

Experience in the Cohort Intermediate Care Unit Arrangement and Nursing management of patients with COVID-19 at Bangkok Hospital Headquarters

Chutikan Suwalapha, RN, MBA^{1,2}; Thitaree Yongprawat, RN, MSc, MNS^{1,2}; Wirongrong Charoengid, RN, MNS²; Pompimol Laongam, RN, MBA²



Chutikan Suwalapha, RN, MBA

¹ Center of Excellence Neuroscience, Bangkok International Hospital, Bangkok, Thailand

² Nursing Staff Organization, Bangkok Hospital Headquarter, Bangkok, Thailand

*Address Correspondence to author:
Chutikan Suwalapha
Center of Excellence Neuroscience,
Bangkok International Hospital
2 Soi soonvijai 7, New Petchaburi Rd.,
Bangkok 10310, Thailand.
email: chutikan.su@bangkokhospital.com

Abstract

OBJECTIVES: To share experiences for the Cohort Intermediate Care Unit (IMCU) setup description. It also involves the focusing on integrated nursing care in collaboration with Multi-professional team to improve patient outcomes.

MATERIALS AND METHODS: We collected and searched many articles from the published medical literature that reported standard protocols for the IMCU and nursing management of SARS-CoV-2 (COVID-19). This study was a collection of data from COVID-19 patients who were confirmed cases with positive real time-PCR test results. They were receiving treatment and admitted at Bangkok Hospital Headquarters (BHQ) from May 1st- June 30th, 2021. Descriptive statistics were used to describe the results in frequency, percentage and mean. We compared the average number of days for COVID-19 patients stay between two groups. A confidence interval (CI) was used to explain a different sample proportion and a different interval of hospital mortality rate.

RESULT: Among 122 COVID-19 patients, 41 (33.6%) patients were admitted to the Cohort IMCU. The average length of stay (LoS) was 5.1 days, with minimum 1 day and maximum 15 days. Three quarter of them (31/41, 75.6%) had clinical improvement and were transferred to Cohort ward, while a quarter (10/41, 24.4%) had experienced clinical deterioration and were transferred to intensive care unit (ICU). Mortality rate of this group was 4.9% (95%CI -1.7, 11.5). During the same time period, 81 COVID-19 patients were directly transferred to ICU. The average LoS in ICU of 6.2 days. Among them, 8 of 81 patients did not survive. As a result, mortality rate among this group was 9.9% (95%CI 3.4, 16.4).

CONCLUSION: In our experience, the Cohort IMCU can reduce mortality rate of the COVID-19 patients and proper management also decrease crowding of ICU.

Keywords: COVID-19 guideline, nursing management for COVID-19, Intermediate Care Unit, Cohort ICU, integrated care for nursing, Telehealth

It was found a local cluster of pneumonia patients with unknown causes in Wuhan, China in late December 2019.¹ Originally, it was believed that bats were caused the coronavirus and mutated.² It was later officially announced by the World Health Organization (WHO) that the disease caused by an infection with SARS-CoV-2 (Severe Acute Respiratory Syndrome CoronaVirus-2), called as the coronavirus disease 2019 or COVID-19. There is an epidemic pattern (Propagated) that spreads of Human to Human transmission.³ Later on January 30, 2020, the WHO declared the new coronavirus outbreak a Public Health Emergency of International Concern. It was raised to the highest level of alarm, because of the continuous increase in the number of patients as a pandemic.⁴

In Thailand, the outbreak of COVID-19 was spread rapidly in all regions.⁵ Especially, Bangkok city is the center of the current COVID-19 pandemic. Cumulative number of patients found since 2020 were 165,462 cases, 114,578 cases were recovered, and deaths 1,107 cases.⁶ At present, a pandemic has entered stage of the third to fourth wave of the outbreak.⁷ There were many

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patients with COVID-19 who had pneumonia progress to be Acute Respiratory Distress Syndrome (ARDS) and needed more ventilators or special equipment, e.g., Extracorporeal Membrane Oxygenation (ECMO) and Hemodialysis for their life support.⁸ The massive increasing of COVID-19 patients affected survival rate especially in ICU.⁹ It involved both public and private hospitals.

