

## Managing COVID-19 Pandemic in Teaching Hospitals: An Early Preparedness Setting

AZMAWATI MOHAMMED NAWT<sup>1</sup>, AZIMATUN NOOR AIZUDDIN<sup>2</sup>, ROZITA HOD<sup>3</sup>, NORFAZILAH AHMAD<sup>4</sup>, FAIZ DAUD<sup>5</sup>, SHARIFAH AZURA SALLEH<sup>6</sup>, NAJMA KORI<sup>7</sup>, PETRICK PERIYASAMY<sup>8</sup>, MOHD ROHAIZAT HASSAN<sup>9</sup>, HANAFIAH HARUNARASHID<sup>10</sup>, KAMARUZAMAN JUSOFF<sup>11</sup>, MOHD AFIQ ARIFIN<sup>12</sup>

### Abstract

*The World Health Organization (WHO) declared the 2019-20 coronavirus disease (COVID-19) outbreak a pandemic on 11th of March 2020. The Ministry of Health, Malaysia has made preparations for the involvement of all government hospitals, including some teaching hospitals. This report elaborates and discusses the early establishment of the Hospital Canselor Tuanku Muhriz Crisis Preparedness and Response Centre (HCTM CPRC), highlighting how teaching hospitals function in handling the clinical and epidemiological management of COVID-19 among hospital staff. The setting comprises of four critical functions of the HCTM CPRC, namely case investigation, close contact tracing, surveillance for data reporting and risk communication. This report highlighted that a CPRC in teaching hospitals benefits not only the patients and the hospital administration but also all hospital staff, especially in managing COVID-19 pandemic emergency crisis.*

**Keywords:** COVID-19, CPRC, Malaysia, Preparedness, Teaching Hospital.

### Introduction

Coronavirus disease 2019 (COVID-19) is an infectious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). On 31st December 2019, the World Health Organization (WHO) China office was informed of pneumonia cases of unknown aetiology that had been detected in Wuhan, Hubei, central China. The WHO later announced it was a novel coronavirus. The virus

---

<sup>1</sup> Department of Community Health Faculty of Medicine Universiti Kebangsaan Malaysia Jalan Yaacob Latif, Bandar Tun Razak Cheras 56000, Federal Territory, Kuala Lumpur Malaysia

<sup>2</sup> Department of Community Health Faculty of Medicine Universiti Kebangsaan Malaysia Jalan Yaacob Latif, Bandar Tun Razak Cheras 56000, Federal Territory, Kuala Lumpur Malaysia.

<sup>3</sup> Department of Community Health Faculty of Medicine Universiti Kebangsaan Malaysia Jalan Yaacob Latif, Bandar Tun Razak Cheras 56000, Federal Territory, Kuala Lumpur Malaysia.

<sup>4</sup> Department of Community Health Faculty of Medicine Universiti Kebangsaan Malaysia Jalan Yaacob Latif, Bandar Tun Razak Cheras 56000, Federal Territory, Kuala Lumpur Malaysia.

<sup>5</sup> Department of Community Health Faculty of Medicine Universiti Kebangsaan Malaysia Jalan Yaacob Latif, Bandar Tun Razak Cheras 56000, Federal Territory, Kuala Lumpur Malaysia

<sup>6</sup> Infection Control Unit Hospital Canselor Tuanku Muhriz Universiti Kebangsaan Malaysia Jalan Yaacob Latif, Bandar Tun Razak 56000 Cheras, Federal Territory, Kuala Lumpur Malaysia

<sup>7</sup> Department of Medicine Hospital Canselor Tuanku Muhriz Universiti Kebangsaan Malaysia Jalan Yaacob Latif, Bandar Tun Razak 56000 Cheras, Federal Territory, Kuala Lumpur Malaysia

<sup>8</sup> Department of Medicine Hospital Canselor Tuanku Muhriz Universiti Kebangsaan Malaysia Jalan Yaacob Latif, Bandar Tun Razak 56000 Cheras, Federal Territory, Kuala Lumpur Malaysia

<sup>9</sup> Department of Community Health Faculty of Medicine Universiti Kebangsaan Malaysia Jalan Yaacob Latif, Bandar Tun Razak Cheras 56000, Federal Territory, Kuala Lumpur Malaysia

