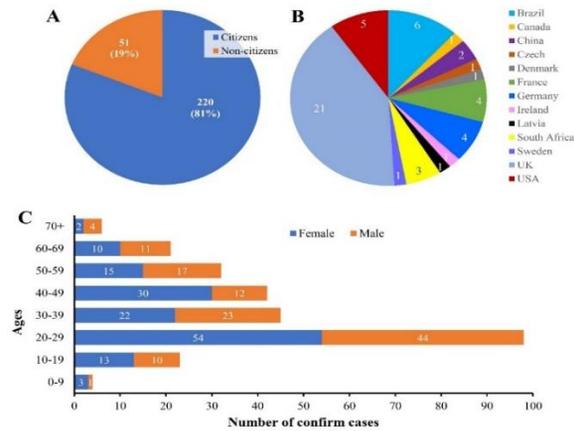


Figure 2. Infection sources and chains of outbreaks in Viet Nam.



**Figure 3.** Patients by nationalities (A, B), and by sexes and ages (C) of COVID-19 in Viet Nam (MOH data, May 4<sup>th</sup>).

### 3.1.2. Tracing contacts of the sources

In Viet Nam, people who had contact with confirmed cases (F0) during their incubation time were classified as F1 individuals, those with contact to F1 individuals were classified as F2, and so forth. The tracing contacts were reduced from three days at the beginning of the pandemic to one day thereafter. Patient numbers and exposure duration in each outbreak (see Fig. 2 and Table 2) revealed that faster tracing contributed to improved disease control. Very few COVID-19 cases infected outside of Viet Nam (Patients 17, 34, 91, 124, 243) spent time in their communities before being traced, tested positive, and hospitalized [5].

### 3.2. Characteristics of COVID-19 patients in Viet Nam

By May 4<sup>th</sup>, there were 271 confirmed cases of COVID-19 in Viet Nam, 167 (61.6%) of which evidently had been infected outside of the country, including 51 noncitizens (Fig. 3). Most of the confirmed cases were F0 individuals without relative infections. Among 271 cases, only 32 F1, six F2 and two F3 individuals were infected in outbreaks (Fig. 2 and Fig. 3). Two other F1 individuals linked to cases 22, 23 and 24 were infected (patients 35 and 39, infection chains not showed).

**Table 2.** Patient zero or first confirmed cases in outbreaks of COVID-19 in Viet Nam.

No	Outbreak	Patient zero/ or suspected	Epidemiology	Confirmed date	Expected days in communities
1	Son Loi, Vinh Phuc	005 (F, 23)	Jan. 17 <sup>th</sup> from Wuhan to Viet Nam	Jan. 30 <sup>th</sup>	13 days
2	Truc Bach str., Hanoi	017 (F, 26)	Mar. 2 <sup>nd</sup> from UK to Viet Nam (flight VN0054)	Mar. 6 <sup>th</sup>	4 days
3	Phan Thiet, Binh Thuan	034 (F, 51)	Mar. 2 <sup>nd</sup> from USA to Viet Nam (transit in Qatar)	Mar. 10 <sup>th</sup>	8 days
4	Buddha Bar & Grill	091 (M, 43)	Mar. 3 <sup>rd</sup> from UK to Viet Nam	Mar. 20 <sup>th</sup>	12 days; transferred to each other evening of Mar. 14 <sup>th</sup>

5	Bach Mai hospital (Hanoi)	086 (F, 54)	Domestic travel from Mar. 6 <sup>th</sup> to 8 <sup>th</sup>	Mar. 20 <sup>th</sup>	12 days; unknown infection date
		162 (F, 63)	Take care of patient 161 at Bach Mai hospital	Mar. 27 <sup>th</sup>	Short time
6	Truong Sinh company	168 (F, 35);	Provide service at Bach Mai hospital	Mar. 28 <sup>th</sup>	Unknown infection date
		169 (F, 47)			
7	Ha Loi, Me Linh, Hanoi	243 (M, 47)	Health checking at Bach Mai hospital on Mar. 12 <sup>th</sup>	Apr. 6 <sup>th</sup>	Unknown infection date

3.2.1. Ages and Sexes of COVID-19 cases in Viet Nam

Among 271 first confirmed cases, COVID-19 patients are typically young with 36.2% aged 20-29 and 16.6% aged 30-39. Only 9.96% of patients were 60 years old or older (Fig. 3).

