COVID-19 Clusters in Malaysia:
A Descriptive Analysis

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ABSTRACT
Understanding COVID 19 cluster infection is vital as it evaluates the current situation and serves as the basis of further action in control and prevention strategies. We aim to describe the characteristics of COVID-19 clusters in Malaysia based on location, types, positive percentage, and case fatality ratio (CFR). We used open-source data of COVID-19 clusters from the GitHub Ministry of Health Malaysia website. The data were downloaded, cleaned, and analysed using SPSS version 27. The analysis includes data of clusters that have been declared as ended from 1st March 2020 to 10th August 2021. A total of 3,495 clusters of COVID19 were reported in Malaysia involved 317,935 confirmed cases, representing 24.4% of total cases in the country within the same period. The majority of the clusters occurred in a single state (88.1%) compared to multiple states' involvements. There were increasing trends of reporting clusters and more involvement in workplace and community clusters. Workplace clusters represent the highest percentage of all clusters (54.1%). The positive percentage of COVID-19 testing was highest with a detention centre cluster (32.9%); meanwhile, CFR was highest in the cluster of high-risk populations. Strategic action in controlling and preventing COVID-19 has to be focused on high-risk areas such as the workplace. More COVID-19 screening should be done in clusters involving high-risk populations and institutions such as detention centres.

Keywords: *cluster infection, COVID-19, case fatality ratio, positive percentage*

1. INTRODUCTION

Since the discovery of a novel coronavirus from China in late December 2019, the virus has rapidly progressed to become an unprecedented pandemic and affect the global community. Until 3rd December 2021, World Health Organization reported that COVID-19 has spread to almost all countries globally with 263,563,622 confirmed cases with 5,232,562 deaths [1].

In Malaysia, the country's first three cases of COVID-19 were imported cases confirmed on 25th January 2020 [2]. Since then, the Government of Malaysia has been working hard to reduce and limit the spread of the disease through multiple approaches and collaboration efforts such as the enforcement of a series of movement control orders (MCO), vaccination program, and working toward a national recovery plan. Until 5th December 2021, the total COVID-19 cases in Malaysia was 2,658,772 cases with 30,614 death and a total case fatality rate of 1.2% [3].

The COVID-19 virus was easily spread, as the mode of COVID-19 transmission primarily by droplet and fomite. In certain situations, the virus also could transmit through the airborne. In addition to that, the virus could be transmitted either by symptomatic or asymptomatic patients, and this coupled with ranges of the incubation period, these have created an opportunity for the virus to spread in clusters and cause outbreaks. A cluster is defined as a group of epidemiologically linked cases categorised as workplace, community, education, religion, detention centres, import, etc. [4]. A systematic review of 108 COVID-19 clusters in 13 countries, excluding Malaysia, has highlighted the disease's transmissibility in various circumstances and the critical role of cluster infection in the rapid evolution of disease transmission [5]. Early identification and containment of COVID-19 clusters are crucial in slowing down the spread of the disease [6,7].

This unprecedented COVID-19 pandemic has posed an extreme challenge to policymakers globally to develop effective strategies based on the local spread of the diseases and balancing healthcare system resources, economic and political factors, and public perception. Understanding the spread of disease in cluster infection is crucial. It not only helps to evaluate the current pandemic situation but also serves as a basis for planning effective and strategic prevention and control programs such as planning for the vaccination program, targeted screening for high-risk groups, and developing strategic health education and promotion campaigns. To date, there was a lack of evidence in the description of COVID-19 clusters in Malaysia. This study aims to describe the COVID-19 clusters in Malaysia in terms of state distribution, time, type, positive test percentage, case fatality ratio, and outcome of patients. The finding of this study might be used as a basis for policymakers in planning COVID-19 prevention and control action in Malaysia.

2. MATERIAL AND METHOD

This is an observational study using secondary data of COVID-19 clusters in Malaysia from March 2020 to August 2021.

