



**RISK FACTORS OF COVID-19 TRANSMISSION AMONG HEALTH WORKERS  
IN SOUTHEAST ASIA**

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**ABSTRACT**

The transmission of Covid-19 to health workers is an important issue in the pandemic era. Health workers are the front line in handling Covid-19 so they are very vulnerable to being exposed to and even contracting Covid-19 disease. It is necessary to conduct an assessment of the factors that influence the transmission of Covid-19 to health workers, especially in the Southeast Asian Region. The aim of the systematic review is to examine the factors that influence the transmission of Covid-19 cases to health workers in Southeast Asia. The research journal database was retrieved by accessing PubMed and Google Scholar, and using the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) method using the keywords “risk factors” AND “transmission” AND “Covid-19” AND “health workers”. After going through a series of selections, 11 research journals of 241 journals found that were published in 2020-2023 and were considered relevant for study. Based on the results and discussion of the systematic review, it is known that the factors that influence the transmission of Covid-19 to health workers in Southeast Asia are: average age, type of profession, comorbid history, travel history, community contact at work, contact with Covid-19 patients, adherence to the use of PPE and implementing health protocols, levels of workload, levels of stress and immunization status of health workers.

Keywords: covid-19; health workers; risk factors; southeast asia

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**INTRODUCTION**

In early 2020 the Coronavirus Disease-19 (Covid-19) outbreak has spread to all countries in the world. Since January 2020 WHO declared the world in a global emergency related to the Covid-19 virus. The Covid-19 outbreak was designated a global pandemic by WHO on March 11, 2020, with a 13-fold increase in the number of cases reported outside of China. The transmission of Covid-19 to health workers is an important issue in this pandemic era. Covid-19 cases not only occur in the general public, but also in health workers who are at the forefront of handling Covid-19 so that they are very vulnerable to exposure and even contracting infectious diseases (Zhan et al, 2020). Reporting on September 22, 2020 the number of positive cases of Covid-19 in the world reached 30,949,804 cases with a CFR of 3.1%, and in Indonesia the total confirmed cases of Covid-19 were 248,852 cases with a CFR 3.9%. Covid-19 cases among health workers in the world reached 25 thousand consisting of doctors, nurses, midwives, analysts, pharmacists and others.

The Indonesian Covid-19 task force reported that every 100 people who died, there were 6-8 people who were health workers. Data entered on August 1, the number of deaths of health

workers in Indonesia due to Covid-19 was 153 cases (Parwanto, 2020). In Malaysia, the government has reported that 5.8% of positive cases are health workers. The International Council of Nurses noted that as of May 5, 2020 more than 90,000 health workers in the world were infected with Covid-19, and it is even predicted to exceed that number. The burden experienced by health workers is very heavy. In addition to working against new pathogens and trying to save lives, they must also protect themselves from the virus in order to continue working and not spread the virus to their patients, colleagues, friends and family. Working on the front lines, many healthcare workers have lost their lives (Harist et al., 2022). At that time, the high rate of transmission and death of health workers is very worrying. The government's efforts to increase the capacity of health services by providing Covid-19 patient services at public health center, Covid-19 special hospitals, providing referral hospitals, and adding medical equipment such as ventilators, will ultimately be in vain if health workers resources are not available.

The death of medical personnel due to Covid-19, especially doctors and nurses, is increasing. The latest data shows that around 130 doctors (as of October 20, 2020) died due to Covid-19. Based on the data from the Influence of Health Workers Death Index (IPKN) until July 21, 2020, the ratio of deaths of medical personnel and health workers compared to the total confirmed deaths of Covid-19 in Indonesia is one of the highest among other countries, namely 2.4%. This is due to the lack of PPE, age, gender, the presence of comorbidities, the lack of good patient screening in health facilities, fatigue of medical personnel due to the increasing number of Covid-19 patients and long working hours, and psychological pressure. These things make medical personnel very vulnerable to Covid-19 infection. Poor body and mental conditions due to this can eventually also cause health workers to be infested and die. In fact, medical personnel are one of the spearheads of efforts to deal with Covid-19.

