DEVELOPMENT AND VALIDATION OF QUESTIONNAIRES ON PERCEPTIONS TOWARDS COVID-19 VACCINATION AND ATTITUDE TOWARDS COVID-19 BOOSTER DOSE VACCINATION AMONG HEALTHCARE WORKERS IN MALAYSIA

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LIST OF ABBREVIATIONS

ACoBV	Attitude towards COVID-19 booster dose vaccination
AMOS	Analysis of moment structure
AVE	Average Variance Extracted
CFA	Confirmatory Factor Analysis
CFI	Comparative fix index
Chisq/df	Chi-square/degrees of freedom
CoVaP	COVID-19 vaccination perceptions
CR	Composite reliability
CVI	Content Validity Index
EFA	Exploratory Factor Analysis
FVI	Face Validity Index
GFI	Goodness-of-fit index
I-CVI	Item- Content Validity Index
IC	Internal Consistency
I-FVI	Item- Content Validity Index
JEPeM	Research Ethics Committee (Human) University Sains Malaysia
KMO	Kaiser-Meiyer-Olkin
MI	Modification indices
MOH	Ministry of Health
NFI	Normed Fit Index
PAF	Principal axis factoring
RMSEA	Root mean square error of approximation
S-CVI/Ave	Scale-level Content Validity Index/Average method
SD	Standard deviation
TLI	Tucker-Lewis Index
USM	Universiti Sains Malaysia
WHO	World Health Organisation

LIST OF APPENDICES

PEMBANGUNAN DAN PENGESAHAN SOAL SELIDIK MENGENAI PERSEPSI TERHADAP VAKSINASI COVID-19 DAN SIKAP TERHADAP DOS PENGGALAK VAKSIN COVID-19 DALAM KALANGAN PETUGAS KESIHATAN DI MALAYSIA

ABSTRAK

Berikutan berakhirnya pandemik COVID-19, memahami persepsi dan sikap pekerja penjagaan kesihatan terhadap vaksinasi COVID-19 dan dos penggalak kekal penting untuk mengekalkan kadar vaksinasi yang tinggi dan kesiapsiagaan untuk wabak masa depan. Walau bagaimanapun, terdapat kekurangan instrumen yang disahkan untuk menilai persepsi HCW terhadap vaksinasi COVID-19 dan sikap terhadap dos penggalak. Kajian ini bertujuan untuk membangunkan dan mengesahkan soal selidik Persepsi Vaksinasi COVID-19 (CoVaP) dan Sikap terhadap vaksinasi dos penggalak COVID-19 (ACoBV) dalam kalangan HCW di Malaysia. Kajian literatur dan perbincangan dengan ahli pasukan penyelidik telah dijalankan untuk mengenal pasti kandungan soal selidik CoVaP dan ACoBV. CoVaP awal ialah satu dimensi, skala 12 item, manakala ACoBV awal ialah 22 item di bawah 3 domain. Soal selidik telah menjalani proses pengesahan berurutan, termasuk kandungan, muka, dan kesahan konstruk. Proses pengesahan konstruk dua langkah menggunakan reka bentuk kajian keratan rentas dijalankan secara berurutan; a) Analisis Faktor Penerokaan (EFA) menggunakan data daripada 125 HCW, dan b) Analisis Faktor Pengesahan (CFA) menggunakan data daripada 300 HCW. Kajian ini dijalankan melalui platform bersemuka dan dalam talian. Pertama, analisis EFA soal selidik CoVaP mendedahkan 7 item dengan 2 domain. Analisis seterusnya dengan CFA menunjukkan model dua faktor bagi 7 item dengan tahap indeks kesesuaian kebaikan yang boleh diterima

(Indeks Kebaikan-kesesuaian (GFI) = 0.987, indeks kesesuaian perbandingan (CFI) = 0.999, indeks Tucker-Lewis (TLI) = 0.999, Indeks Kesesuaian Normed (NFI) = 0.987, khi kuasa dua/darjah kebebasan (Chi-kuasa dua/df) = 1.039, dan punca ralat purata kuasa dua anggaran (RMSEA) = 0.011). Untuk kebolehpercayaan, alpha Cronbach adalah memuaskan untuk kedua-dua domain (0.899 dan 0.815). Kedua, untuk soal selidik ACoBV, EFA menunjukkan bahawa 2 daripada 22 item telah dialih keluar, meninggalkan 20 lagi di bawah 3 domain. CFA mengesahkan bahawa soal selidik telah dibina dengan baik. Model tiga faktor dengan 16 item mempunyai indeks kesesuaian yang baik (GFI = 0.907, CFI = 0.965, TLI = 0.946 dan NFI = 0.931). Konsistensi dalaman untuk ACoBV adalah sesuai mengikut Cronbach alpha 0.905, 0.941 dan 0.859 untuk 3 domain. Kesimpulannya, soal selidik CoVaP dan ACoBV ialah alat yang sah dan boleh dipercayai untuk mengukur persepsi HCW terhadap vaksinasi COVID-19 dan sikap terhadap vaksinasi dos penggalak COVID-19. Walau bagaimanapun, memandangkan ini adalah soal selidik yang baru dibangunkan di Malaysia untuk menilai isu tersebut, satu kajian sebenar perlu dijalankan pada masa hadapan untuk mengetahui hasil yang tepat bagi persepsi dan sikap petugas kesihatan ini terhadap vaksin COVID-19 dan dos penggalak.