A dataset containing official data on the COVID-19 epidemic provided by the Ministry of Health Malaysia, available in open-source software GitHub at *https://github.com/MoH-Malaysia/covid19-public* was used.

Details of COVID-19 clusters based on the type of cluster, date announced, location, number of confirmed cases, number of tests, and death per cluster were downloaded and cleaned. Only clusters declared as ended were chosen for analysis from 1st March 2020 to 10th August 2021.

Based on available data, the COVID-19 clusters were divided into six categories based on community or location: workplace, community, education, high-risk patient, religion, detention centre, and import clusters.

Descriptive analysis of the distribution of the COVID-19 clusters by state and types, positive rates, case fatality ratio was conducted using SPSS version 27.

3. RESULT AND DISCUSSION

A total of 3,495 clusters of COVID19 were reported in Malaysia from 1st March 2020 to 10th August 2021, which involved 317,935 confirmed cases. It represents 24.4% of total cases in the country within the same period.

The number of COVID-19 clusters was reported to be increased from across the year, with 523 clusters (1st March 2020- 31st December 2021) to 2,972 clusters (1st January to 10th August 2021)

3.1. Distribution of COVID 19 clusters by state

The COVID-19 cluster in Malaysia is reported in two categories, namely single state or multiple state involvement.

The majority of the clusters occurred in a single state (88.1%) compared to multiple state involvement, as in Figure 1. State Johor and Selangor reported the highest number of clusters for single-state involvement. For both states, the numbers of clusters in the year 2021 exceeded the numbers of clusters reported in the previous year. The high occurrence of COVID-19 clusters in a single state compared to multiple state involvement might be explained by series of MCO implementation in Malaysia. Interstate travel restrictions included in MCO enforcement have contained the infection within the original state and prevented it from spreading to other states [8,9]. Despite the Government's effort in containing and limiting the disease spread through various phases of MCO, non-conformity to social distancing and public compliance to MCO might contribute to the constant numbers of clusters across the year [10,11].

