

**THE PREVALENCE OF COVID-19 POSITIVITY AMONG
HEALTHCARE WORKERS MANAGING COVID-19, ITS ASSOCIATED
FACTORS AND ADHERENCE TO PERSONAL PROTECTIVE
EQUIPMENT IN TERENGGANU**

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LIST OF ABBREVIATION

HCW	Healthcare worker
HHT	Hospital Hulu Terengganu
HSNZ	Hospital Sultanah Nurzahirah
JKNT	Jabatan Kesihatan Negeri Terengganu
PPE	Personal protective Equipment
RTK	Rapid Antigen Test Kit
SPSS	Statistical Package for the Social Sciences
SARS-CoV-2	Severe Acute Respiratory Syndrome coronavirus 2
USM	Universiti Sains Malaysia
PPK	Pembantu Perawatan Kesihatan (Medical Health Assistant)
SN	Staff Nurse
JM	Jururawat Masyarakat (Community Nurse)

ABSTRAK (BAHASA MELAYU)

Pengenalan

Penyakit Coronavirus 2019 (Covid-19) mempunyai kadar jangkitan yang tinggi serta telah merebak ke seluruh dunia dengan cepat. Ramai dalam kalangan petugas kesihatan barisan hadapan yang telah dijangkiti, malah ada diantara mereka yang telah terkorban kerana Covid-19. Walaupun banyak kajian berkaitan pekerja kesihatan telah dilakukan di Malaysia, namun kajian mengenai pekerja kesihatan yang menjaga pesakit Covid-19 atau bekerja di kawasan Covid-19 di Terengganu masih terhad. Oleh itu, objektif kajian ini adalah untuk mengenalpasti kadar Covid-19 positif dan faktor-faktor penyebab Covid-19 serta mengenal pasti kadar kepatuhan terhadap PPE dan faktor-faktor penyebab kepatuhan kelengkapan pelindung diri (PPE) dalam kalangan petugas kesihatan yang menjaga pesakit Covid-19 atau yang bekerja di kawasan berkaitan dengan Covid-19 di Terengganu.

Kaedah

Kajian ini bersifat semakan rekod retrospektif. Semua petugas kesihatan yang terdedah atau bekerja dengan pesakit Covid-19 akan diletakkan di bawah Saringan Pengawasan untuk Covid-19 memandangkan mereka tergolong dalam 8 kumpulan berisiko untuk Covid-19 positif. Mereka yang memenuhi kriteria iaitu bekerja di Hospital Sultanah Nurzahirah (HSNZ) atau Hospital Hulu Terengganu (HHT) bermula dari Jun 2020 sehingga Disember 2021 telah di ambil sampel mereka. Mereka juga diberi satu set soalan kajian berkenaan kepatuhan dalam pemakaian Kelengkapan Pelindung Diri (PPE), yang merupakan sebahagian daripada penilaian berterusan dalam menangani kes Covid-19. Kesemua data ini telah pun di kutip dan di simpan di Unit Penyakit Berjangkit HSNZ dalam bentuk helaian kertas sebelum data ini di masukkan ke “*excel sheet*” untuk di analisa.

Keputusan

Seramai 300 petugas kesihatan yang menjaga pesakit positif Covid-19 atau bekerja di kawasan berkaitan Covid-19 di Hospital Sultanah Nurzahirah dan Hospital Hulu Terengganu telah menyertai kajian ini, 40 daripada mereka di saring di sebabkan borang yang tidak lengkap menjadikan keseluruhan peserta ialah 260 orang . Namun, tiada sebarang kes positif Covid-19 di kesan dalam kalangan semua petugas kesihatan yang terlibat. Secara keseluruhan, 187 petugas kesihatan (71.9%) melaporkan 100% tahap kepatuhan terhadap kesemua lima elemen kelengkapan pelindung diri (PPE), dengan kadar kepatuhan penuh terhadap penutup muka adalah paling tinggi iaitu 250 orang (96.2%). PPK adalah 16.68 lebih berisiko untuk tidak memakai PPE secara sempurna berbanding Pembantu Pegawai Perubatan (*Adjusted OR*=16.68; $p=0.003$). Pekerja kesihatan yang terdedah selama 2 hingga 4 minggu adalah 3.913 lebih berisiko untuk tidak memakai PPE secara sempurna berbanding pekerja kesihatan yang terdedah lebih daripada enam minggu (*Adjusted OR*=3.913; $p=0.009$).

Kesimpulan

Kajian kami menunjukkan tiada risiko yang signifikan untuk dijangkiti Covid-19 dalam kalangan petugas kesihatan yang menjaga pesakit Covid-19 atau bertugas di kawasan berkaitan Covid-19 di Terengganu. Ini kerana tiada kes jangkitan Covid-19 di rekodkan di kalangan kesemua 260 petugas kesihatan. Kelengkapan pelindung diri (PPE) terutamanya pelindung muka memainkan peranan utama dalam mengelakkan jangkitan Covid-19 terhadap para petugas kesihatan. Jawatan dan masa terdedah merupakan faktor-faktor berkaitan dengan kepatuhan terhadap PPE dengan nilai $p<0.05$.