DEVELOPMENT AND VALIDATION OF QUESTIONNAIRES ON PERCEPTIONS TOWARDS COVID-19 VACCINATION AND ATTITUDE TOWARDS COVID-19 BOOSTER DOSE VACCINATION AMONG HEALTHCARE WORKERS IN MALAYSIA

ABSTRACT

Following the end of the COVID-19 pandemic, understanding healthcare workers' perceptions and attitudes toward COVID-19 vaccination and booster doses remains crucial for maintaining high vaccination rates and preparedness for future outbreaks. However, there is a lack of validated instruments to assess the HCWs' perceptions of COVID-19 vaccination and attitude towards the booster dose. This study aims to develop and validate the COVID-19 Vaccination Perceptions (CoVaP) and Attitude to COVID-19 booster dose vaccination (ACoBV) questionnaires among HCWs in Malaysia. A literature review and discussion with research team members were conducted to identify the content of CoVaP and ACoBV questionnaires. The initial CoVaP is a unidimensional, 12-item scale, while the initial ACoBV was 22 items under 3 domains. The questionnaires underwent a sequential validation process, including content, face, and construct validity. A two-step construct validation process using a cross-sectional study design was conducted sequentially: a) Exploratory Factor Analysis (EFA) using data from 125 HCW, and b) Confirmatory Factor Analysis (CFA) using data from 300 HCW. The study was conducted via both face-to-face and online platforms. First, the EFA analysis of the CoVaP questionnaire revealed seven items with two domains. Subsequent analysis with CFA analysis demonstrated a two-factor model of seven items with an acceptable level of goodness fit indexes (Goodness-of-fit index (GFI) = 0.987comparative fit index (CFI) = 0.999, Tucker-

Lewis index (TLI) = 0.999, Normed Fit Index (NFI) = 0.987, chi-squared/degree of freedom (Chi-square/df) = 1.039, and root mean square error of approximation (RMSEA) = 0.011). For the reliability, Cronbach's alpha coefficient was satisfactory for both domains (0.899 and 0.815). For the ACoBV questionnaire, the EFA analysis showed that two of the 22 items were removed, leaving 20 remaining under three domains. CFA analysis confirmed that the questionnaires were well-constructed. The three-factor model with 16 items had good fit indices (GFI = 0.907, CFI = 0.965, TLI = 0.946 and NFI = 0.931). The internal consistency for the ACoBV was good according to Cronbach alpha coefficients 0.905, 0.941 and 0.859 for three domains. In conclusion, the CoVaP and ACoBV questionnaires are valid and reliable tools for measuring HCWs' perceptions of COVID-19 vaccination and attitudes toward COVID-19 booster dose vaccination. However, since these are the newly developed questionnaires in Malaysia to asses the issue, an actual study needs to be conducted in the future to know the exact outcomes of these perceptions and attitudes of the HCWs towards COVID-19 vaccines and the booster dose.

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

The World Health Organization (WHO) classified the new coronavirus disease 2019 (COVID-19) outbreak a global pandemic on 11 March 2020 (Cucinotta & Vanelli, 2020). The devastating effects of the COVID-19 pandemic have highlighted the critical need for an effective vaccination to keep outbreaks under control. COVID-19 vaccination is acknowledged as the most effective method for preventing severe COVID-19 cases, mitigating the risk of long-term disability, and decreasing COVID-19 mortality rates. Additionally, it is noteworthy that due to the emergence of virus variants and the gradual decline in vaccine efficacy over time, the administration of booster doses to fully vaccinated individuals are being considered in numerous countries. Internationally, clinical trials have assessed the safety and efficacy of booster doses against various virus strains. At the same time, real-world studies have demonstrated that individuals who receive booster doses experience lower infection rates, hospitalisation, critical illness, and mortality (Fu et al., 2023).

Malaysia, similar to other nations, has been actively involved in vaccination campaigns to reduce the spread of the virus. The landscape of COVID-19 vaccination strategies has evolved with the introduction of booster doses, marking a critical juncture in the ongoing fight against the ongoing fight against the pandemic. The importance of an authorized vaccine to safeguard populations from this virus and protect economies from ongoing disruption and damage cannot be emphasized enough. The Malaysian government also recommends that healthcare workers get a booster dose 6 to 12 months after their previous dosage. Even if one had contracted

COVID-19 before, he may get the infection again since the immune body of the person is not protected.