The youngest was patient 15 (3-month old), and the oldest was an 88-year-old woman. There have been fewer male (45%) than female COVID-19 patients (Fig. 4); this is different from the sex ratio among patients in other countries.

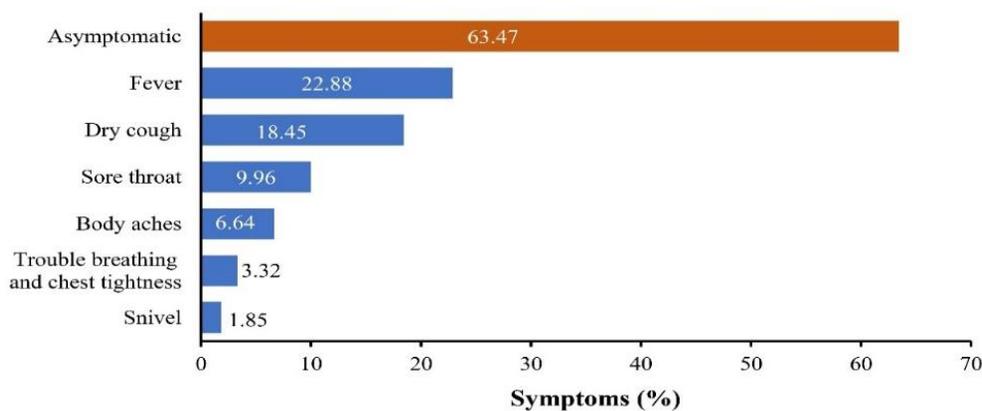


Figure 4. Symptoms of COVID-19 in Viet Nam.

3.2.2. Symptoms of COVID-19 in Viet Nam

According to Viet Nam’s Ministry of Health (MOH), symptoms of COVID-19 in the Vietnamese population included fever (22.88%), dry cough (18.45%), sore throat (9.95%), body aches (6.64%), trouble breathing and chest tightness (3.32%), and snivel (1.85%). Up to 63.33% patients are on record as having no symptoms [8] (<https://ncov.vncdc.gov.vn>) (Fig. 4). Notably, no deaths linked to COVID-19 in Viet Nam reported by July 19<sup>th</sup>.

3.2.3. The third wave in Vietnam

After the pandemic seem to be restrained in 100 days with no infection in communities, the third wave broke out from Jul. 25<sup>th</sup> to Sept. 4<sup>th</sup>. No source detected, and the epidemic was infected among patients with severe conditions in three main hospitals of the city of Da Nang before spreading to the community. A total of 551 patients, about 41.7% of total patients in Viet Nam (to Nov. 26<sup>th</sup>), were confirmed associated with the break-out in Da Nang (Table 1), of those, 402 cases lived in Da Nang and 100 other cases in its sister province, Quang Nam.

From July 25<sup>th</sup> to present, there have been 35 deaths in Viet Nam and are all related to patients being treated for other illnesses in Da Nang hospitals then infected with Covid-19 (Table 3). Of those, 31 cases lived in Da Nang, 3 cases in Quang Nam province. Most of the deaths are elders with more than 60% over 60-year-old. The oldest death case was 93-year-old

(P.666), and the youngest was 28-year-old (Table 3). All death cases had severe conditions such as end-stage chronic kidney failure, end-stage blood cancer, hypertension, type 2 diabetes... (Table 3) before being infected by SARS-CoV2 [9]. After last case confirmed on Sept. 4<sup>th</sup>, no new infections have been reported in the community in Viet Nam (by Nov. 26<sup>th</sup>).