The BHQ has prepared a Cohort ward (isolated ward) to support this crisis situation. Afterward, the coronavirus that causes COVID-19 has been mutated to a new variant from India, which is called “Delta”.¹⁰ It is more easily transmitted and severe than other variants. It was consistent with previous studies that showed 84 patients (41.8%) of COVID-19 patients having a progression of ARDS and 44 patients (52.4%) died.¹¹

A professional Nursing Organization (NSO) at BHQ was actively responding to this COVID crisis. They prepared facilities and set up the Cohort IMCU for patients with COVID-19. The Cohort IMCU also helps to distinguish patients who have co-morbidity diseases with mild condition from moderate and severe cases with COVID-19. Moreover, patients with co-morbidity diseases should be monitored closely because of progressive clinical to severe stage.

In addition, there was a shortage of doctors and nurses. It associated with the beginning of this pandemic crisis among healthcare providers who closed contact with COVID-19 patients and high-risk groups. Many nurses also had to self-quarantine for 14 days and they must be treated immediately if their COVID-19 test results were positive. It affected human resources planning and health care quality of these patients.¹²

Therefore, the objective of this article is to share experiences for the Cohort IMCU arrangement. This article discusses how the idea of the Cohort IMCU has been applied in BHQ, Thailand.

Methods

We collected and searched many articles from the published medical literature that reported standard protocols, review concepts of admission criteria and transfer guidance for the IMCU and nursing management of COVID-19. It was applied from a variety of the specialty guidelines and then adjusted to evidence-based pathway, including this unit applied of new healthcare technology and medical devices to reduce the direct transmission routes to healthcare providers.

A professional nursing organization’s responsiveness to the COVID-19 pandemic situation

The NSO at BHQ has organized a working group to set up an Intermediate Care Unit and review guidelines of nursing practice for patients with COVID-19¹³ to prevent and control the spread of this illness. It is based on the guidelines of the Department of Medical Services Ministry of Public Health (Thailand),¹⁴⁻¹⁶ COVID-19 guidance of The Centers for Disease Control and Prevention (CDC)¹⁷ and followed the standards of Joint Commission International (JCI)¹⁸ for continuous quality improvement and safety of medical care as detailed below:

1. Set up the Cohort Intermediate Care Unit (Cohort IMCU)^{19,20}

The Cohort IMCU has developed as specialized unit that providing an intermediate level of care between a Cohort ward and ICU for patients with COVID-19 whose conditions are clinically unstable. Their illness requires continuous vital signs monitoring for ensuring patient safety but no need mechanical ventilation with the following steps:

1.1. Developed the Cohort IMCU admission criteria and Transfer guidance of COVID-19 patients,^{14-18, 21-24} which the recommendations include:

Department	Classification	Clinical presentation
Cohort ward	Mild	<ul style="list-style-type: none"> Mild symptoms like Upper Respiratory Infection (URI) such as, mild temperature (37.3-37.8 °C), dry cough, sore throat, fatigue, muscle or body aches, runny nose and headaches including, shortness of breath (SOB), loss of taste or smell, nausea or vomiting, diarrhea, red eyes and maculopapular rash Room Air Oxygen saturation \geq 96 % Mild pneumonia on imaging
Cohort IMCU	Moderate	<ul style="list-style-type: none"> Pneumonia with high fever ($>$ 37.8 °C) and respiratory symptoms like inflammation moving into the bronchioles or lower lungs Having a progression of infiltrates or room air SpO₂ $<$ 94% and breathless (rapid and shallow breathing) with respiratory rate $>$30/min COVID-19 conditions with High risk patients of severe disease and uncontrolled medical conditions such as, Hypertension (HT), chronic lung diseases, chronic kidney disease (CKD), Diabetes (DM), obesity, heart disease and cerebrovascular disease
ICU	Critical	<ul style="list-style-type: none"> Hypoxia with Respiratory rate $>$ 35/min, accessory muscle use Respiratory failure as Acute respiratory distress syndrome (ARDS) condition that requires intubation and mechanical ventilation support Shock (blood pressure (BP) $<$90/60 mmHg) with other organ failure and requiring ICU care