<sup>10</sup> Director, Hospital Canselor Tuanku Muhriz Universiti Kebangsaan Malaysia Jalan Yaacob Latif, Bandar Tun Razak 56000 Cheras, Federal Territory, Kuala Lumpur Malaysia

<sup>11</sup> Universiti Kebangsaan Malaysia 43600 UKM Bangi, Selangor Darul Ehsan Malaysia

<sup>12</sup> Pharmaceutical Services Division Kelantan State Health Department 15590 Kota Bharu, Kelantan Darul Naim Malaysia

was initially referred to as 2019-nCoV (novel coronavirus 2019), but it has since been termed COVID-2019. Coronaviruses are RNA viruses usually found in animals and humans, and cause respiratory symptoms (Mayoclinic 2020). Two well-known coronaviruses that cause respiratory syndromes are SARS-CoV and MERS-CoV (Middle East respiratory syndrome coronavirus). Both are of zoonotic origin and can cause fatalities (Ye et al. 2020). The WHO declared the COVID-19 outbreaks a Public Health Emergency of International Concern (PHEIC) on 30th January 2020 (WHO 2020a; Washington Post 2020) and declared a pandemic on 11th March 2020 (WHO 2020b). Local transmission of the disease has been recorded in most countries across all six WHO regions (WHO 2020c). COVID-19 is a novel disease that has caused a considerable amount of panic and insecurity among the public. Being a novel disease, there has been no documented study. Every country, including Malaysia, has drafted a preparedness plan for the pandemic. Here, the Malaysian Ministry of Health (MOH) has activated the National Crisis Preparedness and Response Centre (CPRC) to prepare for COVID-19.

Hospital Canselor Tuanku Muhriz (HCTM) is the main teaching hospital for the Faculty of Medicine, Universiti Kebangsaan Malaysia (UKM). One of the leading teaching hospitals in the country and located in the heart of Kuala Lumpur, HCTM had also activated COVID-19 preparedness plans once the epidemic had been declared in Wuhan. Initially, the MOH did not include HCTM as a dedicated COVID-19 hospital, unlike other hospitals under the ministry. However, in late March 2020, HCTM was announced as one of the COVID-19 screening and admitting hospitals in Malaysia. Hence, HCTM has prepared comprehensively not only for admitting COVID-19 patients but has also prioritised the health and safety of its staff and healthcare workers (HCWs). This article elaborates and discusses the processes and preparedness plans of HCTM, as a teaching hospital, during the COVID-19 pandemic.

#### *Covid-19 Alert Preparedness Plan for Early Hospital Settings*

The HCTM infection control unit continuously monitors news on outbreaks globally and assesses the risk that the institution would be affected. Based on information gathered from daily reports stating that the infection was spreading fast globally, there was a strong possibility that HCTM would receive COVID-19 cases, given the massive volume of mainland Chinese tourists to Malaysia.

