# A Study of COVID-19 Mortality From Deployed Military Field Intensive Care Unit Supporting Penang Hospital: Risk Factors Analysis

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## ABSTRACT

**Introduction**: The third wave of COVID-19 struck Malaysia in a tougher way. It was not only straining the health system but also carried a higher mortality rate. The phenomenon not only led to an influx of critically ill COVID-19 patients, but also outstripped the number of Intensive Care Unit (ICU) beds available. Consequently, the first Field Intensive Care Unit was set up in the compound of Hospital Kepala Batas (HKB) in Penang, known as HKB Field ICU (HKB FICU). **Objectives**: This study would like to focus on the outcome of patients admitted to the field ICU, primarily describing the mortality rate and risk factors or comorbidities among non-survivors. Methods: This is a retrospective study. The details of the non-survivor hospital record, including the length of stay, and comorbidities were collated and examined to determine the key risk factors. Hypertension, Diabetes Mellitus, Obesity, Pregnancy, Cardiovascular events such as stroke and ischemic heart disease, vaccination status, and older age are among the risk variables investigated in this study. The study period was from May 28, 2021 until Dec 29, 2021. **Results**: Out of 421 patients, 40 were non-survivors, resulting in a mortality rate of 9.5% for the HKB FICU. The oldest non-survivor was 89 years old, and the youngest was 27 years old, with a mean age of 54.58 (SD=16.65). Males account for 67.5% of deaths (27 patients), while females account for 32.5%(13 patients). Most non-survivors (62.5 %) had two risk factors, 20% had three or more risk factors and 17.5% had at least 1 risk factor. Hypertension (42.5 %) and Diabetes Mellitus (42.5 %) were the most common risk factors among the non-survivors (40%). **Conclusion**: The highest risk factors and comorbidities for HKB FICU Mortality were hypertension and diabetes mellitus, which are similar with the findings from other studies. COVID-19 patients had a significant mortality rate, with death occurring most frequently on the day of admission.

**Keywords**: COVID-19, Field ICU, Mortality

## INTRODUCTION

The World Health Organization declared COVID-19 a pandemic in March 2020. Following an uptick in cases in Malaysia, the Malaysian government issued a movement control order (MCO) to halt the spread of the virus. However, the virus continues to spread, urging the declaration of a state of emergency, which enacted harsher penalties for violators in order to guarantee that people adhere to the new regulation.

The mass vaccination effort, started in February 2021, successfully reduced the number of cases by the end of May 2021. Malaysia, on the other hand, has been hit by the third wave of COVID-19 by a new variant type of the virus which can be easily transmitted with a higher infection probability[1].

In a multi-center cohort analysis of critically ill patients admitted for pneumonia, the mortality rate was 30.7% [5]. In Selangor, a review of the outcomes of ventilated critically sick patients reported 18.3% fatality rate[2]. All the studies conducted among hospital setting ICU patients. We were unable to locate any studies that describe the mortality rate within COVID-19 patients in field or temporary ICU settings.

The third wave was much tougher to Malaysia as compared to the 2 previous waves. It was not only straining the health system but also carried higher mortality rate [2]. The phenomenon was not only lead to influx of critically ill COVID-19 patient, but also the number of Category 4 and 5 patients requiring ventilation and life support had outstripped the number of Intensive Care Unit (ICU) beds available in authorized facilities for COVID-19 in several affected states. Consequently, the Malaysian government decided to open the first Field Intensive Care Unit in the compound of Hospital Kepala Batas (HKB) in Penang[3].

This Field ICU, known as HKB Field ICU or KKB FICU was the first ever in Malaysia and was designed as an extension of HKB Penang's main ICU. It was equipped with 24 beds with a capacity to be further extended to 27 beds. Thus, we would like to focus on the outcome of patients admitted to the field ICU, primarily describing the mortality rate and risk factors or comorbidities among non-survivors.