1.2 Rapidly developing protocols and guidance for healthcare personnel.^{13,16, 18}

These protocols can prevent and control the spread and transmission of infection. NSO is working with the Infection Control Committee (ICC) and Infection Control Nurse to supervise all nurses and health care workers should continue to follow protocols and the guidance on working safely and to monitor their performance. For example: if the patients have tested positive for COVID-19, the nurse will consider and proceed to isolate them according to the guidelines for Isolations, Precautions and Transmission-Based Precautions which includes handwashing and gloving, transporting of patients with infection, routine COVID-19 cleaning and disinfection and waste management.

1.3 Managing Medical equipment and facilities for protecting healthcare providers^{13,14,16,18} that were recommended by The CDC¹⁷ as shown below:

- i. NSO was supporting all types of Personal Protective Equipment (PPE) for Health care professional. All staffs who contact the patients must be covered as an N95 respirator, face shields, face masks, gloves, surgical cap, goggles, protective gown, boots, or leg cover that depending on the type of exposure risk as much as necessary.
- ii. Coordinate with Ancillary Division to prepare the High-flow Nasal Cannula Oxygen (HFNC).¹⁵ It provides oxygen deliver up to 100% heated for treatment and humidified oxygen at a maximum flow nasal cannula of 60 LPM, therefore it can reduce the endotracheal intubation rates in COVID-19 patients with oxygen deficiency. Furthermore, ancillary department also manage inventory and stock effectively that all medical supplies and devices should be available 24 hours on the unit.
- iii. Working with Clinical Laboratory.²⁵ These process was transported blood samples or the nasopharyngeal specimens to the laboratory rapidly for detection and identify infected people or patients who were tested positive for COVID-19.
- iv. Cooperate with the Facility Management Department. NSO provides work procedures (WP) for "Isolation Precautions" to them and ensure that they are following Hospital protocols and WP.^{13,16,18} It included the guidance in cleaning and disinfection practices to prevent the spread of infection according to the Thai-Department of Disease Control (DDC) guidelines for COVID-19 and reduce the risk of worker exposure to COVID-19 patients.

1.4 The IMCU set up and facilities¹⁹⁻²⁰ : The IMCU has 7 individual bed units in closed spaces with negative pressure environment. All patients receive continuous pulse oximetry with vital sign monitoring 24 hours. Ventilation systems are designed to provide the lower air pressure inside the relative negative pressure is -2.5 Pa than outside the room. Circulated air through 90-95% medium filter and Ultraviolet (UV) light before removes it to the outside of the hospital.^{13, 18} In-room service solutions have brought the new Telehealth technology and medical devices used

for two-way communication between a multidisciplinary team and patients, which can track their symptoms, evaluate, diagnosis and consultation. It can also help physicians and nurses to reduce direct contact with the infection patients and decrease the airborne transmission of COVID crisis, including:

- Using the Tytocare^{TM26} device as physicians' assistance for an initial Health Assessments for COVID-19 patients. The patients can use this device to check self-examination for temperature, ears, throat, heart and lung. Their exam results will be consulted with physicians through the TytocareTM application. It can keep interactions between physicians, nurses and patients anytime.
- COVID-19 Tele-monitoring for vital signs in real-time 24 hours via the DoCare^{©27} solution. The patients can use it to self-monitor for temperature exam, BP, and blood oxygen saturation. It uses Bluetooth to connect between the Base Unit in the patient room and the nurse station. DoCare[©] is very important in COVID-19 patients who have uncontrolled morbidity disease. Nurse can assess symptoms and tracking their health record and receive the advices from the physician.
- Apply the Huawei Cloud Conferencing Platform²⁸ for patients with COVID-19. It can be quickly delivered to remote video conferencing for physician diagnosis and treating the patients during their admission in the Cohort IMCU. The system monitors the abnormal conditions and status of patients for immediate intervention and nursing care with efficient remote communication.

