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ORIGINAL ARTICLE

The Preparation, Delivery and Outcome of COVID-19 Pandemic Training Program among the Emergency Healthcare Frontliners (EHFs): The Malaysian Teaching Hospital Experience

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ABSTRAK

Salah satu dari strategi untuk memperkasakan petugas kesihatan di dalam menentang kesan pandemik COVID-19 ini adalah melalui latihan yang berkesan. Keselamatan dan ketidak laziman merupakan dua perkara pokok yang menyebabkan modul ini dihasilkan. Modul latihan ini dibentuk berdasarkan tiga strategi utama iaitu belajar dari pengalaman lalu, mereka-bentuk modul latihan yang khusus, dan mengenal kelemahan yang ada. Modul yang dihasilkan ialah pemakaian-penanggalan alat perlindungan kendiri (PPE), pengurusan salur pernafasan dan resusitasi kardiopulmonari bagi pesakit yang disyaki COVID-19. Seramai 178 Perawat Kesihatan Barisan Hadapan (PKBH) telah dilatih. Setiap modul disertakan dengan senarai-semak yang mana peserta merasakan ianya sangat membantu. Tiada peserta yang jatuh sakit atau mengalami simptom setelah lebih dua minggu tamat latihan dan ini berkemungkinan hasil dari pelaksanan senarai semak persediaan pra-latihan yang ketat. Senarai semak pra-latihan ini mempunyai tujuh perkara penting iaitu ruang latihan, bilangan peserta, saringan COVID-19, pemeriksaan suhu badan, sanitasi tangan, PPE, dan pensanitasi peralatan sebelum dan selepas latihan. Latihan menggunakan senarai semak yang terarah didapati sangat membantu para petugas di dalam menguruskan situasi COVID-19. Kesimpulannya semasa menghadapai keadaan yang di luar kelaziman serta masa dan sumber yang terhad, latihan praktikal bersama senarai semak merupakan satu kaedah yang dapat membantu. Mengikuti langkah keselamatan pra-latihan yang betul juga boleh mengurangkan penyebaran penyakit ini.

Kata kunci: COVID-19, keselamatan, latihan, resusitasi kardiopulmonari, salur pernafasan

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ABSTRACT

One of the strategies in strengthening the healthcare providers in mitigating the impact of COVID-19 pandemic is through training. Safety and disease unfamiliarity with COVID-19 was the main reason for developing this dedicated specialized training modules in order to address the issue. The training modules were developed based on three strategies that are learning from experience, design suitable dedicated module and identify weakness and vulnerability. The training modules created were donning-doffing of Personal Protective Equipment (PPE), airway management and cardiopulmonary resuscitation of suspected COVID-19 patients which were delivered through immersive life simulation technique. A total of 178 Emergency Healthcare Frontliners (EHFs) were trained. Each module was guided with a checklist that the participants found to be very useful. None of the participants reported developing symptoms of infection after undergoing the face-to-face simulation training even after two weeks of post-training periods. Seven important steps were found to be crucial that contributed to these findings which included room space, participants number per group, COVID-19 screening, taking of temperature, hand sanitization, PPE, and equipment sanitization before and after training. Hands-on training with guided-checklist was found to be very useful to the EHFs in managing an unfamiliar situation of COVID-19. In time-constraint-resource-limited conditions, training modules should be focused on addressing the pressing problem at hand. In conducting a face-to-face training, precautionary safety measures should be strictly adhered to prevent the spread of the disease.

Keywords: airway, cardiopulmonary resuscitation, COVID-19, safety, training

INTRODUCTION

Coronavirus-2019 (COVID-19) outbreak, which began in Wuhan, China, has led to the global pandemic which has been declared as the 6th public health emergency of international concern by the World Health Organization (WHO) on 30th January 2020, following H1N1 (2009), polio (2014), Ebola in West Africa (2014), Zika (2016), and Ebola in Congo (2019) (Lai et al. 2020). Up to 20th May 2020, the number of cases was approaching 5 million, with more than 300,000 deaths worldwide. (WHO 2020).

In Malaysia, this pandemic has caused a massive health crisis, until end of May 2020 more than 7000 cases detected with a death rate of 1.7% (Ministry of Health Malaysia 2020). Transmission to healthcare workers was a real threat, and death due to COVID-19 has been reported globally (Rimmer 2020; Xiang et al. 2020). Locally, there have been 325 healthcare workers been infected with three death cases (Ibrahim et al. 2020).

