STRATEGIES IN TRANSFORMING STANDARD HOSPITALS AND CLINICS FOR COVID-19 TREATMENT

NAVEEN JAYAKUMAR A/L VIJHAY KEERRTHI

FACULTY OF ENGINEERING
UNIVERSITY OF MALAYA
KUALA LUMPUR

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STRATEGIES IN TRANSFORMING STANDARD HOSPITALS AND CLINICS FOR COVID-19 TREATMENT

NAVEEN JAYAKUMAR A/L VIJHAY KEERRTHI

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STRATEGIES IN TRANSFORMING STANDARD HOSPITALS AND CLINICS FOR COVID-19 TREATMENT

ABSTRACT

In Malaysia, total COVID-19 cases as of 7th June 2021, is 622,086 and total death of 3,460. Initially, Ministry of Health has assigned 11 government hospitals and UMMC (University Malaya Medical Centre) to treat COVID-19 patients. As of quarter 3 2021, almost all public hospitals and 96 private hospitals have agreed to provide COVID-19 treatment during this state of emergency. With surging numbers of COVID-19 cases more hospitals and even clinics are required to manage the patients. However, many of these hospitals and clinics hospitals lack of specific resources, flexibility and expertise to accommodate COVID-19 patients with confirmed symptoms. Therefore in this study, systematic study will be conducted to ascertain material and human resources, facilities upgrades and changes in operations required to manage COVID-19 patients in hospitals and clinics. Therefore, the aims of this study are to evaluate the best management practices (BMPs) worldwide in terms of infrastructure, logistics, and Standard Operating Procedures (SOPs) in COVID-19 treatement hospitals and to propose BMPs and strategies to transform the standard hospitals in our country to COVID-19 treatment hospitals for treatment. To meet the objectives, checklist provided by WHO, was simplified and distributed to frontliners and their feeback was analayzed. Based on the analysis, patient management recorded highest percentage of 98%. Hospitals in Malaysia have well established the SOPs for patient management. However, 82% of respondents had shown low agreement for statement of COVID-19 plan is available to potentially refer or outsource care of non-critical patients to alternative health facilities. By implementing the checklist in non-covid hospitals, it can be transformed to COVID-19 treatment hospitals immediately to support the increase number of cases. In addition,our community should follow all the SOPs in order to

support the government, and healthcare providers, to curb the transmission of this virus, this is everyone's responsibility.

Keywords: COVID-19, Ministry of Health, Standard Operating Procedure, Best Management Practice, barisan hadapan.

ABSTRAK

Di Malaysia, jumlah kes COVID-19 setakat 7 Jun 2021, adalah 622,086 dan jumlah kematian 3,460. Pada mulanya, Kementerian Kesihatan Malaysia telah menugaskan 11 hospital kerajaan dan UMMC (Pusat Perubatan Universiti Malaya) untuk merawat pesakit COVID-19. Sehingga suku 3 2021, hampir semua hospital awam dan 96 hospital swasta telah bersetuju untuk memberikan rawatan COVID-19 semasa keadaan perintah berkurung ini. Dengan jumlah kes COVID-19 yang meningkat, lebih banyak hospital dan klinik diperlukan untuk menguruskan pesakit. Walau bagaimanapun, kebanyakan hospital dan klinik ini kekurangan sumber daya, fleksibiliti dan kepakaran khusus untuk menampung pesakit COVID-19 dengan gejala yang disahkan. Oleh itu, dalam kajian ini, kajian sistematik akan dilakukan untuk memastikan bahan dan sumber manusia, peningkatan kemudahan dan perubahan operasi yang diperlukan untuk menguruskan pesakit COVID-19 di hospital dan klinik. Oleh itu, tujuan kajian ini adalah untuk menilai Amalan Pengurusan Terbaik (BMP) di seluruh dunia dari segi infrastruktur, logistik, dan Prosedur Operasi Standard (SOP) di hospital rawatan COVID-19 dan untuk mencadangkan BMP dan strategi untuk mengubah hospital standard di negara kita kepada hospital rawatan COVID-19 untuk mendapatkan rawatan. Justeru it, untuk memenuhi objektif, senarai semak yang disediakan oleh WHO, dipermudahkan dan diedarkan kepada barisan hadapan dan maklum balas mereka dianalisis. Berdasarkan analisis, pengurusan pesakit mencatatkan peratusan tertinggi sebanyak 98%. Hospital di Malaysia telah menetapkan SOP untuk pengurusan pesakit. Namun, 82% responden telah menunjukkan persetujuan yang rendah untuk pernyataan mengenai rancangan COVID-19 tersedia untuk berpotensi merujuk atau mengalihkan perawatan pesakit tidak kritikal ke kemudahan kesihatan alternatif. Dengan menerapkan senarai semak di hospital bukan COVID-19, ia dapat diubah menjadi hospital rawatan COVID-19 dengan segera untuk menyokong peningkatan jumlah kes. Sebagai tambahan, komuniti kita harus mengikuti semua SOP untuk menyokong and memudahkan kerajaan, dan penyedia perkhidmatan kesihatan, untuk mengekang penularan virus ini, adalah tanggungjawab masyarakat.

Kata kunci: COVID-19, Kementerian Kesihatan Malaysia, Prosedur Operasi Standard (SOP), Amalan Pengurusan Terbaik (BMP), barisan hadapan.

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TABLE OF CONTENT

ABSTRACT v

ABSTRAK VII

LIST OF FIGURES xiii

LIST OF TABLES xv

LIST OF SYMBOLS AND ABBREVATIONS xvi

LIST OF APPENDICES xviii

Chapter 1 INTRODUCTION 1

1.1 Background of Study 1

1.2 Problem Statement 3

1.3 Research Questions 5

1.4 Research Aim and Objectives 5

1.5 Scope and Significance of Study 6

1.6 Dissertation Outline 6

Chapter 2 LITERATURE REVIEW 8

2.1 Healthcare in Malaysia 8

2.2 Introduction to COVID-19 and Treatment 8

2.3 COVID-19 Hospitals Standard Operating Procedures (SOPs) and Practices 12

2.4 Facilites and Operational Requirement 14

2.5 Limitation of COVID-19 Hospitals 26

2.6 Status of Non-COVID-19 Hospitals and Clinics 26

2.7 Transformation Strategies 27

2.7.1 Sewage Treatment and Renovation 27

2.7.2 Transmission Route 29
2.7.3 Laundry Management 29
2.7.4 Biomedical Waste (BMW) 30
2.7.5 Patients Discharge 30
2.7.6 Death Management 30
2.7.7 Other strategies 31
2.8 Future Requirements 31
2.9 Literature Review Summary 33
Chapter 3 RESEARCH METHODOLOGY 35
3.1 Introduction 35
3.2 Checklist preparation 37
3.3 Data analysis 39
3.4 Safety Precaution 39
Chapter 4 RESULTS AND DISCUSSIONS 43
4.1 Introduction 43
4.2 Respondents background 43
4.3 Communication & Coordination analysis 45
4.4 Risk communication and community engagement analysis 46
4.5 Administration, finance and business continuity engagement analysis 47
4.6 Human resources analysis 50
4.7 Continuity of essential services analysis 51
4.8 Patient Management analysis 53
4.9 Occupational health support analysis 54
4.10 Rapid identification and diagnosis analysis 55

4.11 Infection prevention and control analysis 56
4.12 Overview of hospital readiness: key components 58
Chapter 5 CONCLUSION AND RECOMMENDATIONS 60
5.1 Conclusions 60
5.2 Recommendations for future work 61
APPENDICES 62
REFERENCES 79

LIST OF FIGURES

Figure 2:1: COVID-19 cases in Malaysia by states as of November 12, 2020 (source: Department of Statistics, Malaysia (DOSM) 10

Figure 2:2: COVID-19 cases in Malaysia according to gender (source: Department of Statistics, Malaysia (DOSM) 10

Figure 2:3: Personal protection equipment [13]. 14

Figure 2:4: Schematic of the hospital modification (a) and the flow chart of the treatment process of suspected COVID-19 patients (b) [14]. 17

Figure 2:5: Management strategies in emergent hospital reform for COVID-19 [19]. 20

Figure 2:6 Sewage treatment flow [20] 28

Figure 3:1 : Flowchart of this project 36

Figure 3:2:Spider chart mapped to the 10 components and scores. 41

Figure 4:1:Background of respondents 44

Figure 4:2: Incident Management System analysis 44

Figure 4:3 Communication and coordination feedback 45

Figure 4:4: Standardized form available to report COVID-19 feedback 46

Figure 4:5:SOP for infection prevention and control feedback 47

Figure 4:6:Hospital corporate strategy feedback 48

Figure 4:7: Hospital incident management system feedback 49

Figure 4:8: COVID-19 plan availability feedback 50

Figure 4:9:Hospital staffing strategy feedback 51

Figure 4:10:SOP for patients receiving and transfer within the hospital feedback 54

Figure 4:11:Staff training in patients handling feedback.....55

Figure 4:12 Overview of hospital readiness 59

LIST OF TABLES

Table 2.1:Essential Components of a Hospital Preparedness Plan for COVID-19 23

Table 3.1: Simplified checklist from the World Health Organization (WHO) checklist on the rapid hospital readiness for COVID-19 treatment.....37

Table 3.2: Summary of components and scores in the checklist 39

Table 3.3: Gantt chart of the project 42

Table 4.1: Survey questions for the sixth components in the checklist and the responds. 52

Table 4.2: Survey questions for the ninth components in the checklist and the responds 56

Table 4.3: Survey questions for the tenth components in the checklist and the responds 57

LIST OF SYMBOLS AND ABBREVATIONS

SOP	:	Standard Operating Procedure
COVID-19	:	Coronovirus disease 2019
ICU	:	Intensive Care Unit
PPE	:	Personal Protective Equipment
EMCO	:	Extracorporeal Membrane Oxygenation
BMW	:	Biomedical waste
WHO	:	World Health Organization
KKM	:	Kementerian Kesihatan Malaysia
BMP	:	Best Management Practise
UMMC	:	University Malaya Medical Centre
MOH	:	Ministry Of Health
MCO	:	Movement Control Order
BPR	:	Bed to Patient Ratio
DOSM	:	Department Of Statistics Malaysia
FAHZU	:	First Affiliated Hospital of Zhejiang University

RT-PCR	:	Reverse Transcription – Polymerase Chanin Reaction
MSWiA	:	Central Clinical Hospital of the Ministry of Interior and Administration in Warsaw
CCH	:	Central Clinical Hospital
EOP	:	Emergency Operational Plan
HLIU	:	High-level Isolation Unit
HIV	:	Human Immunodeficiency Virus

LIST OF APPENDICES

Appendix 1: WHO Rapid hospital readiness checklist for COVID-19 ……..61

Appendix 2: Screenshot of google form that was created for the survey ……...72

Appendix 3: Flow Chart of Management of Suspected Case Admitted to Ward ...73

Chapter 1

INTRODUCTION

1.1 Background of Study

In late December of 2019, the Chinese authority reported an outbreak of acute respiratory syndrome coronavirus 2 (SARS-CoV-2), called coronavirus disease 2019 (COVID-19) which originated from Wuhan, Hubei Province, China. The first Malaysian who has tested positive for COVID-19 is a 41 year-old-man and was attending an international conference in Singapore from 16th to 23rd January 2020. The conference was also participated by several delegates from China [1]. He developed symptoms such as flu and cough after back to Malaysia and sought treatment in one of the private hospital and was transferred to Sungai Buloh Hospital, Selangor, for further treatment. On 12th March 2020, the government made the decision to designate Sungai Buloh Hospital, a public hospital as the country's first and main COVID-19 hospital.

Consequently, to cater the substantial number of COVID-19 cases, Ministry of Health (MOH) had immediately formulated a standard guidelines for the management of COVID-19. Director General of Health, Dr. Noor Hisham appointed by Ministry of Health, was put in charge of the medical response to the outbreak. Apart from public hospitals, UMMC (University Malaya Medical Centre) was the only non-Ministry of Health hospital that handled confirmed cases for treatment. Moreover, MOH has established 34 hospitals and screening centers specifically for the affected patients in each state of Malaysia. This include Kuala Lumpur Hospital, Sungai Buloh Hospital (Selangor), Tuanku Jaafar Hospital (Negeri Sembilan), Sultanah Aminah Hospital (Johor Bahru), Miri Hospital (Sarawak), and Tawau Hospital (Sabah) [2]. In addition,

due to massive outbreak of this virus in all states, eventually each states public hospital become the treatment centre.

Since end of January 2020, reported cases gradually increasing and the number surged by March 2020, hence recording the largest number of cumulative cases in whole of Southeast Asia. As of the 17th April 2020, there were 5,251 COVID-19 cases including 86 deaths and 2,967 cases of recovery reported by the Ministry of Health (MOH) in Malaysia [3]. As of 30th April 2021, the cases tremendously increased with total positive cases are 408, 713 and total death of 1,506 in Malaysia [4]. This shows about 78 times increase within 1 year period. According to Dr Suresh Kumar, an infectious diseases clinician explained that initially Sungai Buloh is a 900-bedded hospital and once they are aware of the alarming situation in Wuhan, the hospital has been quickly renovated so that it could accommodate over 2000 beds for patients and the intensive care units (ICUs) fitted with more beds. Thus, Malaysia's COVID-19 preparedness and planning activities led to a remarkable 86% increment in diagnostic laboratories. Besides that, the diagnostics capacity for COVID-19 increased from an initial 6 laboratories to 43 laboratories, including those in public hospitals, public health laboratories, university laboratories, private laboratories laboratories within the Malaysian Armed Forces, the and Malaysian Genome Institute [5].

The government has to handle this situation with abrupt actions and to ensure the designated COVID-19 hospitals are well-equipped and able to handle the surge in the number of patients daily. Most often, modern hospitals lack the flexibility to accommodate sudden surge of patients and that they run out of space and resources to treat COVID-19 patients with severe symptoms. Apart from that, the fear that handling

patients with symptoms may infect other hospital staffs and other patients in the facilities. Therefore, the aims of this study are to evaluate the best management practices (BMPs) worldwide in terms of infrastructure, logistics, and Standard Operating Procedures (SOPs) in COVID-19 treatement hospitals and to propose BMPs and strategies to transform the standard hospitals in our country to COVID-19 treatment hospitals for treatment.

To meet the objectives, a simplified checklist that can be used for the transformation was developed based on the established best practices reported and confirmand to date. The checklist will be validated by consulting frontliners with experience in managing COVID-19 patients and from the designated treatment hospitals.

1.2 Problem Statement

COVID-19 outbreak started in December 2019 and still exist and the number of cases are increasing significantly. During the first wave of this pandemic, many countries were under lockdown or movement control order (MCO). To date, distinct variants of coronaviruses have spread worldwide, with record of 219 countries and territories now reported the presence of COVID-19 infected cases.