ABSTRACT (English)

Background

Coronavirus Disease 2019 (Covid-19) is highly contagious and spread rapidly to affect almost the whole world. Though there are many studies focusing on healthcare workers in Malaysia, there are limited published studies on healthcare workers caring for Covid-19 positive patients or worked in Covid-19 related areas in Terengganu. Therefore, this study objectives is to determine both the prevalence and risk factors associated with Covid-19 positive and compliance to Personal Protective Equipment (PPE) among healthcare workers caring for Covid-19 patients or work in Covid-19 related areas in Terengganu.

Methodology

This is a retrospective record review study. All healthcare worker who exposed or worked with Covid-19 patients will be screened for Covid-19. Among them, those who fulfill the criteria of working at Hospital Sultanah Nurzahirah or Hospital Hulu Terengganu from June 2020 to December 2021 are included in the study. They were also given set of validated questionnaires as part of continuous improvement for assessment of compliance to PPE in managing Covid-19 cases. All data already collected, and they will be kept in Infectious Disease Unit HSNZ as hardcopy. Data will be reviewed and extracted into an excel sheet.

Results

A total of 300 healthcare workers caring for Covid-19 patients or work at Covid-19 related areas at Hospital Sultanah Nurzahirah and Hospital Hulu Terengganu were screened, 260 included in the study while another 40 were excluded due to incomplete form for PPE surveillance. None of the 260 healthcare workers were noted to be positive for Covid-19 PCR. Overall, 187 workers (71.9%) had a 100% self-reported compliance towards all five components of main personal protective equipment (PPE) while facemask recorded the highest rate of all time compliance with 250 workers (96.2%). PPK workers increased the risk of inadequate PPE by 16.68 compared to medical assistant workers (Adjusted OR=16.684; $p=0.003$). Healthcare workers with a duration of exposure of 2 – 4 weeks increased the risk of inadequate PPE by 3.913 compared to healthcare workers with longer than six weeks (Adjusted OR=3.913; $p=0.009$).

Conclusion

Our data showed that no significant risk of getting Covid-19 amongst healthcare worker who provide care to Covid-19 positive patients or work in Covid-19 related areas in Terengganu. This is because none of 260 participants tested to be positive. Personal protective equipment (PPE) compliance is vital in preventing transmission. Out of 260 participants, 187 workers (71.9%) had a 100% self-reported compliance towards all five components of personal protective equipment with highest compliance aspect reported towards facemask with 250 workers (96.2%); better compliance associated with designation and duration of exposure with p -value <0.05 .

CHAPTER 1: INTRODUCTION

1.0 Introduction

Coronavirus Disease 2019 or otherwise known as Covid-19 is the outbreak of the respiratory disease and considered as the latest threat to global health and humanity. The virus that causes Covid-19 is a new novel virus known as Severe Acute Respiratory Syndrome coronavirus 2 (SARS-CoV-2). Covid-19 was first discovered in Wuhan, China in December 2019 and three months after that, on March 11 2020, the World Health Organization (WHO) recognized it as a pandemic considering its significant ongoing spread in multiple countries across the world (Sohrabi *et al.*, 2020). As of June 15, 2021, World Health Organization (WHO) reported that there are more than 175 million cases of Covid-19 in more than 210 countries resulting in around 3.8 million deaths (WHO, 2021). Covid-19 was first detected in Malaysia on 25 January, contracted from foreign travellers from China arriving via Singapore following the outbreak of Covid-19 in Hubei, China (“Malaysia: First cases of 2019-nCoV confirmed January 25,” n.d.).

In response to the global pandemic, doctors, nurses and people working in the healthcare sectors are vulnerable to the highly infectious disease. Since the coronavirus outbreak, healthcare professionals have not only felt the satisfaction of curing illnesses and saving lives, but also sacrificed their own lives for the greater good in the line of duty (Singhal, 2020). Worldwide, as millions of people stay at home to minimise the transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), healthcare workers are prepared to do the exact opposite. They will go to clinics and hospitals as their normal daily routine, putting themselves at high risk to be infected with Covid-19.

The National Health Commission of the People's Republic of China had reported that as of February 24, 2020, a total of 3387 out of 77,262 patients with Covid-19 (4.4%) in China were healthcare workers or others who worked in medical facilities (Zhan *et al.*, 2020). Meanwhile, in Malaysia, the KPK Press Statement on 23 April 2020 entitled "Current Situation of Coronavirus Disease 2019 (COVID-19) in Malaysia" had reported that 325 out of 5603 healthcare workers were tested positive Covid-19. In Italy, 20% of responding healthcare workers were infected with Covid-19, and some had died. Aside from high infection risk, reports from medical staff also described physical and mental exhaustion, the torment of difficult triage decisions, and the pain of losing colleagues and patients during their battle against the Covid-19 (Remuzzi and Remuzzi, 2020).

