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Comparison of the COVID-19 mortality occurring in hospitals and those brought in dead within Malaysia

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ABSTRACT

Background: Measuring the success of the control of COVID-19 in any country includes a review of the mortality especially to compare the deaths of those dying in hospitals and those brought in dead (BID). The objective of this study was to compare the death groups with the demographic factors that influenced the type of death.

Methods: This was a case-control study (1:1 ratio) looking at COVID-19 secondary public data from March 2020 to February 2021. Data such as the basic demographic data and comorbidities were analysed descriptively and then using a binary-logistic regression analysis to compare the independent variables against the outcome of BID. From the database, 120 cases were included as BID (4 excluded due to insufficient information) and 120 patients from the 1006 who passed away in hospital were randomly selected as comparators. The data was analysed in SPSS v21.0.

Results: The mean age for the BID was 59.59 (SD: 18.74), with more males (70.8%) than females (29.2%), of which 61.7% were Malaysians, 46.7% from the state of Sabah, and 64.2% having at least one co-morbidity (50% of them had hypertension). A univariate binary logistic regression analysis yielded factors such as age, nationality, and presence of any co-morbidities that are favourable to be included into the multivariate analysis. From the final analysis, the only factor that distinguished the BID from those dying in the hospital was being a foreigner (AOR: 4.32 [95%CI: 2.02–9.24], p<0.001).

Conclusions: This concluded that foreigners in Malaysia were likely to die from COVID-19 outside of the hospital compared to Malaysians. Amongst the reasons that needed to be addressed were cost, accessibility issues regarding medical care, and the testing policies in Malaysia.

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KEYWORDS:
COVID-19, BID, foreigner deaths, pandemic

INTRODUCTION

In 2019, the Hubei province in China had reported several cases characterised by pneumonia and respiratory failure caused by a fatal unknown virus. This was later successfully isolated and termed the novel coronavirus and later dubbed as SARS-CoV-2.[1] The virus originates from the coronaviruses of the Coronaviridae family in the Nidovirales order and is known to have a single-stranded RNA.[2] Being from the list of coronaviruses, there has been much debate and controversy about the origins of the virus – it is now accepted that the virus originated as a zoonotic virus that found its way into infecting humans (human-to-human) through droplet spread.[2] Since that discovery, the virus has mutated multiple times causing different variants. Though the spread and mitigation of the virus remains the same, the transmissibility and infectiousness of each variant differs, with the Omicron (B.1.1.529), Delta (B.1.617.2), and Beta (B.1.351) strains dubbed collectively as the variants of concern.[3,4] COVID-19 can affect the infected population with several severities, from being asymptomatic to having full-blown respiratory failure needing ventilation.[5] The ultimate acute complications that are faced include ventilator -related medical issues and death.[5] Deaths however can occur in two instances: one that occurs in hospitals after all medical interventions/diagnostics have been done and the other occurring before the patient can be given medical attention, largely termed as 'brought in dead' (BID), and this sometimes is used interchangeably with the term 'dead on arrival'.[6,7] Part of the issues in some countries, especially very early on in the pandemic, were the number of BID that occurred perhaps due to COVID-19.[6]

Malaysia, a country situated in the region of South East Asia with a population of 32 million consisting of Malays, Chinese, Indians, Indigenous population, and foreigners, is a country that has also been affected by COVID-19. The first documented case of COVID-19 in Malaysia was recorded on 25 January 2020 that was traced back to three Chinese mainland national citizens who were infected whilst being in Singapore.[8] The first Malaysian to have had contracted COVID-19 happened on 4 February 2020 who had claimed to have contracted it from Singapore.[8]

Malaysia has already seen five waves of COVID-19 cases with the biggest coming with the Delta and Omicron variants. The deaths however differed in both waves due to the presence of better vaccination rates during the Omicron phase. Until the time of the data collection period (28 February 2021), the country had seen 300,752 cases with the recovery being at 273,417 (90.91%), 6.2 million tests performed and 1,130 deaths already witnessed (case fatality rate: 0.38%).[9] From these 1,130 deaths, they were broadly categorised into two categories: those dying after receiving treatment and those who were BID and were found to have had COVID-19 after being tested (post-mortem).