COVID-19 is a life threatening pandemic across the globe and as of 29th April 2021, the total cases recorded were 147,443,848 with 3,117,542 deaths. America is the top country with highest number of cases of about 61 824 341 and followed by Asean countries [6]. Initially, Europe became the epicentre of the disease, but now has been overtaken by the America.

Malaysian government has implemented several intervention plans to curb the spread of COVID-19 pandemic by imposing strict SOPs (standard operating procedure). For instance, social distancing, wearing face masks in public, movement control restrictions, regular hand washing and sanitizing and quarantine up to 14 days [7]. However, after Malaysia has succeeded to flatten the COVID-19 infection curve in during the first and second waves of infections till September 2020, the cases rebound dramatically starting from October 2020. From early January 2021 to date, the number of cases remain in the range of four digit figures[8]. During this third wave, it is distinguishable that the infection proliferating rapidly in the community and the number of active cases spike irregularly [9]. Initially, our country is aware with the overwhelming cases in China and quickly has taken massive actions by accommodating more beds in Sungai Buloh hospital and nation-wide preparing the government hospitals for COVID-19 patients, to cope with the soaring number of cases.

However, by the first quarter of 2021, total of 408,713 cases and 3778 [10] daily new cases were reported and the occurrence of this outbreak has presented a remarkable medical challenge to health systems. Many decisions have been made with limited clinical experience and scientific evidence. To cater the increasing number of cases, healthcare system must develop sufficient clinical infrastructures. There is no standard guidelines for COVID-19 treatment hospitals and the current SOPs were developed in limited time. Therefore, this study intends to evaluate the best management practices (BMPs) in hospitals worldwide and to propose the suitable management practices to our local hospitals as part of preparedness plan and to ascertain the strategies in transforming standard hospitals to COVID-19 treatment hospitals. Thereby, the

existing hospitals or clinics should be ready to accept the infected patients to avoid the shortage in treatment facilities and accommodate the high number of cases.

1.3 Research Questions

i. How to increase the number of COVID-19 treatment hospitals and ways to measure their readiness?

ii. How to transform and strategies of current Non-COVID hospitals to COVID-19 treatment hospitals to cater for the increasing number of patients?

1.4 Research Aim and Objectives

The aim of this study is to increase COVID-19 treatmemt capacity in Malaysia by converting non-COVID clinics and hospitals to COVID-19 treatment facilities, and produce more bed to patient ratio (BPR). To achieve these aims, thereby the objectives of this study are as follows:

i. To evaluate the readiness of Non-COVID hospitals best management practices (BMPs) in terms of infrastructure, logistics and SOPs required to treat COVID-19 patients in hospitals and clinics.

ii. To develop strategies required to transform any hospitals and clinic for COVID-19 treatment.

1.5 Scope and Significance of Study

In this study, the operation and management in COVID-19 hospitals will be evaluated across the globe and comparison is to be done with hospitals in Malaysia. The strategies to transform existing hospitals and clinics for COVID-19 treatment will be determined. The scope is limited to infrastructure, logistics, human resources, infection prevention and control, health and safety aspects, and risk management to establish safe and systematic COVID-19 treatment hospitals.

1.6 Dissertation Outline

This project consist of five (5) chapters as follows:

Chapter 1 – Introduction on the background of the study which comprises of theCOVID-19 outbreak, Malaysia`s preparedness and planning to curb the outbreak. The problem statement on the limitations of the preparedness plan, research questions, research aims and objectives and scope of study.

Chapter 2 – Literature reviewbased on the healthcare in Malaysia, COVID-19 and treatment, COVID-19 hospitals SOPs and practices, facilities and operational requirements, limitations of COVID-19 hospitals, status of Non-COVID 19 hospitals, transformations strategies, future requirements and summary of literature review.

Chapter 3 – In this capter, the materials and methodology were explained. A simplified checklist form WHO standard checklist was created, transformed and distributed via Google form to healthcare professionals and frontliners.

Chapter 4 – The data form the questionnaire were analysed and interpreted. Justification was provided in the discussion.

Chapter 5 – The significant findings were concluded and recommendation for future work was suggested.

Chapter 2

LITERATURE REVIEW

2.1 Healthcare in Malaysia

Malaysia has a dual-tiered or also known as a dichotomous system of healthcare services: a government-led and funded public sector, and a thriving private sector. Currently, COVID-19 patients are being treated only in government hospitals. The skyrocketing cases impact the healthcare sector in Malaysia in several ways, such as lack of beds, space in ICUs, and other medical supplies for COVID-19 patients. The low hospital bed-to-total population ratio (BPR) needs to meet a higher demand for hospital beds. In addition, the availability of PPE (personal protection equipment) to be used by medical staffs in treating coronavirus patients, such as face masks, face shield, surgical gloves, and medical gowns; and equipments like life-saving mechanical ventilators, X-ray machines and patient monitors are lacking and need to meet the high demand.

2.2 Introduction to COVID-19 and Treatment

COVID-19 is a disease caused by coronavirus 2 (SARS-CoV-2), severe acute respiratory syndrome. It has become a major health threat due to its high spreading rate and high mortality rate. The total number of cases worlwide has reached more than 7 million with approximately 400,000 of confirmed deaths by June 2020. The transmission of the disease is by person-person

mainly via respiratory dropltes, often due to cough and sneezing. The virus originated in Wuhan, China in December 2019 as a zoonotic infection, the human-human transmission began shortly fater that. Symptomatic infections are mild where infected individuals develop dyspnea and hypoxia, however critical illness has been seen in the form of septic shocks and respiratory and multi-organ failure. Global spread of the disease is rapid and its the first time since 1918-19 H1N1 influneza pandemic, that the world responded to a global emerging disease of enourmous scale with no access to vaccines. The economic impact is also tremendous where closure of businesss to prevent close contact and spread of disease caused people to lose thier jobs and source of income.

Figure 2:1 shows the number of COVID-19 cases according to states in Malaysia. Sabah outcompete other states with number of cases of 21,767, followed by Selangor about three-fold lower than Sabah. Perlis recorded the lowest number of cases,40. The total number of cases in Malaysia is 43,791 as of 12th November,2020. On the other hand, Figure 2:2 shows the number of cases according to gender. Male category recorded 68.3% and female is 31.7%. Worldwide, the number of reported cases is 52.7 million which is dramatically increasing day by day.

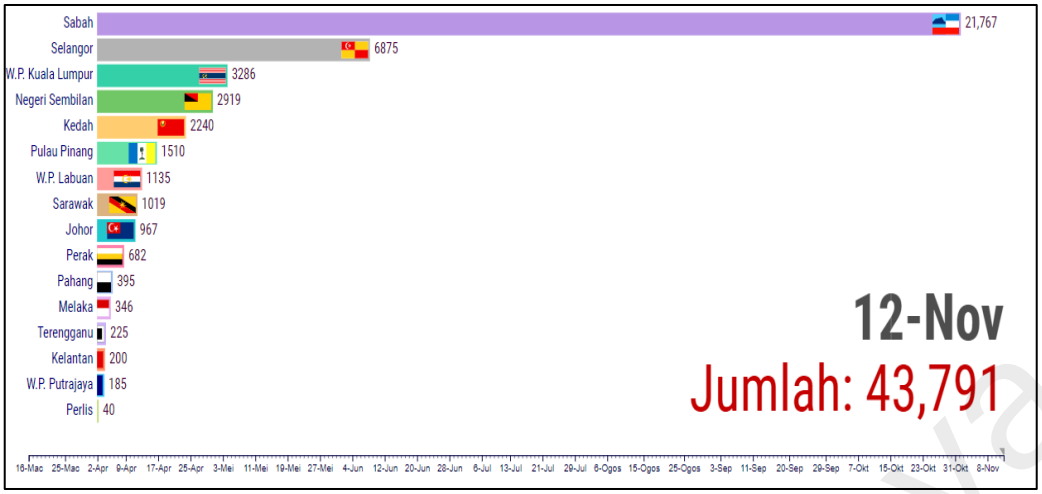


Figure 2:1: COVID-19 cases in Malaysia by states as of November 12, 2020 (source: Department of Statistics, Malaysia (DOSM)

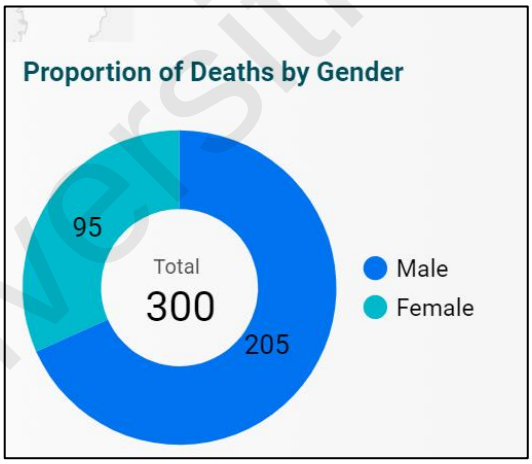


Figure 2:2: COVID-19 cases in Malaysia according to gender (source: Department of Statistics, Malaysia (DOSM)

Severe Acute Respiratory Syndrome Coronavirus 2 [SARS-CoV-2], is a newly discovered infectious disease and known as COVID-19. The outbreak started in December 2019, and then spread at an unprecedented rate throughout the world. Regrettably, it is still spreading. The disease causes respiratory illness with symptoms which includes flu, cough, fever, and, more severely, difficulty in breathing. Eventhough majority of patients recover from COVID-19 without the need for special treatment, the disease itself can be serious and even fatal. The most vulnerable group are older people and people with coexisting medical conditions, whom become severely ill [11]. The newly confirmed coronavirus disease 2019 (COVID-19) cases are still increasing strikingly in many countries according to the data reported by the World Health Organization. With the recent spike in India having almost 386,452 case in a day, it is very scary.

As for treatment plans for COVID-19 patients in Malaysia are based on 5 levels of severity or clinical category of patients:

Category 1: No symptom

Category 2: Symptomatic without lung infection

Category 3: Symptomatic with lung infection

Category 4: Symptomatic with lung infection and need oxygen supplementation

Category 5: Critical patients with multiple organs complications

For Category 1, there is no specific treatment for COVID-19 patients. As of Category 2 and 3, the patients will be given symptomatic treatments such as medicines to relieve fever, cough and flu. Furthermore, care will be given to patients to optimise their nutritional status and maintain good blood circulation. Meanwhile for Category 4 and 5, the use of anti-virals, immuno-modulatory (to reduce inflammatory response) and anti-coagulants (to prevent clotting) are intended for more critically ill COVID-19 patients.

Malaysian government has taken vigorous action to curb the skyroketing number of cases by introducing the vaccination programme to protect the public. The immunization program is currently being implemented in phases all over the states in Malaysia from 24th February 2021 to February, 2022 [12].

2.3 COVID-19 Hospitals Standard Operating Procedures (SOPs) and Practices

In this subtopic, the SOPs and practices of COVID-19 hospitals around the globe were referred and discussed. Consequently, to cater the substantial number of COVID-19 cases in Malaysia, the Ministry of Health (MOH) had immediately formulated a standard guidelines for the prevention and control of COVID-19 cases in time to curb the spread of this infection. Director General of Health, Dr. Noor Hisham appointed by the MOH, was put in charge of the medical response to this outbreak. Apart from public hospitals, UMMC (University Malaya Medical Centre) was the only non-Ministry of Health hospital that handled confirmed cases for treatment. Moreover, in mid 2020, MOH has established 40 hospitals and screening centers specifically for the affected patients in each state of Malaysia [including Kuala Lumpur Hospital (Kuala Lumpur),

Sungai Buloh Hospital (Selangor), Tuanku Jaafar Hospital (Negeri Sembilan), Sultanah Aminah Hospital (Johor Bahru), Miri Hospital (Sarawak), Tawau Hospital (Sabah)] [2]. In addition, due to massive outbreak of this virus in all states, eventually each states' public hospital become the treatment centres.

The SOP for public hospitals in screening and triaging COVID-19 suspected patients is somewhat different from that of a private clinic or private hospital. Specified triage areas are set-up with a dedicated team of healthcare personnel where patients can come directly to be assessed. Screening process designed to identify the identification detail of patient who has attended event with known COVID-19 cluster or red zones, travelled to foreign countries within 14 days prior to onset of illness or have been in close contact with a confirmed case in 14 days of illness. Fullfillment of these above criterias requires special care, whereby the patient is to be placed at least 1 meter away from healthcare workers and other patients, practicing proper hand hygiene, and surgical masks provided for all. Proper disposal of used PPE, decontamination of isolation area and transport vehicles are disinfected regularly to minimize risks of infection and this is monitored by a dedicated team.

2.4 Facilites and Operational Requirement

The outbreak of COVID-19 could be particularly risky for healthcare workers because of their ongoing professional exposure to the virus. As the pandemic progresses, it is regrettable to know the health care workers, including anesthesiologists, are being infected constantly [13]. Therefore, studying the personal protection of health care workers and the risk factors related to their infection, based on the different stages of the COVID-19 epidemic is important. All health workers in the transformed hospitals should wear full PPE as in Figure 2:3.

Figure 2:3: Personal protection equipment [13].