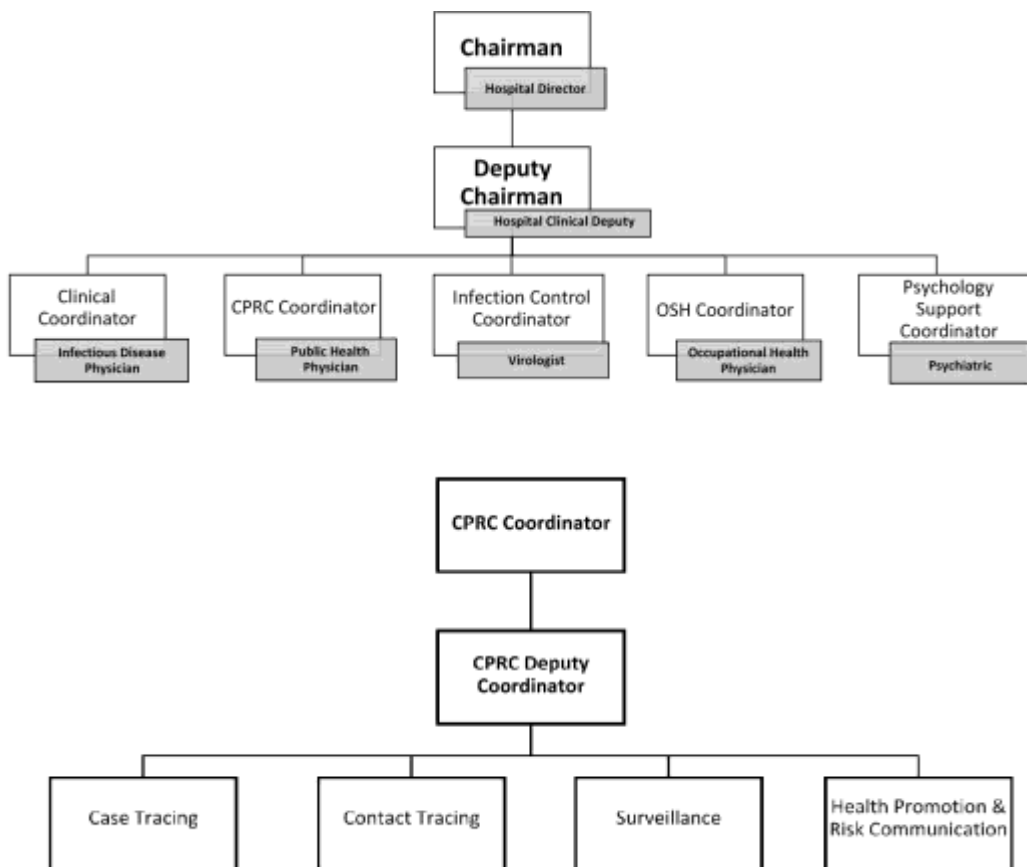
The HCTM COVID-19 committee was formed on 8th January 2020 and was chaired by the hospital director. The committee members included HCTM deputy directors and representatives from the infection control and infectious disease units, and the emergency, medical, paediatric, obstetrics and gynaecology, family medicine, nursing, pharmacy, anaesthesiology, diagnostic laboratory services, occupational health and safety and security departments. The committee analysed the hospital's current outbreak preparedness. It concluded that HCTM needed to refresh staff knowledge, attitudes and practices regarding infection prevention and control in preparation to face the outbreak and to ensure an adequate supply of personal protective equipment (PPE).

In response to this, the infection control unit conducted training workshops for staff from the emergency, anaesthesiology, nursing, family medicine, and diagnostic laboratory departments. The objective of these workshops was to re-train the staff on the proper selection, donning, and doffing of PPE. The most critical PPE workshop was a train-the-trainer workshop that involved 70 infection control link nurses in preparation for hospital-wide staff re-training. The HCTM staff attended lectures on COVID-19 and its transmission and prevention. Communication on the risk of infection and prevention steps was issued over three months to increase HCTM staff and visitor knowledge and awareness of COVID-19 and included the setup of a COVID-19 information booth in the hospital lobby. The routine influenza vaccination and hand hygiene compliance audit for HCTM staff was continued during this period to supplement the education and training sessions. The MOH released the first Guidelines on COVID-19 Management in Malaysia on 18 January 2020, which stated the case definition, clinical specimen, management flowchart and list of admitting hospitals (MOH 2020). The first COVID-19 cases in Malaysia were three imported cases involving Chinese tourists, which were reported on 25th January 2020. In response to this, the HCTM emergency department (ED) established a COVID-19 person under investigation (PUI) screening centre, and patients that fulfilled the PUI criteria were transferred to admitting hospitals for further management. The first wave of COVID-19 in Malaysia consisted of 22 imported cases.

The second wave started on 27th February 2020, 11 days after there had been no new cases.

The HCTM department of diagnostic laboratory services had started to prepare the molecular laboratory for diagnosing SARS-CoV-2 in January 2020 even though HCTM was not a designated hospital for screening and admitting COVID-19 cases at that point. RT-PCR testing has started in February 2020 to screen for SARS-CoV-2 in patients admitted to HCTM with severe acute respiratory infection (SARI) and influenza-like illness (ILI). The service also used to screen HCTM staff who had been exposed to COVID-19 patients without full PPE.

The HCTM COVID-19 CPRC was established in anticipation that COVID-19 cases would be diagnosed among the SARI/ILI patients. The organisation of the COVID-19 CPRC involved a multidisciplinary unit (Figure 1). The main tasks of the HCTM CPRC mainly involved case tracing, close contact tracing, surveillance for data reporting and risk communication for hospital staff.