2. The Human Resources and preparation of the team^{12,29}

Shift work in the Cohort IMCU is a 12-hour rotation (morning shift 7.00-19.00 and afternoon shift 19.00-07.00). There is one Internal physician (daytime) and one On-call physician (overnight coverage) for their patients with a multi-professional team, in detail as:

2.1 Total healthcare workers are 12-13 people per day (excluding Head of Department, a unit secretary, and preceptor). The work schedule is divided into 2 shifts. Each shift consists of 1 in-charge nurse (Critical care nurse), 2 Medical nurses (1 Critical care nurse and 1 General nurse) and 3-4 Practical Nurses per 7 bed units. The number of nurses per patients at the Cohort IMCU ratio was 1:3 based on their patients' health conditions.²⁹

2.2 Using concept of the Mitosis scaling model.^{30,31} This model is the redesign of human resources planning and facility management. It aims to use limited staffs and medical equipment effectively. These is suitable for hospitals or departments that require rapid expansion in new unit and the innovation technology. Thus, a new health information system actually implementation starts within the Cohort IMCU and using lean startups with potential preceptors who can teaching and motivate individual nurses and also expand the service area like scale-up ICU to the Cohort IMCU as a Modular ICU³² for continuous improvement transformation.

2.3 Ensure all of nurses were completed the specific **training and workshop program**. It was designed by Nurse Manager of Critical care and was monitoring and evaluation skills by Nurse Preceptor for staffs that working in the Cohort IMCU. NSO provided all knowledge following the nursing guidelines, such as: Prevention and infection

Control, Advanced nursing assessment and special investigation, Nursing Care and treatment of the patients with COVID-19, Respiratory Rate-Oxygenation (ROX score) and Modified Early Warning Signs (MEWS) assessment, Pharmacology and nursing management and psychosocial intervention for COVID-19.^{33,34}