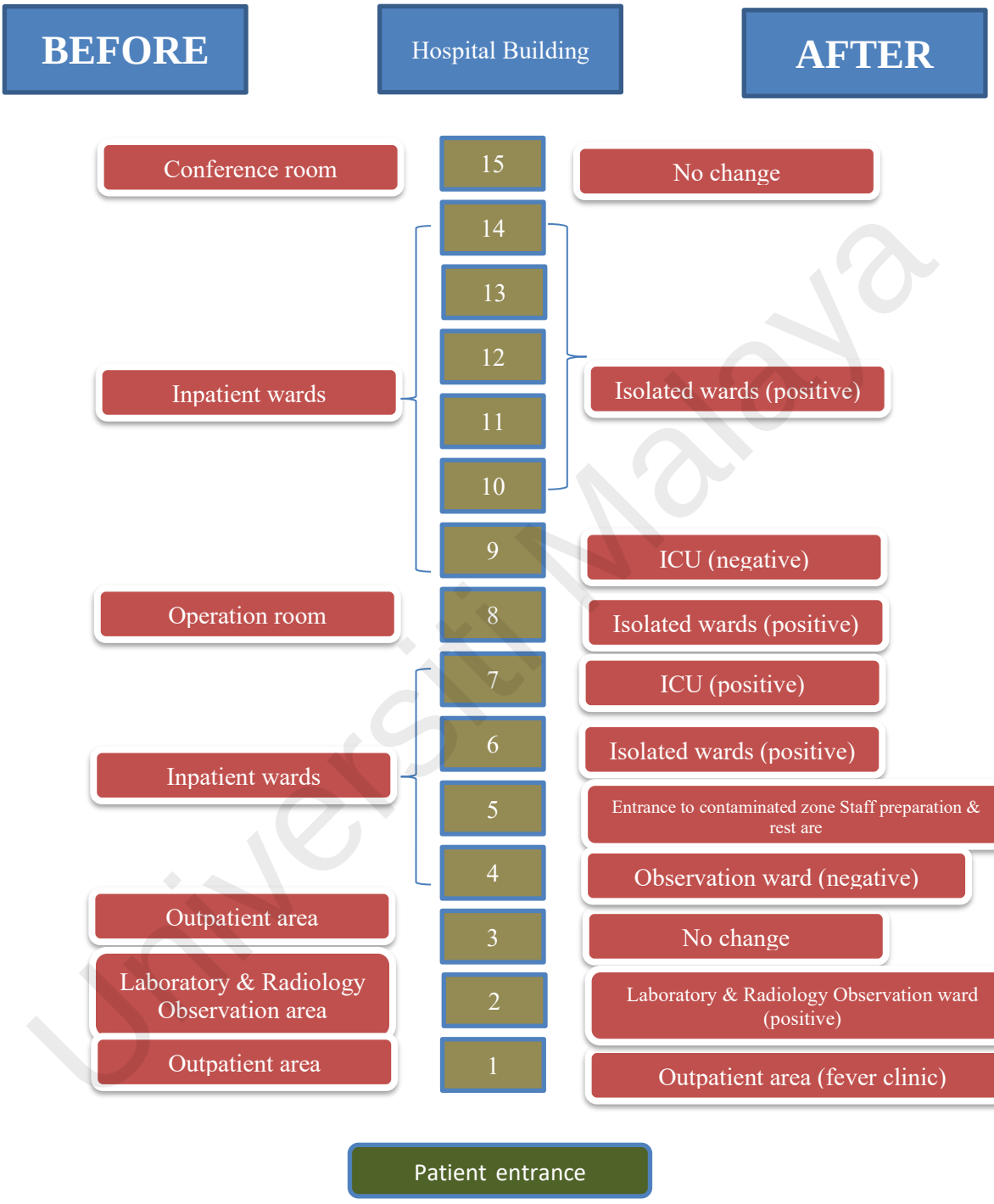
Another prominent issue is the difficulty faced by patients with other illnesses due to COVID-19 preventive measures presently undertaken at medical facilities. For example, cancer patients are prone to higher risk of complication from COVID-19 complications; they should be protected from infection while still ensuring access to cancer care and undergo treatment on time.

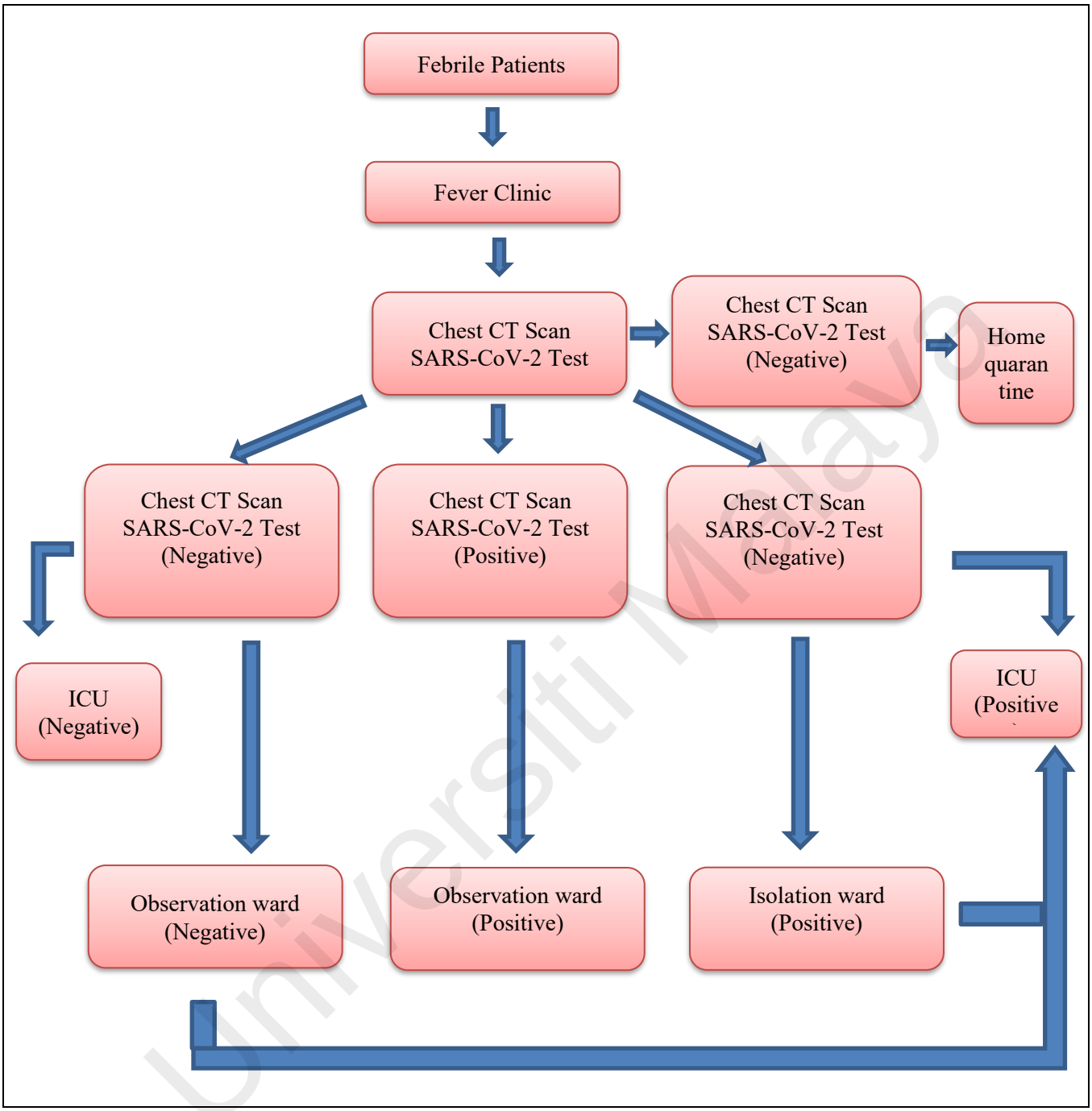
Therefore, it is suggested for private hospitals to support government hospitals by providing treatment forother illness with affordable cost or government could provide certain incentives as an important strategy to simultaneously prepare for the epidemic and treat other important diseases [14].

Besides that, strict SOP is in place for selection of patients for admission into normal wards to avoid the spread of COVID-19 infection. All patients who had close contact with suspect, probable or confirmed cases are not eligible for admission in norma ward. Whoever attends the ward must follow the general risk prevention and mitigation measures. The application of this practical strategy can contribute to breaking the cycle of community-hospital-community transmission. There are general rules for the healthcare professionals, patients, and caregivers. There are also established rules for the management of the environment (Patient room/common areas/access routes to the ward and patient transport) [15, 16].

In an attempt to curb the widespread of COVID-19 especially to the health workers, separate hospitals were built specially for COVID-19 patients. Most of the facilities were built within the shortest possible time by transforming either an existing hospital/clinic, hotels, parking lots, stadiums etc. some of which are; Wuhan Red Cross Hospital (WRCH), First Affiliated Hospital of Zhejiang University (FAHZU), Central Clinical Hospital of MSWiA, Hospital das Clinicas, São Paulo, Brazil, Shantou Central Hospital, China.

The case of Wuhan Red Cross Hospital was reviewed. It is a secondary general hospital with 500 beds. In the transformation stage, a full-time emergency leading group, an infection prevention team and a medical treatment expert group were set up to coordinate and oversee COVID-19 operation for the whole hospital. All the uninfected patients were transferred to other hospitals. The hospital building was revamped, and the changes are shown in Figure 2:4.





Second SARS-CoV-2 Test

Figure 2:4: Schematic of the hospital modification (a) and the flow chart of the treatment process of suspected COVID-19 patients (b) [14].

Total of five passageways including employee, patient, administrative personnel, cleaning personnel and sewage channel were established to meet the requirements of hospital infection protection. Two intensive care units (ICU) and two independent observation areas for both positive and negative cases were rebuilt for COVID-19 patients with ICU beds occupying 26.1–32% of total beds [17, 18]. Moreover, twelve fever clinics were set to triage the patients and the protocol is shown as in Figure 2.5

Wuhan Red Cross Hospital also focused on infection prevention and control measures that designed for patients, doctors and nurses to reduce the exposure risk. Adequate personal protective equipment (PPE), medical equipment such as high-flow nasal cannula, ventilator, bronchoscope, sterilizing equipment, etc were prepared well to ensure smooth treatment procedures. Besides that, sufficient oxygen supply is also very crucial for the patients and the hospital authority had stocked up the supply. To further assist the hospital, several medical teams consist of doctors and nurses from infectious disease, pulmonary department, and ICU from other regions also joined them to provide assistance. To reduce the spread of infection among staff, the hospital authority also provide training for all medical staff with infectious disease hospital instructions for self-protection and COVID-19 treatment with a standard protocol of Chinese Guideline. The hospital was also embarked on recruiting more doctors and nurses specialized in infectious and respiratory disease.

The hospital authority also explored on alternative initiative, to coordinate other hospitals and health systems to transfer COVID-19 patients, by forming tertiary care centers and community hospitals network. Another initiative is to perform multidisciplinary team consultation for COVID-19 patients both in our hospital system and between different hospitals, via a telehealth network. Finally, a rear service team formed, including both administrative staff and social

volunteers, working together with greatest efforts to fully ensure the welfare of key frontline personnel were taken care such as clothing, food, housing, travel and safety for steady operation of the hospital [14, 19].

In an attempt to improve emergency response ability, the First Affiliated Hospital of Zhejiang University (FAHZU), in China, known as the earliest designated hospital, accomplished the transformation from general hospital to infectious disease hospital within 48 hours. The transformation was undertaken with comprehensive approach of centralized patients, experts, resources, and treatment with measures to transfer the hospitalized patients promptly, organize the space layout, create space for patient diagnosis and treatment, streamline and transform transport and logistics facilities within the limited time period [20].

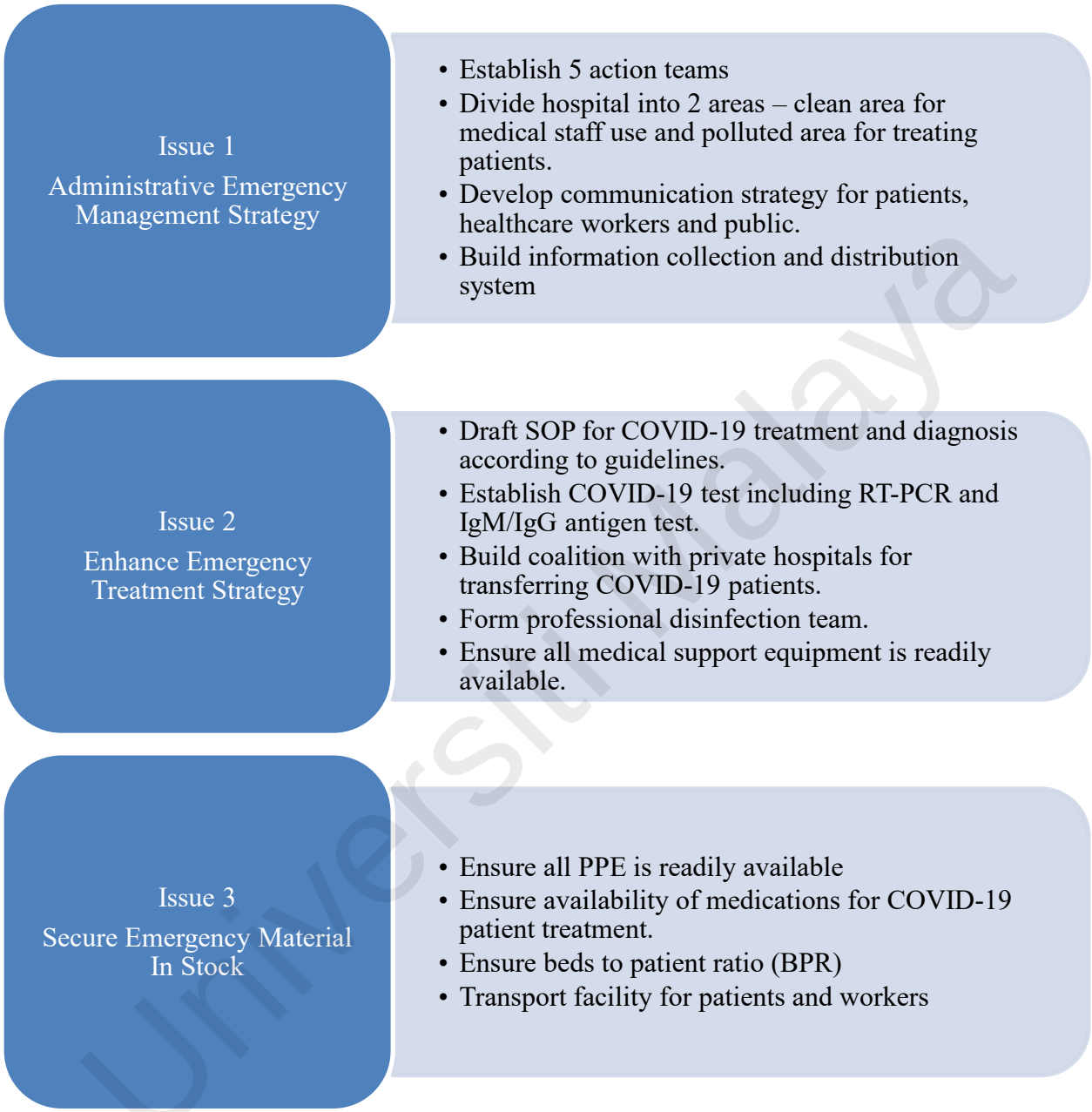


Figure 2:5: Management strategies in emergent hospital reform for COVID-19 [19].

Another transformation of COVID-19 treatment hospital was reviewed in China, Shantou Central Hospital. This hospital has given special emphasis to maintain the high standard of care for each patient, the nursing department had planned the following contingency management strategic objectives: establish a technical support team, set up designated COVID-19 wards, ensure the hospital has ready and available reserve nurses, prepare training plan to meet all requirements, manage nursing manpower in isolation wards to ensure normal operation of medical care in the hospital could continue, provide a quarantine place for all nurses who had direct contact with COVID-19 patients, provide psychological counseling via Wechat group and equip isolation ward with isolation protection materials [21].

Another example in Poland, the process of converting a large multi-specialized hospital (Central Clinical Hospital of the Ministry of Interior and Administration in Warsaw (MSWiA)- into one dedicated to COVID-19 patients was described, and established standards of work organization in all the wards and training system of the healthcare workers. There are several challenges confronted by the manager with the task of protecting the healthcare workers from transmission of the disease within medical institutions, and issues concerning the physical and psychological depletion of personnel. Reconstructive strategic plan was developed based on analyses of the structure and work processes in Central Clinical Hospital (CCH). It included: weekly plan for supplying personal protection equipment (PPE); division of existing wards into observation and isolation wards; installing locks; designating new access to the hospital ; communication routes; training of medical and supporting staff [22].