As the pandemic accelerates, compliance to the Personal Protective Equipment (PPE) is deemed as effective in protecting HCW against Covid-19 infections by reducing the transmission and spread of the virus (Zangoue et al., 2021). Therefore, the World Health Organization (WHO) had recommended the use of PPE to all healthcare workers involved in the Covid-19 cases (WHO, 2020).

Though there are many studies focusing on healthcare workers in Malaysia, there are limited published studies on healthcare workers caring for Covid-19 positive patients or work in Covid-19 related areas in Terengganu. Therefore, this study objectives is to determine the prevalence and risk factors for Covid-19 positive among HCW who care for Covid-19 patients and

work in Covid-19 related areas in Terengganu as well as to determine the prevalence and risk-factors associated with their compliance to full PPE. By identifying all these factors, we can improve our compliance to PPE and eventually further reduce risk of Covid-19 infection amongst HCW

Literature Review

Prevalence and Factors Associated with Covid-19 Positive among Healthcare Worker (HCW).

Coronavirus disease (Covid-19) was first discovered in Wuhan, China in December 2019 and has been spreading to various countries in just a few months. The transmission of the virus can occur through contact, aerosol (airborne) or droplets (Park, 2020). The contact can occur through direct physical contact with the Covid-19 patients or through contaminated objects or surface areas (Park, 2020). Generally, healthcare workers (HCW) are more likely to be infected with Covid-19 compared to the general community (Nguyen et al., 2020). This is because they are frontliners responsible for treating, caring and managing Covid-19 patients. Frequent close contact with the Covid-19 patients particularly when not wearing appropriate PPE was associated with greater risk of being infected with Covid-19 among HCW (Kim et al., 2021). Meanwhile, in Malaysia, HCW are mainly infected in healthcare settings when they are treating and caring for patients that were not suspected of having Covid-19 with no adequate PPE worn (Nienhaus & Hod, 2020).

Globally, the prevalence of HCW getting infected with Covid-19 at Spain, China, France, Italy and United States are ranging from 15% to 20% (Ali, Noreen, Farooq, Bugshan, & Vohra,

2020). Meanwhile, the prevalence of positive Covid-19 cases among HCW caring for Covid-19 patients in USA and UK was 2.7% (Nguyen et al., 2020), which is much lower than the Spanish study (4%) (Algado-Sellés et al., 2020) and Southern Italy study (3.4%) (Fusco et al., 2020). As in Malaysia, the prevalence of positive Covid-19 among HCW at University Malaya Medical Centre (UMMC) which is one of the Covid-19 designated hospitals was 0.3% (17 out of 5826) (Wan et al., 2021). However, out of 17 HCW, 5 of them had community exposure close contact, leaving only 12 of them had work-related exposure (Wan et al., 2021).

Risk factors associated with Covid-19 are PPE, profession, workplace setting, exposure, contact and testing (Gholami et al., 2021). In contrary, previous study in Ethiopia found no significant association between PPE use and the exposure to Covid-19 (Atnafie, Anteneh, Yimenu, & Kifle, 2021). Healthcare workers who had close contact and were exposed to the Covid-19 patients in healthcare settings had higher risk to be infected with Covid-19 compared with those not directly involved with the patients (Mhango, Dzobo, Chitungo, & Dzinamarira, 2020; Nguyen et al., 2020; Sahu et al., 2020). As for professions, nurses and medical doctors are the HCW that mostly being infected with Covid-19 as they had frequent, close contact with the patients and spend more time at their bedside (Soebandrio et al., 2021). In regards to workplace settings, HCW in non-Covid-19 wards are at higher risk to be infected with Covid-19 than HCW in the Covid-19 wards because they are not wearing appropriate PPE while caring for not-yet-diagnosed Covid-19 patients, while HCW in Covid-19 wards wearing appropriate PPE upon contact with the infected patients (Algado-Sellés et al., 2020).

Moreover, positive Covid-19 among HCW are also associated with age, work experience, perception toward Covid-19 infection, lack of understanding of the disease, inadequate use of PPE and hand-washing habits (Ali et al., 2020; Atnafie et al., 2021). Older HCW with longer work experience (21-30 years) were less likely to be infected with Covid-19 than HCW with less than 1-year (<1 year) experience because they are better at following recommendations guidelines than the less experienced ones (Atnafie et al., 2021). Similar results also obtained from the Belgian study as they found that the odds of getting infected by Covid-19 decreased by 23% for every 10 years increased in working experience (Haegdorens et al., 2022). Meanwhile, HCW that perceived they will not get infected with Covid-19 are more likely to contract Covid-19 as they are more likely to be less cautious and less careful compared to their counterpart (Atnafie et al., 2021).