During the initial period, strategies

on how to face this deadly threat and improved our staff resilience towards it were still undetermined. We, in the Emergency Department (ED) of a university hospital, feel that training for the Emergency Healthcare Frontliners (EHFs), the staffs that deal directly with patient's care which include doctors, nurses, assistant medical officers and health attendants, is one of the most important strategies in fighting this pandemic.

The readiness of our EHFs depends a lot on their knowledge, skill and confidence in managing the cases. In fact training for emergency airway management for suspected COVID-19 or severe acute respiratory infection (SARI) is crucial to ensure the safety of EHFs during this pandemic (Brewster et al. 2020). Therefore, we set out to develop our strategic plan in a resource-limited and time-constrained situation against this deadly pandemic.

MATERIALS AND METHODS

We developed our training modules based on three strategic plans. The first strategy was learning from previous experience. Second, designing a suitable training module and third, identify weaknesses and vulnerability. This study was approved by the medical research and ethic committee (MREC) of UKM (approval number JEP-2020-267).

Learning from Previous Experience

Implementing immediate training during the pandemic period is consistent with the first strategic objective by WHO, which is to interrupt human-to-human transmission, including reduction of secondary infections among EHFs, thus preventing transmission and further international spreading (WHO 2020). Treating physicians, especially those working in the ED, critical care and infectious disease units, are at the highest risk of contracting the infection (Wang et al. 2020).

Under normal circumstances, most EHFs are familiar with airway management. However, most of the usual steps are considered as aerosol-generating procedures (AGP), which ought to be omitted (Brewster et al. 2020). Therefore, immediate training and simulation sessions are required to familiarize themselves with the changes (Cook et al. 2020). Four factors were identified to contribute to COVID-19 infection among healthcare workers (HCWs), which include inadequate preparation and systematic training after initiation of emergency response (Wang et al. 2020).

On the other hand, lack of understanding about the nature of the virus, improper Personal Protective Equipment (PPE) and prolonged exposure to infected patients among the HCWs also amplified the negative impact (Wang et al. 2020). During the last SARS outbreak in 2002, the rate of nosocomial transmission among HCWs was high (Moore et al. 2005). Furthermore, this will result in a reduction in human resources available at this critical time (Public Health England 2020).

Designing Suitable Training Module

The initial discussion was made to identify the critical areas that the EHFs need to be trained, particularly in embracing this pandemic. Four main areas were noted to have the most pressing needs which were proper donning-doffing of PPE, airway management, resuscitation and nebulization technique in suspected COVID-19 patient. Staff safety and unfamiliarity to the changes were the main reason for this choice. In fact, based on a quick survey, the majority of staff were concern and unaware of the precautions during airway management and resuscitation of COVID-19.

A team consisting of Emergency Physicians (EP), a clinical simulationist, medical educator, medical officers, senior paramedics, and staff nurses were given the task to develop a workable model for the EHFs. Since this was an unprecedented scenario, there were a lot of aspects that need to be considered when preparing for these training modules. The modules were developed according to these headings: *the needs, the target group, learning objectives of each module, content delivery (methods, trainers, preparation of the training room and participants), participant competency, duration of the training, and location*. As a result of short preparatory time and the need to implement the training as soon as possible, the whole team had to work around the clock to complete the preparation of the training modules, including the alpha and beta testing.

The Needs

The need for this training was evident as we are dealing with an exceptional situation that most of our young staff have not encountered it before. Most of them were not involved in the previous pandemic that hit the country like SARS in 2003 (Peeri et al. 2020) or H1N1 in 2009 (Jhaveri 2020). In fact, the magnitude of the COVID-19 pandemic was expected to be much greater (Wilder-Smith et al. 2020). In addition to that, our hospital was declared as a COVID-hybrid hospital, which means we have to attend to both suspected COVID-19 and non-COVID-19 patients. It was imperative to get our staff well-prepared. Based on our quick survey, even though our staff were well-trained in the usual situation, majority of them were often caught off-guard when practically handling the real clinical situation of suspected COVID-19 patients. In fact, handouts, or videos on how to perform procedures like PPE donning-doffing, airway intubation or cardiopulmonary resuscitation, were insufficient to prepare our EHFs effectively. Hence there was a strong need to conduct the hands-on training.