As in Latin America (Brazil),when they were ranked as the second highest country with elevated number of COVID-19 cases in early March 2020, they immediately planned several

strategies to quickly respond to this situation. In their strategic plan, they choose to physically isolate a large complex of Central Institute with 900 hospital beds to become exclusively designated for COVID-19 care. This strategy means to avoid contact with other non-COVID-19 patients and provide better management. The finding was after 152 days, 4241 patients with severe COVID-19 were hospitalized, 70% of whom have already been discharged, whereas the remaining institutes of the complex successfully maintained high complexity inpatient and urgent/emergency care to non-COVID-19 patients [23]. An Emergency Operational Plan (EOP) was also developed the implementation took place in four subsequent phases, namely, preparedness, response, recovery, and mitigation. For its governance, the plan encompasses five major functional areas: operation, command, planning, logistics, and finance/administration, under the responsibility of skilled staff members. A major challenge to the EOP, however, was how to build a minimally safe strategy to allow the academic health system to continue providing urgent/emergency tertiary care and management of relative urgencies for non-COVID-19 cases, simultaneously to the compelling need to establish specialized care units for COVID-19 patients in the same hospital complex [23]. Table 2.1 shows the essential components for a hospital preparedness plan. The information in this table can be adopted as strategies of transformation for hospitals in Malaysia.

Table 2.1: Essential Components of a Hospital Preparedness Plan for COVID-19 [24]

Component	**Function**
Full-time emergency manager	To coordinate and oversee COVID-19 operations
Operations task force	Composed of key frontline personnel, such as emergency department physicians, hospitalists, critical care physicians, nurses, and infectious disease physicians, along with project managers to support activities—such as triage, staffing, and facilities management
Well-resourced infection prevention team	Develop and revise personal protective equipment protocols with backup plans in the event of supply shortages; facilitate personal protective equipment training; provide education about transmission risks; perform exposure investigations; and track epidemiology within the hospital
Bed capacity plan	Aim to be able to free up at least 30% of beds for an influx of patients at each facility; develop plans for critically ill patients and managing patients who may require advanced therapies, such as extracorporeal membrane oxygenation and mechanical ventilation
Regional coalition	Includes local, county, and state public health and emergency management partners and neighboring hospitals and health systems to coordinate bed capacity

In another scenario, following an incident of a hotel guest who seek treatment in a hospital of Tenerife ,Spain, and confirmed with positive test for COVID-19, a field clinic was established immediately outside of a hotel when suspected cases arose, to organize daily activities, the medical needs of guests and the sampling of residents displaying any of the related symptoms. Staff and guests were recommended to maintain personal distance, practice good hand hygiene and to wear masks. Hotel staffs monitored themselves by taking their temperatures every morning and evening and were granted access to the hotel, provided appropriate personal protective equipment (PPE) requirements were met. As such, the authors believed the specific tools used to mitigate this outbreak were: (i) the field clinic set up outside the hotel to work closely with the staff and guests of the hotel to monitor symptoms and have a direct line of communication (ii), the rapid action taken to quarantine the hotel, (iii) close collaboration between the field clinic, hospitals and the public health authorities, and finally (iv) specific recommendations provided to other hotels with information to guests regarding how to act if experiencing symptoms corresponding to COVID-19 [25].

Some patients with suspected or confirmed tested positive for COVID-19 may require urgent surgical procedure such as elective surgery. It is important to discuss the modifications required in the operating room during COVID-19 for minimal laparoscopy, access, and robotic surgery, especially with regard to minimally invasive surgical instruments, such as buffalo filter, trocars with smoke evacuator, and special personal protection equipment. In addition to surgical patients, health care workers should also protect themselves by following the recommendations and guidelines while treating these patients. Although there is little chances of viral transmission

through open approaches or laparoscopic, authors recommend modifications to surgical practice such as the use of safe smoke evacuation and minimizing energy device use to reduce the risk of exposure to aerosolized particles to the health care team. Therefore, hospitals must follow specific protocols and arrange suitable training of the health care workers. Compliance to well-established plans to accomplish un-deferrable surgeries in COVID-19–positive patients is strongly recommended since it is highly contagious kind of virus [26].

Furthermore, when it comes to management aspect, factors as competent leadership, policy instruments, or cultural dispositions affects COVID-19 management in hospitals. Although competence of top leadership and agile actions are necessary to confront an unprecedented crisis, they are by themselves inadequate. It is an unexpected pandemic that hit the world and due to that lack of expertise during the early few months. Policy instruments factor are more likely to succeed when existing institutional infrastructure supports their administration and implementation. For an instrument to generate enduring impact, it must be compatible with a community's essential culture; instruments that adapt to this essential cultural orientations are more likely to obtain voluntary compliance over time and community cooperation. Policy instruments must also address equity issues by reaching marginalized groups in a population. [27].

In previous discussion, several scenarios around the world were studied and reviewed in the aspect of transformation strategis involving operation, facilities, management, infrastructures and logistics. In addition to this, the possibility of co-infection and super-infection among hospitalized patients with COVID-19 were also assessed. Garcia and his co-workers [28] did an observational study on patients that were admitted for more than 48 hours in Hospital Clinic of Barcelona and discharged or dead. Their findings were that co-infection at COVID-19 diagnosis

is uncommon, however, few patients developed superinfections during hospitalization and their length of hospitalization were longer and high mortality rate was recorded [28].

2.5 Limitation of COVID-19 Hospitals

Most of the public hospitals are facing low bed- to-total population ratio (BPR) and need to meet a higher demand for hospital beds. In addition, the availability of PPE to be used by medical staff in treating coronavirus patients, such as face masks, surgical gloves, and medical gowns; and sophisticated equipment like life-saving mechanical ventilators, patient monitors, and X-ray machines are lacking and need to meet the high demand. Thereby, strategies for standard hospitals to transform to COVID-19 hospitals is critical.

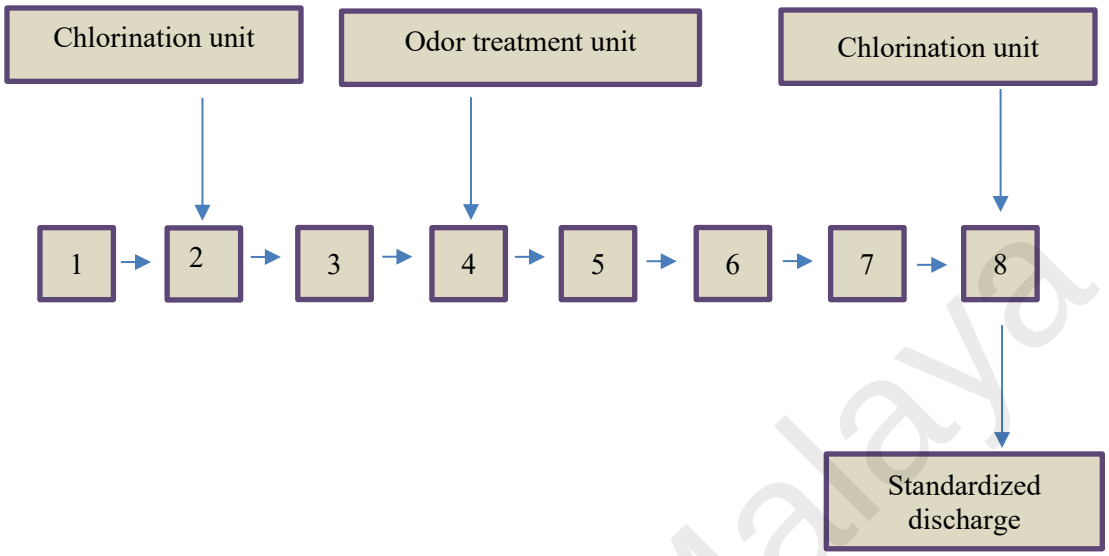
2.6 Status of Non-COVID-19 Hospitals and Clinics

On 17th May 2021, Bernama reported that the Association of Private Hospitals Malaysia hopes that doctors in government hospitals will refer non-Covid-19 patients to private hospitals for elective surgeries and procedures without further delay. Its president Datuk Dr Kuljit Singh said this followed an updated circular by the Health Ministry allowing government hospitals to outsource services to private hospitals to treat non-Covid patients in order to create more treatment space for Covid-19 patients.He said that, at present, all private hospitals in the country have the capacity to help the government manage non-Covid-19 patients effectively, thereby allowing public hospitals to exclusively treat COVID-19 patients to meet the current increase in cases [29].

2.7 Transformation Strategies

2.7.1 Sewage Treatment and Renovation

Positive nucleic acid of the novel coronavirus, were found in the feces of patients diagnosed with pneumonia. Therefore, it is possible that the feces contains viable novel coronavirus, and this could increase the risk of fecal-oral transmission. Hence, there were substantial implications regarding sewage treatment discharge from the hospital reaching standards for environmental protection and control of disease spread. In addition to that, the designed and built in of Zhijiang campus is in accordance with the standards of a comprehensive hospitals, and not than infectious disease hospitals to be exact. Besides, infectious disease hospitals have a sewage the sewage discharge standard which is way higher than general hospital standards. Sewage treatment standards for infectious disease hospital requires the removal of sewage treatment system urgently as follows: wards and clinics of infectious disease were fitted wih the pretreatment setting of sludge wastewater in the front section.; standing time of chlorine and the amount of chlorine in the end of the disinfection tank were increased; sampling were done in a continuous follow-up manner, this is to ensure that the discharge water did not contain the pathogenic viruses, as in Figure 2.6 [20].



Notes

1. Waste water
2. Septic Tank
3. Water gathering well
4. Regulating tank
5. Service reservoir
6 Flow-separated biochemical tank
7. Collecting tank
8. Disinfecting tank

Figure 2:6 Sewage treatment flow [20]

2.7.2 Transmission Route

The main transmission routes for the new coronavirus are via transmission by respiratory droplets and contact. Therefore, to be aligned with that, infectious disease hospital had to incorporate tremendous effort into to the design of the air conditioning and ventilation system of the air flow organization, air conditioning of contaminated areas, semi-contaminated areas and clean areas, in the design requirements. In addition to that, it is important that the ventilation system setting is independant, by directing supply air flow from the clean area to the semi-contaminated area, and then from semi-contaminated area to the contaminated area through, via pressure difference, ensures a relative negative pressure environment within the facility. In addition to that, the exhaust air rate must be higher than the air output rate of each area. On the contrary, Zhijiang campus is a general hospital, and it does not meet the above requirements. Therefore, all logistics vehicle movement including entranec and exit into facility, the central air conditioning, fresh air system, and other systems in the campus stopped running in order to block all possible transmission routes.

2.7.3 Laundry Management

To handle the laundry, all linen from patient care areas such as wards, ICU and other areas were immersed in 1% sodium hypochlorite solution for a period of half an hour (24). The disinfected linen, were then transported by a laundry attendant wearing full PPE as per infectious disease standards, using an dedicated elevator, adjoining the one used for patient movement in the contaminated area.

2.7.4 Biomedical Waste (BMW)

Due to the the extensive use of PPE by all staff involved in service delivery, a large amount of biomedical waste (BMW) is generated in every shift. According to the authors, all the generated waste is to be collected in double bags and disinfected as per the current guidelines. Personnel donned in PPE from the BMW department would visit these areas in every shift with their transport trolley using the contaminated elevator for BMW.

2.7.5 Patients Discharge

COVID-19 had created a unique situation wherein, at times, no patient attendants are available at the time of discharge of patients. Therefore, the route by which the patients enter the hospital was also the same route used for discharge. The social stigma associated with the disease compounded the problem further. Thus, it sometimes needed to drop these patients to their homes by ambulance.

2.7.6 Death Management

After the death of a COVID-19 patient, the body is wrapped in double body bags, and shifted to the mortuary by trained personnel donned in PPE. The local governing body undertook the responsibility of transportation from the hospital mortuary to the area dedicated to performing the last rites. The ambulance used to carry patients to the hospital or the dead bodies to mortuary is always disinfected using 1% sodium hypochlorite between patients [30]. Body preparation; 6.1

First layer : Wrap body with white cotton linen. 6.2 Second layer : Place body in body bag. 6.3 Third layer : Place body in body bag, then wipe with 0.5% sodium hypochlorite/disinfectant.

2.7.7 Other strategies

Other strategies that were not mentioned includes, adaptation and implementation of correct procedure for PPE usage. Besides, that, its impretaive to have designated new accesses and communication routes for both patients and healthcare workers. In addition to that, theses access routes should also be in such a way that streamlines all apatients and healthcare workers movement. Ward cleaning and disinfecting procedures as well as staff training system improvement. Nevertheless, its important to implement a full-bodied and transparent open communication policy that clearly and concisely assist in increasing the social alarm. Additional support to be given to to protect healthcare workers on the front lines and at the same time outline a strategy to allocate healthcare resources. Most importantly, a strategy must be developed to handle the increasing volume of patients and complexity of the disease.

2.8 Future Requirements

The best practices from other country can be adopted and suggested for implementation in local hospitals. The most important aspect of providing quality patient care is to ensure that COVID-19 transmission chain is disrupted. If proper isolation and can be maintained, then all hospitals including private hospitals and clinics will be able to simultaneously treat Covid-19 patients and patients with other illnesses, in the same facility. Patients with highly infectious diseases require

safe, secure, high-quality medical care with high-level infection control, which may be most effectively delivered by specially trained staff in the setting of a high-level isolation unit (HLIU). HLIUs are designed to provide optimum medical care for patients with highly infectious diseases, while at the same time protecting health care workers, other patients, and the wider community from infection [31]. These diseases such as HIV, diabetes, accident and emergency, cancer, kidney/heart (Dialysis), tuberculosis etc should have a model center with sub-division handling covid at the same time. This is possible in major national hospitals. However, measurement needed. This means that a core set of measures needs to be adopted to monitor the health and functional outcomes for COVID-19 and other patients at risk for functional decline and to assess the quality, availability and accessibility of services.

The COVID-19 pandemic is working out to be an extended circumstance. By rehearsing inter-team segregation between groups of healthcare workers, both in real working space and during rest times, we can guarantee that just one group will be infected should any personnel be associated with a suspected or confirmed COVID-19 case. Guaranteeing staff security is of foremost importance. Supplies of fitting PPE are made accessible at all settings and promptly open to clinical staff over the span of their day by day duties for dealing with suspect cases. Proper training to be provided in terms of donning and doffing full PPE, and guarantee staff conform to suitable techniques, particularly in taking care of suspected or confirmed cases.

It is of highest paramount that communication is continuously maintained between the Inpatient/Ward, Operating theatre and Outpatient teams. A pair of doctors comprising of one specialist and one trainee from the Operating theatre team can be appointed as the point-of-contact treatment (POCT) to liaise with colleagues manning the ward using confidential communication

tools such as TigerText, to achieve proper hand over of cases and continuity of care. In addition to that, doctors from the clinical department should communicate any form of concers to healthcare workers in wards

Essentially, the medical doctors in the clinics impart any worries or instructions to the ward personnel for any patients that were admitted from clinic, and the ward personnel responds for any patients that require specific attention during the discharge outpatient review. Consistently, suspected COVID-19 cases are featured, so that each progress between the ward, clinic and operating theatre is carefully managed in order to minimize exposure to staff.