Compliance and Factors Associated with Personal Protective Equipment (PPE).

World Health Organization (WHO) guidelines recommended the use of Personal Protective Equipment (PPE) to all healthcare workers providing care to the Covid-19 patients including medical mask, gown, gloves and eye protection (goggles or face shield), while N95 respirators are required when performing aerosol-generating procedures on Covid-19 patients (WHO, 2020). Meanwhile, boot covers or shoe covers are required when there is a possibility for spillage and vomiting (Yasin, Muzaini, Samsudin, Selamat, & Ismail, 2020). Both shoe cover and head cover are recommended during aerosol-generating procedures (AGP), taking sample swabs as well as when handling samples (Yasin et al., 2020).

Proper use of PPE is effective in protecting HCW against Covid-19 infections (Zangoue et al., 2021). Compliance to PPE is crucial in reducing the transmission and spread of Covid-19 to healthcare workers (Algado-Sellés et al., 2020; Soebandrio et al., 2021). For example, wearing masks all the time was found to be protective against Covid-19 whereas not wearing N95 respirators was found to be a risk factor for Covid-19 (Guo et al., 2020). The PPE usage and hand hygiene were expected to be high in the Covid-19 wards compared to the non-Covid-19 wards because the HCW in the Covid-19 wards had higher awareness on the risks of the Covid-19 as proven by the Jordan study and German study (Badran et al., 2021; Neuwirth, Mattner, & Otchwemah, 2020).

Reuse and inadequate PPE are reported as the factors that increased the risk of Covid-19 among healthcare workers exposed to Covid-19 patients (Nguyen et al., 2020). Inadequate PPE is also associated with increased risk for SARS-CoV-2 infection among healthcare workers caring for Covid-19 patients (Nguyen et al., 2020). SARS-CoV-2 or severe acute respiratory syndrome coronavirus-2 is the pathogen responsible for Covid-19. Furthermore, inadequate PPE also considered as the main barrier for the HCW to fully comply with the PPE usage (Badran et al., 2021).

The main route of transmission for SARS-CoV-2 is through hand contact with the patients (Ran et al., 2020). Good hand-washing habits particularly before putting on and after taking off PPE decreased the risk of Covid-19 infection to the HCW (Atnafie et al., 2021; WHO, 2020). Therefore, it is important for the healthcare workers to wash hands after contact or caring for

Covid-19 patient to prevent the spread of the coronavirus. A survey performed in Louisiana had highlighted a few factors for poor compliance to the PPE such as insufficient training, low level of awareness, and insufficient PPE stocks (Aggarwal et al., 2021). Besides, another study reported that the HCW with longer working experience are more compliant in the use of PPE than the less-experienced HCW (Neuwirth et al., 2020).

CHAPTER 2

OBJECTIVES OF THE STUDY

Research Questions

Research Question(s)

1. What is the prevalence of Covid-19 positive among HCW who provide care to Covid-19 patients and work in Covid-19 related areas in Terengganu?
2. What are the risk factors for Covid-19 positive among HCW in Terengganu?
3. What is the prevalence of HCW who provide care to Covid-19 patients and work in Covid-19 related areas wearing full PPE?
4. What are the factors associated with HCW compliance to full PPE in Terengganu?

Objectives:

General Objective:

To describe outcomes regarding prevalence and risk factors associated to Covid-19 positive and compliance to PPE among healthcare workers who provide care to Covid-19 patients and work in Covid-19 related areas in Terengganu.

Specific Objectives:

1. To determine the prevalence of Covid-19 positive among HCW who care for Covid-19 patients and work in Covid-19 related areas in Terengganu
2. To determine factors associated with Covid-19 positive among HCW who care for Covid-19 patients and work in Covid-19 related areas in Terengganu
3. To determine the proportion of HCW who provide care to Covid-19 positive patients who have self-reported wearing full PPE in Terengganu.
4. To determine the risks associated with full PPE compliance in HCW who care for Covid-19 patients and work in Covid-19 related areas in Terengganu.

CHAPTER 3: STUDY PROTOCOL

Research Title: THE PREVALENCE OF COVID-19 POSITIVITY AMONG HEALTHCARE WORKERS MANAGING COVID-19, ITS ASSOCIATED FACTORS AND ADHERENCE TO PERSONAL PROTECTIVE EQUIPMENT IN TERENGGANU