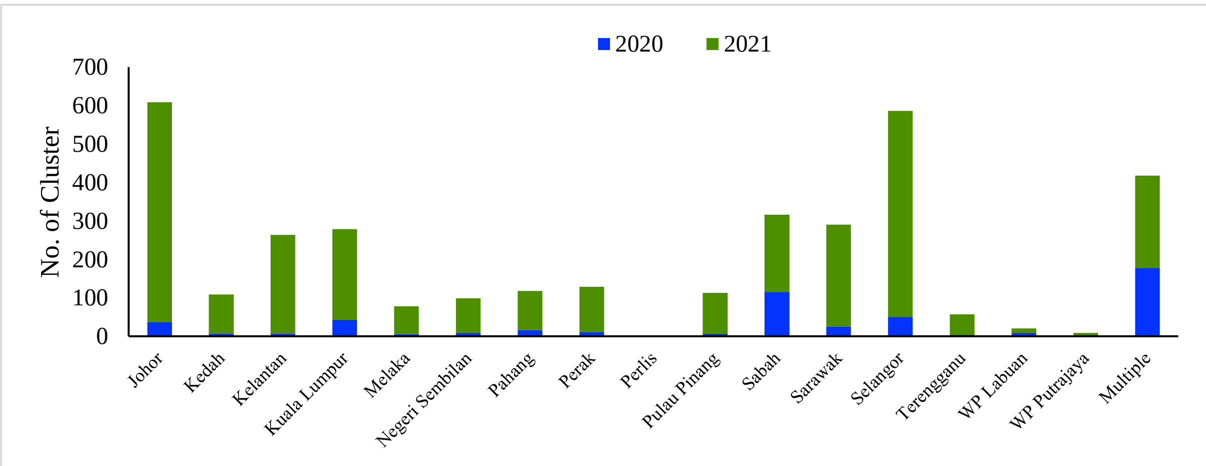

Figure 1: Covid-19 clusters by state

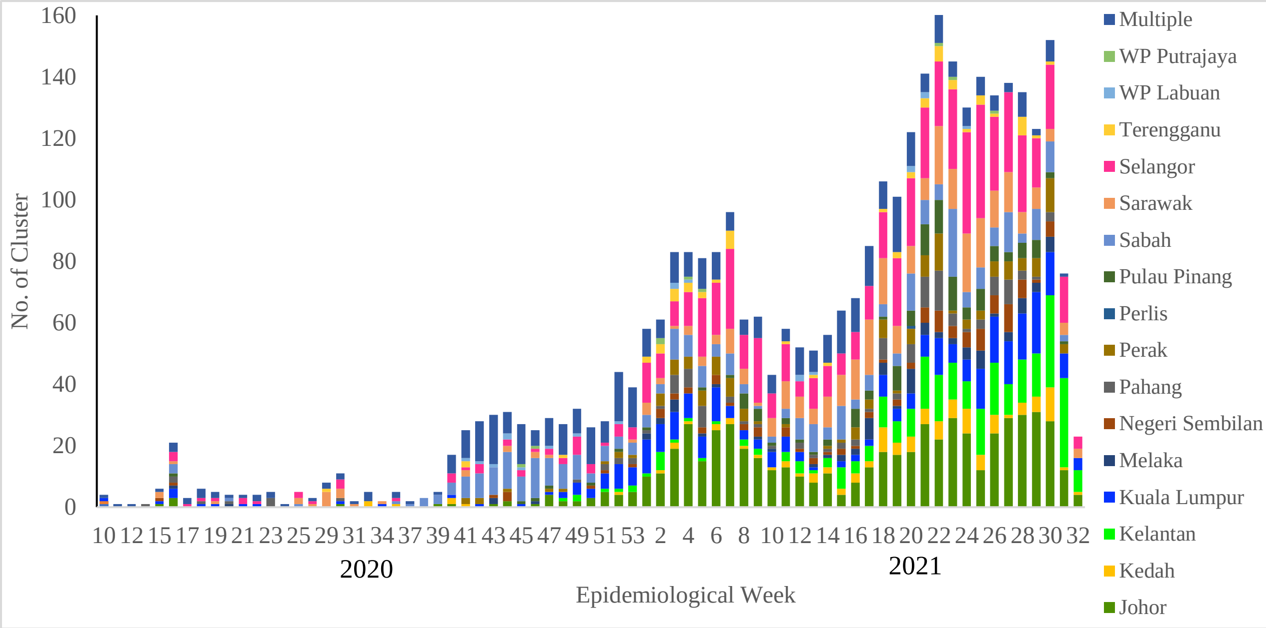

Figure 2: Covid-19 clusters by state in Malaysia by epidemiological week

Figure 2 showed the trend of COVID-19 clusters according to state and epidemiological weeks. The clusters were started to increase after week 40 in the year 2020 and reported mainly in Sabah. Following that, an increased number of clusters were reported in Peninsular Malaysia, especially for Selangor and Johor. The increase of clusters in the peninsular was a consequence of the Sabah state election during which interstate travelling has been permitted and mandatory quarantine of 14 days of returnees from Sabah was not yet imposed [12]. The third wave of COVID-19 in Malaysia has been announced following the increasing number of cases and clusters after that event, subsequently, MCO re-enforced.

3.2. Type of Covid-19 clusters

The type of COVID-19 clusters in Malaysia was categorised by population or place involved, namely workplace, community, education, high-risk patient, religious, detention centre, and import. Table 1 shows the number of COVID-19 clusters based on type. The majority of the COVID-19 clusters in Malaysia were workplace (54.55%), followed by the community (26.5%) and education clusters. (6.2%).

Table 1: COVID-19 Clusters in Malaysia by type and number of cases.