**Figure 1. Organisation Chart at The Hospital Level and Crisis Preparedness Response Centre (Cprc)**

### *Covid-19 Alert Teams and Taskings*

#### *Case Tracing*

The case tracing team has two main tasks, namely, to gather information on PUI and SARI cases and to chronology map COVID-19 patients. All PUI and SARI cases seen and treated by HCTM doctors are recorded in the HCTM CPRC database. This information is recorded and updated daily, and a report is submitted to the National CPRC in the Ministry of Health. The information includes variables such as name, age, sex, address, symptoms and date of onset of symptoms (Table 1).

The team's second task is focussed on COVID-19 patients confirmed by RT-PCR testing. The team contacts the patient to obtain a full and detailed history of their activities and the places they had visited during the past 14 days from the day they had been diagnosed with COVID-19. This history-taking process is vital, as the team

needs to identify all the people with whom the patient may have been in contact. This is to shed light on where, when and from whom they might have contracted the highly infectious disease. The chronology of their onset of symptoms and disease progression are also recorded carefully.

From these process, the team will obtain information on the patient's close contacts. If the patient had been seen and treated at HCTM prior to confirmation of their positive COVID-19 status, then the team will contact the heads of the departments involved in managing the patient. This is to identify the contacts among hospital staff that had been exposed to the patient. The team will record the names and mobile numbers of these contacts and then pass this vital information to the contract tracing unit. The case tracing team documents all the cases' details in the HCTM CPRC database and fills up the line listing, and records the cases' chronological maps to ensure that all possible contacts (among HCTM staff) are identified, and the contact tracing unit continues further actions.

### *Contact Tracing*

The process begins after the contact tracing unit has received a COVID-19 positive case alert from the case tracing team. Screening the contacts of positive COVID-19 cases is important for identifying close contacts of the cases, ensuring that action can be taken immediately to control and prevent the spread of COVID-19. Each close contact is identified as either a close contact for cases within or outside HCTM. If the positive case is from within HCTM, basic information such as a list of names and phone numbers is identified in collaboration with the head of department/supervisor/division according to the case chronology (Table 2).

All close contacts identified are issued an online contact tracing form to complete with the information required by the HCTM CPRC for contact tracing risk assessment. All contact tracing forms are reviewed daily to update the information on the contact tracing master list. Next, risk assessment is conducted for each close contact under the fifth-edition Guidelines on COVID-19 Management in Malaysia to identify whether they are required to undergo swab sampling and quarantine with home surveillance monitoring. Besides that, each close contact is categorized as clinical (HCW) or non-clinical staff, as HCWs follow a different workflow according to the 5th Edition Guidelines (MOH 2020).

The contact tracing team updates the close contacts with the most recent and essential information, such as the start and end of their quarantine or sick leave dates, the first and second sampling dates in the laboratory, and the laboratory results obtained. In addition, the health status of each close contact is monitored via the online home surveillance form. The contact tracing team reviews and updates the close contact feedback via the home surveillance form response daily during the quarantine or sick leave. The team will communicate with the close contact if they have any significant symptoms or if the contact does not respond. If the contact has significant symptoms, they are referred to the ED or infectious disease (ID) physician for further assessment and treatment. Apart from carrying out contact tracing of close contacts, the contact tracing team also carries out and monitors home surveillance on HCTM staff discharged from any hospital after being COVID-19-positive. Their health is monitored daily throughout the quarantine period. The team also monitors close contact cases for PUI and for

HCTM staff who have just returned from overseas within their 14-day quarantine.

### *Surveillance and Data Reporting*

The HCTM CPRC surveillance team operates through concerted efforts and collaboration with other units. Among the team's main functions is collecting and consolidating relevant data from all other units. Routine data analyses are conducted, and essential reports are generated for disseminating pertinent information by

the administrative level to staff and students. Related disease trends are monitored and reported according to epidemiological week. The data and reports are also fed forward to the relevant health and related agencies (district and central levels) daily and weekly. The relevant agencies involved are the National CPRC, the Cheras district health office CPRC, the MOH Medical Development Division and The Royal Malaysia Police. Notably, there are various information-sharing and reporting systems depending on the type of data and information reported and the urgency of conveying the information to the related agencies (Table 3). Despite this, the surveillance team tries to implement and adhere to the national guidelines for data reporting.