**Table 3.** Death cases of COVID-19 in Viet Nam.

No	Patient	Age	Sex	Severe condition(s)
1	428	70	M	CKD (chronic kidney disease), hemodialysis, hypertension, heart failure
2	437	61	M	CKD, hemodialysis for 10 year, hypertension, diabets, gout
3	499	68	F	Blood cancer, type-2 diabetes, hypertension
4	524	86	F	Heart failure, CKD
5	475	83	F	Degenerative polyarthritis, stomach surgery
6	429	53	F	Heart failure, CKD, type-2 diabetes
7	426	62	F	CKD for 10 years
8	496	65	M	End-stage CKD, hypertension, sepsis
9	651	67	F	CKD, lupus erythematosus, type-2 diabetes
10	718	67	F	Malignant plasma multiple myeloma, type-2 diabetes, sepsis
11	456	55	F	Hypertension
12	430	33	F	End-stage CKD, hypertension, sepsis, heart failure
13	737	47	F	End-stage CKD, hemodialysis, heart failure, hypertension
14	436	66	M	End-stage CKD
15	522	68	M	CKD, kidney cancer, type-2 diabetes
16	832	37	M	Heart failure, exhaustion, type-1 diabetes
17	431	55	M	Type-1 diabetes, end-stage CKD, hypertension
18	485	52	F	End-stage CKD, hypertension, type-2 diabetes
19	623	83	F	Heart failure, myelosuppression
20	479	87	M	Hypertension, diabetes, myocardial infarction
21	585	61	F	Hypertension, obese
22	702	63	M	End-stage CKD, homodialysis, hypertension, heart failure
23	699	75	M	End-stage CKD, homodialysis, hypertension, type-2 diabetes
24	575	82	F	Meningitis
25	698	51	F	Ovarian cancer, kidney stones, urinary infection, left kidney removed
26	666	93	M	Heart failure, hypertension, CKD, dementia
27	577	73	F	End-stage CKD, heart failure, anemia, hypertension
28	758	36	F	End-stage CKD, hypertention, heart failure
29	827	66	M	CKD, hypertension, stroke
30	696	51	F	CKD, homodialysis for 15 years, hypertension, heart failure
31	996	28	M	Acute lymphoblastic leukemia, myelosuppression
32	957	57	F	CKD, type-2 diabetes, stroke
33	472	69	M	Heart failure, CKD, type-2 diabetes, atrial fibrillation
34	1040	55	M	Septic shock, type-2 diabetes
35	761	83	F	End-stage CKD, homodialysis, hypertension

### **3.3. Government resources and strategies to control COVID-19 in Viet Nam**

#### **3.3.1. The healthcare system and prior lessons from SARS**

Viet Nam's healthcare system is still evolving. There are approximately eight doctors for every 10,000 people in Viet Nam [10] (<https://data.worldbank.org/>) and approximately 4,000 ventilators at medical facilities across the nation [11]. These limited resources make it highly challenging for Viet Nam to respond to a healthcare crisis.

Viet Nam was impacted by the SARS outbreak in the early 2000s, with several known fatalities. Viet Nam was also the first country to stop local infections and control the spread of SARS-2003 within its borders [12-14]. Since SARS-2003, Viet Nam has continuously expanded and modernized the healthcare facilities to deal with a possible similar pandemic. Protocols for treatment of SARS and control outbreaks were developed and given to all hospitals and healthcare facilities throughout the country [15]. These protocols were activated in January 2020, before alerts by the WHO and travel bans imposed by other countries [16].

As part of the COVID-19 response, facilities across the country were readied to receive positive, high-risk, and suspected cases of COVID-19, for treatment and quarantine purposes (Fig. 5). This included dormitories at some universities and all local military bases in every province in Viet Nam [5,15]. All individuals returning to Viet Nam were quarantined in dormitories or military bases for at least 14 days and tested.

Similar to the situation with SARS-2003, the prime minister of Viet Nam called for the unity and mobility of the entire political and social system in confronting COVID-19 [17,18]. A

National Steering Committee (NSC) was established (Fig. 5) and assigned for COVID-19 prevention and control on Jan. 30<sup>th</sup>, 2020 [19]. The NSC directed the response of the entire healthcare system, including national and local centers for disease control and prevention (CDC). Furthermore, quick-response teams of governors and health veterans were established in every city and province. Mobile numbers of all members of NSC and local quick-response teams were made public to facilitate access to officials; hotlines were established to the MOH and 21 assigned hospitals to facilitate rapid COVID-19 detection and treatment.

#### **3.3.2. Border control**

On Jan. 2<sup>nd</sup> 2020, the CDC of Viet Nam announced that there was undetected-source pneumonia in China, with 27 confirmed cases, including 7 severely infected patients [20]. The MOH issued a document to tighten border control with China from Jan 3<sup>rd</sup> onwards (Fig. 5) [21]. All travelers were asked to wear face masks at all of Viet Nam's airports [22], and masks were freely provided.