Conceptual framework

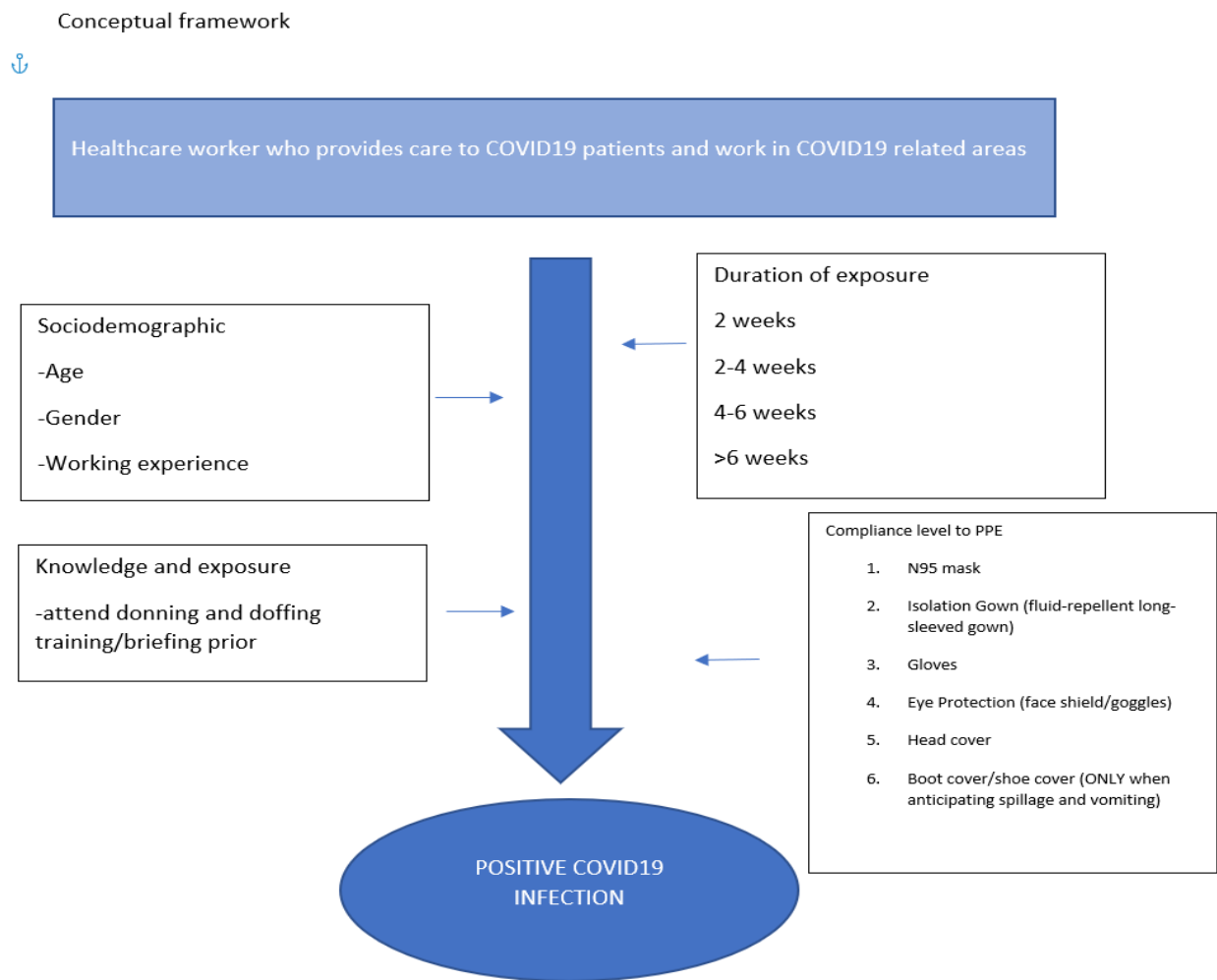


Figure 1: Conceptual framework of the study.

Research design

This is a retrospective record review study using healthcare worker registry at Hospital Sultanah Nurzahirah (HSNZ) and Hospital Hulu Terengganu (HHT)

Study duration

The duration of the study approximately 05 months from January 2022 to May 2022

Study area

The study was conducted at the Hospital Sultanah Nurzahirah (HSNZ) Kuala Terengganu and Hospital Hulu Terengganu (HHT) among healthcare workers who provide care to Covid-19 positive patients and work at Covid-19 related areas.

Study population**Reference population**

Healthcare workers who provide care to Covid-19 patients and work in Covid-19 related areas in Terengganu.

Target population

Healthcare workers who provide care to Covid-19 positive patients and work in Covid-19 related areas in HSNZ and HHT

Source population / sampling pool

All healthcare workers who provide care to Covid-19 positive patients and work in Covid-19 related areas in HSNZ and HHT from June 2020 to June 2021 and attending the screening programme under Jabatan Kesihatan Negeri Terengganu (JKNT).

Sampling frame

Healthcare workers who provide care to Covid-19 positive patients and work in Covid-19 related areas in HSNZ and HHT who fulfil the inclusion criteria and do not have any of the exclusion criteria.

Subject criteria**Inclusion criteria**

1. All healthcare workers who exposed /provide care to Covid-19 positive patients prior sampling taken
2. Working at HSNZ, or HHT in Covid-19 related areas from June 2020 to December 2021
3. HCW with PPE

Exclusion criteria

1. Under-quarantined for close contact either from community or hospital contact for COVID-19 positive patient
2. Incomplete form for PPE surveillance.