Target Group

The aim was to train all the EHFs, including re-enforcement staff from the other departments, such as from primary care clinic, general wards, specialist clinics, and operation theatre. The training was geared initially for those who work primarily in the Zone A (a zone that treats all respiratory cases), patient-under-investigation (PUI) centre, and triage. Once these

Figure 1A: Series of images showing the intubation head box (IHB): side-view of the IHB

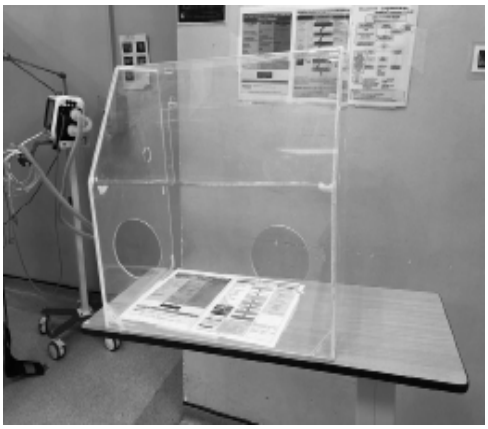

Figure 1B: Series of images showing the intubation head box (IHB): front-view of the IHB

groups completed their training, other clinical staffs that work in ED Zone B (non-respiratory) joined the training.

Setting of the Learning Objectives and Creating of Modules Content

We focused our learning objectives on the four selected topics. Considering the limitation we were facing, such as time constraint, which included short preparatory time, lack of training slots availability and the multitude of staff backgrounds, the training modules learning objectives were set based on the pressing matters that need to be addressed. Donning-doffing of PPE was conducted through an on-going session of hands-on and direct observation by the facilitators. Learning objectives were set for proper PPE application, and how to perform cross-check among their colleagues. The learning objectives for airway management (AM) and CPR include enhancing the awareness regarding symptomatic patients, modes of transmission, risk of nosocomial transmission and staff safety, AGPs, special techniques, algorithms required in handling these cases, and how to handle any deviation from the protocols. We created protocols and checklists on how the training should be conducted.

One of the greatest challenges during the preparation for training contents was the lack of available robust scientific evidence, particularly in the area of concern, e.g. the best way to perform endotracheal intubation, the correct CPR protocol, how to conduct face-to-face training, etc. Training modules were formulated based on the available evidence extrapolated from the previous SARS and H1N1 experience and prepared according to the currently available resources.

Delivery of the Training

Our initial idea was to provide screen-based simulation through the e-learning platform for the content delivery or creating a video and sharing it with the EHFs to maintain social

Figure 1C: Intubation process using the IHB

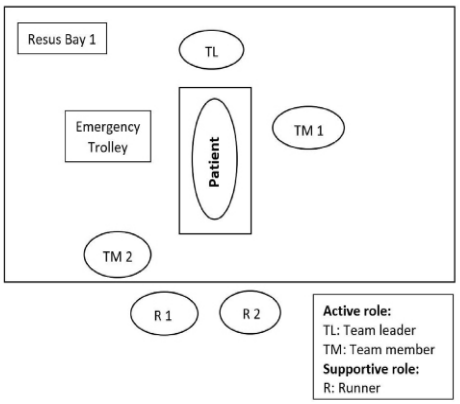

Figure 2: Layout and position of resuscitation team members and team support

distancing (World Health Organisation 2020). Nevertheless, in our resource-limited situation, the lack of expertise in creating the content within a short time span was the obstacle. Although video-based learning was a good option for knowledge enhancement and decision making, but it lacks in procedural training e.g. endotracheal intubation through an 'intubation head-box (Figure 1 & 2). Therefore, the decision was made to conduct life simulation training with special precautions.

Two scenarios were created specifically to address the airway management and CPR of COVID-19 patients. To enhance the effectiveness of the training, procedural checklists were prepared to guide the participants. Participants were encouraged to use the checklist during the training session to familiarize themselves with all the crucial steps. Pre-reading materials were provided, which included basic facts on the risk of transmission, AGPs and procedural checklists and protocols (Table 3-8).

The developed scenario underwent alpha testing among the module developer. This was followed by beta-testing. Improvement and adjustment were made based on the feedback obtained after each series of testing before the final version was completed.

