



Descriptive Epidemiology of Covid-19 Linked to Community Transmission and Lockdown Effect in Cambodia

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Received July 27, 2021; revised August 20, 2021; accepted August 22, 2021

ABSTRACT

Introduction

The Covid-19 pandemic has affected over 200 countries to date. In Cambodia, the first case was reported in January 2020 from a Chinese traveler. The hard-hit of community transmissions struck on February 20, 2021, and has yet to be fully contained. This paper aimed to describe the Covid-19 epidemiology linked to this community transmission event, and to discuss the effect of government's lockdown.

Methods

Available public data on Covid-19 cases reported daily by the Ministry of Health were collected between February 20 to March 26, 2021. Then, the data were recorded in Excel included both demographic and epidemiological variables. Also, from February 20 to April 30, 2021, the numbers of Covid-19 cases aggregated by province were tabulated in Excel, and we constructed the daily notification using ArcGIS software 10.8 to visually map cases by province. Finally, preventive measures and government's lockdown were chronologically recorded.

Results

From February 20 to March 26, 2021, there were 1,622 confirmed cases in which 52.3% were men with the mean age of 31 (SD = 11.2) years. Most was in ages of 20-29 (41.6%), 30-39 (30.7%) and 40-49 (10.5%) years. More than half of cases were Cambodian (52.8%) followed by Chinese (39.6%), and Vietnamese (5.3%). From February 20 to April 30, 2021, there were 13,255 confirmed cases initially started with Phnom Penh, then it spread over 85% of the total provinces (22/25) nationwide. Preventive measures and, a 14-day lockdown of Phnom Penh and Takhmao, city of Kandal from mid-April to early May 2021 were strictly implemented.

Conclusions

The paper highlights the initial picture of the Covid-19 epidemiology and the rapid dynamics of community spread within a shorter duration. It has been critically important to highly acknowledge the significant role of government in taking preventive measures and administrative measures in controlling the rise of Covid-19 pandemic. Despite this comprehensive effort, the increase of daily cases was still observed. The preventive measures and the lockdown may impact the daily infected cases, but might not be visible in a short time.

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Citation: Um S, Vang D, Oy S, Sopheab H. Descriptive Epidemiology of Covid-19 Linked to Community Transmission and Lockdown Effect in Cambodia, *CJPH* (2021) 02:09

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"Keywords: Covid-19; Epidemiology; Community transmission; Lockdown; Cambodia;"

Introduction

The coronavirus disease (Covid-19), a newly coronavirus was first identified in Wuhan city, Hubei province, China in December 2019 caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) [1]. On 30 January 2020, WHO declared that the outbreak constituted a Public Health Emergency of International Concern. Since then, it has become the global pandemic affected 223 countries [2]. By the end of April 2021, globally, more than 150 million cases of Covid-19 with 3,158,792 deaths were reported [3].

In Cambodia, the first imported case of Covid-19 was detected in Sihanouk Ville, seaport province on 27 January 2020 among a Chinese traveler [3, 4]. Hereafter, the imported cases were reported throughout the year until the first confirmed community transmission in late November 2020 [2]. According to Ministry of Health (MoH), by the end of April 2021, there were more than 13,000 reported cases in more than 20 provinces and cities with close to 100 deaths due to Covid-19 nationwide [4]. The third community transmission event was declared on 20 February 2021.

Since that event, the new daily Covid-19 cases have exponentially increased with fast spreading particularly among factory neighborhood [4], traditional markets, construction sites, casinos, karaoke establishments, clubs, special economic zones in Phnom Penh, Kandal, Preah Sihanouk Ville, Svay Rieng provinces where sample testing were targeted, with commonly poor living condition and crowded rental rooms [5, 6].

In the past, there have been widely used the Geographic Information System (GIS) to understand the spread and impacts of epidemics such as for SARS-CoV, MERS-CoV and Ebola outbreak [7-9]. It is a useful tool to visualize risky behaviors and to better understanding the effective intervention [10]. However, there has been a limited use of this technique to apply for the epidemiology of Covid-19 in Cambodia. Therefore, we aimed to describe the epidemiology of Covid-19 linked to community transmission event and the use of GIS technique to visually map the dynamics of transmission by province, and to discuss the effect of government's lockdown.