## STUDY DESIGN

This is a retrospective study, conducted to describe the data of the non-survivors of COVID-19 patients admitted into HKB FICU. The details of the non-survivor hospital record, including the length of stay, and comorbidities were collated and examined to determine the key risk factors. Hypertension, Diabetes Mellitus, obesity, pregnancy, cardiovascular events such as stroke and ischemic heart disease, vaccination status, and elderly (defined

as individuals aged 60 and older) are among the risk variables investigated in this study, as commonly reported in other studies [2,4-12]. The study period was from May 28, 2021 until Dec 29, 2021.

## RESULT

Out of 421 patients, 40 were non-survivors, resulting in a mortality rate of 9.5% for the HKB Field ICU. Table 1 shows the sociodemographic data from this investigation. Malay is the most common ethnicity treated during this time (58.6%), as well as the majority of death (75%) followed by Chinese (15%) and Indian (10%). The oldest non-survivor was 89 years old, and the youngest was 27 years old, with a mean age of 54.58 (SD=16.65). Males account for 67.5 percent of deaths (27 patients), while females account for 32.5 percent (13 patients). The majority of patients admitted (26 patients, or 65%) were in Category 5, while the remaining 14 patients were in Category 4 (35%).

**Table 1: Socio-demographic Characteristics of COVID-19 Deceased Cases in HKB Field ICU (n = 40)**

| Characteristics | | N (%) |
|---|---|---|
| Gender | Male | 27 (67.5) |
| | Female | 13 (32.5) |
| Age (years) | Median: 54.00; Mean (SD) :54.58 (16.65) | |
| Age Groups | 18-59 | 24 (60) |
| | ≥60 | 16 (40) |
| Ethnicity | Malay | 30 (75) |
| | Chinese | 6 (15) |
| | Indian | 4 (10) |
| COVID-19 Category | Category 4 | 14 (35) |
| | Category 5 | 26 (65) |
| Length of Stay (Days) | Median: 3.00; Mean 4.45; Mode (%): 1.00 (25) | |

The majority of non-survivors (62.5 %) had two risk factors investigated in this study, 20% have three or more risk factors and 17.5% had at least 1 risk factor. Hypertension (42.5 %) and Diabetes Mellitus (42.5 %) were the most common risk factors among non-survivors (40 %). Non-vaccinated non-survivors accounted for 55% of non-survivors, whereas partially vaccinated and fully vaccinated non-survivors accounted for 20 and 25 percent, respectively. Table 2 lists other risk factors.

## DISCUSSION

### Discussion on Mortality Rate And Risk Factors of The Non-Survivor

According to the findings, hypertension and diabetes are the leading risk factor for death among COVID-19 non-survivors in the HKB Field ICU. Even in the early study hypertension, respiratory system disease, and cardiovascular disease were already known as the risk factors for the severity of COVID-19 patients[13]. The later study which found that hypertension, diabetes, COPD, unspecified form of lung disease, coronary heart disease, heart, unspecified type of cardiovascular disease, hyperlipidemia, obesity, chronic renal failure, and cancer were all found to be significant predictors of ICU admission in a meta-analysis review[14].

**Table 2: Risk Factor Among COVID-19 Deceased Cases in HKB Field ICU (*n* = 40)**

| Risk factors | | N (%) |
|---|---|---|
| Hypertension | | 17 (42.5) |
| Diabetes Mellitus | | 16 (40) |
| Obesity | | 3 (7.5) |
| Pregnancy | | 1 (2.5) |
| Cardiovascular Event | | 1 (2.5) |
| Vaccination Status | Fully Vaccinated | 10 (25) |
| | Partial Vaccination | 8 (20) |
| | Non-Vaccinated | 22 (55) |
| Age > 60 (years) | | 16 (40) |
| Number of Risk Factor (s) | 1 | 7 (17.5) |
| | 2 | 25 (62.5) |
| | 3 | 8 (20) |

The study also discovered that hypertension, diabetes, COPD, coronary heart disease, and cancer became more prominent as sample sizes grew larger. However, the study also indicated that there were three meta-analysis studies that revealed pre-existing conditions were not associated with severity of illness, which could be due to the smaller sample size of the studies, whereas the other studies showed the opposite finding. The result obtained in this study is also consistent with a study conducted in the early stages of COVID-19[15,16], a study conducted during the emergence of the SARS-CoV-2 Delta (B.1.617.2)[8,17], and a study conducted after primary vaccination[18].