Training Room and Participants Preparation

Strict protocol for the simulation training and debriefing session was created to maintain safety and social distancing, which included seven critical items. The crucial items included room size, number of participants trained at any one time, COVID-19 screening, presence of sign and symptoms including taking temperature, hand sanitization, PPE, and equipment cleaning before and after training session (Table 1).

Duration of the Training and Location

A maximum of 2 hours training per day was allocated which included an hour each for airway and CPR scenarios,

Table 1: Pre-training safety checklist'

	Item	Description	Check box
1	Number of participants	Each session can only comprise not more than 5 people	
2	Room size	Training room size appropriate with good ventilation (>45 sqft/person) (≥300 sqft for 5 people + simulator)	
3	COVID-19 Screening	All participants were screened for the possibility COVID-19 infection based upon the COVID-19 triage screening criteria - Fever - ILI symptoms - Recent travel	
4	Presence of sign or symptoms	Take temperature. Participants who have fever or ILI are not allowed to attend	
5	Hand sanitization	Hands need to be sanitized before and after each training sessions	
6	PPE	Surgical face-mask and glove must be worn during training at all time	
7	Equipment cleaning & sanitization	All equipments and simulators were cleaned and sanitized before and after each group usage	

Table 2: Debriefing worksheet (De-BRIEF technique)

	Particular	Debriefer Point & cues
Defuse	To defuse the: Emotion- Yes / No	How do feel? Let's talk about….
	Misconception/ Misunderstanding: Yes / No	We need to clarify this thing first ……
Delineate	List the Learning Objective (LO)	1. 2. 3. 4.
Bring Back	Bring Back the experience and allow the learners to narrate the experience from the point of…	
Review the experience	Review learners understanding of the LO	1. Why do you do that ……..? 2. What makes you think ……..? 3. How are you going to ……..?
In-depth discussion	Explore learner ability to think deeper (outside the box) with hypothetical situation: What if? Or why not? Or Let's say	
Explanation (optional)	Any salient point needs to be explained?	
Future Use	How is learner going to use the things they learn	1. How are you going to apply the …….. you have learn?

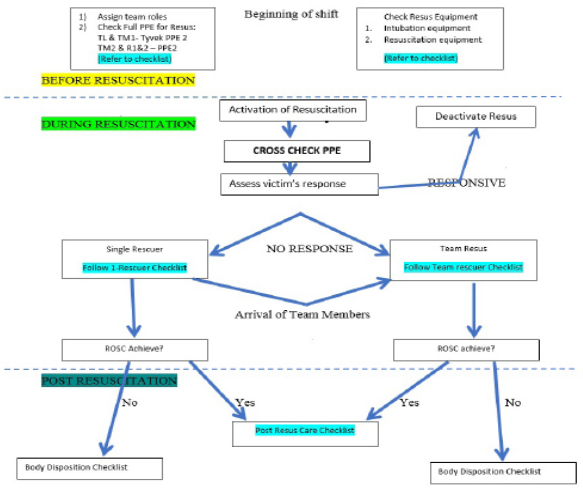

Figure 3: COVID-19 resuscitation algorithm

respectively. Each scenario included two 10 to 15 minutes simulation session followed by debriefing session. Debriefing was done using the DeBRIEF technique (Table 2). Participants' level of competency was based on the successful completion of the items listed on the checklist (Table 3, 6 & 8)

Identifying Our Weaknesses and Areas which are Vulnerable

Two weaknesses identified which were knowledge and skill. The knowledge was on AGPs while the skill was on the familiarity with the 'new norm' of resuscitation, especially in the airway management and CPR. These warranted immediate attention hence the design of the training module.

RESULTS

Three training modules were produced, which were the proper technique of donning-doffing of PPE; airway management of suspected COVID-19 patients, and CPR team-training module suspected COVID-19 patients. The first round of training sessions to all the EHFs was completed over a period of three weeks. In total there were 178 participants trained with ten people trained per day. There were 67 Medical Officers (MOs), 52 Assistant Medical Officers (AMOs) and 59 Staff Nurses (SNs) trained. None of the participants exhibit symptoms of COVID-19 post-training period.