Vaccine hesitancy, which refers to "delays in acceptance or refusal of vaccination despite the availability of vaccination services," is a growing concern worldwide (MacDonald et al., 2015). Edwards et al. (2016) defined vaccine-hesitant individuals as those with differing levels of uncertainty regarding specific vaccines or vaccinations in general. Vaccine hesitancy poses a major obstacle to achieving widespread vaccine uptake and potentially hinders our progress towards reaching the COVID-19 herd immunity threshold. Regarding COVID-19 vaccine hesitancy, other factors have also been influential, such as the rapid development of the vaccines, which has raised public concerns about their safety, and the uncertainty surrounding the long-term effectiveness of the immune response acquired through vaccination (Callaghan et al., 2021; Dror et al., 2020). As the worldwide campaign against COVID-19 infection progresses with booster vaccine dosages, a new obstacle arises in reluctance toward these extra injections. Although clinical trials and real-world investigations have shown improved protection, some people are still hesitant. Addressing concerns and promoting awareness is essential to navigate this phase of the vaccine campaign and achieve universal protection against the developing virus.

Lee et al. (2022) and Tung et al. (2022) conducted study in the United States, America and China, respectively, show a strong interest among participants in getting a booster vaccine for COVID-19 (96.2% and 91.1%, respectively). 74% of people in Israel are willing to get vaccinated, whereas just 51% in Japan and 31% in Hungary show a lower willingness to receive the vaccination (Goodwin et al., 2022). According to a study in Malaysia., only 43.4% of their participants expressed a definite

willingness to receive a COVID-19 booster vaccine (Elnaem et al., 2021). Studies have integrated the Health Belief Model (HBM) into their surveys (Al-Metwali et al., 2021; Kocoglu-Tanyer et al., 2020; Wijesinghe et al., 2021). This model is frequently utilized as a framework for studying psychosocial determinants of health behaviours and is acknowledged as a factor in vaccination uptake. Various factors such as age, gender, education, income, and employment have been linked to the acceptance of the COVID-19 booster vaccine (Abdullah et al., 2023).

There is a need to identify factors that could contribute to COVID-19 vaccination hesitancy, especially among healthcare workers (HCWs), who are at a high risk of being infected with COVID-19. Worldwide, extensive research has been conducted on healthcare workers' views, opinions, and concerns regarding COVID-19 vaccination. These studies, mainly carried out during the pandemic, have highlighted the crucial influence of healthcare workers on public opinion and compliance with vaccination recommendations. However, the context of Malaysia, particularly regarding hesitancy towards booster doses, is still a research area that has yet to be extensively covered in the existing literature. As HCWs can influence patient vaccination uptake, improving their confidence in vaccination and engaging them in activities targeting vaccine hesitancy among their patients is crucial.

Ensuring high vaccination coverage is crucial to safeguard the health and safety of this vital workforce, not only for their own well-being but also for the well-being of their patients, families, communities, and the overall health of our nation. The WHO has listed HCWs as a priority category for COVID-19 immunization. They are also trusted sources of vaccine-related information and can influence the public (MacDonald et al., 2015). This is also in line with the WHO step forward in the fight

against COVID-19 vaccine hesitancy. COVID-19 infection in HCWs may cause a reduction in the workforce during the pandemic (Kwok et al., 2020). Not only that, HCWs who contract COVID-19 can transmit the virus to their patients and coworkers (Kwok et al., 2020). Many of these individuals may have preexisting health issues that make them vulnerable to severe COVID-19 disease. Thus, HCWs with COVID-19 vaccine hesitancy tremendously impact the healthcare system.

Due to the need for studies on this topic, there is an apparent demand for a validated tool specific to the local context in Malaysia. Several validated tools are available worldwide, but their relevance to Malaysia could differ. Creating and validating a questionnaire tailored to Malaysian healthcare workers is essential to guarantee the assessments' cultural and contextual relevance. Studies are needed to assess Malaysian HCWs' vaccine hesitancy, which may be tailored depending on this country's cultural, societal, and personal beliefs. Having adequate information based on local studies can help the government to act and take measures to curb this problem. The study employs a questionnaire as the primary validated tool to evaluate HCWs' perceptions of COVID-19 vaccination and attitudes toward booster doses. The questionnaire will go through thorough development and validation processes to guarantee its reliability and validity in capturing the subtle perspectives of Malaysian healthcare professionals.

In conclusion, this research focuses on increasing the global understanding of healthcare workers' attitudes towards COVID-19 vaccination. It also focuses on filling the gap in literature specific to Malaysia, highlighting the unique considerations related to booster doses. This questionnaire will be a powerful tool for revealing essential insights to enhance public health strategies in Malaysia.

1.2 Problem statement and Study rationale

Healthcare workers worldwide, including Malaysia, have been at the forefront of the battle against the global spread of coronavirus infection. According to reports from developed and underdeveloped countries, significant healthcare workers have contracted COVID-19 (Albaqawi et al., 2021; Ashinyo et al., 2020; Iyengar et al., 2020). In Malaysia, HCWs were significantly more likely to acquire COVID-19 infection than the general population, with a 2.9 times higher incidence risk ratio (Harith et al., 2022). The record shows that it is vital to address potential issues that can arise in the healthcare system, particularly within healthcare facilities. To facilitate this, all HCWs should take COVID-19 vaccines and booster doses to protect themselves. Immunization is essential for safeguarding against the consequences of climate change and the potential for future disease outbreaks. Thus, the booster dose is necessary for a more protective shield and to avoid worse complications.