The day (Jan. 23<sup>rd</sup>) China banned travel to and from Wuhan, the first case of COVID-19 was detected in Viet Nam. On the following day, Vietnamese authorities banned all flights between Viet Nam and Wuhan [23] and, on Feb. 1<sup>st</sup>, between Viet Nam and China [17]. All travellers from China arriving in Vietnam in the previous 14 days were subjects to quarantine [18,24]. Similar restrictions were applied to travellers from other countries, based on an assessment of the COVID-19 situation in their countries of origin. By Mar. 21<sup>st</sup>, all individuals entering Viet Nam were quarantined regardless of nationality [25]. Strict controls and surveillance measures were added to all land-based ports of entry along the Vietnamese border [2,23]. All commercial flights into the country were halted after Mar. 25<sup>th</sup> [26].

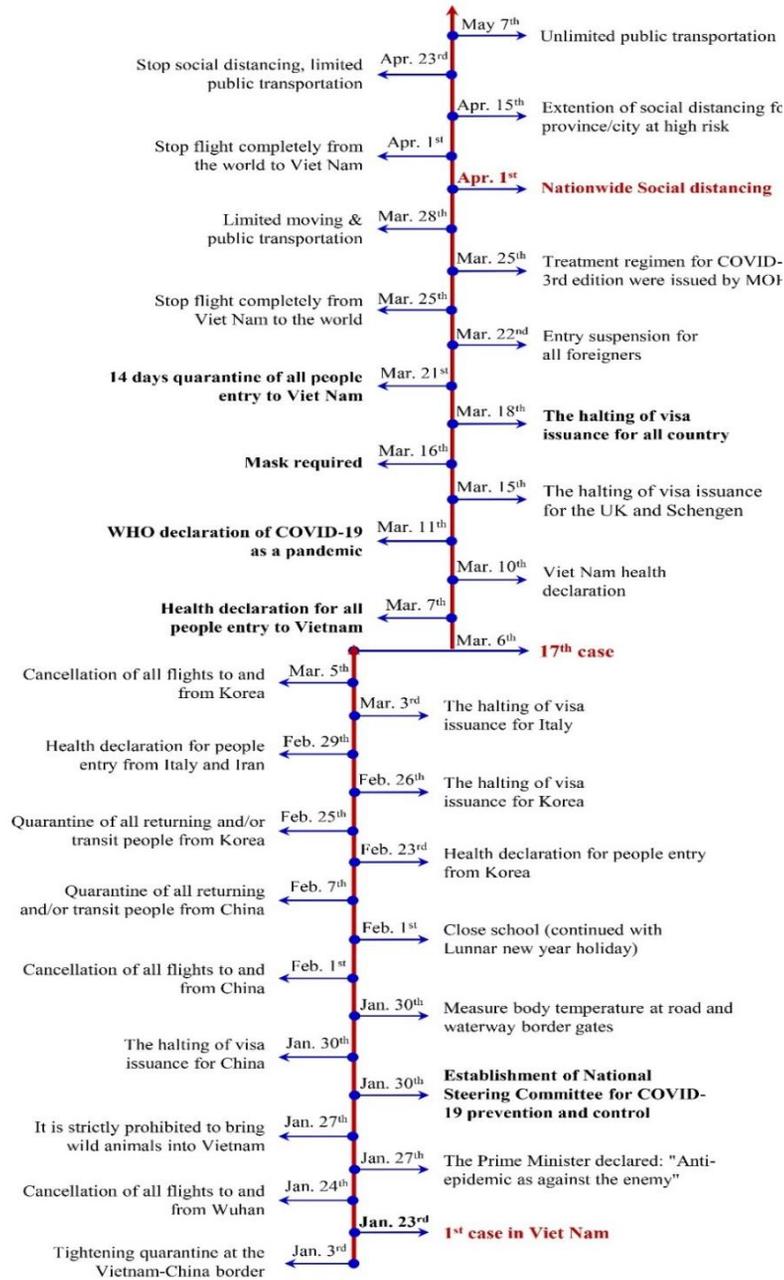


Figure 5. Timeline of government responses.

### 3.3.3. Information and Communication

The centralized information dissemination system in Viet Nam allowed health authorities to rapidly reach the general public with guidelines and messages concerning COVID-19. Guidelines for COVID-19 prevention were quickly made public online and messaged to all active phone numbers. Prevention posters were displayed in public places, entries of schools,

government and apartment buildings and citizen blocks (for example, see Fig. 6). Thousands of articles on COVID-19 were generated in online newspapers with the goal of raising public awareness of the disease and instructing people on disease protection and prevention.