During the early stages of the vaccination campaign, the vaccine was primarily recommended for those with comorbidities and those who were older, as the vaccine has been shown to reduce mortality[19]. Vaccination has consistently been shown to lessen the severity of disease since the advent of the Delta variation in Malaysia, even though its effectiveness against symptomatic infection has been reduced[20]. Non-vaccinated patients account for the highest percentage of non-survivors with no comorbidities (12.5%), while no fully vaccinated patients died without any risk factors. Therefore, the Malaysian government's determination to encourage the completion of two doses for the general public is reasonable in order to avoid hospitalization and serious consequences such as death.

The majority of the patients died on the first day of their admittance, with an average stay of 4.45 days. The majority of the cases are Category 5 patients who require intubation, indicating the infection's severity. This is already described in the study about the timing of the death in critically ill patient[21]. This also could be connected to a higher rate of brought-in-dead cases during the research period, which corresponded with the arrival of the Malaysian third waves[22,23]. The majority of the

cases that were brought-in-dead to the hospital were already in a critical stage, or there was no accessible healthcare institution nearby as reported in other study[24]. The study also further stated that the higher numbers of the brought-in-dead were among non malaysian from Sabah which most of them are stateless peoples.

**Field ICU vs In-Hospital ICU**

As the number of COVID-19 patients grows and the present hospital's bed capacity is reached, a temporary hospital in the form of a makeshift hospital as established in MAEPS 2.0[25] and a Field Military Hospital[26] has been used to manage and treat the patients. Since the COVID-19 was originally discovered in Wuhan, China, this is almost a standard strategy in nearly every country[27]. HKB Field ICU, on the other hand, is the first of its kind in Malaysia to be dedicated solely to COVID-19 critical patients requiring ventilation or life support. Other countries, such as Bahrain, were also constructing temporary ICUs[28]. There are a number of drawbacks and technical concerns that must be addressed prior to the ICU's functioning, such as oxygen support, electricity backup, and well-trained ICU staff. There is the worry that the standard of care provided to patients in field ICUs may not be comparable to that provided to patients in hospital ICUs. According to our findings, the HKB Field ICU's mortality rate for In-ICU Death is 9.5 %, which is higher than the total mortality rate of the Field ICU in Bangladesh Military Hospital[29]. However, there are various aspects to consider, such as the length of the study and the ICU's capacity. It was a temporary short-term ICU established for HKB Field ICU to help critical patients with limited staff and resources compared with the Bangladesh Hospital. A systematic review and meta-analysis of ICU mortality rates among patients admitted due to COVID-19 found that mortality rates range from 0% to 84.6%, with a cumulative mortality rate of 41.6% among studies from Asia, Europe, and North America[30]. According to a local study in Selangor, the mortality rate among critically ill patients admitted to ICU was 18.3 percent[2]. This is greater than the HKB Field ICU fatality rate, suggesting that the care provided was comparable to that provided by the conventional In-Hospital ICU. However, due to the limitations of the study, the result needs to be interpreted with caution.

## RECOMMENDATION

It is recommended for the next deployment of field ICU or any temporary hospital, the data management either medical or administration needs to be more comprehensive and systematic to prevent data losses and easier for post-mortem improvement. It is hoped that in future research, the standard of care in the field of ICU can be further evaluated with adequate data.

## LIMITATION AND ADDED VALUE

The study's limitation was the restricted amount of data that could be analyzed. As a result, only a few risk variables and comorbidities were looked into. There was also no detailed information on the patient's treatment, which limits the scope of the study.

The added value of this study is that it is the first study describing the risk factors among the non survivor in field ICU setting in Malaysia to the best of our knowledge.

## CONCLUSION

The highest risk factors for HKB Field ICU Mortality were hypertension and diabetes mellitus, which are similar with the findings from other studies. COVID-19 patients had a significant mortality rate, with death occurring most frequently on the day of admission.

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Nil.

**Conflict of Interest**

There are no conflicts of interest

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