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Malaysia since has setup a specific COVID-19 surveillance and management system. There is a specific mode of reporting especially for testing, positive case reporting, and analytics – all of which are centralised to the federal government system officially runned, maintained, and handled by the Ministry of Health Malaysia. Their daily public communication from this central repository comes in two different ways, either through the sharing from the official health portal concerning COVID-19 (available at http://covid-19.moh.gov.my/) or from the Director General of Health's official website (available at: https://kpkesihatan.com/) that is updated daily. All numbers that were reported have been on a 24-hour basis (from 12 pm the previous day to 12 pm on the day of reporting). Until the time of publication for the stipulated time period, both resources have reported the same statistical numbers and they tally.

After the emergence of COVID-19 in Malaysia, Malaysia beefed up its capacity to handle COVID-19 cases in multiple stages. At the point of preparation of this manuscript in 2021, Malaysia had 63 hospitals to treat COVID-19 throughout the country, which includes 6,755 beds and 543 ICU beds.[10,11] These are specifically reserved for those diagnosed with COVID-19 at Tier 3, 4, and 5. These numbers exclude the numerous quarantine centres across states in Malaysia (some even potentially capable to house 10,000) for those that were tested positive for COVID-19 but were suffering from Tier 1 or 2 stages of the disease. At present, Malaysia is practicing a home-quarantine policy if someone tests positive (Tier 1/2) unless the house/living situation is deemed inappropriate by the authorities, to which they are then quarantined in the government quarantine centres. Those that are having COVID from Tier 3 onwards are required to be admitted into a designated COVID-19 hospital for treatment. Deaths are dealt accordingly as how deaths were reported within the hospitals, but for COVID-19, a special report has to be sent to the central repository for documentation. From this pandemic, there have been cases that patients were BID, and when they were tested, they tested positive for COVID-19 and were included in the daily reporting to the central repository.

There were very few publications at the time of authorship regarding the BID due to COVID-19.[6] A study reported that 72.5% of the COVID-19 deaths in the Zambian community were found to have been BID.[6] Amongst the reasons cited for this was the question of the health seeking behaviour in their local population.[6] Some of the reasons that BID was deemed important was for the country to know if their mitigation of the COVID-19 pandemic in terms of testing, contact tracing, and public health measures was effective. It is important to study the BID as it reflects if enough was being done to contain the virus within any nation. Another study comparing the deaths which analysed the data based on BID by age in the United States was done- it reported that the range was from 9.8% to 38.9%.[12]

The aim of this study was to compare the deaths including demographic factors that influenced them with deaths that occurred outside the hospital and within the hospitals in Malaysia.

MATERIALS AND METHODS

Methodology

This study was a case-control study (1:1 ratio between the BID and hospitalised deaths) that was conducted using secondary publicly made available data on COVID-19 in Malaysia. Data from the pandemic starting on 17 March 2020 until 28 February 2021 were taken into account for this study. The reason the time line was started on 17 March 2020 despite the pandemic being reported since 24 January 2020 was simply because that the researcher decided to obtain data from the first recorded death in Malaysia, which occurred on 17 March 2020.

Data such as age, gender, the nationality, the place where the death occurred (by state), and the presence of co-morbidities were made readily available as granular data on a day-to-day basis. The researcher collated the data by accessing the data pages of each day on the stipulated dates to obtain the data. All data collected were entered into Microsoft Excel for tabulation before being exported into SPSS v21.0 for statistical analysis.

Selection of data and authenticity

Data were obtained from the following sources:

1. The Director General's website (https://kpkesihatan.com/)
2. The Official Malaysian Health Ministry Portal for COVID-19 information (http://covid-19.moh.gov.my/terkini)

Data on the stipulated dates were obtained on a day-to-day basis (as per reported by the above websites). Data of the daily deaths were made available in detail by source 1, whilst general clumped data details (e.g., daily total deaths) were made available from source 2. Data consisted of patients who had been admitted and died due to COVID-19 or those who were BID and were later diagnosed (post-mortem) to have had died from COVID-19 causes. Patients included were both Malaysians and foreigners who availed from medical facilities within Malaysia (both government and private healthcare facilities). BID was identified within the daily report as entries worded with '*Jenazah dibawa ke Hospital …*', which directly translated from Bahasa Melayu (native Malaysian language) to English as 'Corpse brought to Hospital …' within the column that identifies the place of where the post-mortem was conducted.