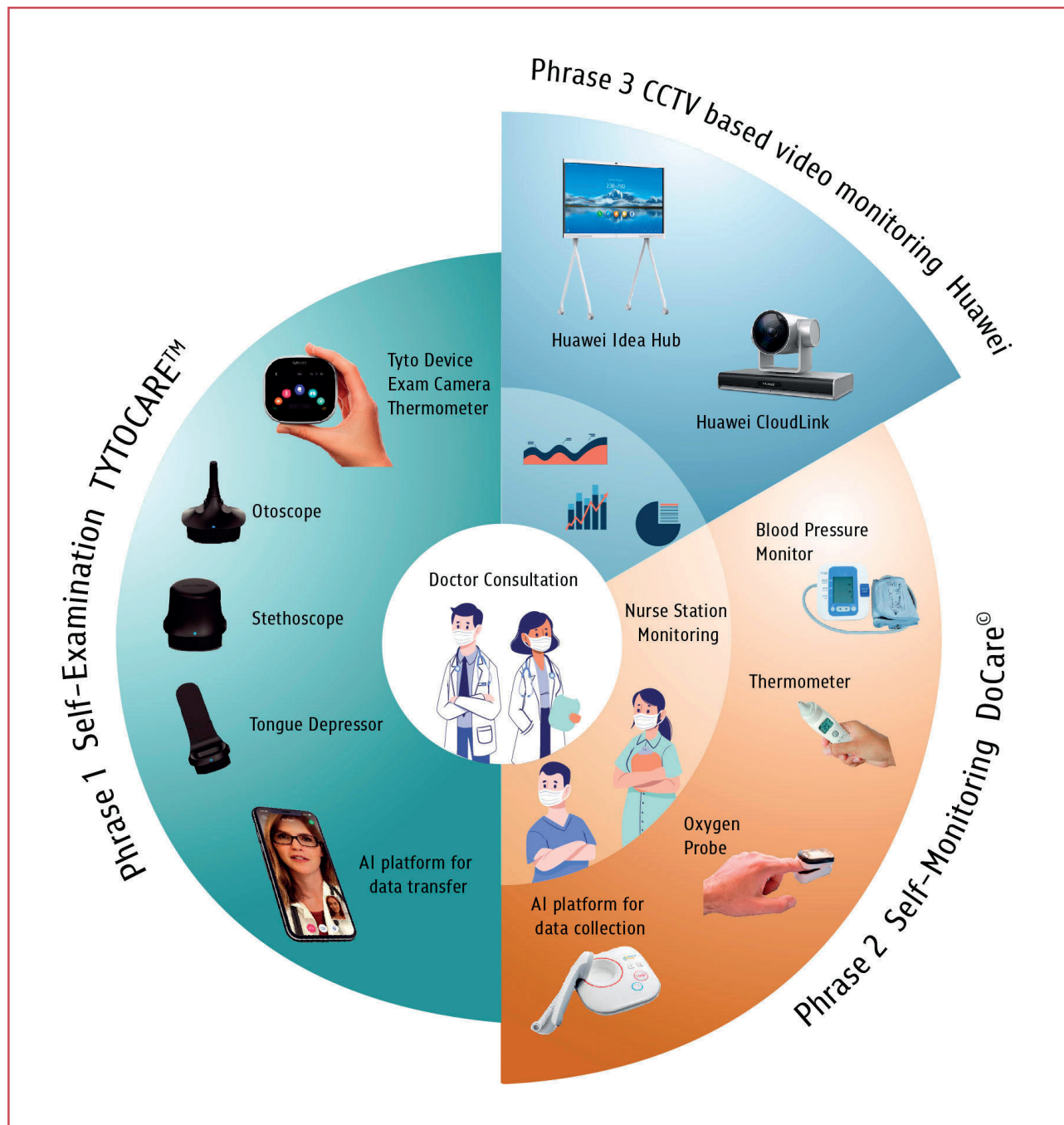


Figure 1: The new Telehealth technology and medical devices used for efficient communication in the Cohort IMCU