### *Risk Communication*

Risk communication has been acknowledged as a lifesaving intervention, especially in public health emergencies (Cloes et al. 2015; Hunka et al. 2015; Watanabe et al. 2015). Communication is an integral component in dealing with a crisis. Here, the government has announced a nationwide shutdown involving practically all industries; only a minute number of essential services are allowed to operate. Establishing the risk communication team was paramount in ensuring the safety of HCTM healthcare personnel. The team provides hospital staff (both clinical and non-clinical) access to fast, effective and transparent communication. Amongst others, there are various information inputs via a hotline and email.

The team has responded quickly to this pandemic by generating infographics, which convey messages quickly. This has to be done with great speed, as it affects both the clinical as well as non-clinical staff. Realizing the scope of risk communication in preventing this disease from spreading among the workforce and thus creating panic, the risk communication team must develop infographics in the form of posters/messages to respond effectively to the situation.

In general, risk communication in our setting is aimed at conveying expert information, opinions, and medical advice to the masses; in our context, this refers to the 5,000 HCTM staff. The primary objective of effective risk communication is to enable people at risk to make well-informed decisions to protect not only themselves but also their loved ones from the current emergency by taking appropriate, timely protective and preventive actions. However, the success of risk communication is eventually dependent on a thorough understanding of people (in terms of their knowledge, practices, perceptions, concerns, and beliefs), experts' attributes (such as their credibility, caring and empathic nature, level of trust between experts and affected persons), and the ability of the communicator to detect and address prevalent rumours/myths/misconceptions promptly before they interfere with preventive and control measures (WHO 2015).

### **Discussion**

The early establishment of the HCTM CPRC was initiated due to the COVID-19 pandemic. Its establishment was decided upon after a positive COVID-19 case came to HCTM. The MOH decision that our teaching hospital would become a COVID-19 screening and admission hospital spurred us to protect our staff. Therefore, with proper guidelines, the HCTM CPRC units are mobilized to achieve the target of reducing transmission among the healthcare staff. The first task for the HCTM CPRC in terms of case and close contact tracing among hospital staff was systematically performing line listing. The line listing was prepared, and further communication with the hospital staff was carried out. CPRC home surveillance of close contacts is crucial for reducing transmission (MOH 2020). The COVID-19 intermediate source of origin and transfer to humans is not known; however, the rapid human-to-human transfer has been confirmed widely (Shereen et al. 2020). Staff who have been in close contact with positive COVID-19 cases are referred to the hospital occupational health unit for further surveillance when they return to work. They are also referred to the psychology unit for counselling support while under home surveillance. Ensuring the physical and mental health of our staff is important for them to provide good service to patients. Therefore, a multidisciplinary team is important, and our CPRC includes an ID physician, and public health, virologist, infection control, occupational and psychology teams for the hospital staff.

Data reporting helps to show the trends of the case and close contact involvement among hospital staff. It shows the timeline of each case and enables the detection of a COVID-19 cluster among the staff. The data collected is accumulated together with Malaysian data for presenting the COVID-19 situation by day and week. The data are important for circulation among hospital staff, together with health promotion posters mainly related to PPE use. Risk communication is vital to enhance understanding of PPE use and risk of disease transmission.

The early establishment of a CPRC in teaching hospitals has excellent value to students, especially those in public health and field epidemiology, and teaches collaboration with multidisciplinary teams and other agencies. Hopefully, hospital staff, either as a COVID-19 patient or a close contact, will benefit from the existence of the CPRC.

The early setting of CPRC HCTM is a new experience for us in teaching hospitals. We did a SWOT analysis for further improvement in the future, as shown in Table 4. The strength of CPRC HCTM was mainly as we have a mix of expertise, human and budget priority is given, close relationship and supervision from nearest district health office, healthy relationship with Ministry of Health leads to immediate and latest updates or CPG from them. CPRC HCTM also has an excellent organizational structure and human resources capacity; therefore, is adequate to mobilize outbreak management activities such as swabbing team and health promotion.

The main weakness of CPRC HCTM was the enforcement for home quarantine is not under us but from the nearest district health office. Therefore, it is out of our control and may contribute to miscommunication regarding quarantine and surveillance activities, especially if the source of close contact is the non-HCTM staff. The bits of help from the health district office may resolve many issues related to this.