Methods

Data source and data analysis

First, from February 20 to March 26, 2021, publicly available data reported daily on Covid-19 cases from the Cambodia Ministry of Health (MoH) was used. They were recorded daily in Microsoft Excel included

demographic and epidemiological data (sex, age, nationality, date of testing and confirmed cases). Ages were grouped into 0-9, 10-19, 20-29, 30-39, 40-49, 50-59, 60-69, 70-79, and ≥ 80 years old. Nationalities were recorded as Cambodian, Chinese, Vietnamese and so on. Then, we conducted descriptive statistics included frequency and percentage for sex, age groups and nationalities.

Secondly, between February 20 and April 30, 2021, the numbers of Covid-19 cases aggregated by provinces were tabulated daily in Excel. Then, we constructed a trend of daily infected Covid-19 cases using ArcGIS software (Version 10.8) to visually map the distribution dynamics of Covid-19 cases by provinces. Finally, all preventive and administrative measures were chronologically described including the two-week lockdown implemented by the government.

Results

Sex and age distribution of cases linked to community transmission from February 20 to March 26, 2021

According to **Table 1**, of the 1,622 confirmed cases, more than half were men (52.3%). The mean age of the cases was about 31 (SD =11.2) years with the youngest age at 10 months old and the oldest age of 84 years old. Many cases were in age groups of 20-29 (41.6%), 30-39 (30.7%) and 40-49 (10.5%).

Table 1: Sex and age distribution of Covid-19 cases linked to the community transmission

Variables	Cases (N = 1,622)	
	n	%
Sex of the cases		
Female	773	47.7
Male	849	52.3
Age in year (mean \pm SD)	31.3 \pm 11.2	
Age group, in year		
< 10	33	2.0
10-19	119	7.3
20-29	674	41.6
30-39	499	30.7
40-49	171	10.5
50-59	75	4.6
60-69	29	1.8
70-79	20	1.2
80 +	2	0.1