The author presumed that the date the death was reported as the day of death and the case number assigned to COVID-19 patient (case number assigned were numbers in sequence following the total cumulative cases Malaysia has seen) was used to determine the day of admission when comparing to the correspondence of the cumulative cases. Data entered were cross-checked by two other independent individuals to see if there were any discrepancies. Any discrepancies were rectified and corrected before analysis.

Data selection and randomisation

From 17 March 2020 till 28 February 2021, the author recorded 124 (10.97%) cases of BID and 1006 (89.03%) deaths of those passed away in hospital (total 1130) due to COVID-19. From the total of 124, the author excluded 4 BID cases as they were backdated (date of death not reported), they had died outside the country, or the information shared on the

official reporting portals (sources 1 and 2) were incomplete. After the exclusion, a total of 120 (96.77%) of the 124 were included into the final analysis.

The author then randomly selected 120 patients (accounting for 10.62% of the total 1130 deaths) who had died in the hospital settings due to COVID-19. From the 1006 patients who died in hospital during the stipulated time, the author assigned an individual number to each patient following the sequence of deaths according to the date of death. The author then used the EpiCalc 2000 (v1.01) to select 120 random numbers from the possible 1006 to be included in the study as a comparator. These selected numbers were inspected, and all the initial selected 120 numbers were included as comparators after affirming that the data of these patients were complete. The data was selected and included in a Microsoft Excel file containing the BID cases previously entered. Once the data was cleaned and standardised, it was imported into SPSS v21.0 for the final analysis.

Ethics approval

Ethics approval was obtained from the National Medical Research Registry and the Malaysian Research Ethics Committee (NMRR-21-962-60004). There were no identifiers as data obtained and used were secondary data already anonymised by the provider.

Mode of analysis

Data were analysed and provided as numbers/percentages (for categorical data) and mean/median with standard deviation/inter-quartile range for continuous variables. The continuous variables that were normally distributed (each skewness was between -1/+1 and Kurtosis between -3/+3) were reported as mean (standard deviation). The variables that were not normally distributed were reported as median (inter-quartile range). For the logistic regression, *p* values ≤0.3 for the univariate regression were considered significant and included for the multivariate analysis. For the multivariate analysis and all other statistical tests (other than the univariate analysis), *p* values of <0.05 was considered statistically significant. To see if both groups were homogenous, we used the presence of comorbidities as a comparative baseline. This was done because during the time of data collection, the ministry had always suggested that the presence of comorbidities made a difference between recovering from COVID-19 or succumbing to it.[13]

RESULTS

Demography

The demographic characteristics of the people who were BID and those who were randomly selected that died in hospital are listed in Table I. The comparative baseline of having comorbidities was done via a chi-square, which showed no statistical significance between the two groups (p=0.06), thus making the groups comparable (the breakdown of each comorbidity compared was also not significant at p=0.68). The mean age for the BID group was 59.59 (SD: 18.74) years and for those who died in hospitals was 64.33 (16.00) years. In both groups, there were more males than females. There were also more Malaysians than foreigners (p<0.001) and many deaths happening in the state of Sabah (p=0.04), all of which when compared were statistically significant. Most of the co-morbidities present were similar, with hypertension being the most common (50.0% in the BID group and 55.8% in the hospital group), followed by diabetes (29.2% in the BID group and 48.3% in the hospital group) and chronic kidney disease (12.5% in the BID group and 23.3% in the hospital group).

A statistical analysis was also conducted to see if the demographics varied between the two groups. Conducting an independent t-test analysis yielded a statistically significant difference (p=0.03), which showed that the two groups were indeed different from each other, with the BID being more prone to die at an early age from COVID-19 compared to those who died in hospitals. There was also a significant difference amongst the nationalities of those who passed away. A chi-square test showed that there was a statistically significant difference amongst the nationalities (p<0.001). This was because there was a larger proportion of foreigners who were BID compared to those who died in the hospital. The median time from the time of admission to the time of death amongst those who passed away in hospitals was 5 days (IQR: 12.25).