Cluster type	Cluster (n,%)	Cases (n)
Workplace	1905 (54.5%)	193653
Community	927 (26.5%)	56043
Education	216 (6.2%)	14094
High Risk	176 (5.0%)	6818
Religious	149 (4.3%)	14262
Detention Centre	91 (2.6%)	30952
Import	31 (0.9%)	2113
Total	3495	317935

On further analysis, a comparison of clusters reported between 2020 and 2021 revealed workplace clusters remain the highest increment in cases between years compared to other clusters, as in Table 2. Community clusters reported a reduction of cases from 2020 to 2021; in contrast, educational cluster, there is an increased cluster reported in 2021 compared to the previous year. These results showed that workplace and education clusters were susceptible to the COVID-19 outbreak, which required strategic and effective preventive strategies.

Table 2: Comparison of COVID-19 cluster by type and year

Type of Cluster	2020		2021	
	n	%	n	%
Workplace	220	43.05	1685	56.47
Community	150	29.35	777	26.04
Education	16	3.13	200	6.70
High Risk	43	8.41	133	4.46
Religious	30	5.87	119	3.99
Detention Centre	27	5.28	64	2.14
Import	25	4.89	6	0.20

Figure 3 depicts the trend of clusters by type and epidemiological week. In early 2020, there was an increased number of religious clusters in Malaysia. The largest religious cluster was the Sri Petaling cluster, which was announced on 11th March 2020 and generated 17 religious subclusters across the country. The cluster was initiated at a religious event in Sri Petaling, Kuala Lumpur, and attended by thousands of Malaysian and international attendees[2].

The first movement control order (MCO 1.0) was announced following the incident to control and prevent further infection in March 2020. The cluster ended on 11th June 2020 after four months.

The increase of import cluster in week 29 to 30 in 2020 was due to non-compliance of home surveillance order (HSO) implied to returnees or foreign spouses [13]). To overcome the issue, on 24th July 2020, the Government of Malaysia was an order of compulsory 14 days quarantine at the allocated centre provided by the Malaysian Government was imposed to overcome the issue.

The increasing community clusters at the beginning of week 39 were contributed by the Sabah State Election events, where positive cases were detected among returnees from Sabah. It caused an increase in community clusters in Peninsular, which later spilled over to working clusters towards the end of 2020[12].

In the year 2021, although there was a week-to-week variation in the type of cluster reported, working clusters still showed a high proportion most of the time compared to other clusters and followed by community clusters. Despite a strict Standard Operating Procedure (SOP) in opening economic sectors in which only selected industries were allowed to be operated during MCO subjected to approval by the Ministry of International Trade and Industry (MITI), the workplace cluster remains high in year 2021. Multiple factors contributed to the emergence of workplace clusters ranging from accommodation facilities to working nature, contributing to poor compliance to SOP at the workplace—subsequently, this spill over to the community, causing community outbreak.

3.3. COVID-19 positive test percentage

Table 3 shows the positive test percentage according to cluster type. Detention centre clusters reported the highest positive percentage (32.9%), followed by workplace (26.7%) and education (17.6%). Further detailed analysis of each detention centre's clusters was conducted and revealed huge ranges of positive percentage from 0.31% to 100%. This finding was similar to a study conducted in United States detention centres (April – August 2020) which also found a high positive test rate compared to the US population [14]. As COVID-19 positivity percentage helps understand the spread of the disease in a particular community and the adequacy of the test, the finding is closely related to characteristics of the community screened for the disease.