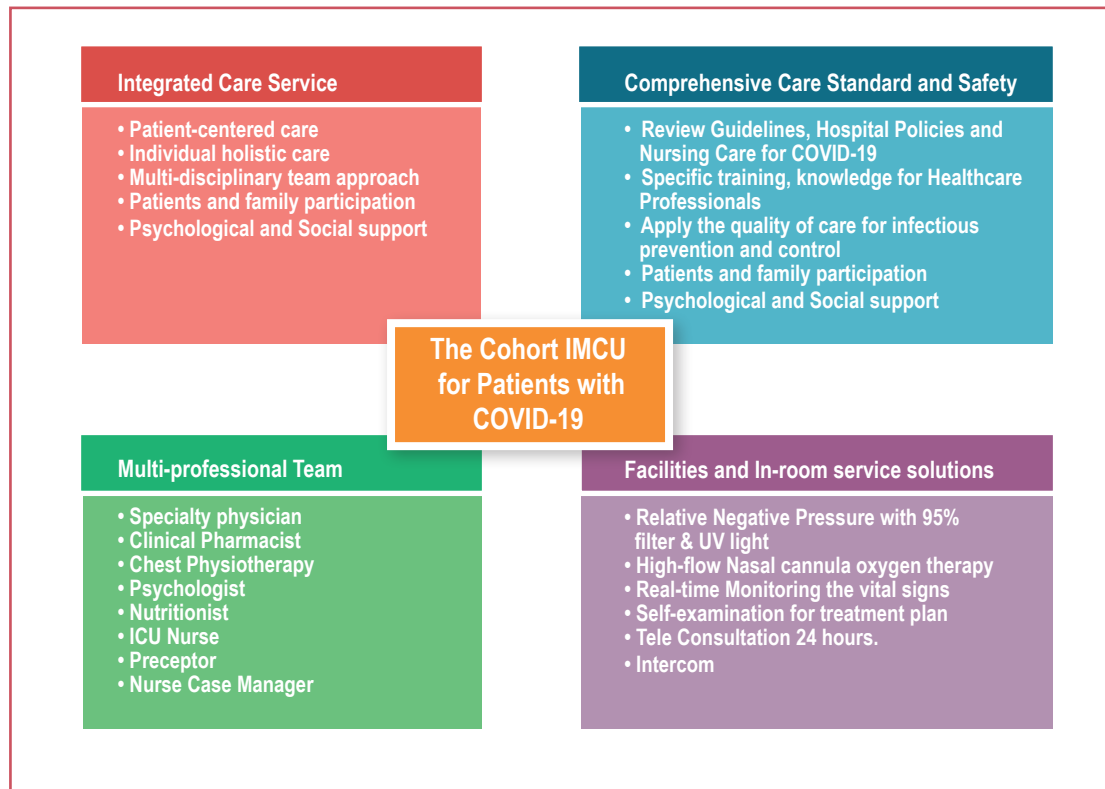


Figure 2: Overview of the Cohort IMCU at Bangkok Hospital Headquarters, Thailand

3. *Develop an integrated care services and providing excellent clinical care for patients with COVID-19.*

Integrated Care Services^{35,36} is a nursing model to provide reasonable interactions across physicians, nurses, and patients to cover all dimensions of holistic health care such as physical, mental, spiritual and social for balance wellness. It also

focusses on the Patient-centered care³⁷ as a respect for patients' individual needs, described in the sections below

Review Clinical Practice Guidelines about the nursing process with integrated care³⁸⁻⁴⁰ for COVID-19 patients.³⁶⁻³⁸ It is classified according to Nursing Diagnosis as follows:

3.1 Nursing care to prevent the spread of infection and reducing transmission may include:

Risk	Nursing care
1. Risk of infection in the respiratory system such as pneumonia.	<ul style="list-style-type: none"> • Restricting certain activities to prevent the spread of coronavirus infection • The airways suctioning and clearing secretions with aseptic technique • Medication administration according to the treatment plan as antibiotic or antimicrobial agents • The chest physiotherapy interventions • Teaching the deep breathing exercise and cough effective for patients • Follow lab, especially CBC and chest x-ray results • Monitor vital signs and oxygen saturation every 4 hours
2. Risk of hypoxia	<ul style="list-style-type: none"> • Monitor signs and symptoms of hypoxia such as shortness of breath, dyspnea, alteration of consciousness, restless and cyanosis. (If abnormalities are found, report to your doctor immediately) for maintaining respiratory function • Oxygen therapy by nasal cannula flow 5 LPM with mild hypoxia • Prone position for improved oxygenation • Teaching the deep breathing exercise and cough effective for patients • Give medications according to the doctor's treatment plan. • Monitor vital signs and oxygen saturation every 1 hour until stable, then measure every 4 hours