Advance analysis

Binary logistic regression analysis comparing the BID patients with the patients who died in hospital

Goodness-of-fit model

The researcher decided to perform a binary logistic regression analysis to compare the basic demographic variables when comparing the outcome of being BID or patients dying in hospitals. The researchers first ran a 'goodness-of-fit' Hosmer and Lemeshow modelling for the data, which yielded only the categorical variables with p= 0.76 and a goodness of fit amounting to 67.9%. The researcher also ran the goodness of fit via the Nagelkerke R^2, which yielded 20.7% or 79.3% fit. All variables were left in the original categorical form except for the age variable that was analysed as a continuous variable.

Univariate analysis

The researcher then proceeded with a univariate analysis, which was conducted to compare variables such as age, gender, nationality, states where the death occurred, and co-morbidities (all of which underwent an interaction check and there were no interactions with the data). The outcome was the comparison of the BID (numerator) with the patients dying in hospital (denominator). The univariate analysis conducted used the variables that yielded a p≤0.3 to be included for the multivariate analysis. From the univariate analysis, it was found that age (OR: 0.98, 95% CI: 0.97–0.99), gender (male having the OR: 1.51, 95% CI: 0.88–2.58), nationality (foreigners having an OR of 5.12, 95% CI: 2.58–10.13), those without any co-morbidities (OR 1.92, 95% CI: 1.09–3.40), those with co-morbidities including hypertension (OR: 1.40, 95%CI: 0.84–2.32), diabetes mellitus (OR: 2.27, 95%CI: 1.33–3.87), chronic kidney disease (OR: 2.13, 95%CI: 1.07–4.23), ischemic heart disease (OR: 2.47, 95%CI: 1.07–5.67), chronic lung disease (OR: 2.42, 95%CI: 0.61–9.57), and those who are immunocompromised or with some oncological disorders (OR: 4.10, 95%CI: 0.45–37.26)

Table I: Demographic details of those who were brought in dead (BID) and those who died in hospital, and a statistical comparison between the two groups

Variables	BID n (%) N= 120	Died in hospital n (%) N= 120	p value
Age*	59.59 (18.74)	64.33 (16.00)	0.03
Gender			
Male	85 (70.8)	74 (61.7)	0.13
Female	35 (29.2)	46 (39.3)	
Nationality			
Malaysian	74 (61.7)	107 (89.2)	<0.001
Foreigner	46 (38.3)	13 (10.8)	
States where deaths occurred			
Sabah	56 (46.7)	39 (32.5)	0.04
Selangor	29 (24.2)	37 (30.8)	
Kuala Lumpur	12 (10.0)	10 (8.3)	
Sarawak	5 (4.2)	5 (4.2)	
Perak	4 (3.3)	3 (2.5)	
Labuan	3 (2.5)	0	
Pahang	3 (2.5)	2 (1.7)	
Johor	2 (1.7)	15 (12.5)	
Melaka	2 (1.7)	0	
Negeri Sembilan	2 (1.7)	2 (1.7)	
Penang	2 (1.7)	3 (2.5)	
Kedah	0	1 (0.8)	
Kelantan	0	2 (1.7)	
Putrajaya	0	1 (0.8)	
Co-morbidity			
Yes	77 (64.2)	93 (77.5)	0.06
No	42 (35.0)	27 (22.5)	
NA	1 (0.8)	0	
Hypertension	60 (50.0)	67 (55.8)	0.68
Diabetes mellitus	35 (29.2)	58 (48.3)	
Chronic kidney disease	15 (12.5)	28 (23.3)	
Dyslipidaemia	12 (10.0)	16 (13.3)	
Stroke	11 (9.2)	14 (11.7)	
Ischemic heart disease	9 (7.5)	20 (16.7)	
Obesity	7 (5.8)	7 (5.8)	
Asthma	5 (4.2)	5 (4.2)	
Gout	5 (4.2)	6 (5.0)	
Bronchiectasis	2 (1.7)	0	
Chronic lung disease	2 (1.7)	7 (5.8)	
Anaemia	1 (0.8)	1 (0.8)	
Autoimmune diseases	1 (0.8)	2 (1.7)	
Immunocompromised/oncology	1 (0.8)	4 (3.3)	
Chronic liver disease	0	1 (0.8)	
Thyroid disorder	0	1 (0.8)	
Average time from admission to death**		5 (12.25)	

*reported as Mean (SD) **reported as Median (IQR)

were factors that had a p value of less than 0.3 and were included into the multivariate analysis. The *p* values of ≤0.3 were only for the purpose of including them into the multivariate analysis (any comparison without the multivariate analysis, significance should be considered at $p<0.05$).