The transformation efforts will ultimately be appraised at the end of the epidemic. Therefore, it is suggested to restructure existing hospitals into standard hospital to accommodate both patients with COVID-19 and other illnesses as an important strategy to simultaneously prepare for the epidemic and treat other important diseases [14].

2.9 Literature Review Summary

The emerging number of COVID-19 positive cases has lead to many challenges in terms of infrastructure, facilities, operational, PPE and waste management. To accommodate the rising number of COVID-19 patients, there is a need to transform standard hospitals and clinics to COVID-19 treatment hospitals and clinics. Thereby, this study intended to evaluate the strategies which includes facilities and operations, sewage treatment and renovation, transmission route, laundry management, biomedical waste management, patients management and the management of COVID-19 patient corpses. In conjunction with that, the best management practices from all

over the world were critically reviewed and proposed as future requirement and guidelines for the transformation strategy.

Chapter 3
RESEARCH METHODOLOGY

3.1 Introduction

In this chapter, the methodologies to achieve the respective objectives have been discussed.I have visited several hospitals in Malaysia for first-hand view on the SOPs that are in place and how it functions. The publics hospitals that I visited were, the major state hospitals Hospital Selayang, Hospital Sungai Buloh, Hospital Kuala Lumpur, Hospital Shah Alam, , Hospital Pulau Pinang, and some of the smaller district hospitals were Hospital Kajang, Hospital Seri Manjung, Hospital Kepala Batas, Hospital Taiping, Hospital Changkat Melintang, Hospital Seberang Jaya Institute Jantung Negara, Hospital Port Dickson, Hospital Pakar Sultanah Fatimah, Muar, Hospital Sultanah Haji Ahmad Shah, Temerloh and Hospital Tengku Ampuan Rahimah, Klang. As for the private hospital that I visited were Universiti Malaya Medical Centre, Sime Darby Medical Centre, Subang Jaya, Columbia Asia Puchong and Bukit Rimau, Sunway Medical Centre, KPJ Damansara and Pantai Ipoh Hospital. All these hospitals above had similar SOPs in terms of social distancing, PPE usage and streamline of traffic flow with boxed marking on floor for waiting and space between seats in waiting areas. Besides that, most hospitals do require a swab test to be done within 48 hours prior to vist and a specials perisiion letter will be given to vendors prior to visit into hospital facilities. For the first objective, that is to evaluate the best management practices (BMPs) worldwide in terms of infrastructure, logistics, and Standard Operating Procedures (SOPs) in COVID-19 treatement hospitals-comparisons study to be conducted. For second objective- to propose BMPs and strategies to transform the standard hospitals in our country to COVID-19

treatment hospitals for treatment- a checklist was crafted which contains salient criteria from objective 1. Figure 3.1 shows the flowchart of this project.

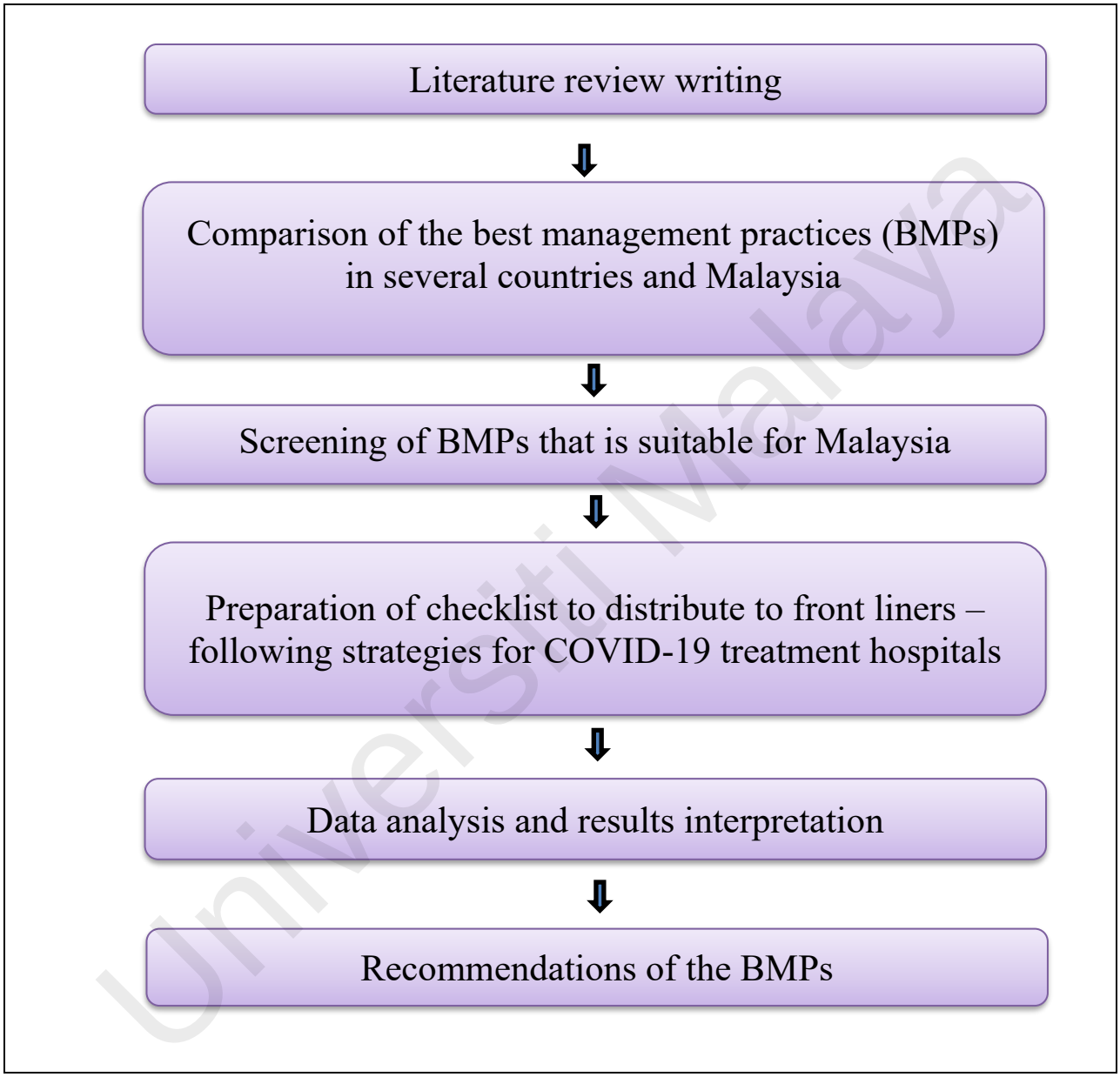


Figure 3:1 : Flowchart of this project

3.2 Checklist preparation

Simplified checklist from the World Health Organization (WHO) on the rapid hospital readiness for COVID-19 treatment is shown as in Table 3.1. The original WHO checklist as shown in Appendix 1. This checklist to be distributed to several hospitals in Selangor and determine their preparedness and readiness to treat COVID-19 patients. There are 10 key components with specific recommended actions were evaluated. For each sub-components, the responds have been categorized as follows- strongly agree, agree, neutral, disagree and strongly disagree. The checklist was validated by consulting front liners with experience from the designated treatment hospitals and new hospitals that deemed to be suitable.

Table 3.1: Simplified checklist from the World Health Organization (WHO) checklist on the rapid hospital readiness for COVID-19 treatment

Key components	Recommended action	A - Strongly Agree B - Agree C - Neither Agree Or Disagree D - Disagree E - Strongly Disagree				
1. Incident Management System	1.1 The hospital/clinic has well established emergency response plan for COVID-19 and mechanisms to coordinate with Ministry of Health (KKM) and local authorities and the community for actions related to COVID-19 prevention, preparedness, readiness, response and recovery.	A	B	C	D	E
2. Communication & Coordination	2.1 All staff have been informed about and trained in COVID-19 case definitions, in terms of close contacts and the quarantine system.	A	B	C	D	E
	2.2 Standardized forms are available to report COVID-19 case information to a centralized health information system within 24 hours of case identification.	A	B	C	D	E
3. Risk communication and community engagement	3.1 Infection prevention and control, including SOP for COVID-19 risks are available for use by all staff, patients, visitors and members of the community.	A	B	C	D	E
	3.2 All staff are briefed regularly about COVID-19 risk and community engagement actions that have been conducted.	A	B	C	D	E
4. Administration, finance and business continuity	4.1 Hospital corporate strategy includes staff turnover and absenteeism, is in place to avoid staff fatigue due to the COVID-19 workload.	A	B	C	D	E
	4.2 The hospital's incident management system team has ways for assessing and identifying the expansion of hospital inpatient, **outpatient** and **intensive care unit** capacity in case of an increasing COVID-19 workload.	A	B	C	D	E
	4.3 A COVID-19 plan is available to potentially refer or outsource care of non-critical patients to appropriate alternative health facilities (e.g. private hospitals, University Halls, Stadium and community service centres).	A	B	C	D	E
5. Human resources	5.1 The hospital has identified the optimum number of staff (medical and non-medical) needed to ensure the continuity of essential services during the COVID-19 pandemic.	A	B	C	D	E

6.Continuity of essential services	6.1 Procedures are in place to ensure management of the COVID-19 surge supply chain for essential medicines, diagnostics (including laboratory reagents, personal protective equipment and test kits) and supplies for clinical care, therapeutic interventions and clinical management.	A	B	C	D	E
	6.2 Hospital inventory, stock are in place for food, oxygen, cleaning materials and disinfectants.	A	B	C	D	E
	6.3 The hospital security system has identified potential safety and security challenges, including maintaining secure access to the facility.	A	B	C	D	E
	6.4 The hospital security system has set up markers for physical distance of at least 1 m between patients and visitors and well as staff.	A	B	C	D	E
	6.5 The hospital security system has ensure rational use of masks if someone has symptoms of COVID-19, patient flow.	A	B	C	D	E
	6.6 The hospital security system has optimized patient flow, traffic, parking and access for visitors, and stocks of essential pharmaceuticals. The hospital also has a mitigation plan for security risks.	A	B	C	D	E
	6.7 The hospital has tested an expansion plan for clinical management (e.g. a contingency plan for constructing additional isolation wards).	A	B	C	D	E
	6.8 The hospital waste management is linked to the local water, sanitation and hygiene (WASH) system.	A	B	C	D	E
7. Patient Management	7.1 SOP are available and functional for receiving patients and transferring them within the hospital to COVID-19 isolation areas or rooms.	A	B	C	D	E
8. Occupational health support	8.1 All staff are well trained and equipped to provide initial medical care to people with suspected or confirmed COVID-19, including providing primary screening, resuscitation, initial stabilization, early supportive therapies.	A	B	C	D	E
9. Rapid identification and diagnosis	9.1 Staff have been trained in accurate, rapid identification and timely screening of suspected COVID-19 cases, with timely reporting to the designated authority.	A	B	C	D	E
	9.2 Emergency department has a triage procedure, that focuses on rapid identification, isolation and testing of patients with signs and symptoms of acute respiratory infection.	A	B	C	D	E
	9.3 SOP for collecting samples and transferring them to the reference laboratory, including their disposal is available.	A	B	C	D	E
10. Infection prevention and control	10.1 Designated isolation areas are available for providing medical care to people with suspected, probable or confirmed COVID-19 , with appropriate signage and equipment, and adequate ventilation.	A	B	C	D	E
	10.2 Airborne isolation room is available. Airflow from clean-to-less clean zones is ensured whenever aerosol-generating procedures are performed. Where a mechanical ventilation system is available, negative pressure is created and maintained to control the direction of airflow from clean-to-less clean zones.	A	B	C	D	E
	10.3 Appropriate measures such as hand hygiene stations, available for use before hospital entry and throughout the hospital should be stocked with water, soap, paper towels or an alcohol-based hand rub; waste bins with lids are placed at strategic locations in the hospital.	A	B	C	D	E
	10.4 A protocol is available about how to avoid transporting COVID-19 patients out of their rooms and if this cannot be avoided, a protocol for transporting COVID-19 patients safely out of their rooms is available.	A	B	C	D	E
	10.5 All surfaces in the hospital and in ambulances are routinely cleaned and disinfected, according to infection prevention and control guidelines.	A	B	C	D	E
	10.6 Waste management protocol and infrastructure, including the management of biological and clinical waste, are available in the hospital.	A	B	C	D	E

3.3 Data analysis

For the survey, the simplified checklist's recommended actions statements were used to create google form to gather feedback from frontliners. The google form was distributed randomly to 60 participants and 40 responded the survey. From the checklist, the scores for each components determined based on the feedback received. Table 3.2 shows the 10 components with score and percentage achieved. Besides that, Figure 3.2 presents the spider chart mapped to the 10 components and scores that represents the overview of hospital readiness.

Table 3.2: Summary of components and scores in the checklist

Overview of hospital readiness: key components	
Component	**Percent Achieved**
1. Incident management system	0%
2. Communication & Coordination	0%
3. Risk communication and community engagement	0%
4. Administration, finance and business continuity	0%
5. Human resources	0%
6. Continuity of essential support services	0%
7. Patient management	0%
8. Occupational health support	0%
9. Rapid identification and diagnosis	0%
10. Infection prevention and control	0%

3.4 Safety Precaution

During the course of this study, many safety precautions were taken to ensure that I was not in any way at harm of contracting the virus or putting others at risk of infection. During each visit,

strict SOP was followed, firstly by requesting and getting permission to travel to a particular hospital to carry out the data collection. Secondly, perform a COVID-19 RT-PCR swab test or antigen test, as per required by the hospital to be visited, and fill up the Vendor/Contractor visit form prior to visit refer to Appendix 3. Upon, arrival at the hospital site, the forms and RT-PCR or antigen test results attached must be given to the hospital Safety and Health committee to be endorsed and approved. Subsequently, all SOP for entering the hospital premises must be followed, which includes following the uni-directional traffic flow into hospital premises, scanning of MySejahtera at the enatrance or lobby, followed by scanning of hospital QR code, and temperature check and green label tagging, performed by heathcare workers at the entrance. Upon arrival at the wards or pathology lab, proper donning were performed prior to entering the wards or lab. This PPE includes, an apron, N95 respirator or 3 ply mask, latex or nitrile gloves and a face shield. If required to enter Operations Theatre or COVID ICU, then full PPE were worn, provided by the hospital. The full PPE includes, hospital gown or full coveralls, N95 respirator or 3 ply mask (double layer), latex or nitrile gloves (double layer) and a face shield, booties, head cover and safety goggles. The donning process is done in the clean area, prior to entering the contaminated area, and upon exit doffing is done at the semi-contaminated area, before proceeding to clean area for exit. All worn or used PPE are disposed off in the yellow biohazard bin provided. Hand washing was also done soon after entering the wards or lab, and immediately before exiting. In Operations Theatre or COVID ICU, however, its is required to perform handwash before donning and shower after doffing.