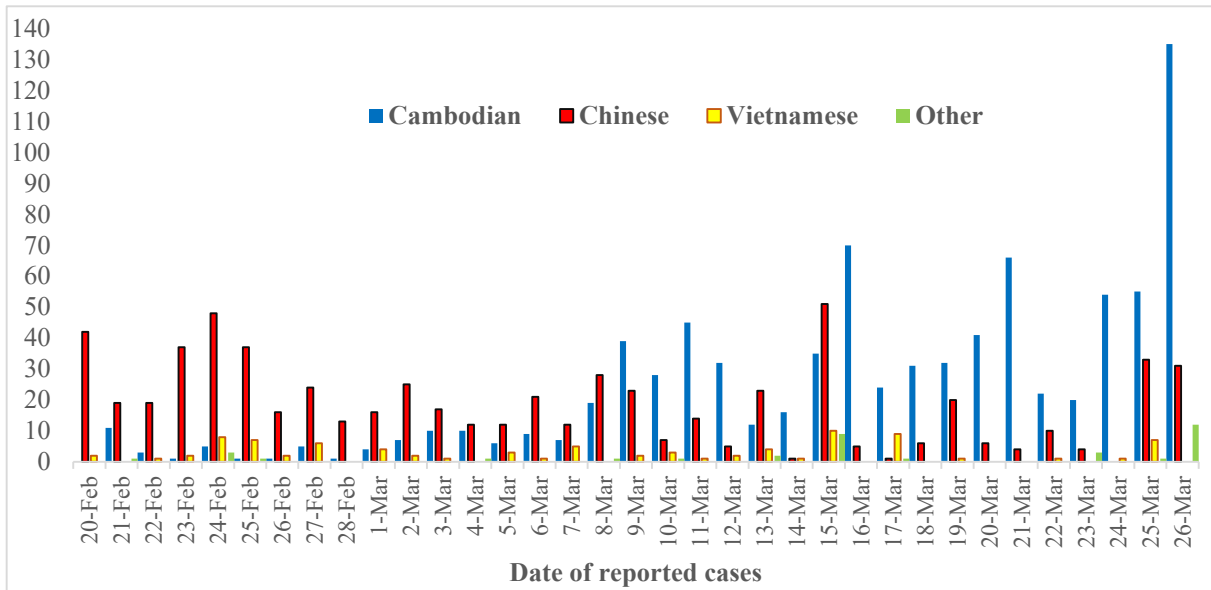


Figure 1: Covid-19 cases by nationality linked to community transmission (N = 1,622)

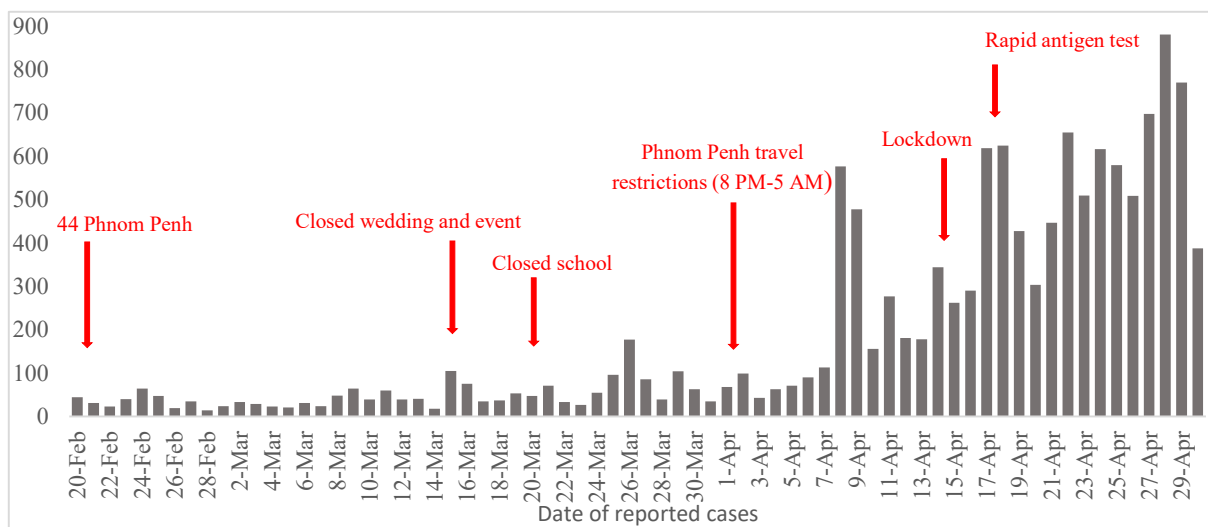


Figure 2: Covid-19 cases linked to community transmission until April 30, 2021 (N = 13,255)

Nationality distribution linked to community transmission

Two nationalities with most Covid-19 cases were Cambodian (52.8%) and Chinese (39.6%), followed by Vietnamese (5.3%), Thai, Burmese, Korean and other nationalities. As illustrated in Figure 1, the first 42 cases were primarily Chinese. As indicated in the next following first 15 days, 421 cases were Chinese nationality followed by 81 cases of Cambodian nationality. Then, the Cambodian cases increased exponentially up to 135 cases on March 26, 2021.

Distribution by date linked to community transmission from February 20 to April 30, 2021

As shown in Figure 2, more than two months (70 days) since the community transmission,

there was a total of 13,255 confirmed cases. This transmission started with the total of 44 cases on February 20 in 2021. The cases were stable at the level of about 100 cases per day until April 07, 2021. Subsequently, the cases jumped up to 576 cases on April 8, 2021. During the 23 days from April 08-30, 2021, average cases of Covid-19 reported by the MoH were 479 cases daily with the lowest report of 156 cases (April 10) and the highest report of 880 cases on April 28, 2021.