The main threat will be the miscommunication that may happen between different types of HCTM staff. Since HCTM is a teaching hospital with a vast difference in occupation, risk communication may misinterpret by different education levels of HCTM staff. However, CPRC HCTM is an opportunity platform for postgraduate students to hands on training and knowledge empowerment, especially on managing pandemic COVID-19. By having CPRC HCTM, we can strengthen the public health function and capacity in teaching hospital settings.

**Table 1. Data Collected for Reporting on The Number of Positive Covid-19, Pui and Sari**

Information collected	Positive COVID-19	PUI	SARI
	n	n	n
Case Status			
New case			
Existing case			
Discharge			
Total in ward			
Age group			
Children (4-12 years)			
Adolescent (13-18 years)			
Adult (19-59 years)			
Elderly ( $\geq$ 60 years)			
Ethnicity			
Malay			
Chinese			

Indian		
Others		
Nationality		
Malaysian		
Non-Malaysian		
Ward Location		
A		
B		
C		
D		
E		

**Table 2. Data Collected for Reporting on Details of Case Positive Covid-19 And Close Contact Among Staff in The Hospital**

Staff information	Positive COVID-19	Staff information	Close contact
Name		Name	
Age		Age	
Gender		Gender	
Ethnicity		Ethnicity	
Location of exposure		Location of exposure	
Date of onset		Date of contact	
Type of staff		Type of staff	
Clinical		Clinical	
Non-clinical		Non-clinical	
Comorbidity		Comorbidity	
Date of first swab taken		Yes	
Result of first swab		No	
Date of second swab taken		Risk of assessment on exposure	
Result of second swab		High	
Date of diagnosis		Moderate	
Date of admitted		Low	
Status of patients		No risk	
Asymptomatic		First swab taken	
On treatment		Second swab taken	
Intubated		Date of quarantine start	
Alive		Date of quarantine end	
Yes			
No			
History of travel			
Yes			
No			
History of contact			

Yes	
No	
Date of discharge	

**Table 3. The Report and Agency Involved**

No	Agencies	Documents
	<i>Daily basis</i>	
1.	National CPRC	a) COVID-19 positive and PUI cases and status in the wards
2.	Cheras District Health Office CPRC	a) Line listing of COVID-19 positive cases b) Line listing of PUI cases c) Report of COVID-19 positive cases
3.	Medical Development Division, Ministry of Health, Malaysia	a) Report on COVID-19 positive and PUI cases management
4.	The Malaysian Royal Police	a) Infographic of relevant current situation on COVID-19 in HCTM b) Returns on COVID-19 patients in their respective wards c) Returns on COVID-19 patients according to relevant socio- demographic characteristics.
5.	CPRC, HCTM	a) Infographic of relevant current situation on COVID-19 in HCTM b) Report on daily status and cumulative case
	<i>Weekly basis</i>	
1.	CPRC, Cheras District Health Office	a) Report of ARI
2.	CPRC, HCTM	a) Surveillance data for E-Bulletin

**Table 4. Swot Analysis of Cprc Hctm Setting and Preparedness**

SWOT Analysis	Findings
---------------	----------



Strength	<ol style="list-style-type: none"> <li>1. A mixed of expertise: Public Health, Microbiologist, Infectious Disease Physician</li> <li>2. Hospital Director Key Performance Index, therefore, human and budget resource is given a priority for CPRC HCTM</li> <li>3. Relationship with Ministry of Health is strong: immediate and latest information/updates/CPG</li> <li>4. Close relationship and supervision from nearest Health District Office (Cheras District Health Office)</li> <li>5. Organizational structure and human resources capacity is adequate to mobilize activities such as swabbing, health promotion, hostel monitoring (quarantine centre)</li> </ol>
Weakness	<ol style="list-style-type: none"> <li>1. The enforcement for home quarantine not under CPRC HCTM but from District Health Office</li> <li>2. Miscommunication regarding quarantine activities and surveillance, especially if the source of close contact is a non-HCTM staff</li> </ol>
Threat	<ol style="list-style-type: none"> <li>1. The interprofessional miscommunication between different type of professional and support staff</li> </ol>
Opportunities	<ol style="list-style-type: none"> <li>1. A platform for postgraduates to hands-on training and knowledge empowerment</li> <li>2. Strengthening the public health function and capacity in teaching hospital settings</li> </ol>