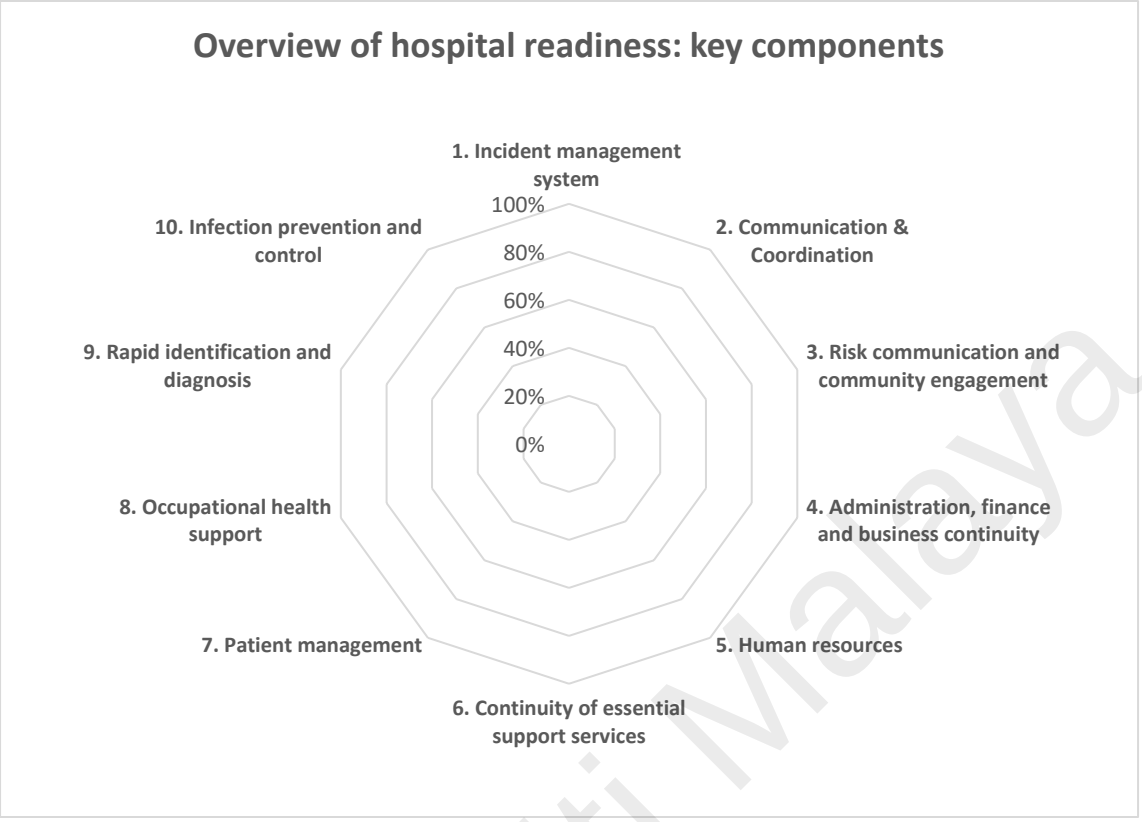


Figure 3.2: Spider chart mapped to the 10 components and scores.

Non-COVID hospitals can utilize this checklist of hospital designs, plans and protocols and administration to quickly decide the capacity limits of emergency hospital services and infrastructure to react to the COVID-19 pandemic and to recognize gaps and significant areas that require some attention and action in order to improve the hospital readiness. This tool can be utilized periodically to monitor emergency operational readiness of hospital and its increment in treatment capacity.

Table 3.3 shows the gantt chart of this project and activities to be carried-out.

Table 3.3: Gantt chart of the project

Bil	Task	2020			2021					
		October	November	December	January	February	March	April	May	June
	Preparation Phase									
1	Identify research area and topic									
2	Formulate research strategy and research method									
3	Preparation of thesis proposal									
4	Presentation of thesis proposal									
	Research Phase									
5	Data collection									
6	Data analysis									
	Research Writing Phase									
7	Write first draft									
8	Write second draft									
	Final Phase									
9	Final draft									
10	Dissertation submission									

Chapter 4

RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter consists of data analysis and interpretation of the questionanaire that was distributed randomly by creating google form for the respondents. Total of 40 respondents attempted the survey that consists of 29 questions, and the analyses as in this chapter.

4.2 Respondents background

The respondents of this survey is as shown in Figure 4.1. About 32.5% of the respondents were Medical Doctors and Medical Assistant (MA). Medical Engineers were 25%. Besides that, staff Nurses, Pharmacist, Scientific Officer and other categories were 7.5% , 10%, 17.5% and 7.5 %, respectively.

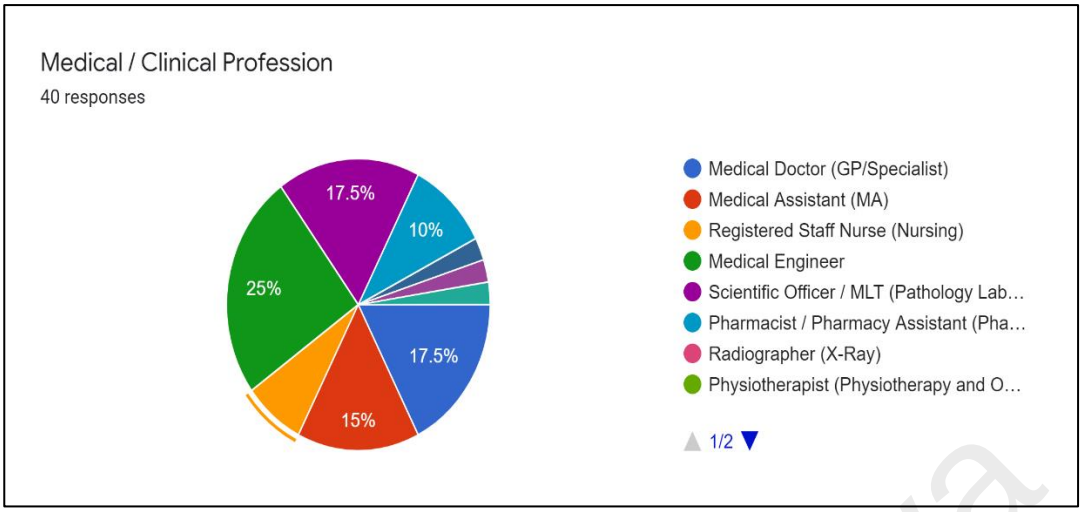


Figure 4:1:Background of respondents

For incident management system survey, the question was as follows- the hospital/clinic has well established emergency response plan for COVID-19 and mechanisms to coordinate with Ministry of Health (KKM) and local authorities and the community for actions related to COVID-19 prevention, preparedness, readiness, response and recovery. The majority of the respondents agree and strongly agree with this statement and only 5% disagree. It means that 95% of the respondents were aware that COVID-19 hospitals have established a systematic emergency response plan and also well organized in the aspects of preparedness and readiness to manage the COVID-19 cases.

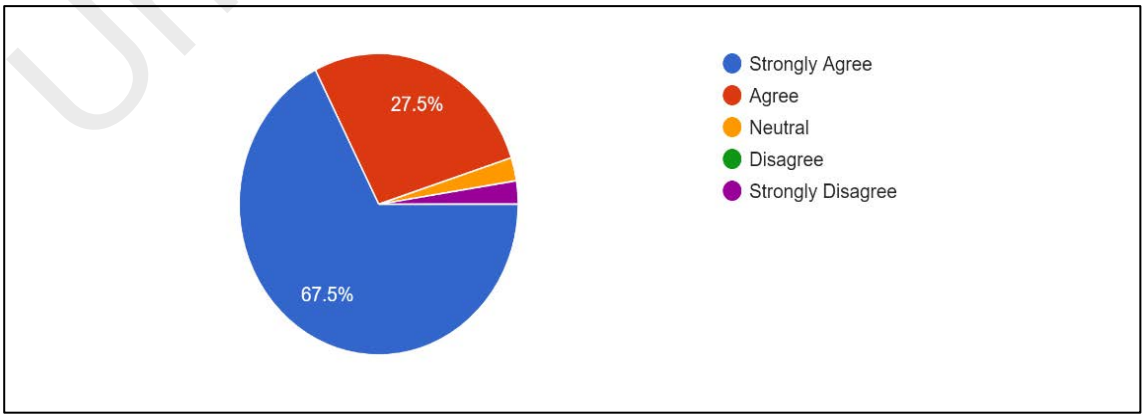


Figure 4:2: Incident Management System analysis

4.3 Communication & Coordination analysis

To enhance internal communication and coordination, all staffs were well trained in terms of close contacts and the quarantine system. Most of the respondents agree with 92.5 % of positive responds as shown in Figure 4.3. On the other hand, Figure 4.4 shows the feedback on standardized forms are available to report COVID-19 case information to a centralized health information system within 24 hours of case identification. 95% respondents agreed with this statement as they know through their experience in hospitals.

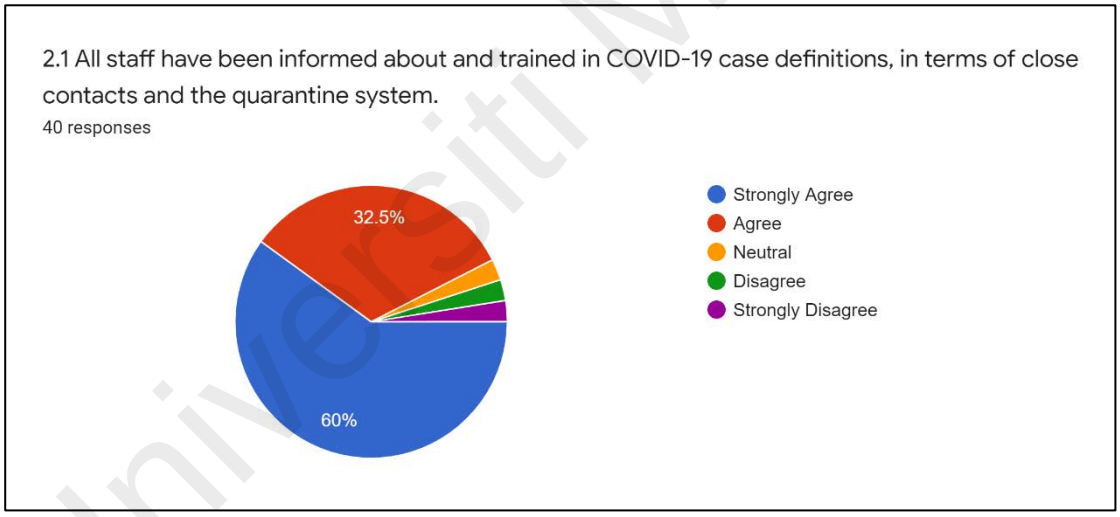


Figure 4:3 Communication and coordination feedback

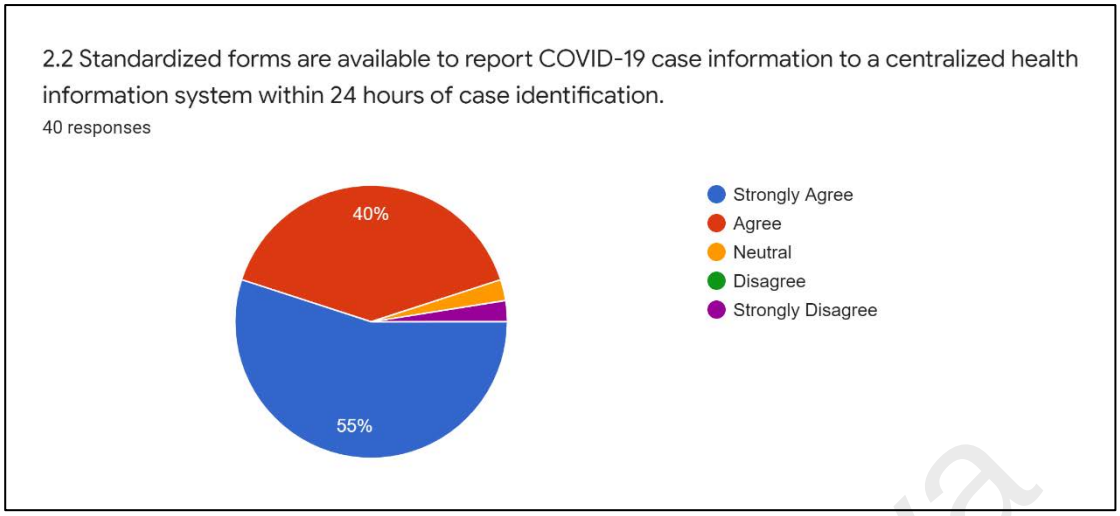


Figure 4:4: Standardized form available to report COVID-19 feedback

4.4 Risk communication and community engagement analysis

The third component of the checklist is to measure on risk communication and community engagement. In Figure 4.4, 85% of respondents agreed that the hospitals are engaging all their staffs, patients, visitors and others to educate on the SOPs that should be followed by everyone for infections prevention and control. All the staffs are aware of the SOPs and strictly adhere to it. However, another 15 % were not sure about or disagree .

Figure 4.5 presents the survey if the staffs were briefed regularly about COVID-19 risk and community engagement actions have been conducted. Total of 87.5% respondents agreed that hospitals do regularly update their staffs in the protocols, risk and also engaged with community to create more awareness.

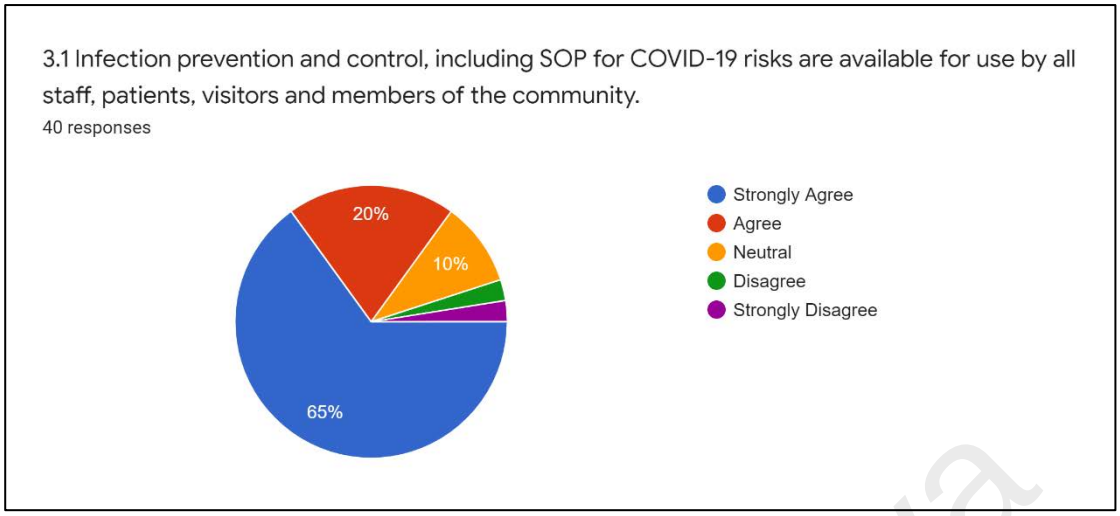


Figure 4:5:SOP for infection prevention and control feedback

4.5 Administration, finance and business continuity engagement analysis

Due to increasing trend of COVID-19 cases, hospitals are also looking carefully in strategy such as staff turnover and absenteeism. This is to avoid staff fatigue due to COVID-19 workload. The findings was 70% of the medical staffs agreed that hospitals have incorporated strategy to avoid staffs being overloaded and fatigue with their task assigned to them during COVID-19 period. Whereas, another 20% showed neutral respond to this statement. Only 10% respondents were strongly disagree and in opinion that they exhausted with their workload as in Figure 4.6. In a study conducted by Toniolo-Barrios and Pitt [32] early this year, they did emphasize on employee burnout inevitably will be a longer-term risk of major crises such as the current pandemic, and this should be of utmost concern to employers. Furthermore, employee well-being is beneficial to both staff and employers alike as it leads to enhanced organizational performance via increased employee health, reduced absenteeism, and reduced turnover [33].