Sample size estimation

Sample size for specific objective 1:

Sample Size Calculation:

The sample size was calculated to estimate the prevalence of Covid-19 positive among HCW who care for Covid-19 patients and work in Covid-19-related areas. A sample size of 185 was estimated to be sufficient to address specific objective 1, including an allowance of additional 10% possibility data entry error (95% confidence, $Z_{\alpha} = 1.96$ and the precision, $= 0.05$). Probability of Covid-19 positive among HCW who provide care to Covid-19 positive patients were set as 5.8% (DG MOH Press statement, March 2020)

Single proportion formula for objective 1:

$$n = \left(\frac{Z_{\alpha}}{\Delta} \right)^2 * P (1 - P)$$

○ Prevalence of HCW infected Covid-19 = 5.8%

○ $z = 1.96$

○ Number of subjects = $84 \times 2 = 168$

○ Dropout 10% = 17

$\frac{1.96^2 \times 0.058(1-0.058)}{0.05} = n$ (84) $\times 2 = 168 + 10\%$ dropout

Therefore, sample size calculated for objective 1 is 185 respondents.

Proportion (p)	Precision	Significance level (α)	Power (1 - β)	nx2	Dropout Rate, 10%	Total sample size, n	Literature review*
0.058	0.05	0.05	0.8	168	17	185	(DG MOH Press statement, March 2020)

Sample size for specific objective 2:

Using two proportion calculation by Sample Size Calculator (Arifin, W. N. (2020).

Factors	Proportion of Control (P0)*	Proportion of Expected (P1)	Significance level (α)	Power (1 - β)	m	n x 2	Dropout Rate, 10%	Total sample size, n	Literature review*
Gender (Male)	0.29	0.5	0.05	0.8	1	168	17	185	(Lai et al., 2020)
Primary site clinical practice (Inside COVID ward)	0.05	0.2	0.05	0.8	1	150	15	165	(Alajmi et al., 2020)
Designation (Doctors)	0.34	0.6	0.05	0.8	1	114	11	125	(Lai et al., 2020)

Sample size for specific objective 3:

Using single proportion formula by Sample Size Calculator (Arifin, W. N. (2020)

Proportion (p)	Precision	Significance level (α)	Power (1 - β)	nx2	Dropout Rate, 10%	Total sample size, n	Literature review*
0.85	0.05	0.05	0.8	196	22	218	(Neuwirth et al., 2020)

Sample size for specific objective 4:

Using two proportion calculation by Sample Size Calculator (Arifin, W. N. (2020)).

Factors	Proportion of Control (P0)*	Proportion of Expected (P1)	Significance level (α)	Power (1 - β)	m	nx2	Drop out Rate, 10%	Total sample size, n	Literature review*
Gender (Male)	0.5	0.3	0.05	0.8	1	186	19	205	(Nguyen et al., 2020)
Primary site clinical practice (Inside COVID ward)	0.15	0.3	0.05	0.8	1	240	24	264	(Neuwirth et al., 2020)

*Hence the total final sample size for the present study is 264 samples.

METHODOLOGY

Sampling method and subject recruitment

All healthcare workers who exposed or worked with Covid-19 patients will be put under Surveillance Screening for Covid-19; considering HCWs are among 8 high risk groups of Covid-19 Positive. Based on “*Mesyuarat Pengurusan Covid-19 Peringkat JKNT*” dated 4th May 2020 (reference number: HSNZ.KT.600/1/1/12(48)) (see Appendix 2) have decided that all healthcare workers involved in Covid-19 management will be asked for sample surveillance started 31st May 2020 in a divided group as listed. All HCW were grouped according to date, time and number specific for each HCW which will be used as “subject number” as part of data collection.

Therefore, both Oropharyngeal and Nasopharyngeal sample were taken. The sample were sent to lab for RT-PCR test as per guidelines. The cost and expenses for the test RT-PCR were covered by Jabatan Kesihatan Negeri and Hospital. Besides that, they were also given a set of questionnaires as part of continuous improvement for assessment of compliance to PPE in managing Covid-19. Data will be kept anonymous, and no further disciplinary action will be taken following the PPE surveillance if the participants revealed to not fully comply with the PPE regulations.

All the PCR Covid-19 samples have been taken and PPE survey has been done (data already collected). All the data from both HSNZ and HHT were kept in ID unit HSNZ in the form of hardcopy. Anonymised data will be reviewed and extracted into an excel sheet. Only HCW that fulfill both inclusion and exclusion criteria were included in this study.