There were numerous studies regarding the hesitancy, perceptions, and attitudes of HCWs toward COVID-19 (Adane et al., 2022; Fares et al., 2021; Koh et al., 2022; Mohammed et al., 2021). Most of the studies were done during the pandemic. The hesitancy towards COVID-19 vaccines may differ since the pandemic phase has already passed. The existing studies in Malaysia regarding the COVID-19 vaccine hesitancy and perceptions are only being done among the public population. (Lee et al., 2022; Mohamed et al., 2023; Syed Alwi et al., 2021). Even the study regarding COVID-19 booster doses in Malaysia was done among the general population (Lee et al., 2023). More research is needed in Malaysia regarding healthcare workers' views on COVID-19 vaccination, especially booster doses. To address this gap, the study concentrates explicitly on HCWs in Malaysia and their viewpoints regarding both the initial vaccination and booster doses.

An understanding of the HCWs' hesitance towards COVID-19 vaccination has yet to be sought. Assessing perceptions and attitudes towards COVID-19 vaccination and the booster dose could significantly address this issue. Perceptions and attitudes towards COVID-19 vaccination and the booster dose are crucial in determining vaccine hesitancy for future pandemics. Suppose early detection reveals negative perceptions and attitudes. In that case, there is a valuable chance to educate and implement encouraging programs that can assist HCWs in making better choices and adopting healthier lifestyles. The availability of validated tools to examine this topic is relatively lacking, and existing scale validation is not robust enough. Several studies have used the validated and reliable tools used worldwide, mainly among the public (Campo-Arias et al., 2023; eriş, 2022; Kocoglu-Tanyer et al., 2020; Mejia et al., 2021). Development and validation of a questionnaire and their potential implications to assess these issues at the national level is needed. The test assesses comprehension of perception, attitude, and strategies for reinstating vaccine trust.

Besides, the assessment of levels and concerns can also provide valuable insights into the psychological states of HCWs and help identify any perceived barriers or resistance to change (Avakian et al., 2022). There is no validated questionnaire measuring perceptions and attitudes towards COVID-19 vaccination and booster doses among HCWs in Malaysia. So, this study utilizes the development and validation of questionnaires regarding the issues to provide information on the local burden and understanding of this problem. The researchers aim to develop and validate two questionnaires and provide the framework for COVID-19 vaccine hesitancy among HCWs. The findings of this study may help identify the perceptions and attitudes towards both COVID-19 vaccines and the booster using validated tools. Later, this

study can also help policymakers and government prepare for future risks of outbreaks such as COVID-19 or other infectious diseases.

1.3 Research Questions

1. What is the validity and reliability of the perceptions towards the COVID-19 vaccination questionnaire?

2. What is the validity and reliability of the attitude towards the COVID-19 booster dose vaccination questionnaire?

1.4 Objectives of the Study

1.4.1 General Objective

The study aims to develop and validate the perceptions towards COVID-19 vaccination and the attitude towards COVID-19 booster dose vaccination questionnaires among HCWs in Malaysia.

1.4.2 Specific Objectives

1. To develop the perceptions towards the COVID-19 vaccination and attitude towards the COVID-19 booster dose vaccination questionnaires.
2. To determine the validity and reliability of the Perceptions towards COVID-19 Vaccination Questionnaire.
3. To determine the validity and reliability of the Attitude towards COVID-19 Booster Dose Vaccination questionnaire.

1.5 Hypothesis

It is hypothesized that the perceptions towards COVID-19 vaccination and the attitude towards COVID-19 booster dose vaccination questionnaires among HCWs in Malaysia are valid and reliable.

1.6 Operational Definitions

a) COVID-19 vaccination perceptions (CoVaP)

The CoVaP is a newly developed and validated questionnaire that is designed spesifically to measure the perceptions of HCWs towards COVID-19 vaccination issue. There are two domains produced in this scale which are Safety and Efficacy (ES) and Misinformation and Trust Issues (MT). Items inside ES domain more focusing on the effectiveness and safety of the vaccines while MT domain asking regarding the religious issues, vaccines containing electronic chips, and using complementary medicines to protect against COVID-19 infection.

b) Attitude to COVID-19 booster dose vaccination (ACoBV)

Another questionnaire that named ACoBV is also newly created and validated tailored to HCWs in Malaysia to assess their attitude towards COVID-19 booster dose vaccination. The questionnaire divided into three parts according to the Health Belief Model (HBM): 1) Perceived Benefits of Booster Dose (PBB), 2) Perceived Susceptibility of Infection (PSI), and 3) Perceived Barriers (PB). The PBB domain is about the benefits getting from taking the booster dose such as protection of oneself and family members from contracting

COVID-19 and it complications due to the booster dose. Next, PSI domain targeting the risk of getting the infection without taking the booster dose. For instance, high risk to get worse complications of COVID-19 and may spread to other person without booster dose. Last, for the PB domain is mainly asking eiher the booster is not have enough studies on them or any other alternative medicines existed.

c) COVID-19

The disease is caused by the acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus (Hu et al., 2021).

d) COVID-19 vaccination

Vaccines develop against COVID-19 virus. It refers to the primary doses of COVID-19 vaccines (one or two doses of COVID-19 vaccine, depending on the product).

e) COVID-19 booster dose vaccination

A COVID-19 booster dose is defined as the COVID-19 vaccination given after the primary doses have been completed.

f) Healthcare workers

Doctors, nurses, midwives, public health professionals, laboratory technicians, health technicians, medical and non-medical technicians, personal care workers, community health workers, healers, and traditional medicine practitioners are all health workers. Health management and support workers

include cleaners, drivers, hospital administrators, district health managers, and others (WHO, 2022). This study used all types of HCWs working at private and government health facilities in Malaysia.