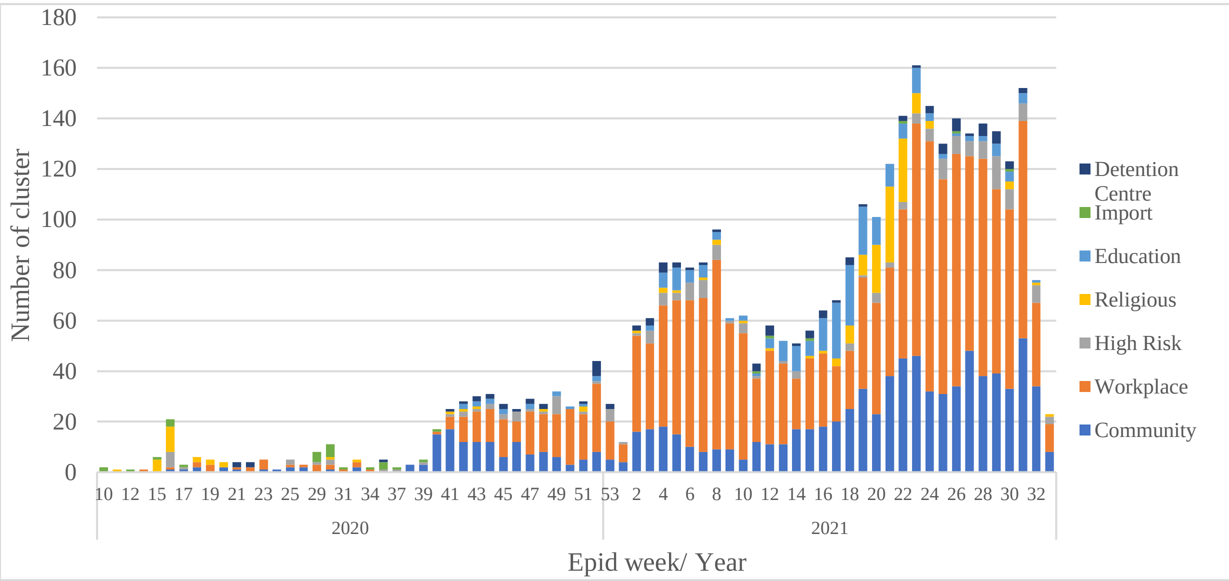

Figure 3: Covid-19 clusters in Malaysia by type and epidemiological week

A high positive percentage among detainees might indicate the large spread of the disease in the facilities in the setting of adequate testing in which all the detainees were screened. The spread of the diseases might be contributed by the living conditions in congregate facilities where implementation of public health intervention such as social distancing, face mask, disinfection was limited.

The workplace cluster also showed the second-highest positive percentage among other clusters, highlighting the importance of the spread of COVID-19 at various workplaces and the requirement to increase the COVID-19 testing among workers in the workplace. Community clusters' positive percentage of 15.08% may represent the widespread disease in the community involved. There might be the possibility of underestimating the number of cases due to inadequate testing. Therefore, rigorous contact tracing was highly needed to detect the cases and limit the transmission as soon as possible.

Table 3: COVID-19 Positive test percentage according to cluster type.

Cluster type	Cases (n)	Sum of tests	Positive test percentage (%)
Detention Centre	30952	94053	32.91
Workplace	193653	725148	26.71
Education	14094	79905	17.64
Community	56043	371667	15.08
Religious	14262	155054	9.20
High risk	6818	75977	8.97
Import	2113	32151	6.57
Total	**317935**	**1533955**	

3.4. Case fatality ratio

Case fatality ratio was reported highest among high-risk clusters (3.83%), as in Table 4. Further detailed analysis of each high-risk's cluster revealed that the case fatality ratio was as high as 35.0%. This might be due to the characteristics of patients in the high-risk cluster who have comorbidities that may contribute to increased risk of complication and mortality. Previous studies highlight increased mortality among COVID-19 patients with high risk, for example, in the elderly and those with comorbidities such as obesity, diabetes, hypertension, cardiovascular disease, cancer, etc.[15]

Despite the workplace contributing to the highest number of clusters, however, the case fatality ratio was the second lowest compared to other types of clusters. The possible reason for this could be, as workers in certain sectors were identified as a high-risk group, vigorous COVID-19 testing was implemented to this group. As the cases are detected earlier, the public health action could be implemented faster and improve the disease outcome. In addition, the working population is usually contributed by young and fit people, compared to other high-risk groups such as comorbidities and the elderly.