Distribution of Covid-19 reported by province until April 30, 2021

Since the beginning of the community transmission to April 30, 2021, there were 22 provinces out of 25 provinces and cities (88%) had been reported of Covid-19 cases (Table 2). The first 10 provinces and

cities with the confirmed cases of Covid-19 at least 40 or more cases arbitrarily classified were Phnom Penh (9,296 cases), Sihanouk Ville (1,722 cases), Kandal (1,058 cases), Banteay Meanchey, Svay Rieng, Prey Veng, Takeo, Kampong Cham, Koh Kong, and Kampong Speu provinces.

Table 2: Report of confirmed cases of Covid-19 by province until April 30, 2021 (N = 13,255)

No.	Province	Cases	Death
1	Phnom Penh	9296	94
2	Preah Sihanouk	1722	5
3	Kandal	1058	0
4	Banteay Meanchey	359	0
5	Svay Rieng	314	1
6	Prey Veng	106	1
7	Takeo	103	0
8	Kampong Cham	70	1
9	Koh Kong	48	0
10	Kampong Speu	41	2
11	Siem Reap	36	0
12	Tboung Khmum	29	1
13	Kampong Thom	24	0
14	Kampong Chhnang	17	0
15	Pursat	8	0
16	Kampot	6	0
17	Kep	6	1
18	Mondulkiri	4	0
19	Battambang	3	0
20	Kratie	3	0
21	Pailin	1	0
22	Preah Vihear	1	0

Dynamics of community transmission from February 20 to April 30, 2021

As illustrated in **Figure 3**, on February 20, 2021 (**Map A**), the community transmission was first reported in Phnom Penh among Chinese with 44 confirmed cases (MoH). By April 06, 2021 (**Map B**), more than a month of community transmission, the total cumulative cases increased up to 2,383 with cases were notified in other 17 provinces out of 25 provinces and cities. By April 30, 2021 (**Map C**), more than two months after the community transmission, cumulatively the total cases increased up to 13,255 detected in 22 provinces out of 25 (88%) of the total provinces and cities in the whole country. Phnom Penh and Sihanouk Ville were the most hard-hit cities by the Covid-19 outbreak.

Government's prevention measures and lockdown

There were both public health measures and administrative measures taken seriously by the government to curb the community transmission. These common public health measures included mask wearing in public spaces, social distancing and frequently washing hand with soap or alcohol. Administrative measures included travel restriction between provinces with high identified infected cases, schools and public gym, sport facility and public market closures, wedding and public event ban, curfew restriction (8:00 PM -5:00 AM). Factories and traditional markets with suspected source of infection and transmission were shutdown. Finally, the lockdown in Phnom Penh and city of Takhmao, Kandal province (April 14 - May 05, 2021, 2-3 weeks), next to Phnom Penh, where high infected cases were identified, were implemented.

Discussion

The paper was the first ever to provide a description of national epidemiology of Covid-19 cases linked to community transmission on February 20, 2021. After two months the number of confirmed Covid-19 cases reached to 13,255 in 22 provinces with close to 100 deaths. Furthermore, most were adult men with predominantly Cambodian and Chinese. Phnom Penh and Sihanouk Ville were the most hard-hit by the pandemic. Most of the cases detected at factory, traditional markets, casinos and entertainment venues were detected. It might be due to the targeted testing among these populations.

Distribution of community transmission

In the first 15 days of the community outbreak, most were Chinese nationalities that might be from imported cases. Cambodia had acted seriously through aggressive case finding and isolation, active contact tracing, and quarantine as the control measures for containment [11, 12]. In the past, this adapted measure had been successfully proved to control Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS) [13]. However, cases were rising over time. Therefore, it might be questionable about the effort of active contact tracing due to index case participation and quarantine issue despite of the government efforts and commitment. For example, unreachable cases could be due to index cases were not fully cooperated with the surveillance team by hiding correct information about all places where they directly had further contacted. Also, there might be issues related to a poor quarantine management and loose administrative measures.