1.7 Structure of the Thesis

This thesis is organized into six chapters. Chapter 1 outlines the study's goal, covering the research backdrop, problem statement, research questions, objectives, hypothesis, definition of words, and overall thesis framework. Chapter 2 explores the relevant literature to get insight into the problems and research patterns about the COVID-19 vaccine hesitancy, perceptions towards the issue, and attitudes towards the booster dose among HCWs and illustrates the conceptual framework for this study.

Next, Chapter 3 addresses the research methodology used in this study and presents the study's flowchart. Chapter 4 reviews the results of all the analysis procedures. Chapter 5 focuses on discussing the overall findings according to the objectives. Lastly, Chapter 6 concludes by investigating the study overview and recommendations needed for further study.

1.8 Chapter Summary

This chapter elucidated crucial facets of the subject under study and elaborated upon the importance of this research. It also provides a detailed explanation of the issue that this study aims to solve, presents research questions, objectives, and hypotheses, includes key terminology definitions, and gives an overview of the structure of the thesis. Chapter 2 extensively reviews the current body of literature pertinent to this research.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In December 2019, several pneumonia cases were reported in Wuhan, China. January 30th, 2020, marked the declaration of a public health emergency of international concern by the WHO (Dubé et al., 2021). On March 12, 2020, the WHO proclaimed a worldwide pandemic due to the 2019 new coronavirus epidemic (Peeri et al., 2020). The COVID-19 pandemic has spread worldwide, with millions infected, and caused global public health concerns. Fortunately, several vaccinations have been produced and authorized for emergency vaccination (Krause & Gruber, 2020; Ledford et al., 2020). Countries and governing bodies throughout the globe have allocated substantial funds to facilitate the vaccination of their respective populations (Syed Alwi et al., 2021).

Vaccination programs can achieve herd immunity without the need for a large portion of the community to get infected. This type of immunity relies on a significant portion of the vaccinated population. Vaccination is acknowledged as a potent method to decrease and eradicate the impact of COVID-19, but its efficacy relies on the population's readiness to receive the vaccine. Several countries have begun the administration of booster doses due to breakthrough infections, the emergence of novel variations, and a decrease in long-term immunity (Mubarak et al., 2023). Booster doses will be crucial in the public health response to the widespread at a particular stage. A possible concern is the public's acceptance of a booster dosage that the HCWs may influence. The HCWs are a distinct subset of the population that faces a significant risk of infection and serve as a significant source of disease transmission. The seroprevalence of COVID-19 among HCWs was as high as 32.8% (Goenka et al.,

2020; Wiggen et al., 2022). Also, more and more studies show that HCWs are seriously impacted by COVID-19, with high rates of illness and death.

According to a recent systematic review, there have been a total of 152,888 cases of COVID-19 infections among HCWs worldwide, resulting in 1,413 fatalities. Most infections occurred in women (71.6%, n = 14,058) and nurses (38.6%, n = 10,706), whereas the majority of fatalities occurred in males (70.8%, n = 550) and physicians (51.4%, n = 525) (Bandyopadhyay et al., 2020). Hesitancy and suspicion have hindered efforts to provide COVID-19 vaccinations (Mahase, 2021; Paul et al., 2021). This time, it is fitting to acknowledge the successful outcome of the vaccination program and everyone's collective effort, which symbolizes a hopeful step towards a new, everyday world. However, attaining a world free from COVID-19 appeared to be a far-fetched notion.

Now that the pandemic has become endemic and several changes have occurred, including the necessity of a booster dose. After the WHO declared on 1 May 2023 that COVID-19 was no longer categories as a Public Health Emergency of International Concern (PHEIC), Malaysia's Ministry of Health updated rules for using facemasks and reduced the home isolation period from seven to five days (Nizam, 2023). COVID-19 hospitalization and fatality rates in Malaysia have declined because of the high immunization rates among target populations (Hamdan et al., 2022). When social restrictions were removed, this resulted in a transient rise in community infection rates. The accompanying rise in rates of severe comorbid diseases and mortality was nevertheless much less prominent. Later, the booster dosage program, known as PICK-B, started in Malaysia on October 13, 2021, for individuals who had

completed the initial immunization series. The scheme was anticipated to benefit 23 million Malaysians (Hamdan et al., 2024).