The NSC published basic residential information, travel history and contacts of

newly confirmed patients. All information was published on news, websites of MOH, local CDCs and newspapers. Updated information was also sent to every active mobile phone via text messages and apps, such as Zalo, twice a day.

Viet Nam also developed domestic health applications, managed by MOH, and recommended (but not demanded) that all citizens use them to report their health situation during the pandemic [27-29]. These tools have reportedly helped reduce the number of quarantined people in Viet Nam [28,29].

### 3.3.4. Social distancing and hygiene

It is widely accepted that social distancing can reduce COVID-19 transmission [30,31]. In Viet Nam, the NSC categorized the risk of COVID-19 transmission (ROT) in every district of the country using three levels: High Risk, Low Risk and Safe. The NSC directed appropriate levels of social distancing according to ROT, either directly or via local governments. A major adjustment involved the shutdown of the country's entire education system from Feb. 1 2020 to May 4th as part of this social distancing program [23]. Non-essential services such night clubs and shopping malls were also closed. In High and Low Risk areas, people were asked to wear masks outside their homes and keep apart by at least 2 meters. Masks were provided by domestic suppliers in adequate numbers for the entire population, with the capacity to still export 25% of domestically manufactured masks between Feb. 28<sup>th</sup> to Apr. 29<sup>th</sup>. However, medical mask prices were rising due to rising prices of input materials.

In every Low Risk and High Risk areas, organizations and businesses were also directed to provide sanitizer stations and take temperatures at their facilities.



**Figure 6.** Seven habits in daily activities during COVID-19 pandemic. 1, No shaking hands; 2, No touching on mouth, nose and eyes; 3, Having shower immediately after getting back home; 4, Gargling after brushing teeth; 5, No visiting and visitors; 6, Call health veterans for help and usual checking; 7, Self-conscious following instructions and asking other doing so. (Source: CDC Viet Nam).

### 3.3.5. Quarantine of suspected COVID-19 cases

All confirmed cases of COVID-19 in Viet Nam were hospitalized, and F1 cases were separated in quarantine centers and tested at three different times [32-34]. F2 cases were asked to self-quarantine at home without any surveillance and to go out only for essential reasons while wearing masks [33,34]. F3 and F4 individuals were asked to wear masks outside their homes and to limit contact with other people.

In COVID-19 “hotspots,” where many suspected cases were concentrated in small areas, citizen blocks were locked down with barriers guarded by police and local patrols. All people inside locked-down zones were tested for the virus [35,36]. Food and other supplies were provided to quarantined residents by phone orders, online shopping [37], “outside” relatives [38], or by local authorities. Food and

supplies were transferred to quarantined residents at designated barrier lines [38].

#### *Financial support*

The Vietnamese central government supported some of the personal costs associated with COVID-19 control and prevention. Testing and treatment fees were fully subsidized for every case [34,38]. Quarantined individuals received food subsidies such as instant noodles, rice or money [34,38]. The central government also called for donations from citizens. Local governments also established donation centers to receive money and goods to assist quarantined people.

### **3.4. Daily habits, public cooperation, and compliance**

#### *3.4.1. Wearing masks*

The WHO and other leading health organizations now recommend that masks be

worn to limit the spread of COVID-19. In Viet Nam, masks have been a familiar public phenomenon since the SARS-2003 epidemic. Masks are also widely used among commuters to reduce the intake of air pollutants, particularly among motorcyclists, who number 50 million or more in the country [39].

Directives to wear masks for COVID-19 were therefore relatively familiar to the Vietnamese public (Fig. 7), and may explain in part why compliance was high. A survey by Q&Me<sup>40</sup> on public health behaviours of Vietnamese citizens during the early phase of the Covid-19 pandemic showed that 89% of respondents routinely wore masks. Additionally, about 80% of respondents reduced activities such as eating out and socializing with friends [40].



**Figure 7.** The habit of wearing mask when participating in traffic in Viet Nam.

#### *3.4.2. Washing hands*

Corona viruses are known to be susceptible to detergents, even very mild ones [41,42] and therefore, washing hands appeared to be one of the most effective ways to limit COVID-19 infection. Vietnamese children are typically taught to wash their hands to prevent common parasites and bacterial and toxic chemicals from entering their digestive tracks [43-45].