In addition, another survey question was conducted for this section - the hospital's incident management system team has ways for assessing and identifying the expansion of hospital inpatient, outpatient and intensive care unit capacity in case of an increasing COVID-19 workload. Figure 4.7 presents the feedback from the respondents with 90% in agreement with this statement and only 5% disagree with this statement. According to Dr Suresh Kumar, an infectious diseases clinician explained that initially Sungai Buloh is a 900-bedded hospital and once they are aware of the alarming situation in Wuhan, the hospital has been quickly renovated so that it could accommodate over 2000 bedded patients and the intensive care units (ICUs) fitted with more beds and also showed increment in diagnostic laboratories[5].

Besides that, from recent article published in 'The Star' newspaper on 15th May 2021, highlighted that all beds in the hospital are almost full and at their maximum capacity. General hospitals such as Kajang, Sg. Buloh, Ampang and Selayang are facing these problems [34].

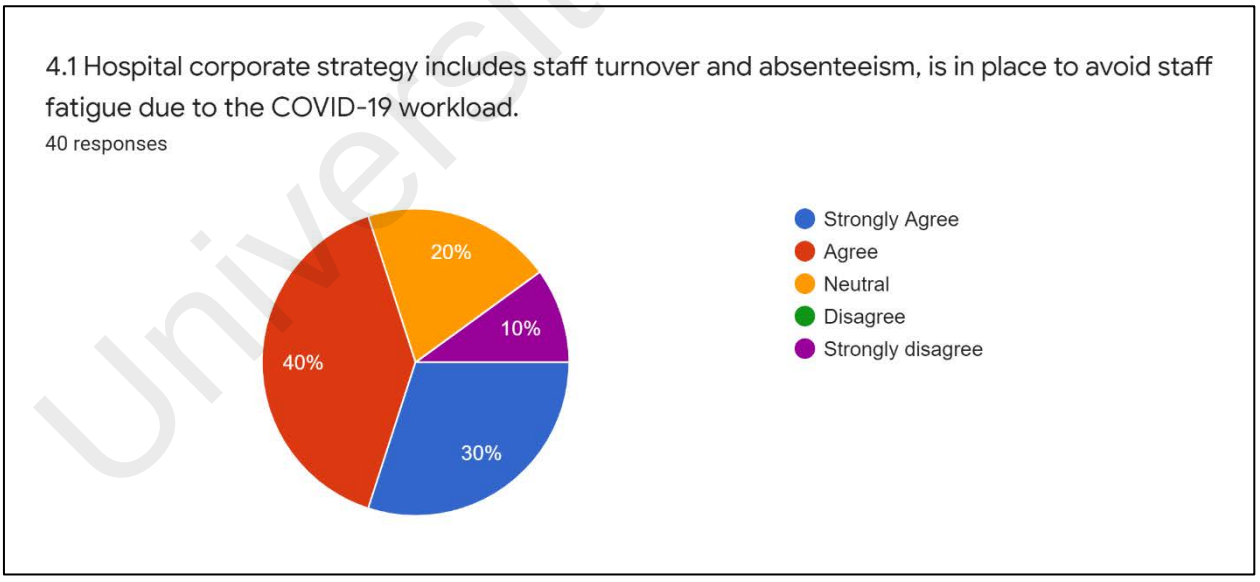


Figure 4:6:Hospital corporate strategy feedback

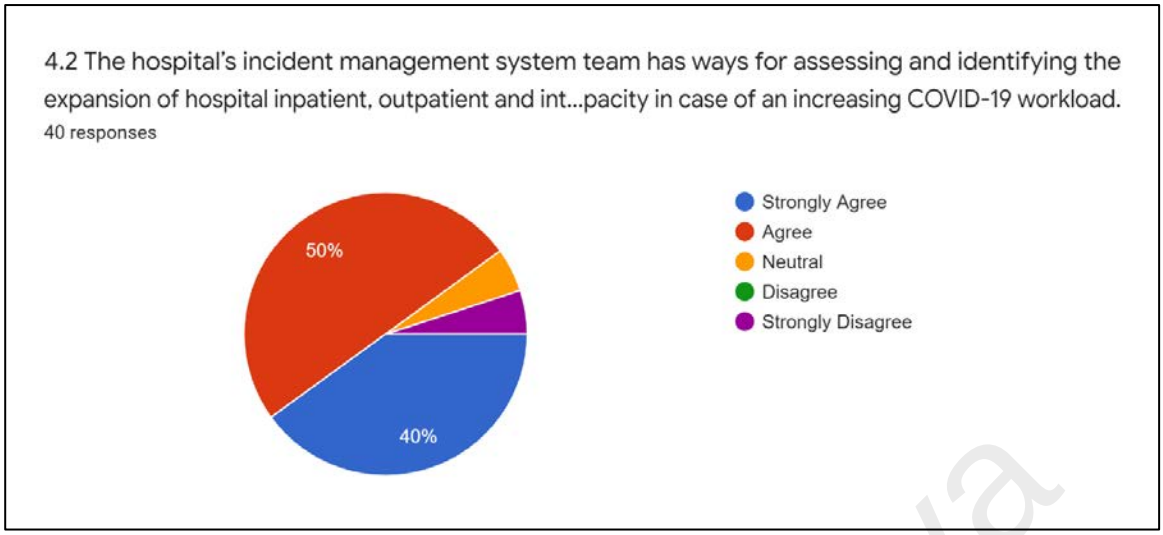


Figure 4:7: Hospital incident management system feedback

On the other hand, to ensure the business continuity, survey question on the possibility to outsource non-critical patients to other alternative health facilities was crafted. Figure 4.8 presents the feedback and 85% medical staffs agreed with such plan and only 7.5% disagree. Besides that, Datuk Dr Kuljit Singh, President of the 'Association of Private Hospitals Malaysia' stated that government hospitals will refer non-COVID-19 patients to private hospitals for elective surgeries and procedures without further delay and able to support government hospitals as they are handling COVID-19 cases daily in [29]. This actions is deemed to reduce the burden of government hospitals for the competitive utilization of ICU for only COVID-19 patients.

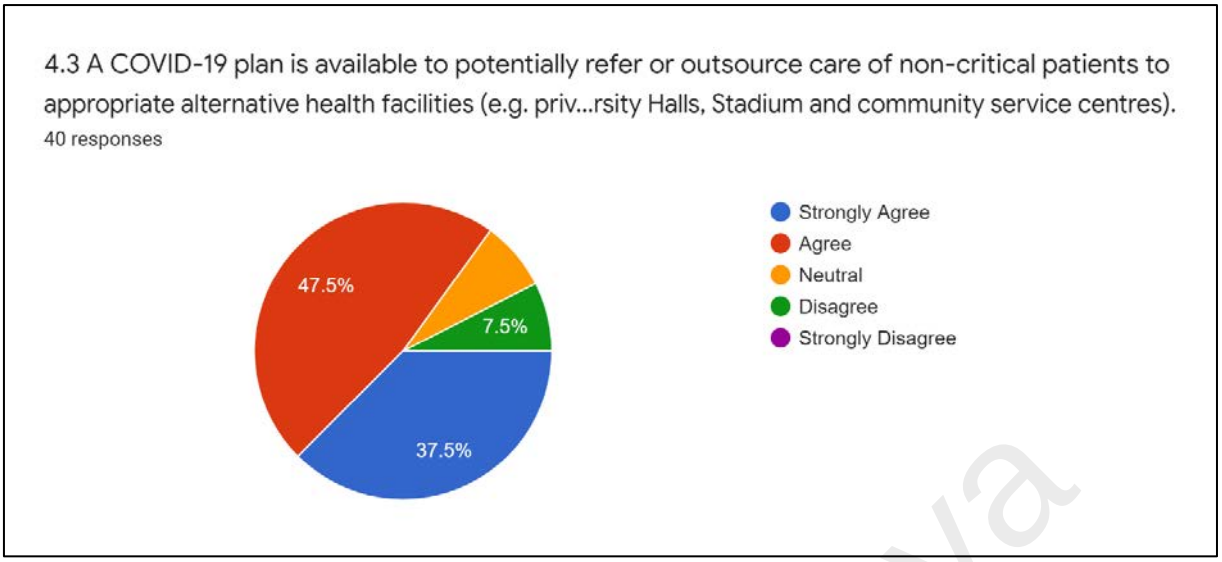


Figure 4:8: COVID-19 plan availability feedback

4.6 Human resources analysis

Figure 4.9 depicts the findings for hospital that have identified the optimum number of staff (medical and non-medical) needed to ensure the continuity of essential services during the COVID-19 pandemic. Total of 90% responded agree and 7.5% disagree Healthcare workers are at risk of infection from COVID-19 too, since they are exposed to daily contact with the patients, which take a disproportionate toll on them, with substantial cost to health systems. Improved infection prevention and control (IPC) programmes can protect them, especially in resource-limited settings where the health workforce is scarcest, and ensure patient safety and continuity of essential health services [35].

In certain circumference, the nurses' facing anxiety problem and also lead to depression due to dealing with the fear of being infected. Thereby, the hospitals have provided the necessary counselling for them.

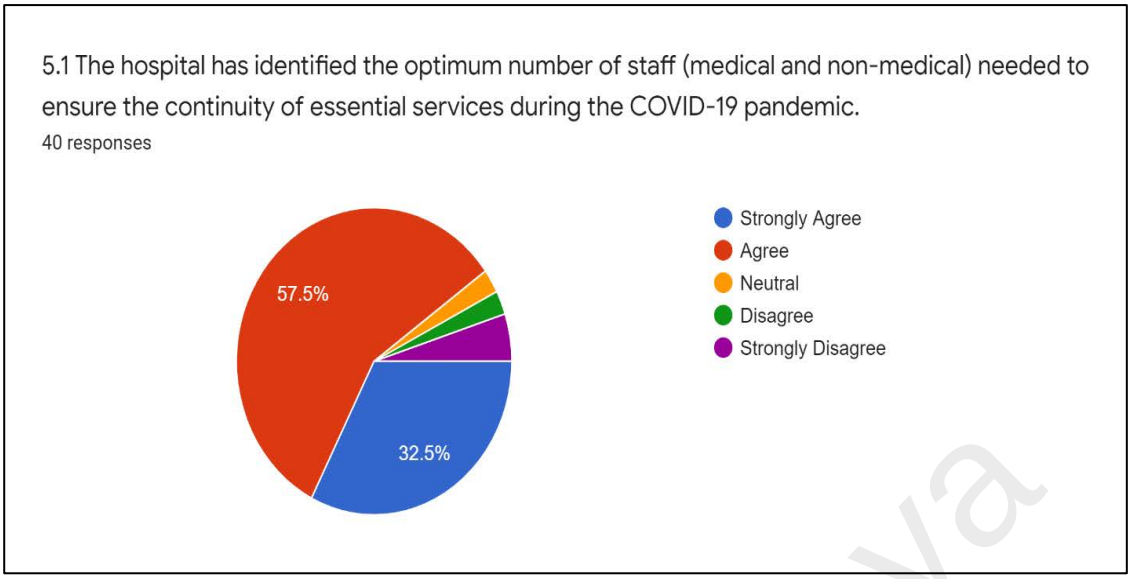


Figure 4:9:Hospital staffing strategy feedback

4.7 Continuity of essential services analysis

For this section, it consists of 8 questions as representation of the sixth component in the checklist and the responds are shown as in Table 4.1. The responds were more than 80% respondents agreed with the statements in the survey and for disagree, only 7.5 % and less than that have chosen this respond.

Preventing spread of infection to and from health care workers and patients relies on effective use of personal protective equipment (PPE) such as gloves, face masks, air-purifying respirators, goggles, face shields, respirators, and gowns. A critical shortage of all of these is projected to develop or has already developed in areas of high demand [36]. In addition, in China, for instance, 22 out of 3000 estimated confirmed positive cases among healthcare personnel died. Whereby in Italy, a high incidence of infection and death among healthcare personnel has been reported. The shortage of PPE was attributed for the high mortality and infection rate [37].

Table 4.1: Survey questions for the sixth components in the checklist and the responds.

No.	Recommended actions as in the checklist	Percentage of respondents (%) Agree	Percentage of respondents (%) Disagree
1.	6.1 Procedures are in place to ensure management of the COVID-19 surge supply chain for essential medicines, diagnostics (including laboratory reagents, personal protective equipment and test kits) and supplies for clinical care, therapeutic interventions and clinical management.	90	5
2.	6.2 Hospital inventory, stock are in place for food, oxygen, cleaning materials and disinfectants.	92.5	2.5
3.	6.3 The hospital security system has identified potential safety and security challenges, including maintaining secure access to the facility.	95	2.5
4.	6.4 The hospital security system has set up markers for physical distance of at least 1 m between patients and visitors and well as staff.	82.5	7.5
5.	6.5 The hospital security system has ensure rational use of masks if someone has symptoms of COVID-19, patient flow.	92.5	2.5
6.	6.6 The hospital security system has optimized patient flow, traffic, parking and access for visitors, and stocks of essential pharmaceuticals. The hospital also has a mitigation plan for security risks.	92.5	2.5

No.	Recommended actions as in the checklist	Percentage of respondents (%) Agree	Percentage of respondents (%) Disagree
7.	6.7 The hospital has tested an expansion plan for clinical management (e.g. a contingency plan for constructing additional isolation wards).	85	5
8.	6.8 The hospital waste management is linked to the local water, sanitation and hygiene (WASH) system.	80	5

4.8 Patient Management analysis

Figure 4.10 shows the responds with 97.5% agree and only 2.5% disagree on the SOPs availability for receiving patients and transferring them within the hospital to COVID-19 isolation areas or rooms.