To get herd immunity, everyone must take their booster dose to prevent contracting COVID-19 and worsening it. The COVID-19 pandemic will not be eradicated, but its impact on societies and livelihoods will significantly diminish (Hadfield, 2022). Therefore, this hesitancy issue must be tackled because it will be helpful for future pandemic evaluation and preventive measures if this pandemic occurs again.

2.2 COVID-19 vaccine hesitancy

There is a noticeable global hesitancy regarding COVID-19 vaccines (Lin et al., 2020; Sallam, 2021). A study conducted among Asian countries showed that 81.2% of participants believed vaccination effectively prevents and controls COVID-19. In comparison, 84.0% expressed their willingness to receive COVID-19 vaccinations once made accessible (Marzo et al., 2022). Additionally, age, location of residence, educational attainment, career situation, and family financial position are all strongly linked to COVID-19 vaccine reluctance (Marzo et al., 2022).

In Malaysia, the Ministry of Health launched a COVID-19 vaccination campaign on 24 February 2020, providing them accessible to all citizens and residents (Jayaraj et al., 2021). Vaccination rates have seen slower progress in certain countries compared to more economically developed nations like the United Kingdom, the United States, and Israel. Several studies have been conducted to assess the hesitancy toward COVID-19 vaccines in Malaysia; most of the population is willing to get the vaccination, and about 35.5% are unwilling to be vaccinated (Mohamed et al., 2023; Syed Alwi et al., 2021).

HCWs are individuals involved in activities to improve health, whether compensated or not. They face a higher risk of exposure due to the nature of their work, making it crucial to achieve high vaccination rates with timely booster doses in this group. As the first group to receive the vaccine and have extensive knowledge, healthcare workers were frequently regarded as reliable authorities for information on COVID-19 vaccination (Katzman & Katzman, 2021). So, HCWs should provide an excellent example for the community by sharing their genuine experiences and speaking from their own experience.

Nevertheless, they exhibited similar levels of vaccine hesitancy as the general population in various countries (Sallam, 2021). Healthcare workers closely treating COVID-19 patients, including physicians, reported less hesitation. These workers also saw themselves as being at high risk. Over time, their confidence improved as they gained a better understanding of the risks and side effects (Gagneux-Brunon et al., 2021; C. Wang et al., 2020).

2.3 Perceptions towards COVID-19 vaccination

Multiple countries have implemented extensive COVID-19 vaccination programs; however, some individuals remain afraid to accept the vaccine. Globally, 25% of people hesitated to vaccinate against COVID-19 (Fajar et al., 2022). Certain demographic factors and personal beliefs were associated with a higher risk of vaccination hesitancy. Additionally, some individuals who considered COVID-19 vaccines unsafe also exhibited higher levels of hesitancy (Fajar et al., 2022). South Asian governments must execute effective immunization initiatives to achieve high vaccine uptake and coverage among susceptible individuals to prevent the COVID-19 pandemic.

This is because the combined percentage of vaccination hesitancy for COVID-19 among all eight countries was 26.5% (Islam et al., 2023). Afghanistan (37%), Pakistan (33%), and Bangladesh (28.9%) had greater vaccine reluctance among the overall population (29%), community levels (27.9%), and 1–12 months from the first epidemic (27.5%) (Islam et al., 2023). The latest study regarding perceptions towards the COVID-19 vaccine in Malaysia revealed that 52.5% of the population had high perceived risks and benefits. Meanwhile, 55.7% had high perceived barriers (Mohamed et al., 2023). Various factors contribute to vaccine rejections, such as concerns about vaccine safety, uncertainty in decision-making, underlying medical conditions, herd immunity, lack of transparency in data, and preferences for traditional or complementary medicine (Mohamed et al., 2023).

2.4 Attitude towards COVID-19 booster dose vaccination

A meta-analysis (Abdelmoneim et al., 2022) showed that having a COVID-19 virus before made people less likely to want to get the extra dose. On the other hand, individuals who had previously contracted the COVID-19 virus were significantly more inclined to receive an additional dosage. The booster dose was taken by 31% of the subjects in eight studies, while 79% intended to receive it. The acceptance rates for the pooled booster dose varied across different regions. The acceptance rate in the WHO region of the Americas was 77%, while in the Western Pacific region, it was 89%. The European region had an acceptance rate of 86%, while the Eastern Mediterranean region had the lowest acceptance rate at 59% (Abdelmoneim et al., 2022). There has been a high percentage of worldwide adoption of the COVID-19 booster vaccination, although it does vary by region. Nevertheless, widespread vaccination uptake is critical for establishing disease-specific immunity in a population.

For the Southeast Asian region, the acceptance of boosters was only 52%, the lowest among other regions worldwide. Malaysia was also included in one of the countries where only half the population took the booster. The latest data shows that as of 5 January 2024, a significant portion of the Malaysian population has received booster doses. Specifically, 50.1% have received the first booster dose, 84.4% are fully vaccinated with two doses, and 86.2% have received at least one dose (MOH, 2024). Despite the widespread immunization coverage, there exist people who remain apprehensive about receiving a heterologous booster dose (Mohamed et al., 2023). A study resulted in approximately 26.7% of individuals expressing hesitancy toward receiving the second booster of the COVID-19 vaccine in Malaysia (Lee et al., 2023).