Various studies have explained the transmission of Covid-19 cases in health workers, but each country in the Southeast Asia region has research results that can be the same or different on the picture of transmissions of Covid-19 cases in health workers seen from the average age, type of profession, comorbid history, travel history, community contact at work, contact with Covid-19 patients, compliance with the use of PPE and carrying out health protocols, workload and stress levels and immunization status in health workers so that it can be seen that the purpose of this systematic review is to examine the risk factors for transmission of Covid-19 cases in health workers in Southeast Asia. Risk factors for Covid-19 transmission in health workers are important to study, knowing the risk factors can help medical personnel in determining priorities and also the right treatment to minimize the possibility of death in medical personnel as the frontline of health services.

In addition, this systematic review aims to provide an overview of the similarities in risk factors for Covid-19 transmission in the Southeast Asia region, making it easier for health workers to identify disease transmission, diagnose Covid-19 disease, improve the early alert system and prevent the spread of Covid-19 disease, and provide proper treatment for Covid-19 sufferers. The novelty of this research study is that systematic reviews on the risk factors for transmission of Covid-19 cases among health workers in Southeast Asia are still rare.

## **METHOD**

The method used in this review is the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) method. This method is carried out systematically by following the correct research stages. Eligibility criteria in this review by including all research journals on the transmission of Covid-19 cases to health workers in the Southeast Asia region found. The

inclusion criteria in this study are articles published from 2020 to 2023, free full text articles, not systematic reviews or literature reviews, focusing on the risk of transmission of Covid-19 to health workers in the Southeast Asia region, and research respondents are health workers. While the exclusion criteria are incomplete articles, cannot be opened and are review articles (not original research), paid articles, respondents are not health workers and not research in the Southeast Asia region.

The article search used Pubmed and Google Scholar database with the keywords “risk factors” AND “transmission” AND “Covid-19” AND “health workers”. A total of 241 articles were found in the initial search. A total of 88 articles were excluded because the sample population was not in the Southeast Asian region, resulting in 153 articles. Through reading the title, a total of 3 articles were excluded because they were systematic reviews, and 3 articles were excluded because of duplication until 147 articles were obtained. After reading the abstract, the researcher decided to exclude 132 articles because the sample was not health workers and did not focus on discussing the risk factors for Covid-19 transmission in health workers. In the next stage, researchers excluded 4 articles because they could not be accessed in full. Thus, 11 articles were obtained that were relevant to the objectives of this study (Diagram 1). The quality of the selected research articles was assessed based on the quality of inclusion and exclusion.

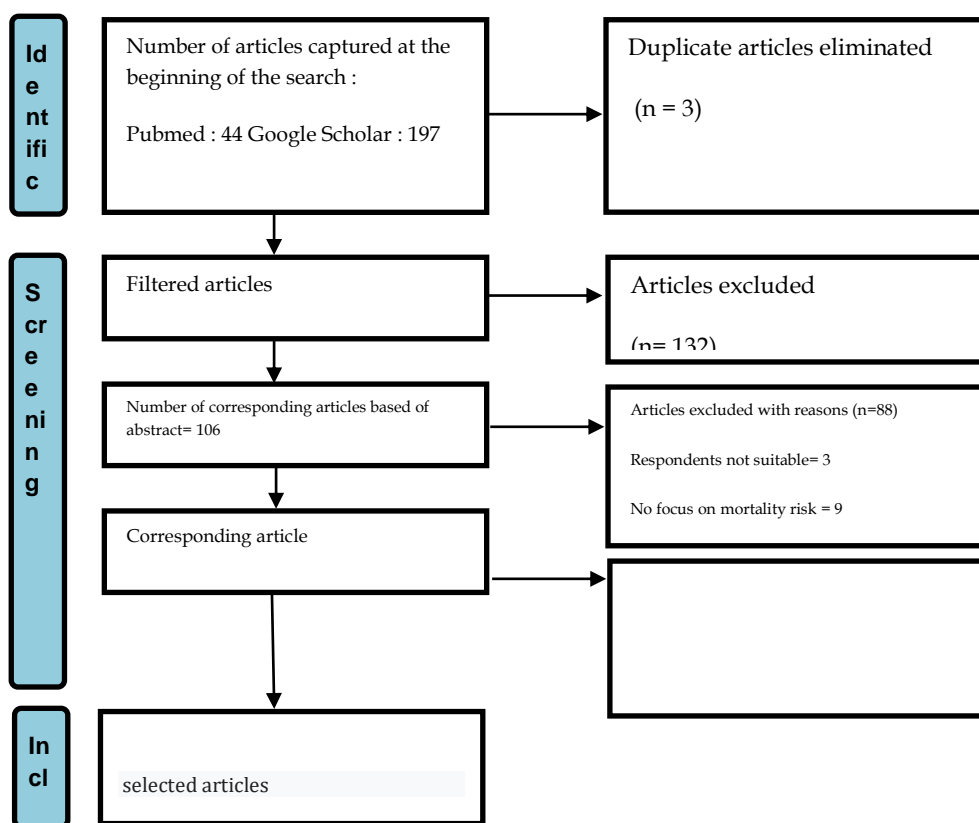


Diagram 1. PRISMA Flowchart

The quality assessment of research articles can be seen from the following inclusion criteria:

Table 1.  
Quality Assessment of Research Articles

No	Indicator	Setyarni, et all (2021)			Yap, et all (2023)			Banjanahor (2021)			Chua, et all (2021)			Ismawati, et all (2022)			Hestanti, et all (2022)			Nguyen, et all (2022)			Tanti, et all (2022)			Wong, et all (2023)			Harits, et all (2022)			Sirijatuphat, et all (2022)					
		Y	N	O	Y	N	O	Y	N	O	Y	N	O	Y	N	O	Y	N	O	Y	N	O	Y	N	O	Y	N	O	Y	N	O	Y	N	O			
1	Are the selected journals published in 2020-2023?	v			v			v			v			v			v			v			v			v			v			v			v		
2	Was the research conducted in Southeast Asia?	v			v			v			v			v			v			v			v			v			v			v			v		
3	Can the selected journal be accessed free full text, not paid?	v			v			v			v			v			v			v			v			v			v			v			v		
4	Is the selected journal an original research, not a systematic review/literature review?	v			v			v			v			v			v			v			v			v			v			v			v		
5	Is the research question or objective in this paper clearly and appropriately stated?	v			v			v			v			v			v			v			v			v			v			v			v		
6	Is the research sample population clearly defined and defined, namely health workers?	v			v			v			v			v			v			v			v			v			v			v			v		
7	did the author include sample size justification?	v			v			v			v			v			v			v			v			v			v			v			v		
8	are the definitions, algorithms or processes used to identify or select cases valid, reliable and applied consistently across all study participants?	v			v			v			v			v			v			v			v			v			v			v			v		

No	Indicator	Setyari ni, et all (2021)			Yap, et all (2023)			Banjar nahor (2021)			Chua, et all (2021)			Ismaw ati, et all (2022)			Hestant i, et all (2022)			Nguye n, et all (2022)			Tanti, et all (2022)			Wong, et all (2023)			Harits, et all (2022)			Sirijatu phat, et all (2022)					
		Y	N	O	Y	N	O	Y	N	O	Y	N	O	Y	N	O	Y	N	O	Y	N	O	Y	N	O	Y	N	O	Y	N	O	Y	N	O			
9	were key potential confounding variables measured and statistically adjusted for in the analysis? did the researcher take matching into account during study analysis?	v			v			v			v			v			v			v			v			v			v			v			v		

**RESULTS**

The number of articles selected for systematic review in this research was 11 articles which are presented in Table 2. All of these articles were research articles conducted with a sample of health workers in the Southeast Asia region, consisting of 5 studies conducted in Indonesia, 2 in Malaysia, 2 in Singapore, 1 in Vietnam and 1 in Thailand. Meanwhile, 1 other article examines 9 regions of Southeast Asia, namely Indonesia, Singapore, Malaysia, Vietnam, Thailand, Brunei Darussalam, Cambodia, Myanmar and the Philippines, so the total area involved is 9 regions.

Table 2.  
Journal search results

Author	Research Title	Year	Place of research	Research Results
Setyarini, et all	Analisa Faktor Resiko Penularan Pada Petugas Kesehatan di Era Pandemi Covid-19 di Kabupaten Jombang. (Analysis of Risk Factors for Infection among Health Workers in the Covid-19 Pandemic Era in Jombang Regency).	2021	Indonesia	Statistical test results Showing that the risk factors for transmitting Covid-19 to health workers are a history of comorbidities with a P-value of 0.00<0.05 (OR = 33.0), and a history of travel from The risk zone obtained P-value 0.00<0.05 (OR = 7.545). History of close contact with staff health or contact with suspected Covid-19 patients P-value 0.436>0.005 (OR = 1.339), history of washing hands with soap P value 1.000>0.05 (OR = 0.9060).
Yap, et all	Factors Associated With Nosocomial Covid-19 Infection Among Health Care Workers in an Urban-Setting Malaysia Hospital	2023	Malaysia	Descriptive test results show that 781 health workers infected with Covid-19 have an average age of 33.8 years. Infected healthcare workers the majority were female (67.7%) with Malay ethnicity (87.2%). More health workers are infected from community transmission compared with workplace transmission (62.6% vs 37.4%). Most of the infected health workers (81.2%) were not have a known medical illness. Reported medical illness The most common is hypertension (5.2%), followed by asthma bronchial disease (4.0%) and diabetes