Most of the participants felt confident in managing the airway with the intubation head-box. One of the participants said, *"….it improved my understanding and confidence level in managing the COVID-19 cases tremendously".* Other participants said, *"….. I like how the training was conducted, easy to understand and remember."* Participants also found the checklist to be extremely useful and requested for it to be made available in the clinical area. All the participants agreed on the importance of PPE and

Table 3: PPE resuscitation checklist

PRINCIPLES		
- All resuscitation personnel MUST ADHERE to PPE PROTOCOL during Resuscitation - No PPE or Breech in PPE - NOT ALLOW TO BE INVOLVED IN RESUS. Top-to-Bottom PPE		
	Non-involve in Patient Airway Management	
No	PPE Item	Check
1	Cap	
2	Head-and-Neck Cove	
3	N-95 mask	
4	Face shield or Goggle	
5	Gown (Yellow- water proof or Blue- non-water proof)	
6	Plastic apron (if wearing blue gown)	
7	Gloves (double layer)	
8	Shoes cover	
	Involve in Patient Airway management	
9	All of the above (no. 1-8) + Tyvek Suit	

Table 4: Assignment of team roles during resuscitation

PRINCIPLES		
A. To minimize the number of people involve in Resuscitation B. To smooth out the resuscitation process Resus Team consisted of a maximum of 5 people		
Team Assignment	**Roles and Responsibilities**	**Check**
1. Team Leader (TL):	Managed patient Airway Lead the resuscitation & Make decision Oversee team performance Decision stopping resuscitation	
2. Team member 1 (TM1)	Performed Chest Compression Assist Team Leader in Intubation Rotate compression with TM2 (ONLY if patient intubated)	
3. Team Member 2 (TM2)	Attached 3-lead ECG electrodes Defibrillate (if needed) Set IV line, take blood, give Meds Rotate chest compression with TM1 (ONLY if patient intubated)	
4. Runner 1 (R1)	Prepare medication Gives medication to TM2 with closed-loop- communication Send blood for Investigation Prepare requested instrument or equipment	
5. Runner 2 (R2)	Read out the checklist and guide team on resuscitation Scribe role	

Table 5: Resuscitation & airway management equipment checklist

PRINCIPLES	
1) Check all equipment in a ready and functioning status 2) Plan and prepare ahead.	
Resuscitation Equipment Checklist	**Check**
Resuscitation trolley (Crash Cart)	
CPR back broad	
Mechanical CPR device (e.g Autopulse or LUCAS if available)	
Defibrillator (check its functioning)	
Defibrillator pads (best option if available)	
Airway equipment NPO2- Non-rebreather mask, Bag valve mask with viral filter	
Intubation set + viral filter	
Intubation medications o Induction agent - Propofol, Ketamine, Midazolam o Analgesic- Fentanyl o muscle relaxant- Suxamethonium, Rocorunium Video laryngoscope > Direct laryngcoscope (prepare straight, curved, and different blade sizes ETT tube 7, 7.5, 8 (for adults) (for peadiatric arrange accordingly) Stylet in ETT Syringe 10 cc Aerosol box or plastic drape Laryngeal Mask Airway (use the correct size that ensures adequate seal) Bougie Gel Gauze & clamp Ribbon and adhesive Surgical airway kit (if available)	
Closed loop suction Vital signs monitoring (cardiac monitor, BP, SpO2, EtCO2 monitor (if available) Mechanical ventilator (if readily available) Pre-set ventilator and connected to hose (keep at standby mode) o AC mode o TV - 6ml/kg o PEEP- 10 o FiO2 of 100% o RR of 10/min	
IV Saline	
Resus Medications (Adrenalin, Atropine, Amiodarone)	
Stethoscope	

Table 6: One rescuer CPR checklist

PRINCIPLES

1. Chest Compression is an AGP, cover patient mouth and nose before starting chest compression
2. DO NOT BAG MASK COVID PATIENTS. Use hands-only/compressions-only CPR until the airway is secured with an advanced airway.
3. CPR is ONLY done in the RESUSCITATION ROOM. Criteria of Resuscitation room for COVID or PUI patients
   I. isolated negative pressure room, or
   II. isolated resuscitation tent outside the ER with natural airflow above 160 L/s; or
   III. sealed isolation bed with HEPA filter; or
   IV. closed room.