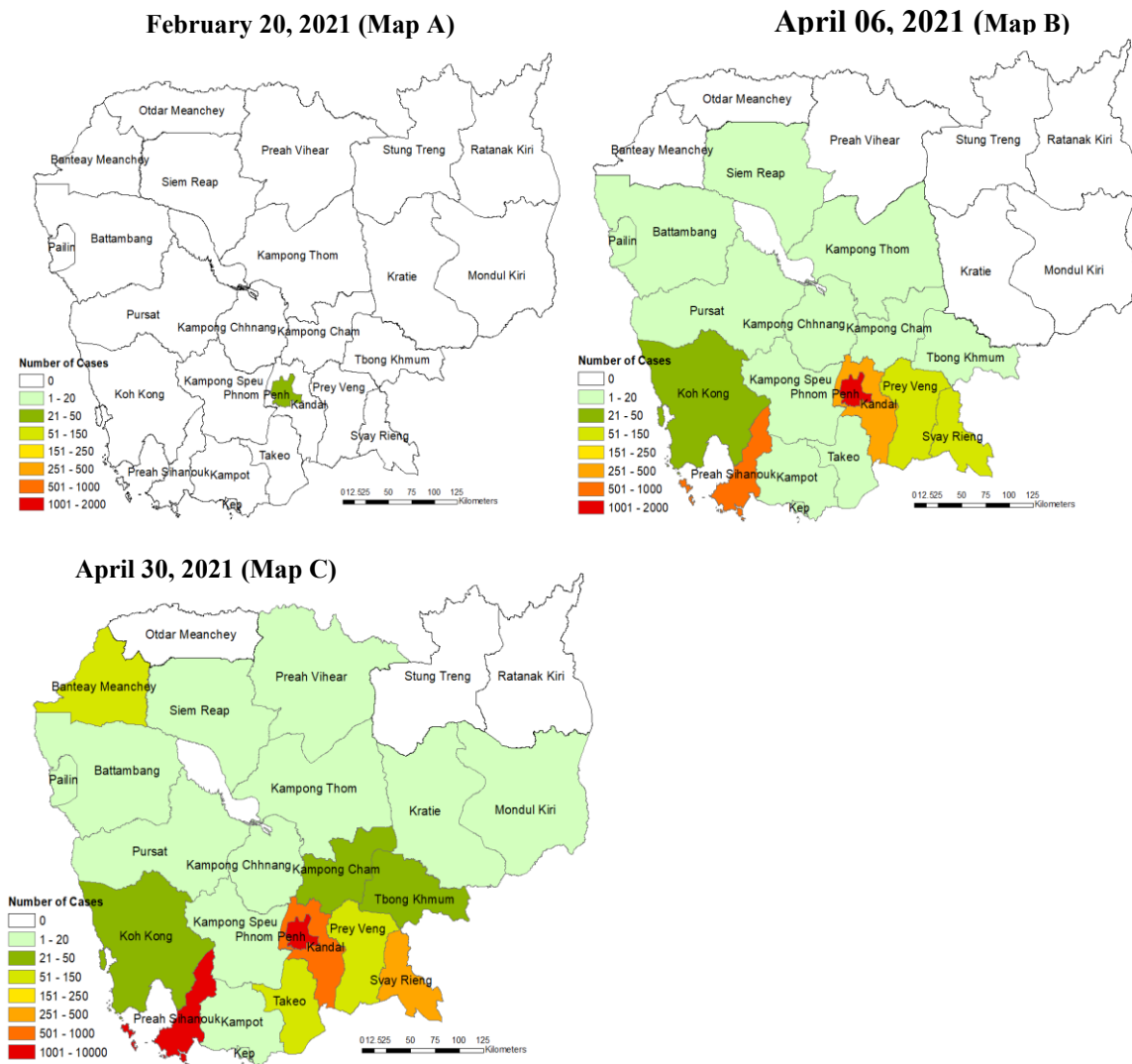


Figure 3: Distribution dynamics of Covid-19 cases linked to community transmission from February 20-April 30, 2021