Risk	Nursing care
3. Risk of acute respiratory failure	<ul style="list-style-type: none"> • Check the ROX score⁴¹ to predict the risk of intubation in hypoxemic respiratory failure and MEWS score⁴² such as Systolic blood pressure (mmHg), heart rate, respiratory rate, temperature (°C), conscious level, and any concern about the patient's condition (score 0-21, if score ≥ 4, consider to transferred to the ICU) • Heated humidified High-flow Nasal Cannula oxygen (HFNC) therapy for ventilation management • Prone position for more homogeneous inflation/ ventilation distribution and nursing care • Deep breathing exercise and cough effective for COVID-19 patients • Give medication according to the doctor's treatment plan, such as bronchodilators, disinfectants • Monitor vital signs and oxygen saturation every 15-30 minute, every 1 hour until stable • Record the urinary output q 1 hour until stable $\text{ROX Index} = \frac{\text{SpO}_2 / \text{FiO}_2}{\text{Respiratory Rate/ minute}}$ <p>SpO₂ = Oxygen saturation FiO₂ = Fraction of inspired oxygen</p> <p>The ROX⁴¹ scoring assessment is predictor of HFNC failure. It measures at 2 hours, 6 hours, and at 12 hours after the management of HFNC (if low ROX score, patients may be a high failure of HFNC and should transfer to the ICU for intubation).</p>
4. Uncomfortable due to symptoms of COVID-19 as acute respiratory illness (e.g., fever, cough, sore throat, fatigue or headache)	<ul style="list-style-type: none"> • Tepid sponge for decrease body temperature levels (temperature > 38°C) and take Paracetamol (500 mg) 1 tablet per oral as need every 4-6 hours. • If you have a cough, sore throat. You should drink lots of water, give Cough Drops and medicines follow a treatment plan accordingly. • If you experience nausea or vomiting. You should rinse your mouth often, cleaning the mouth, eat an esophagitis diet and easy to digest • Fluid management and receive antibiotics according to the treatment plan. • Deep breathing exercise and cough effective for COVID-19 patients • Monitor temperature every 4 hours

3.2 Mental and Spiritual care of COVID-19 patients^{43, 44, 45}

Patients at risk of anxiety and lack of knowledge about disease.

The roles of nurse, as follows:

- First, nurse should establish a trust relationship with the patients, include:
 - Offer an opportunity for patients to talk about their disease and express empathy
 - Paying attention to the patient's needs and ask the patients for clarification with positive communication
- Provide truthful knowledge and health education to patients, such as advice to keep isolation, precautions during hospitalization and ensure patients are aware of prevent the spread of infectious disease
- Encourage the patients to have daily activities to self-monitor their symptoms and take care themselves. For example, how to self-examination as fever measurement, vital signs and oxygen saturation monitor through the Tytocare™ device.
- To support patient's confidence that the nurse is monitoring health conditions of the patient closely 24 hours through the Tele-monitoring system. Nurse support a comfortable environment and easy access to improve effective communication through the hospital telehealth system. They can contact nurses as needs.

- The depression screening on patients as the Patient Health Questionnaire-9 (PHQ-9) on the first day of admission that use to assess the depression severity. They may consult with a psychologist to recover from mental health problems.

3.3 Psychosocial support for COVID patients^{44,46}

Some patients were their relatives as family, siblings as well as neighbors, friends or coworker violence. Also, they have concern and worry about economic factors, e.g., unemployment and financial problem. They must adapt to new daily routine as Work from home, closing public places/schools and social isolate. These has impacted on daily life changes very rapidly during COVID-19 situation.

The role of a nurse is provided knowledge, motivation and discussion with the patients and their family or intimate relatives. Nurse is explained about disease and answer questions clearly for relieve stress. Nurse is also encouraging participation to family members involve in the care of patients and continue to recover them at home. This may have positive affected on social adaptation of patients appropriately.

In addition, nurse is coordinated with Multidisciplinary care team, including a family meeting before discharge. An attending physician may consult a Psychologist for improving the patients' self-esteem and self-confidence because they may have a negative impact on mental health effects of Covid-19 crisis. It also relates to their long-term quality of life and emotional well-being.⁴⁷

Data collection and analysis

This study was collecting data from the COVID-19 patients who were confirmed cases with positive real time-PCR (Poly-

merase chain reaction) test results. We identified all of COVID-19 patients who were receiving treatment and admitted to the Cohort IMCU and ICU at BHQ during May 1st- June 30th, 2021.