Resus Team consisted a maximum of 5 people

No	Steps	Check
1	Ensure you are on PPE level 2 + Tyvek	
2	Don't start CPR yet	
3	Apply non-rebreather mask but do not ON the oxygen (make sure mask cover nose and mouth, (this is to protect against aerosolization), or Cover with a plastic apron, or Cover with a surgical mask	
4	Perform hand only CPR (100/min, 5 cm depth, good recoil)	
5	Stop at 2 minutes or after 200 compression to re-assess.	
6	Continue for another 200 compression until ROSC or you are tired. Stop if tired or other team members have come to help	

Table 7: Post resus care checklist

PRINCIPLES

Follow MNEUMONIC- ABCDEFGI

A	AIRWAY:	Intubate if have not (replace the LMA). Ensure ETT in place.
B	BREATHING AND VENTILATION-	Check ABG and ensure good oxygenation and ventilation. Check all connection seal
C	CIRCULATION-	Check BP, CRT. CBD for circulation monitoring CXR
D	DRUGS	Inotrope (if BP low), Sedation, Relaxation
E	ECG & Electrolyte	12-lead ECG & send/trace Electrolyte results
F	FLUIDS	iv fluids
G	Glucose and Gaster	Glucometer & Gastric decompression
I	Intensive Care (ICU)	I - Contact SARI Doctor & Admit to SARI ICU

Table 8: Team resuscitation checklist

PRINCIPLES		
1. Chest Compression is AGP, cover patient mouth&nose before starting chest compression 2. DO NOT BAG MASK COVID PATIENTS until the airway is secured or intubated. 3. R2 to read out the Resus Team Checklist throughout the resuscitation.		
TEAM RESUSCITATION checklist		
No	**Steps**	**Check**
1	Cross-check all PPE	
2	Everybody assume their roles in resus team.	
3	TL move to airway and prepare to intubate the pt	
4	TM1 (Tyvek) take over CPR	
5	TM2 - attached ECG leads or attached Defib Pad (if available)	
6	TM 1 stop compression a. TL analyse rhythm b. TM2 defib (if necessary) If non-shockable rhythm a. TL & TM1 proceed to intubation if ready, if not TM1 continue with chest compression b. TM2 prepare to put up IV line and take blood for ABG, RP, CE.	
7	TL to intubation once ready a) STOP chest compression for INTUBATION. TM1 to assist TL for Intubation b) Perform airway management according to COVID 19 guidelines · Positioning patient to make 1st attempt successful- Operator comfort · Apply low flow nasal cannula 5L/min - IV Ketamine 0.5mg/Kg (if restless) · Check SpO2, - If still hypoxic- use BVM with 2 hand seal tightly (Don't bag) · Administer medications- induction agent, muscle relaxant and analgesic · off Oxygen (nasal prong or BVM) · Intubation with video laryngoscope @ direct laryngoscope · Inflate the ETT · Withdraw stylet halfway, clamp the ETT, then withdraws the stylet fully · Connect ETT to the ventilator (with pre-setting) · Place closed suction tube on ETT · Unclamp the ETT · Connect to the Ventilator and start the ventilator with the pre-set setting · Check ETT placement- eTCO2 @ 5-point position check (by TM2) · Secure the ETT · If secretion or blood pool in the oropharynx used gauze to clean Optional: a) Cannot intubate - Call anesthesia (ext 7230) - Proceed with a second attempt with Bougie and video laryngoscope with BURP (backward upward rightward pressure) - LMA with gauze inside the mouth b) Cannot intubate cannot ventilate - Follow anesthesia SOP - Not for needle cricoidotomy or ventilation using bougie	
8	Resume and maintain high quality CPR once patient is intubate and airway circulation seal (TM1 & TM2 to rotate)	
9	Manage patient according to ACLS algorithm (TL, TM1, TM2) a) Defibrillate (if needed) - IV adrenaline 1mg (every 3 min) - continue CPR	

No	Steps	Check
	b) Look for reversible causes (6H & 5T) and treat accordingly Hypoxia/ Hypovol/ Acidosis / Hyper@hypokalemia/ HypoMg / Hypothermia / Tension pneumo/ Cardiac Tamponade/ Toxins/ AMI / PE. if pts on Hydroxychoroloquine + Azithromycin think of giving i/v Mg 2g (if suspected hypomagnecaemia) c) R1 to get USG (if needed)	
10	Observe Buddy performance	
11	A minimum of 10 minutes of high-quality CPR duration is needed AND all reversible cause have been ruled out before decision of CPR termination	

the need for cross-checking of the PPE at all times.

A different approached was used in training of nebulisation. Instead of using the usual nebulisation pot for delivering of the inhaled medication, metered-dose-inhalation (MDI) technique using a self-made modified spacer device was used and the training module was developed and followed by a teaching session during the working hours by a designated trainer.