Research Tool

- The 20 items self-administered questionnaire was constructed based on previous literatures.
- Content validity involved of two Senior Physician. Few amendments were made in terms of questionnaires arrangement and word chosen. After minor correction all of them agreed that the questionnaires can be fully understood.
- Evaluation was done on appropriateness of the questions in terms of relevance, clarity, simplicity and ambiguity in four-point scale.
- Finally, an overall percentage of agreement between them was calculated. Content Validity Index, $(CVI) = (\sum \%) \div N$
- CVI for the entire questionnaire can range from 0 to 1. CVI at least 0.90 was considered as acceptable (Di Lorio, 2005).
- For Face validity, the questionnaire was distributed to 40 participants to identify either all questions was understandable or not.

Content Validity

- The content validity index (CVI) was calculated as below.

- $CVI = (\sum \%) \div N$

$$193.75 \div 2$$

$$= 96.9$$

- CVI score was 0.97 which was more than acceptable value which is 0.90. Therefore, this questionnaire can be used in this study.

Face Validity

- All 40 patients agree that all 20 questions were understandable.

Operational definitions

1. Health-care workers (HCW) defined as all staff in the health care facility involved in the provision of care for a Covid-19 infected patient, including those who have been present in the same area as the patient as well as those who may not have provided direct care to the patient but who have had contact with the patient's body fluids, potentially contaminated items or environmental surfaces. This will include health care professionals, allied health workers and auxiliary health workers such as cleaning and laundry personnel, x-ray physicians and technicians, clerks, phlebotomists, respiratory therapists, nutritionists, social workers, physical therapists, laboratory personnel, cleaners, admission/reception clerks, patient transporters, catering staff etc. (El-Sokkary *et al.*, 2021).

2. SN referred to staff nurse or registered nurse means a person who is admitted to the general part of the Register and who has undergone a three-year Diploma in Nursing Programme at a recognized school College of Nursing or University and passed the Nursing Board Examination (MIDA, 2019)
3. JM referred to community nurse and is defined as a person registered under the supplementary part of the Nurses Act, 1950 and who has undergone two and a half years (2 ½) training in a recognized Community Nurses College (MIDA, 2019)
4. PPK referred to healthcare assistant is a support staff that will assist healthcare professionals under supervision of qualified nursing staff to carry out spectrum of duties including assisting patients with personal care and conducting clinical duties in addition to carrying out, monitoring, and recording the results of medical test which the healthcare professionals will analysed (KKM, 2019).
5. Confirmed Covid-19 case defined as person with a positive RTK-Ag in pre-determined areas/locality with prevalence of Covid-19 > 10% or a person (alive or dead) with a positive molecular test (RT-PCR or rapid molecular). (https://covid-19.moh.gov.my/garis-panduan/garis-panduan-kkm/ANNEX_1_Case_definition_30082021.pdf)
6. Personal protective equipment (PPE) is equipment worn to minimize exposure to hazards that cause serious workplace injuries and illnesses. These injuries and illnesses may result from contact with chemical, radiological, physical, electrical, mechanical, or other workplace hazards. Personal protective equipment may include items such as gloves, safety glasses and shoes, respirators, or coveralls, vests and full body suits. (<https://www.osha.gov/personal-protective-equipment>)

7. Adequate and full PPE defined by all healthcare workers who provide care to PUI or confirmed Covid-19 patients must fulfilled all these five items as outlined by Ministry of Health Malaysia at all the time i.e. N95 mask, isolation gown, gloves, eye protection and head cover. Boot or shoe cover only when anticipating spillage and vomiting.

a) Inpatient facilities

Providing care to PUI/confirmed Covid-19 patients:

- i. N95 mask
- ii. Isolation Gown (fluid-repellent long-sleeved gown)
- iii. Gloves
- iv. Eye Protection (face shield/goggles)
- v. Head cover
- vi. Boot cover/shoe cover (ONLY when anticipating spillage and vomiting)

b) Outside patient room (more than 1-2 meters)

All staff including HCW

Any activity that does not lead to direct contact with PUI/confirmed Covid-19

- i. Surgical mask
- ii. Frequent hand hygiene

(GUIDELINES COVID-19 MANAGEMENT VERSION 5/2020 ANNEX 8: THE INFECTION PREVENTION AND CONTROL (IPC) MEASURES IN MANAGING PATIENT UNDER INVESTIGATION (PUI) OR CONFIRMED CORONA VIRUS DISEASE (COVID-19), n.d.)