Multivariate analysis

The significant variables in the univariate analysis ($p<0.3$) were included in the multivariate analysis to identify the variables that had an effect on those who were BID when compared to those who died in the hospital. The value of significance in the multivariate analysis was considered at $p<0.05$. From the final analysis, we found that the nationality was the main variable that had an effect on the patient being BID compared to those who died in hospital. Foreigners had an adjusted odds ratio of 4.32 times (95%CI: 2.02–9.24) more likely to be BID instead of dying in hospitals when compared to Malaysians. This also yielded a significant *p* value at $p<0.001$. The other factors yielded no statistically significant difference, though it must be mentioned that having ischemic heart disease ($p=0.06$, OR: 2.42, 95%CI: 0.96–6.10), having diabetes mellitus ($p=0.09$, OR: 1.79, 95%CI: 0.91–3.53), and being the male gender ($p=0.09$, OR: 1.68, 95%CI: 0.93–3.05) were factors that were rather close to a statistically significant difference. Complete details are available in Table II.

Table II: The odds ratio (OR) and the multivariate analysis of adjusted odds ratio (AOR) for the binary logistic regression performed

Variables	Univariate analysis OR (95% CI)	p value	Multivariate analysis AOR (95% CI)	p value
Age	0.98 (0.97–0.99)	0.04	0.99 (0.97–1.01)	0.25
Gender				
Male	1.51 (0.88–2.58)	0.13	1.68 (0.93–3.05)	0.09
Female	Ref		Ref	
Nationality				
Malaysian	Ref	<0.001	Ref	<0.001
Foreigner	5.12 (2.58–10.13)		4.32 (2.02–9.24)	
States where deaths occurred				
Selangor	Ref	0.55		
Sabah	1.83 (0.97–3.46)			
Kuala Lumpur	1.53 (0.58–4.04)			
Sarawak	1.28 (0.34–4.83)			
Perak	1.70 (0.35–8.21)			
Labuan	>1000			
Pahang	1.91 (0.30–12.22)			
Johor	0.17 (0.04–0.80)			
Melaka	>1000			
Negeri Sembilan	1.28 (0.17–9.61)			
Penang	0.85 (0.13–5.43)			
Kelantan	-			
Kedah	-			
Putrajaya	-			
Co-morbidity				
Yes	Ref		Ref	
No	1.92 (1.09–3.40)	0.02	0.87 (0.35–2.18)	0.77
Hypertension	1.40 (0.84–2.32)	0.20	0.66 (0.30–1.43)	0.29
Diabetes mellitus	2.27 (1.33–3.87)	0.03	1.79 (0.91–3.53)	0.09
Chronic kidney disease	2.13 (1.07–4.23)	0.03	1.37 (0.62–3.01)	0.43
Dyslipidaemia	1.39 (0.63–3.07)	0.42	-	-
Stroke	1.31 (0.57–3.01)	0.53	-	-
Ischemic heart disease	2.47 (1.07–5.67)	0.03	2.42 (0.96–6.10)	0.06
Obesity	1.00 (0.34–2.94)	0.99	-	-
Asthma	1.00 (0.28–3.55)	0.99	-	-
Gout	1.21 (0.36–4.08)	0.76	-	-
Bronchiectasis	0	0.99	-	-
Chronic lung disease	2.42 (0.61–9.57)	0.21	2.65 (0.59–11.87)	0.20
Anaemia	1.00 (0.06–16.17)	0.99	-	-
Autoimmune diseases	2.02 (0.18–22.55)	0.57	-	-
Immunocompromised/oncology	4.10 (0.45–37.26)	0.21	2.82 (0.28–28.15)	0.38
Chronic liver disease	>1000	0.99	-	-
Thyroid disorder	>1000	0.99	-	-