DISCUSSION

It is particularly important to focus on training areas that really can make the difference given the time and resources constraint. That was the reason we paid attention to the first three of the four training modules we intended to do. The three training modules that were executed first were: the donning-doffing of PPE, airway management, and CPR. On the other hand, we adopted a different approach on nebulisation with the floor training.

Two weaknesses had been identified throughout our preparation which were knowledge on AGPs and familiarity with the new norm during airway and CPR. These warranted immediate attention, hence the design of the training module. Steps taken during airway management and CPR such as high flow oxygenation, positive pressure bagging, oral suction (without a closed system) to remove secretions, endotracheal intubation, and chest compression were AGPs which posed significant hazards to EHFs. Since the COVID-19 virus transmitted primarily through respiratory droplets (Lai et al. 2020), when aerosolised, the particles remained afloat for a longer period and may potentially infect all personnel involved in the procedures especially if the PPE applied were inadequate (Kantor 2020). This is crucial as PPE is the last line of defense for our EHFs and potentially exploitable by the virus if not applied properly, hence compromising the safety of our EHFs.

The driving principle for the airway management is to reduce risks to EHFs and to avoid aerosol generation. Consensus statement by Safe Airway Society (SAS), Australia and New Zealand and Australian New Zealand Intensive Care Society (ANZICS) outlined the importance of identifying aerosol-generating events and procedures that were vulnerable to generate aerosol (Brewster et al. 2020). Many of these precipitating events are preventable with adequate

neuromuscular blockade (Brewster et al. 2020). Hence, the emphasis on PPE integrity among the EHFs involved and completeness of equipment during pre-intubation is paramount. Therefore, the training module for COVID-19 must be comprehensively tailored to address these issues at pre-, during and post-intubation phase. Patients with SARI in COVID-19 are likely to be considered for emergency tracheal intubation, mechanical ventilation and may even present to ED requiring immediate CPR (Fried et al. 2020).

Cardiac resuscitation in the setting of the COVID-19 pandemic poses a serious potential hazard to EHFs as it involves various AGPs (Driggin et al. 2020). Hence the usage of external mechanical compression devices has been recommended if available, to minimize contact with COVID-19 suspected patients (Driggin et al. 2020). It is also imperative that the team leader should orchestrate the resuscitation from the head-end of the patient (Saiboon et al. 2019), while handling the tight mask seal at the airway. This is a crucial strategy as endotracheal intubation should be done as smoothly as possible by the most experienced provider and resuscitation is to be conducted with minimal manpower as possible (Brewster et al. 2020; Edelson et al. 2020).

The maximum number of three EHFs per airway resuscitation is reasonable although no recommendations have been proposed or proven up to date (Cook et al. 2020). On the other hand, during resuscitation, a minimum of four or a maximum of five is a workable number (Academy of Emergency Sciences Manila 2020). AHA suggested minimizing the number of personnel for resuscitation (Edelson et al. 2020). Based on our experience, four to five person is just adequate to be in the resuscitation team with three people became the active team members while the fourth person plays a supportive role of getting the drugs, equipment, etc for the team and the 5th person can help with the scribing and counter-checking using the resuscitation guide or checklist (Table 4 & 8). The supportive team-members are positioned outside the resuscitation zone (Figure 2). Nevertheless, the demand may vary from centre to centre, depends on the baseline competency, the experience of the EHFs, and resource availability. These recommendations are purely based on our own experience.

In this study we only focus on the strategies and methods of delivering those approached. We do not evaluate the effectiveness and retention of the knowledge and skill obtained by the EHFs. Future study should look into the competencies of the EHFs and maintenance of those skill obtained. Another limitation noted was that we did not compare the preparedness of strategies taken by other health institutions in facing this pandemic. It would be better if we could see any similarities or differences in the approaches taken by them.

CONCLUSION

To win this COVID-19-versus-human epic battle, one of the most important strategies is to prepare our EHFs well.

Due to the unprecedented scenario and the speed of disease spread, training ought to be done concurrently while facing the wave of the pandemic. We also noted the paramount role of checklists as an adjunct during resuscitation and airway management in a time-constrained and resource-limited situation of this pandemic. Above all, face-to-face training can still be conducted, provided strict adherence to the seven safety pre-training measures is complied.

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