In a study reported by Navin and his colleauges, they've discussed about the transformation of general to COVID-19 treatment hospital in India. They've identified a single elevator in the block designed for patients for their movement to different floors. A triage area was set up in this block near the entrance. The patient was transported from the triage area to the respective floors through a dedicated elevator. This entire zone was labeled a contaminated zone, and barriers were installed to guarantee no movement of staff or materials from this zone to the rest of the block on this level [38]. For Malaysia, Ministry of Health (MOH) has a guideline and the flow chart of management of suspected case admitted to ward as in Appendix 4.

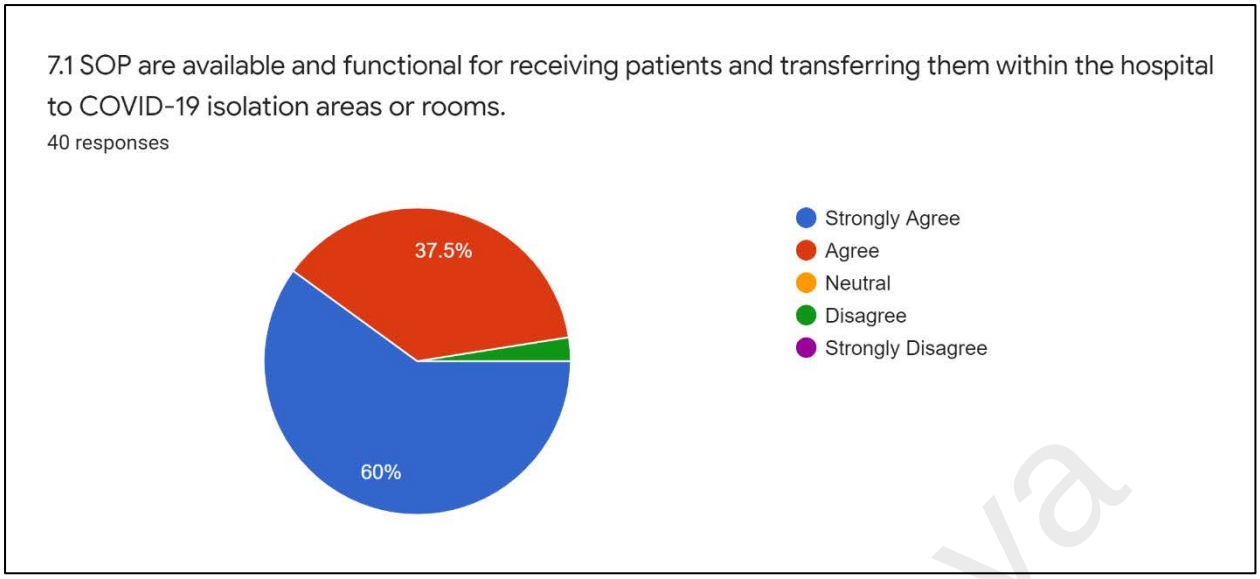


Figure 4:10:SOP for patients receiving and transfer within the hospital feedback

4.9 Occupational health support analysis

For occupational health support, the survey questions was as follows- all staff are well trained and equipped to provide initial medical care to people with suspected or confirmed COVID-19, including providing primary screening, resuscitation, initial stabilization, early supportive therapies. The percentage recorded for agreed respond was 90% and only 5% disagreed as shown in Figure 4.11. There are cases where staff nurses are afraid and faced anxiety problem when deals the patients. The suggested solution for improving staffing for COVID-19 might involve a call for all experts – retired or staff nurses who have essential knowledge, skills, and attitudes, and able to help provide holistic care for patients infected with COVID-19 [39]. However, in Malaysia, our frontliners are dedicated and there were no serious case reported due to poor handling of patients.

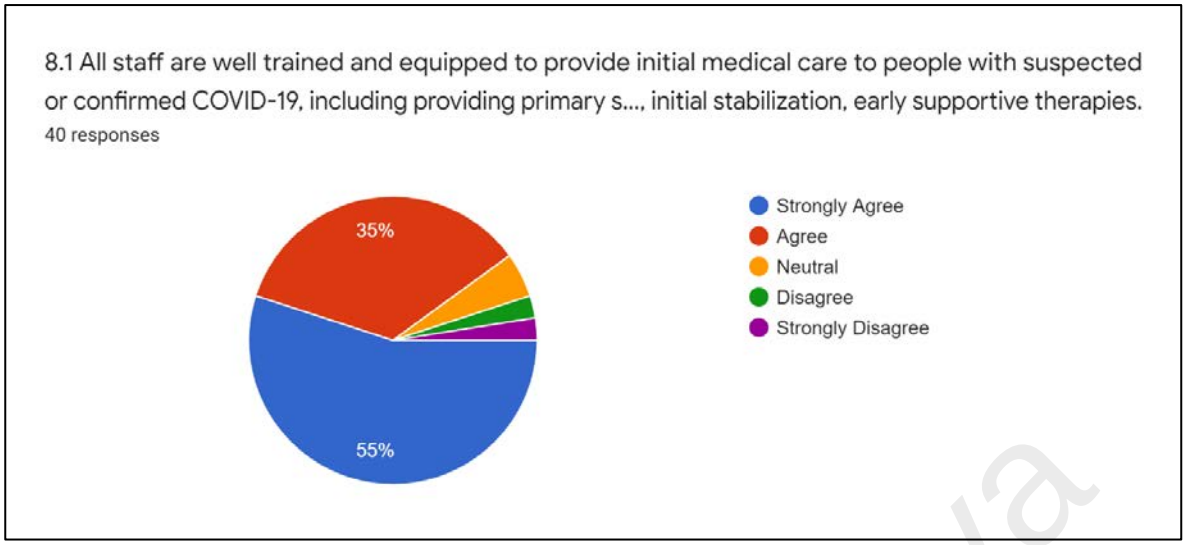


Figure 4:11:Staff training in patients handling feedback

4.10 Rapid identification and diagnosis analysis

For the ninth component in the checklist for rapid identification and diagnosis, three questions were crafted as shown in Table 4.2. Total of 92.5%, agreed with all the questions.

Appropriate screening and triage of all persons entering hospitals were emphasised as an environmental and administrative measure that could help to maintain essential services in hospitals. The proportion of hospitals with COVID-19 screening and triage areas significantly increased from 58% at baseline to 68%, as reported by Patel et al.,[35].

Table 4.2: Survey questions for the ninth components in the checklist and the responds

No.	Recommended actions as in the checklist	Percentage of respondents (%) Agree	Percentage of respondents (%) Disagree
1.	9.1 Staff have been trained in accurate, rapid identification and timely screening of suspected COVID-19 cases, with timely reporting to the designated authority.	92.5	2.5
2.	9.2 Emergency department has a triage procedure, that focuses on rapid identification, isolation and testing of patients with signs and symptoms of acute respiratory infection.	92.5	5
3.	9.3 SOP for collecting samples and transferring them to the reference laboratory, including their disposal is available.	92.5	5

4.11 Infection prevention and control analysis

For the tenth component in the checklist for infection prevention and control, six questions were crafted as shown in Table 4.3. The responds was above 80% agreed with all the statements. In our local hospitals, all the recommended actions are already in full implementation to avoid the chances of contamination and infections to healthcare workers.

Table 4.3: Survey questions for the tenth components in the checklist and the responds

No.	Recommended actions as in the checklist	Percentage of respondents (%) Agree	Percentage of respondents (%) Disagree
1.	10.1 Designated isolation areas are available for providing medical care to people with suspected, probable or confirmed COVID-19 , with appropriate signage and equipment, and adequate ventilation.	92.5	2.5
2.	10.2 Airborne isolation room is available. Airflow from clean-to-less clean zones is ensured whenever aerosol-generating procedures are performed. Where a mechanical ventilation system is available, negative pressure is created and maintained to control the direction of airflow from clean-to-less clean zones.	82.5	5.0
3.	10.3 Appropriate measures such as hand hygiene stations, available for use before hospital entry and throughout the hospital should be stocked with water, soap, paper towels or an alcohol-based hand rub; waste bins with lids are placed at strategic locations in the hospital.	87.5	5
4.	10.4 A protocol is available about how to avoid transporting COVID-19 patients out of their rooms and if this cannot be avoided, a protocol for transporting COVID-19 patients safely out of their rooms is available.	95	2.5

No.	Recommended actions as in the checklist	Percentage of respondents (%) Agree	Percentage of respondents (%) Disagree
5.	10.5 All surfaces in the hospital and in ambulances are routinely cleaned and disinfected, according to infection prevention and control guidelines.	90	2.5
6.	10.6 Waste management protocol and infrastructure, including the management of biological and clinical waste, are available in the hospital.	90	2.5

4.12 Overview of hospital readiness: key components

Figure 4.12 presents the overview of hospital readiness in Malaysia, that include 10 components as in the checklist. The 7th component, that is on patient management recorded highest percentage of 98%. Hospitals in Malaysia have well established the SOPs for patient management in terms of receiving patients and transferring them within the hospital to COVID-19 isolation areas or rooms.

Followed by incident management system with 95% feedback on the readiness. The hospital/clinic has well established emergency response plan for COVID-19 and mechanisms to coordinate with Ministry of Health (KKM) and local authorities and the community for actions related to COVID-19 prevention, preparedness, readiness, response and recovery.

On the contrary, administration, finance and business continuity components scored the lowest among the 10 components in the checklist with 82%. The lowest agreed rate was found for question as follows-a COVID-19 plan is available to potentially refer or outsource care of non-critical patients to appropriate alternative health facilities (e.g. private hospitals, University Halls, Stadium and community service centres). This could be low due to those plans are in progress now and to be in full implementation soon.

Thereby it can be concluded that the checklist have successfully measured the hospital readiness and it could be reference for non-covid treatment hospitals to transform into COVID-19 treatment hospitals to cater the increasing number of the patients and provide immediate treatment.

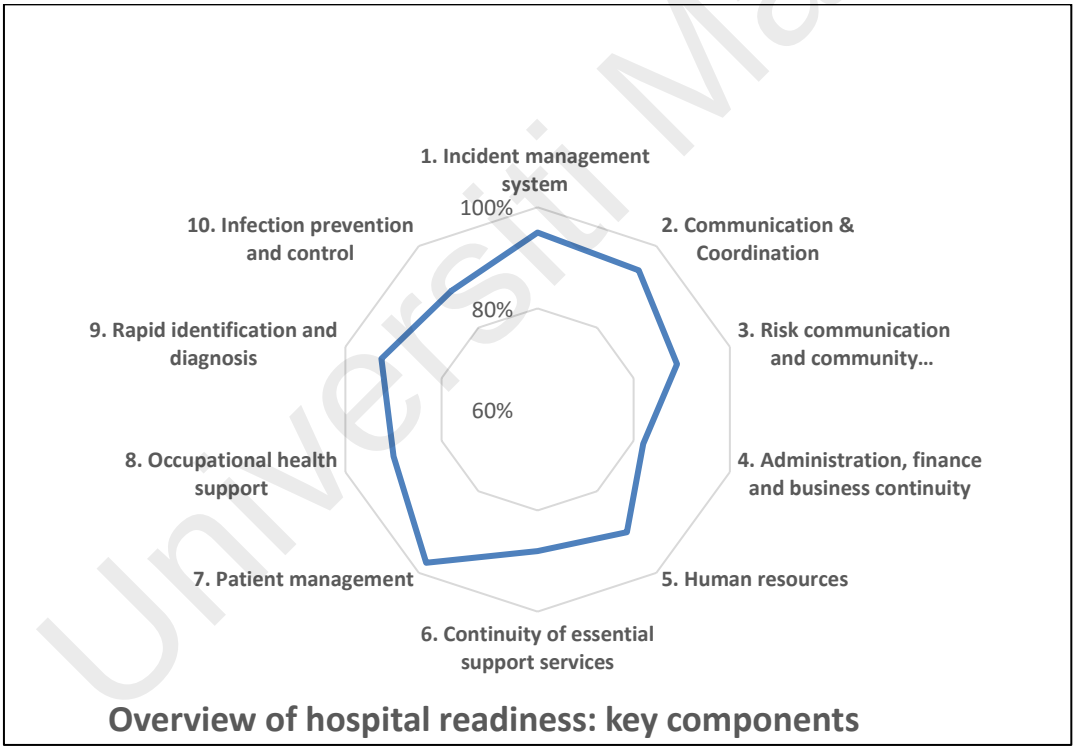


Figure 4:12 Overview of hospital readiness

Chapter 5

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusions

The checklist crafted in this project consists of 10 components to assess the readiness of hospitals in Malaysia and proposed the strategies of transformation to COVID-19 hospitals. The significant findings of this study as follows:

i. From the checklist, this study found that the 7th component, that is on patient management recorded highest percentage of 98%. Hospitals in Malaysia have well established the SOPs for patient management in terms of receiving patients and transferring them within the hospital to COVID-19 isolation areas or rooms. Ministry of Health, Malaysia has established a standard guidelines on the SOPs and requested all the hospitals to adhere to the SOPs as an obligation for healthcare workers.

ii. Incident management system was selected as the second highest criteria from the checklist with 95% feedback on the readiness. The hospital/clinic has well established emergency response plan for COVID-19 and mechanisms to coordinate with Ministry of Health (KKM) and local authorities and the community for actions related to COVID-19 prevention, preparedness, readiness, response and recovery.

iii. However, administration, finance and business continuity components scored the lowest among the 10 components in the checklist with 82%. Many of the respondents had shown low agreement for statement of COVID-19 plan is available to potentially refer or outsource care of non-critical patients to appropriate alternative health facilities (e.g. private hospitals, University

Halls, Stadium and community service centres). As we are still depending on government hospitals to handle the cases and private hospitals are coming forward recently to assist in reducing the burden of government hospitals. However, regardless to the effort of government to improve the non-COVID hospitals, public co-operation is deemed to be more significant in supporting this effort. Our community should follow all the SOPs such as social distancing, self-hygiene and sanitization, and avoiding social activities. In order to support the government, and healthcare providers, to curb the transmission of this virus, is everyone's responsibility.

5.2 Recommendations for future work

Strategis to transform to COVID-19 treatment hospitals are available and the checklist prepared by WHO is useful and identify all the necessary requirement and adhere to the SOPs. More sub-components from the checklist could be extracted and simplified into survey form and distributed to healthcare workers in both, public and private sectors. Apart from that, a formal interview could be done with healthcare professionals and stakeholders to evaluate the transformation starategy and in relation to the costs involved in the transformation process. This will be useful in determining the sub-components to be included into the checklist in terms of cost effectiveness. It takes only about 2 weeks for the transformation process from a standard hospital to COVID-19 treatment hospital, such as reported in India and China. Therefore, it would be of great benefit to evaluate the duration of transformation in Malaysia, because there isn't much data nor publication that implies duration of transformation from non-COVID hospitals and clinics to COVID-19 treatment hospital and clinics. In addition to that, for future study, higher number of respondents from the healthcare sector is anticipated. The large pool of respondents will be useful to futher strengthen the discussion and conclusion.

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