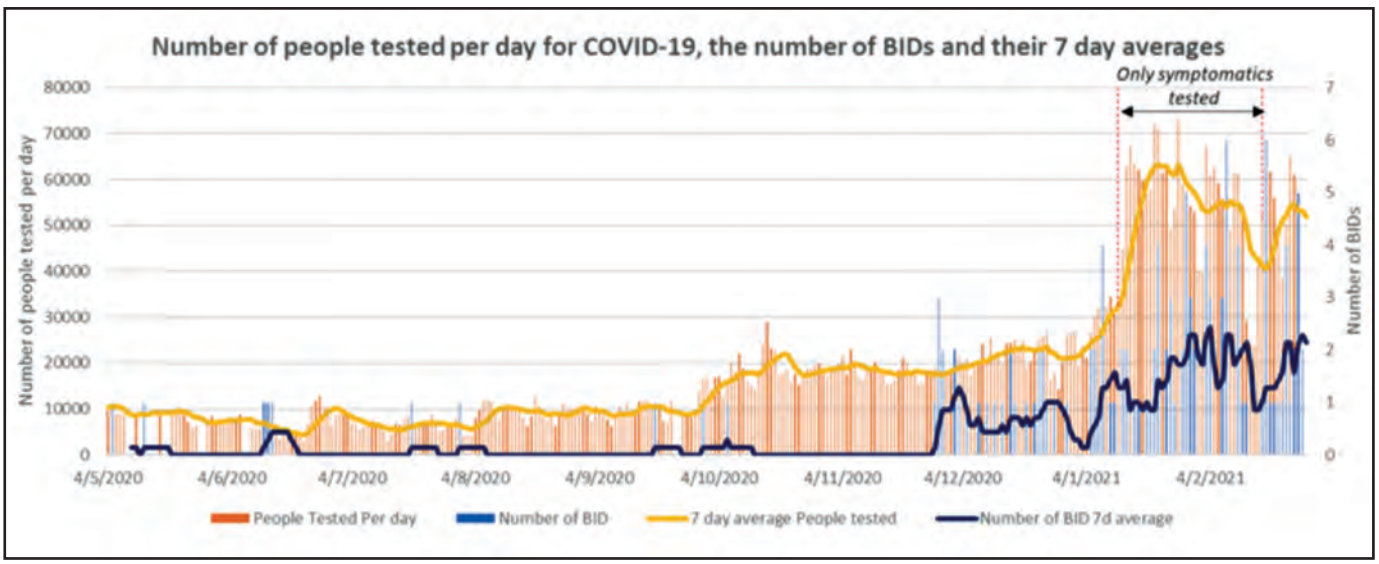

Fig. 1: The number of people tested and being BID per day and their respective seven-day averages with respect to COVID-19.

Summary of Findings

Foreigners were 4.32 times (95% CI: 2.02–9.24) more likely to die by being BID than dying in hospitals compared to Malaysians. In this study, the multivariate binary logistic regression showed that being a foreigner was the only factor that determined if a COVID-19 patient was to be BID or die in hospital (p<0.001).

DISCUSSION

From this study, it was found that the only factor that determined if a COVID-19 patient was BID or died in hospital was the fact of nationality. This has given a rise to the healthcare of foreign workers in Malaysia– a topic that has always been a debate in Malaysia.

The literature search revealed that there were only two papers published on BID concerning COVID-19 in Zambia and another in the United States. The Zambian paper reported that as high as 72.5% of the COVID-19 deaths were occurring within the community and were likely to be BID, which was much higher than the 10.97% cases that were BID in Malaysia.[6] The Zambian study implied that not only were BID a concern for public health safety of the people, but they made contact tracing of COVID-19 much more difficult.[6] Amongst the reasons cited for a potential cause of the BID was the poor "healthcare seeking behaviour" among the population, a lack of knowledge about COVID-19 and its severity along with the reported high proportion of recoveries, perception of illness, stigma associated with the disease, and medication being readily made available over the counter.[6,14] The U.S. study showed that the range of BID were 9.8%–38.9%.[12] They also found that the younger age group were likely to be BID compared to the older group.[12]