Table 4: Case fatality ratio based on cluster type

Cluster type	Cases (n)	Death (n)	Case fatality ratio (%)
High risk	6818	261	3.83
Religious	14262	153	1.07
Community	56043	414	0.74
Import	2113	15	0.71
Education	14904	20	0.14
Workplace	193653	233	0.12
Detention Centre	30952	28	0.09
Total	**317935**	**1124**	

3.5. Patient's outcome by cluster type

The patient's outcome in terms of recovery, intensive care unit admission was compared among COVID-19 clusters as in Table 5.

A majority of ICU admission were among patients in community clusters (50%), followed by workplace (41.57%) and religious clusters (8.33%). In terms of recovery outcome, patients in the workplace have the highest percentage of recovery (61.09%) compared to other clusters and followed by community clusters (17.57%.). This comparison showed that although workplace clusters contribute to the highest percentage of cases compared to other clusters, it has the highest percentage of recovery (61.05%) and a relatively lower percentage of ICU admission and mortality.

In contrast, although the community cluster has a lower percentage of cases than workplace clusters, its highest percentage of poor outcomes within the cluster namely ICU admission (50%) and mortality (36.83%), was alarming. This finding strongly indicates that a highly effective strategic preventive plan such as in identification and contact tracing is needed to contain the disease transmission as fast as possible, especially in communities that are vulnerable to poor health outcomes (such as the elderly, pregnant lady and those with comorbidity)

Table 5: Patient's outcome by cluster type

Cluster type	Cases (n, %)	ICU (n, %)	Recover (n, %)	Death (n, %)
Community	56043 (17.63)	6 (50)	55623 (17.57)	414 (36.83)
Workplace	193653 (60.91)	5 (41.57)	193415 (61.09)	233 (20.73)
High risk	6818 (2.14)	0 (0)	6557 (2.07)	261 (23.22)
Detention centre	30952 (9.74)	0 (0)	30924 (9.77)	28 (2.49)
Education	14094 (4.43)	0 (0)	14074 (4.45)	20 (1.78)
Religious	14262 (4.49)	1(8.33)	14108 (4.46)	153 (13.61)
Import	2113 (0.66)	0 (0)	2098 (0.66)	15 (1.33)
Total	317935	12	316622	1124

This study highlighted the importance of analysis of COVID 19 clusters for policymakers to focus on during planning and prevention strategies in Malaysia. Workplaces have been shown in this descriptive analysis to be the most significant contributors of clusters in Malaysia. Similarly, community clusters also revealed an important aspect to focus on in this analysis. Although the relationship between these two types of clusters is not tested, it is common to know that the cases can spill over from both directions e.g. cases from the workplace went back to community and trigger clusters from community and vice versa. Therefore, the planning of prevention and control of the disease needs to be done strategically to address and control the transmission between those two communities.

As this study was conducted using official secondary data available in open source, the limitation in terms of data details was unavoidable. The analysis was limited by the unavailability of individual data involved in clusters such as socio-demographic profile, risk factors, vaccination status, type of industries, etc. Future research in view of detailed analysis for each cluster and individual involved in the clusters will be beneficial in assessing risk factors and future planning of prevention and control strategies. Further exploration and analysis of close contact according to clusters will provide a further understanding of the adequacy of contact tracing and the spread of the disease.

4. CONCLUSION

In planning for prevention and control programme during pandemics is very challenging. The strategy must be very focused, especially during the surging number of cases that lead to limited resources. Hence, further understanding the characteristic of the cluster that contributes to the larger outbreak could provide some insight for timely decision-making to curb the spread of this disease with available resources.

AUTHORS' CONTRIBUTIONS

ZW: data analysis and manuscript writing. SAM: data analysis and manuscript writing.

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