2.5 COVID-19 Vaccine Hesitancy among HCWs

The HCW's vaccination protection is key to managing the previous COVID-19 outbreak. The global vaccination rate among HCWs was 77.3%, and the vaccine acceptance rate in trials done in North America was 85.6%, which was higher compared to those done in Europe (72.8%), Asia (79.5%) and Africa (65.6%) (Galanis et al., 2022). Regarding total vaccination uptake, 83.6% of doctors and 77.4% of nurses got the COVID-19 vaccine (Galanis et al., 2022).

A study review found that Whites and Asians were found to have higher vaccine acceptance (Biswas et al., 2021). In Malaysia, there is a positive trend among healthcare workers regarding vaccine acceptance (Mahmud et al., 2023). They display a good attitude towards the vaccine, although they do have concerns about potential future effects and commercial profiteering. Therefore, it is important to address these concerns and focus on improving health education and promotion activities for male workers, particularly in terms of their preference for natural immunity (Mahmud et al., 2023). Table 2.1 shows several prevalences of COVID-19 vaccine hesitancy among HCWs.

Table 2.1 The prevalence of COVID-19 vaccine hesitancy among HCWs

No.	Study	Place/country	Prevalence Hesitancy	Questionnaire Used
1	(Nzaji et al., 2020)	Democratic Republic of Congo	72.3%	• Self-administered questionnaire, developed based on the "Exposure Risk Assessment in the context of COVID-19".
2	(Barry et al., 2021)	Saudi Arabia	30%	• A pilot-validated, self-administered questionnaire.
3	(Day et al., 2021)	Texas	24.1%	• Non-validated questionnaire.
4	(Kwok et al., 2021)	Hong Kong	27%	• 15-item tool based on a "5C model" of psychological vaccine antecedents.
5	(Gagneux-Brunon et al., 2021)	France	23.1%	• An anonymous online survey and a written questionnaire.
6	(Mohammed et al., 2021)	Ethiopia	60.3%	• Pre-tested semi-structured questionnaire.
7	(Pal et al., 2021)	United State	7.9%	• A modified online English language survey instrument was developed from a previously published study.
8	(Aw et al., 2022)	Singapore	48.5%	• A questionnaire was designed and pilot-tested after a scoping review.
9	(Thomas et al., 2022)	Minneapolis	11.6%	• English survey was translated into Spanish by a bilingual research author and piloted.

Table 2.1 Continued

No.	Study	Place/country	Prevalence Hesitancy	Questionnaire Used
10	(Koh et al., 2022)	Singapore	5.1%	• Self-administered questionnaire, developed based on the "Exposure Risk Assessment in the context of COVID-19".
11	(İkiışık et al., 2022)	Turkey	49.7%	• The Google Forms survey was created, and the web-based questionnaire link was established.
12	(Avakian et al., 2022)	Greece	14.7%	• An anonymous online questionnaire was created.
13	(Theophilus et al., 2022)	Michigan	28.6%	• The survey that the authors themselves designed.
14	(Aseneh et al., 2023)	Cameroon, Nigeria	Total:50.7%, Cameroon: 56.9%, Nigeria: 42.2%	• A secure online Google Form was created to self-administer the WHO's standardized questionnaire.
15	(Bnqadeem et al., 2023)	Yemen	31.2% with efficacy of 90%, 60.6% with efficacy of 70%, 85.7% with efficacy of 50%	• A self-administered survey that was initially formulated in English was subsequently translated into Arabic.

Various studies have been conducted to gain insights into the factors contributing to vaccine hesitancy surrounding COVID-19. The studies also shed light on the common concerns and barriers that can impact vaccine acceptance. Through careful analysis and strategic action, public health authorities can implement effective interventions to improve vaccine acceptance among HCWs. This will positively impact overall vaccination rates and play a crucial role in curbing the spread of the COVID-19 pandemic. Research has also shown that HCWs worldwide are hesitant to be vaccinated against COVID-19.

The main reasons for this reluctance include worries about the vaccine's safety, effectiveness, and possible adverse effects (Biswas et al., 2021). HCWs are crucial in encouraging the general population to accept COVID-19 vaccination. The lack of adherence to COVID-19 immunization among healthcare workers poses a significant threat to healthcare systems and public health. It is necessary to have a comprehensive understanding of the factors that impact healthcare workers' choices regarding the COVID-19 vaccine. This knowledge will help develop customized communication strategies for those hesitant to vaccinate.

The effectiveness of the COVID-19 vaccine can be enhanced or restored with booster shots, which help maintain a strong level of protection over time (Tregoning et al., 2021). Vaccination programs only work well when the target population is more resilient and accepting of them. There is evidence indicating that a significant number of fully vaccinated individuals in the public are reluctant to receive a COVID-19 vaccination booster shot (Pal et al., 2021; Yoshida et al., 2022). Worldwide, HCWs had a 66% acceptance rate for the booster dose of COVID-19 vaccines (Abdelmoneim et al., 2022).