Although there has been limited literature published about BID with regards to COVID-19, there were a few papers published on different subject matters with relation to BID. From a paper published in 2016 concerning maternal deaths, amongst the reasons cited for BID reported were that 56.25% of patients were guilty of a delay in seeking proper medical attention.[15] Data for the exact reasons for the BID due to COVID-19 in Malaysia were not made available in the current study. In another paper, where BID were assessed in a state in India, it was reported that many BID were due to the fact of unexpected deaths especially in the 21- to 30-year-old age group, which however was attributed to physical factors like motor vehicle accidents and social activities.[16] In the current study, the mean age group of the BID differed at 59.59 (SD: 18.74) compared to the study done in India. The study in Zambia did not report any age groups that were BID due to COVID-19.[6]

In this current research, the researcher found that foreigners were prone to be BID compared to Malaysians. Some of the possible reasons were explored. In a qualitative paper published in 2019 regarding foreign worker's healthcare in Malaysia, it was reported that healthcare services in Malaysia (private or public) has become rather inaccessible to migrant workers.[17] Some of the factors that have been identified were complex access barriers that were mainly related to matters beyond the control of the healthcare sector – including financial constraints, legality issues concerning documentation, language barriers, discrimination/ xenophobia, and employer-related barriers.[17] Amongst the things that were suggested in the paper to overcome these barriers was to ensure that the government has a compulsory healthcare worker insurance cover so that foreign workers are able to attain healthcare services especially in the times of emergency.[17] In another paper published in 2020 by the same author, it was reported that migrant health policies at destination countries (China and Malaysia) were predominantly protectionist, concerned with the transmission of communicable diseases (such as tuberculosis and blood-borne diseases) and diseases that might burden the health systems.[18] Another point of concern was there were reports of instances where migrant workers intending to renew their permits failed their medical examination and ended up overstaying as undocumented workers.[18] This, in a way, has caused them to refrain from getting medical attention during the time of illness to avoid being deported, thus causing them to present to healthcare facilities at a delayed and at dire stages.[18]

Another reason for delayed medical care attention towards foreign workers was due to the fact that foreigners were liable to higher payments when seeking medical care in the public healthcare sector.[19,20] Due to high costs that are incurred in the public sector, the foreigners are more likely to seek private healthcare services especially in primary care.[20,21] There was also a disparity of healthcare access based on the place of stay of these foreign workers.[21] As it is known in Malaysia, there was a delay in allowing the private healthcare services to screen for COVID-19, not forgetting the constant voicing of the private sector mentioning that they were not prepared to receive/treat COVID-19 patients.[22] All of these might have contributed to foreigners being BID.

Another possible reason that foreigners might be prone to BID is due to the fact that they might not be well-educated on COVID-19 symptoms. A study done in Malaysia showed that Malaysians had good knowledge, attitude, and practice when it came to COVID-19 but this study excluded foreigners.[23] However, from a report written in 2020, it can be summarised that the understanding of COVID-19 especially an explanation in the native language of foreigners is vital to disseminate vital public information for prevention.[24]

In this research, we report that many patients that were BID were younger than those dying in hospitals. This possibly throws doubt to the concept of some theories that might consider younger patients to be less risky in succumbing to COVID-19. However, it must be also considered that the presences of co-morbidities might be an influencing factor that determines whether the COVID-19 infection could to be severe or not.[25] In our latest published National Health and Morbidity Survey of 2019, it was reported that many co-morbidities (that were linked to COVID-19 severity) were rather hidden within the community especially diabetes and hypertension (both individually, nearly half of the national prevalence especially among young adults remain silent and unknown).[26] Additionally, the fact that the prevalence of obesity is high in Malaysia could also be a contributing factor to these deaths,[27] which could also be another factor why

many of the young patients in this study were found to have been BID. This however, can only be coupled with the applied methods of active case detection.

In a debate article published in 2020 in the United States, there was a discussion suggesting if COVID-19 management should see a change in the management/admission according to the patients' age.[28] Although there was much debate about fairness and recovery rates, it did show that the concept of admission and the prognosis for recovery is highly debatable. However, in the study conducted in the United States looking at BID, the younger age group had seen higher mortality rates compared to the older age groups.[12] Being younger might might be a contributing factor, owing to the reason that younger people might not show symptoms till the later stages.[12] In this study, we saw that although age was not a predictor to determine if a patient was to be BID or die in hospital, upon comparing, the BID group was indeed statistically significantly younger when compared to those dying in the hospital group. This might give rise to the discussion within the paper that was published in United States on whether the admission and management of patients be done based on tier severity rather than having the confounder of age selection.