As being observed, in the daily report, there were higher proportion of infection among adults between 20-49 years' old which were accounted for more than 80%. This might be due to most cases linked to tourist, travelers and businessmen from China and subsequently from local mobile people who were active for economic activities

Dynamics of transmission from Phnom Penh to other provinces

The dynamics of transmission on 20 February incident starting from the epicenter in Phnom Penh and continued the spread to other provinces mostly through travel and people mobility. Only about two months, the spread was rapid over 85% of provinces nationwide despite government's efforts [4]. Limited capacity of the health system to detect SARS-CoV-2 infection particularly laboratory capacity could contribute to the early case detection. Late travel restriction measures, limited people's awareness and

negligence may also contribute to the increased contact rates between infected and individuals at risk.

As shown in the map from February 20 to April 30, 2021, Phnom Penh, Sihanouk Ville, and Kandal provinces were the first three provinces with most of cases identified. Mostly, they were from karaoke club, casino, and others entertainment places [14]. High population density and main economic zones and hub could contribute to the rise of infected cases. Several studies conducted in Algeria, India, Bangladesh, Indonesia found that increasing of population density could contribute to the increase of infected of SARS-CoV-2 [15-18]. Furthermore, the community incident took place during the Chinese New Year's and right before the Khmer New Year, the main national holiday in Cambodia that could increase travel and touristic activities as well as the population mobility from urban to their rural families. In addition, it may be due to a new variant of the Covid-19 virus, especially in Phnom Penh, a fast-spreading variant, that is rapidly transmitting from person to person [19].

Since the Covid-19 outbreak in Cambodia, especially the events linked community transmission, the government of Cambodia led by the Prime Minister took serious actions included urgent policy and regulation implementation, public health and administrative measures with the main purpose to contain or slow down the spread of Covid-19 infection. For example, these measures included stay-at-home order, travel and workplace restrictions, school, public gym and venue closure especially restaurant and entertainment establishment. Many countries have introduced this containment measure at least once at early stage or delayed stage of outbreak such as UK, USA, Australia, Thailand, Malaysia, Wuhan of China. To some extent, the results were promising with reducing and shortening the epidemic of Covid-19 [20, 21]. However, Cambodia's lockdown and related actions seemed not much effective enough since number of cases still rising over time, clusters of outbreaks still were identified in garment factories, crowded markets and casino in specific areas of Phnom Penh and some provinces (Koh Kong, Kampot, Svay Rieng provinces). There could be two possible explanations: The first explanation might be due to the delayed in lockdown, awareness issues and people's limited participation. However, this one was unlikely. The second one was, indeed the lockdown and necessary measures may impact the infection, but might be not visible enough to see. Without lockdown, the cases may exponentially increase. In fact, the lockdown measures have been faced with social and economic challenges for both people and government's system as a whole particularly for low and middle income countries including Cambodia if lockdown implementation lasts longer up to a month as experienced in many countries [20].

Conclusions

This paper has several limitations. For instance, it is limited by public data we used such as the substantial proportion of missing data and limited variables within some of the sociodemographic (residential such district and commune level, occupation, income, education, marital status), history of travel, and vaccination status. A more complex data and analysis such as estimated cases by infection date and effective reproduction number may be needed to explain the complexity of this transmission dynamics. However, this paper has provided the report from the academic perspective and to document its first descriptive epidemiology and geographic distribution on community transmission dynamics of Covid-19 infected in Cambodia. Necessary public health measures and government's efforts have been highly

committed to curb with this community transmission. Consequently, it could serve as the lesson learned for future public health planning and well preparedness for the coming emerging infectious diseases.

Acknowledgement

We thank the Cambodia's Ministry of Health for daily publishing of Covid-19 information that were helpful and useful for this paper writing. We also acknowledge the National Institute of Public Health through the sabbatical writing program 2021.

Ethical consideration

Ethical approval was not needed since we used the available public data posted daily from the Cambodia's Ministry of Health.

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