The low acceptance rate of booster doses among HCWs is concerning and warrants further investigation in future studies (Abdelmoneim et al., 2022). Also, about one-fifth of Malaysians expressed hesitancy in receiving the second booster dose of the COVID-19 vaccination (Lee et al., 2023) but there is no study regarding HCWs. This current study will help develop a new scale to identify the perceptions and attitudes of HCWs toward COVID-19 vaccination and booster dose vaccination. Even though the HCWs may be vaccinated, their hesitancy toward vaccines was not investigated. Thus, it may wrongly influence the public not to be vaccinated.

In a systematic review and meta-analysis, they found that overall, 50% of HCWs opposed general population vaccination mandates, while 36% opposed HCW vaccine mandates (Politis et al., 2023). According to these numbers, obligatory COVID-19 vaccination of HCWs and the general community is a highly contentious issue among HCWs.

2.6 Validated questionnaires related to Perception towards COVID-19 vaccination among HCWs

Surveys or questionnaires are typically used to gather data on the studies of HCWs' perceptions, attitudes, beliefs, and intentions toward COVID-19 vaccination (Koh et al., 2022; Kwok et al., 2021; Theophilus et al., 2022). Both surveys and questionnaires are tools commonly used in multiple fields, such as research and marketing, to collect data, opinions, and feedback from targeted groups. Thus, this study utilises questionnaires to collect the data because of the many benefits of these tools, which can be easily distributed and managed remotely.

In addition, questionnaires offer a highly effective method for gathering data from various participants. The standardized format of questionnaires facilitates data analysis and allows for easy comparison between different responses. This tool's anonymity is also valuable, allowing respondents to remain anonymous and promoting honest responses.

Several pre-existing questionnaires have been developed among HCWs to determine vaccine hesitancy towards COVID-19 vaccination. However, there are few studies regarding perceptions towards COVID-19 vaccination and attitudes towards the booster dose for specific general HCWs. Most of the studies were done during the pandemic and outside Malaysia, which has different cultures, sensitivity and norms. The ready questionnaires may be too brief, specifically during the pandemic, making this study strongly need to be assessed just after the pandemic. Since no validated questionnaire is available after the pandemic has ended, there is a need to construct, develop, and validate the new questionnaire. Table 2.2 presents a summary of the available scales assessing the perceptions towards COVID-19 vaccination among HCWs.

Table 2.2 Summary of the questionnaires assessing perceptions towards COVID-19 vaccination among HCWs

No.	Study	Characteristics measured	Total items	Limitation
1	(Noushad et al., 2021)	**General attitudes toward COVID-19 vaccines** Targeted group: HCWs in Saudi Arabia. - A five-point scale. - A pilot study was conducted with 10 individuals, followed by consultation with four specialists in the field.	6 items	The study just mentioned the pilot study only; no further validation was done.
2	(Fares et al., 2021)	**Perception and attitude of HCWs in Egypt toward COVID-19 vaccines** Targeted group: HCWs in Egypt. - A five-point rating scale. - Experts assessed the coherence, fairness, and linguistic clarity. - Reliability tested with Cronbach alpha of the Arabic version scored 0.684 for perception and 0.618 for attitude parts, while the English version scored 0.638 for perception and 0.571 for attitude components.	18 items	The questionnaire's development does not include a validation process but only mentions the reliability test, which is the Cronbach alpha value.
3	(H. Wang et al., 2022)	**COVID-19 Vaccine Hesitancy Scale (VHS)** Targeted group: Medical care workers in China. - A five-point Likert-type rating scale. - It has 3 dimensions: complacency, confidence, and convenience. - The Cronbach's α coefficients were 0.930 for complacency, 0.944 for confidence, and 0.864 for convenience.	6 items	The revised questionnaire from the previous study only did the reliability test, Cronbach alpha.

Table 2.2 Continued

No.	Study	Characteristics measured	Total items	Limitation
4	(Avakian et al., 2022)	**Knowledge, attitude and practice (KAP) regarding vaccinations.** Targeted group: Greek HCWs and Administrative Officer - An expert team (an epidemiologist, an occupational health professional, and a public health specialist) reviewed the study. - They were in charge of validating the questionnaire in terms of its face and content. - The initial questionnaire was pilot tested to assess completion speed, question clarity for experts from different fields, and the functionality of the online form. - The questionnaire's internal consistency and reliability were evaluated by calculating a Cronbach's alpha score of 0.70.	25 items	The study only stated that the scale had undergone face and content validity; also, internal consistency and reliability were shown using Cronbach alpha.
5	(Koh et al., 2022)	**5C Psychological antecedents of vaccination questionnaire** Targeted group: Primary HCWs in Singapore. 7-point Likert scale. Content validity: - Five domain experts in vaccinations within primary care provided feedback to assess the representativeness of the questionnaire's question items for the overall domain being measured. Face validity: - 10 HCWs from various departments will review the informed consent form and conduct the questionnaire to assess the comprehension of the targeted respondents on the question items.	15 items	There were no exploratory and confirmatory factor analyses being done; only content and face validity were involved.