Author	Research Title	Year	Place of research	Research Results
				<p>mellitus (2.7%).</p> <p>In the profession, the highest number of Covid-19 infections were among nurses (39.6%), with an infectivity rate of 13.8% of the total 2382 nurse in hospital.</p> <p>Among the 509 health workers who were fully vaccinated, on average the second dose of vaccine was given until they were infected with COVID-19 is 103.9 officers.</p> <p>In univariable analysis, gender, age group, ethnicity, presence symptoms, vaccination status, employment, and involvement in care COVID-19 patients were significantly associated with the source of infection COVID-19.</p> <p>In multivariable logistic regression analysis, women (OR = 0.61, 95% confidence interval [95% CI]: [0.42, 0.88]), aged 30 years (30-39 years: OR = 0.66, 95% CI: [0.46, 0.95]; 40 years: OR = 0.60, 95% CI: [0.37, 0.97]), fully vaccinated (OR = 0.36, 95% CI: [0.25, 0.52]), and working as clinical support staff (OR = 0.58, 95% CI: [0.36, 0.95]) was significantly associated with the probability of transmission COVID-19 in the workplace is lower compared to community transmission. Contact with Covid-19 sufferers has a significant influence on Covid-19 transmission with a p value &lt;0.01</p>
Banjarnahor	Analisa Penularan Covid-19 Pada Perawat di Rumah Sakit. (Analysis of Covid-19 Transmission to Nurses in Hospitals).	2021	Indonesia	The results of the study showed that transmission of Covid-19 to nurses occurred due to a history of contact with Covid-19 patients (80.6%), the habit of eating together with colleagues (67.7%), caring for patients with confirmed Covid-19 in non-isolation rooms. (67.7%), history of contact with hospital staff who confirmed Covid-19 (51.6%), and visiting crowded places (45.2%)
Chua, et all	Factors associated with high compliance behaviour against COVID-19 in the early phase of pandemic: a cross sectional study in 12 Asian countries	2021	Indonesia Singapore Malaysia Brunei Darussalam Vietnamese Thailand Cambodia Myanmar Philippines And East	<p>The research results show that being a health worker has a significant influence on the transmission of Covid-19 with a p value &lt;0.01</p> <p>Interacting with lots of people has a significant influence on the transmission of Covid-19 with a p value &lt;0.01</p> <p>Contact with Covid-19 sufferers has a significant influence on Covid-19 transmission with a p value &lt;0.01</p> <p>Compliance with using masks has a</p>