Descriptive statistics were used to describe the results in frequency, percentage and mean. We compared the average number of days for COVID-19 patients stay and the mortality rate in hospital between two groups. The CI was used to explain a different sample proportion and a different interval of hospital mortality rate. The mortality rate and CI for proportion formulas,⁴⁸ as below:

$$\text{Mortality rate} = \frac{\text{Number of Covid-19 patient deaths in the unit}}{\text{Total number of patients with Covid-19 during the same time period}}$$

$$\text{Confidence Interval} = p \pm z^2 \left(\frac{p(1-p)}{n} \right)$$

p = The sample proportion
 z = The critical value = 1.96 (95%)
 n = The sample size

Results

Among 122 COVID-19 patients, 41 (33.6%) patients were admitted to the Cohort IMCU. The average LoS was 5.1 days, with minimum 1 day and maximum 15 days. Three quarters of them (31/41, 75.6%) had clinical improvement and were transferred, to Cohort ward, while a quarter (10/41, 24.4%) had experienced clinical deterioration and were transferred to ICU. Mortality rate of this group was 4.9% (95%CI -1.7, 11.5).

During the same time period, 81 COVID-19 patients was directly transferred to ICU. The average LoS in ICU was 6.2 days. Among them, 8 of 81 patients did not survive. As a result, mortality rate among this group was 9.9% (95%CI 3.4, 16.4)

Discussion

The results of this study was consistent with a systematic review from four studies in China and outside China, it was found a median hospital LOS in ICU for COVID-19 patients was 8 days and 7 days respectively.⁴⁹ In agreement with previous studies from 10 hospitals in an integrated healthcare system. It was found that the Step Down Unit care was associated with patient outcomes improvement,⁵⁰ especially for high-risk patients. The Step Down Unit admission after an ICU discharge was associated with decrease the hospital mortality rate of 2.5%.⁵¹

Furthermore, previous similar study showed the effective utilizations of Intermediate Care Units that can have increased availability of ICU beds⁵² and the cost of staffing was lower in the IMCU than ICU as well.²⁹ Meanwhile, many patients have psychosocial problems affecting them after discharge from an ICU.⁵³ Tele-consultations may use for improving real-time communication efficiency in the Cohort IMCU,⁵⁴

consequently the health information technology solution for COVID-19 patients should flexible access and easy to use.

Accordingly, the primary role of nurse in the Cohort IMCU should also provide a holistic nursing care and psychosocial support, including sharing the decision making with patients and their families collaboration, which these may improve patients experience and a positive effect on their outcomes. In addition, nurses spend more time with patients with the health assessment, nursing diagnosis, care planning, implementation and patients' evaluation. Therefore, nurses need to prepare both mentally and physically, including their competencies to be ready to respond to this crisis situation that provide excellent and efficient nursing care.

This study aims for sharing our experience among the COVID-19 crisis like a preliminary view. Thus, it may have the selection bias and limitations from the selection of some participants into this study. We compared the LoS of COVID-19 patients between two groups. Some COVID-19 patients were admitted to ICU directly that may have more severe conditions and life-threatening than those who were transferred to the Cohort IMCU. It can be related to prolonged hospitalization. Therefore, hospital mortality rate of ICU was higher than Cohort IMCU. However, further research design should be optimized to reduce bias that could influence study results and further studies are needed more variable which may affect LoS and patient outcomes with COVID-19.

Conclusion

The Cohort IMCU can decrease the mortality rate of the COVID-19 patients. It can also increase the number of ICU beds for COVID-19 patients who require early detection of of the disease's progression needed invasive mechanical ventilation.

Declaration of conflict of interest

The authors declared no conflict of interest and none of the authors had the connection or agreement with medical device companies, such as the Tytocare™ Ltd., the DoCare© from SCG. and the Huawei Cloud Conferencing Platform that used these devices in the Cohort IMCU.

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