Amongst the ways that could have been employed to rampantly reduce the number of COVID-19 cases and deaths in any country at a point of high deaths, especially the BID, is the mass and rapid testing.[29] The reason for this is the turn-over time from test results to mitigation. During the early days, the antibody testing was used; however, since we have known that it was not as sensitive and specific, the reverse transcriptase polymerase chain reaction (RT-PCR) test was used in hospitals for better reliability.[29] However, we know that the RT-PCR can take a few days (1–3 days) to be processed and for a result to be made available.[30] Therefore, with the invention and accurate sensitivity/specificity of some brands of the rapid test kits-antigen (RTK-Ag including the saliva tests done correctly), it was a better alternative than the antibody tests that were used earlier.[30] With this, countries will be able to mitigate with faster decision-making in isolating and contact tracing close contacts within 1–3 hours compared to 1–3 days with RT-PCR.[30,31] When a person is diagnosed early, many of the other mitigation processes like contact tracing, early initiation of treatment, and early isolation can not only help with the detection of other cases, but it will also assist to isolate the case from becoming a potential source of spread to other individuals. This is even more so amongst infected individuals who are asymptomatic. The report received in Malaysia via the Ministry of Health in July 2020 showed that about 70% of the COVID-19 patients in the country were asymptomatic.[32] Figure 1 lists the number of people tested per day in Malaysia since May 2020. As we approached the new year in 2021, Malaysia received a new circular issued (13 January 2021) by the Ministry of Health stating that only symptomatic close contacts would be tested.[33] This was later retracted on 17 February 2021.[34] However, we can see from the graph that the number of cases increased tremendously during that period and so did the 7-day BID average baseline. This might be due to the fact that many positive cases were perhaps not screened and because of not being bounded by the law to quarantine, many would have been in contact with the community, thus causing further spread of the virus within. This might be especially true after Malaysia was seen to have many workplace clusters during the pandemic.[35] With the way testings were conducted from 13 January 2021, it might be indicative in the rise in the BID as patients might have been infected and not known until they reached a critical state of infection that caused them to succumb before medical intervention was possible. Amongst the possibilities is happy hypoxemia that affects younger individuals.[36] This, however, was a time before mass vaccination was done in the country.

STRENGTHS

- Until the time of submission, the researchers are unaware of any other publications in Malaysia comparing the BID patients with those who died in hospitals.
- This study used data from official government sources that verified the deaths of COVID-19 before being made public.

LIMITATIONS

- The assumption of date of deaths and admissions might have a discrepancy of one day as the reporting in Malaysia has a cut-off point of 12 pm daily. The subsequent deaths on the day will be taken into account only the next day.
- Data was entered manually by the author after reviewing the data posted on official sources. The author had allotted two individuals to examine the data entered for accuracy. However, due to manual data entry, there might be random errors (though dataset was inspected multiple times by different individuals).
- All data was obtained from the official source of COVID-19 information in Malaysia. Any discrepancy that was made by the source will be reflected in the dataset.

CONCLUSIONS

Foreigners were four times more likely to be BID due to COVID-19 compared to Malaysians. The mitigation of the pandemic highly depends on the number of deaths a country deals with. With a high number of foreigners being BID, consideration on their access to medical care needs, accessibility, costing, and mass testing might need to be considered to ensure that COVID-19 cases are picked up early for mitigation purposes. The BID at that time might also be more likely linked to the COVID-19 'testing policy' choice adopted by governments, especially those involving the testing of asymptomatic individuals who were close contacts.

DECLARATIONS

• *Ethics approval and consent to participate*

Data in this study were obtained from a public domain data source. No individuals were approached for this study. Consent therefore was not applicable.

• *Consent for publication*

Publication consent was obtained from the Director General of Health. The author would like to thank the Director

General of Health for approving the publication of this study.

• *Availability of data and materials*

Data tabulated in the Excel sheet will be made available to researchers upon request from the author.

• *Competing interests*

The author declares no competing interest in this study.

• *Funding*

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• *Authors' contributions*

As the only author, Arvinder-Singh HS collected the data, compiled the data, performed the analysis, and wrote the final manuscript.

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