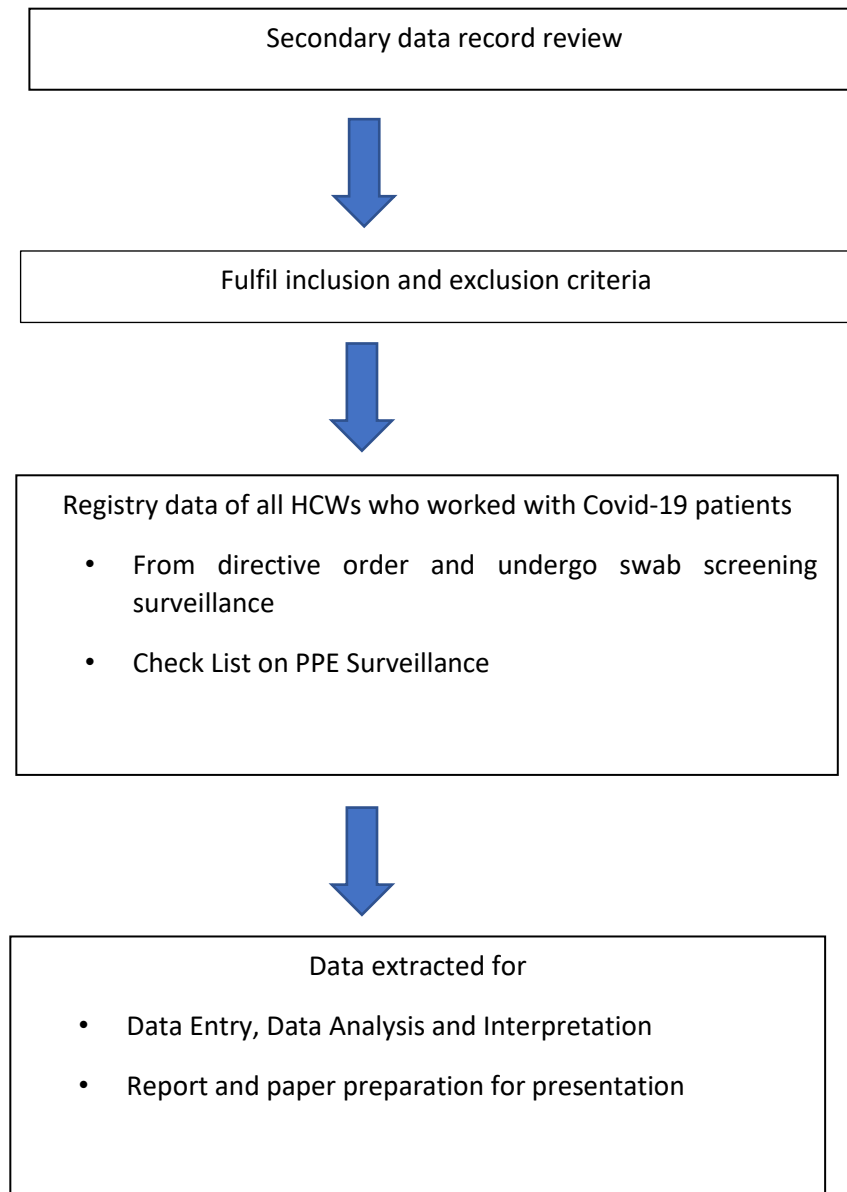
Data collection method

This is a retrospective record review study which involve secondary data review following directive order from Hospital Sultanah Nurzahirah Kuala Terengganu (HSNZ) and Jabatan Kesihatan Negeri Terengganu (JKNT) (reference number: HSNZ.KT.600/1/1/12(48)) (see Appendix 2) for all HCW who provide care to Covid-19 patients to screen for swab sample PCR COVID and PPE assessment prior to return back to non-covid ward routine.

Results dissemination

If required, the results from this study will be informed to the doctors and physician in charge. The information may help doctors to determine the loopholes then eventually improve the adherence to PPE to further reduce risk of Covid-19 infection amongst HCW.

Study flowchart



Data Analysis

Statistical Analysis Plan

All the data obtained will be analyzed using the IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY: IBM Corp. Numerical data will be presented as mean and standard deviation (SD) while categorical data will be presented as frequency (n) and percentage (%). Meanwhile, risk factors for Covid-19 positive and compliance to PPE will be analyzed using simple logistic regression analysis followed by multiple logistic regressions. Variable selection will be performed using forward and backward selection. Then, the most parsimonious model will be chosen to finalize the results.. A p -value < 0.05 will be used as the level of significance.

Expected result(s)

Table 1: Demographic characteristics of healthcare workers who provide care to Covid-19 positive patients and work in Covid-19 related areas

Variables	n(%)	Mean (SD)
Age (Years)		
Gender - Male - Female		
Designation - Medical Assistant - Medical Officer - Nurse		
Working experience (Years)		
Type of working experience		

- Ward - Tent screening - Laboratory		
Duration of exposure - More than 6 weeks - 4 – 6 weeks - 2 – 4 weeks - Less than 2 weeks		
Activity that involved in patient's care - Examine patients - Taking sample swab - Taking vital sign - Aerosolized generating procedure - Blood taking - Serve patients (diet / medication / medications prescribe) - Handling sample - Cleaning patient's room / toilet / lift/ patient's flow - Radiology procedure		
100% compliance to PPE - Hand hygiene before donning - Wearing mask - Fit check mask - Headcover - Face shield - Wearing gown - Shoe cover - Gloves - Hands hygiene each step of doffing		