## Conclusion

As the COVID-19 outbreak spreads, teaching hospitals in Malaysia need to prepare for a potential surge of critically ill patients and counter the high transmissibility of COVID-19. This report has described their necessary preparations and effective management, and we would like to expand on our good advice by sharing lessons learnt from our early experience in HCTM, Universiti Kebangsaan Malaysia, Kuala Lumpur. We realized preparing teaching hospitals for patients with COVID-19 had numerous other requirements such as changes in team dynamics to mitigate the effects of any infected team members by avoiding potential spread between teams but this would need further research. Several principles and

solutions need to be formulated to address the various issues of infection control, information flow, training and psychological well-being of team members which we hope can help other teaching hospitals worldwide to be better alerted and prepared for COVID-19 future management.

## Acknowledgements

We would like to thank the Dean of Faculty of Medicine, Universiti Kebangsaan Malaysia, public health staff and public health postgraduate students who assisted and supported us in producing this report. Special thanks to the Director of Hospital Canselor Tuanku Muhriz for permission to publish this article. All authors contributed equally to this article.

## References

- Cloes, R., Ahmad, A. & Reintjes, R. 2015. Risk communication during the 2009 influenza A (H1N1) pandemic: Stakeholder experiences from eight European countries. *Disaster Med. Public Health Prep.* 9: 127-133.
- Hunka, A.D., Palmqvist, A. & Forbes, V.E. 2015. Effective environmental risk communication-Success stories or urban legends? *Integr. Environ. Assess. Manag.* 11: 173-174.
- Mayoclinic. 2020. Coronavirus Disease 2019 (COVID-19)- Symptoms and Causes. <https://www.mayoclinic.org/diseases-conditions/coronavirus/symptoms-causes/syc-20479963>.
- MOH. 2020. Guidelines on Novel Coronavirus (nCoV) Management in Malaysia. 2020. <http://www.moh.gov.my/index.php/pages/view/2019-ncov-wuhan-guidelines>.
- Shereen, M.A., Khan, S., Kazmi, A., Bashir, N. & Siddique, R. 2020. COVID-19 infection: Origin, transmission, and characteristics of human coronaviruses. *J. Adv. Res.* 24: 91-98.
- Washington Post. 2020. Hundreds of evacuees to be held on bases in California; Hong Kong and Taiwan restrict travel from mainland China. [https://www.washingtonpost.com/world/asia\\_pacific/coronavirus-china-live-updates/2020/02/05/114ced8a-479c-11ea-bc78-8a18f7afcee7\\_story.html](https://www.washingtonpost.com/world/asia_pacific/coronavirus-china-live-updates/2020/02/05/114ced8a-479c-11ea-bc78-8a18f7afcee7_story.html).
- Watanabe, H., Maehara, Y., Fujibuchi, T., Koizumi, M., Yamaguchi, I., Kida, T., Ooyama, M., Horitsugi, G., Hiraki, H., Tsukamoto, A. & Itami, J. 2015. Assessing the effectiveness of risk communication for maintenance workers who deal with induced radioactivity management of medical linear accelerators. *Health Phys.* 109: 145-156.
- WHO. 2020a. WHO Director-General's Opening Remarks at the Media Briefing on COVID-19. 2020. <https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19>.
- WHO. 2020b. WHO Covid-19 Situation Report. <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports>.
- WHO. 2020c. Statement on the Second Meeting of the International Health Regulations (2005). Emergency Committee Regarding the Outbreak of Novel Coronavirus (2019-nCoV). Accessed by [https://www.who.int/news-room/detail/30-01-2020-statement-on-the-second-meeting-of-the-international-health-regulations-\(2005\)-emergency-committee-regarding-the-outbreak-of-novel-coronavirus-\(2019-ncov\)](https://www.who.int/news-room/detail/30-01-2020-statement-on-the-second-meeting-of-the-international-health-regulations-(2005)-emergency-committee-regarding-the-outbreak-of-novel-coronavirus-(2019-ncov)).
- WHO. 2015. Risk Communication: Frequently Asked Questions. <http://www.who.int/risk-communication/faq/en/>.
- Ye, Z.W., Yuan, S., Yuen, K.S., Fung, S.Y., Chan, C.P. & Jin, D.Y. 2020. Zoonotic origins of human coronaviruses. *Int. J. Biol. Sci.* 16(10): 1686-1697.