Washing hands to prevent COVID-19 was a natural extension of this behaviour, and may have been another important factor in Viet Nam's control of COVID-19.

#### *3.4.3. Communication through social media*

Social media is widely used around the world. Facebook and Zalo, with 64 million accounts in Viet Nam [45,46], have helped users to update coronavirus-related information

in real-time [2,46,47], and improve public knowledge and risk awareness on the Covid-19 pandemic. They thereby had positive impact on self-protection and cooperation with government of people and helped restraining the pandemic in Viet Nam [48,49]. Several users were fined by authorities for their misinformation relative to COVID-19 on social media; none of those was found as a cover-up of an outbreak.

### **3.5. Technological innovations**

#### *3.5.1. Development of a test kit*

Part of Viet Nam's capacity to respond rapidly and effectively to the pandemic is attributable to its mobilization of technology. For example, a group of researchers was rapidly funded by the Ministry of Science and Technology to develop a COVID-19 test kit based on real-time PCR technology. The kit was approved by MOH for mass production on Mar. 5<sup>th</sup> by a private company [50], Viet-A. The kit passed European standards and requirements [50,51] and received permission to be sold in the European Union [50,51]. The kit has helped Viet Nam test suspected cases of COVID-19 [51]. Owing to this and other testing resources, Viet Nam has been ranked high among countries for number of tests performed per positive COVID-19 cases [52,53].

#### *3.5.2. Ventilator and face-mask production*

The need for ventilators has also led to innovation. For example, Fig. 8A depicts a ventilator model developed at Duy Tan University [54]. Similarly, a research group in Ho Chi Minh City University of Technology has developed an automatic system for mask production (Fig. 8B). The system can produce 90 masks per minute with either 3-, 4- or 5-layer masks [55]. According to researchers, production costs of the two systems were far less

than those of imported systems. Production independence with respect to technologies and resources such as this are likely to help Viet Nam in the longer-term battle against COVID-19.

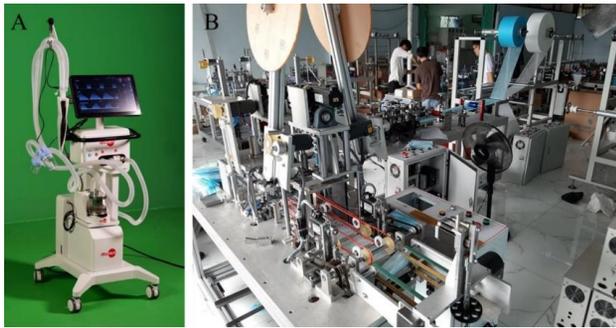
### **4. Discussion**

Travel from China was in all probability the first and primary source of COVID-19 infection in Viet Nam. Yet, compared to other countries, very few cases of COVID-19 were linked to China, suggesting that intervention and follow-up quarantine at international airports is a critical step for prevention of the disease. Lessons from the SARS-2003 outbreak helped Viet Nam recognize the seriousness of the COVID-19 outbreak in China and prepare accordingly. Given that Viet Nam is still an emerging economy, the disease posed a serious threat to the economic and health care systems of the country. Swift and concerted action was needed. This came in the form of immediate government response at border gates, airports, and land ports, quarantine measures, social distancing practices, and tracing and testing.

Data from outbreaks in Viet Nam suggest that quickly separating infected people from their communities helped to contain COVID-19 and reduce further transmission. To date, Viet Nam is among the few countries that have tested all suspected cases of COVID-19 and hospitalized all confirmed cases. This approach, where feasible, may be a significant means of limiting the number of infected individuals and successfully controlling the spread of the virus.

The situation with COVID-19 in Viet Nam is still evolving. The outbreak in Da Nang illustrates the possibility of COVID-19 infections in the wake of rapidly implemented, strict public health measures is still very real. It also confirmed the most vulnerable groups are the elders with one or several health conditions.

Practising of precise safety procedures in hospitals, consistent vigilance and resource-readiness is necessary to maintain control over this disease.



**Figure 8.** Some examples on technology innovations of Viet Nam during COVID-19 pandemic. A, the ventilators from Duy Tan University; B, automatic system for mask production from Ho Chi Minh city University of Technology.

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