Author	Research Title	Year	Place of research	Research Results
			Asian Countries	significant influence on the transmission of Covid-19 with a p value <0.01 Maintain personal hygiene has a significant influence on the transmission of Covid-19 with a p value <0.01 And covering your mouth when coughing and sneezing has a significant effect on the transmission of Covid-19 with a p value <0.01
Ismawati, et all	Analisis Faktor-Faktor yang Berhubungan dengan Covid-19 Pada Petugas Kesehatan di Kabupaten Indramayu. (Analysis of factors related to Covid-19 among health workers in Indramayu Regency).	2022	Indramayu, Indonesia	Bivariate analysis results The results showed that there was a significant relationship between age ( $P = 0.043$ ), type of profession ( $P = 0.0001$ ) and history of contact ( $P = 0.0001$ ) with Covid-19 cases in health workers in Indramayu Regency 2021.
Hestanti, et all	Faktor Resiko Kejadian Covid-19 Pada Tenaga Kesehatan. (Risk Factors for Covid-19 Incidents in Health Workers).	2022	Lampung, Indonesia	The results of statistical analysis show that there is a relationship significant relationship between the incidence of COVID-19 and compliance with the 5M health protocol ( $P = 0.000$ ), compliance with the use of PPE ( $P = 0.001$ ), routine disinfection of rooms ( $0.000$ ) and work environment which corresponds to the standard ( $P = 0.000$ ) based on the multiple logistic regression test, the most variables were found The dominant factor associated with the incidence of COVID-19 is compliance with the 5M health protocol (OR= 13,066)
Nguyen et all	Mental Health Problems Among Front-Line Health care Workers Caring for Covid-19 Patient in Vietnam : A Mix Methode Study	2022	Vietnamese	The research results show that the level of stress in health workers influences the transmission of Covid-19 to health workers Age, type of profession of health workers, and the space where health workers work influence the stress level of health workers and influence the transmission of Covid-19 to health workers.
Tanti et all	Faktor-Faktor Penyebab Covid-19 Pada Pegawai UPTD Pada Pegawai UPTD Laboratorium Kesehatan Daerah Dinas Kesehatan Provinsi Lampung Tahun 2022. (Factors Causing Covid-19 in Regional Health Laboratory Employees of Lampung Provincial	2022	Lampung Indonesia	The research results obtained are available the relationship between workload and the incidence of covid 19 at the UPTD LAB KESDA Department Lampung Province Health with a p value of 0.000. There is a relationship between stress levels and the incidence of Covid 19 in the UPTD LAB KESDA Lampung Provincial Health Service with a p value of 0.001. There is an immune connection with the Covid 19 incident at the UPTD

Author	Research Title	Year	Place of research	Research Results
	Health Service in 2022).			LAB KESDA Provincial Health Service Lampung with a p value of 0.000.
Wong et all	Healthcare workers in Singapore infected with COVID-19: 23 January-17 April 2020	2020	Singapore	The research results showed that 88 health workers were infected with Covid-19. Average age 35 years. A total of 63.6% were in direct contact with patients, 15.9% were doctors, 11.4% were nurses and 44.3% were medical assistants. Close contact with confirmed family also influences the transmission of Covid-19 to health workers by 27.8%, community contact between medical workers at work by 16.7% and social interaction by 15.3%.
Harits, et all	Incidence, Prevalence, and Sources of COVID-19 Infection among Healthcare Workers in Hospitals in Malaysia	2022	Malaysia	Period prevalence of COVID-19 infections and mortality rates among officers health in Malaysia are 1.03% and 0.0019% respectively. Most infections originate from work (53.3%); a total of 36.3% occurred among staff; a total of 17.0% occurred between patients and staff; and 43.2% came from the community. Health workers have a risk ratio of 2.9 times more higher risk of contracting COVID-19 infection compared to the general population. The nursing profession is occupational groups were most frequently infected (40.5%), followed by medical doctors and specialists (24.1%), and health assistants (9.7%). The top three work units that recorded COVID-19 infections are the medical work unit (23.3%), emergency work unit (17.7%), and administration and management manage hospitals (9.1%).
Sirijatuphat, et all	Prevalence and factors associated with COVID-19 among healthcare workers at a university hospital in Thailand	2022	Thailand	The research results showed that 60 health workers (4.2%) were infected with COVID-19; 2 are medical officers and 58 are non-medical health officers. The prevalence of COVID-19 among medical health workers is 1.7% (2/167), and 4.6% (58/1265) in non-medical health workers (P = 0.04). Non-medical health workers, non-medical staff, history contact with confirmed COVID-19 cases at home/family, unvaccinated status, compliance with personal protective equipment (PPE) standards, and Comorbid disease with pneumonia significantly influenced the transmission of COVID-19 (P < 0.05). Medical health worker, history of contact with confirmed COVID-19 cases in clinical care areas in hospitals, status vaccination, good compliance with PPE



Author	Research Title	Year	Place of research	Research Results
				standards, and comorbidity with upper respiratory tract infections significantly influenced COVID 19 transmission ( $P < 0.05$ ). Multivariate analysis revealed exposure history with confirmed cases COVID-19 at home or in the family, unvaccinated status, non-medical healthcare workers, non-medical staff, fair compliance with PPE standards be an independent factor associated with COVID-19 in health workers.

## DISCUSSION

### Age

Based on the results of a systematic review of 11 articles, it was found that 4 articles stated that age had a significant influence on the transmission of Covid-19 to health workers in Indonesia, Malaysia, Vietnam and Singapore (Ismawati, et al., 2022; Nguyen, et al., 2022; Wong, et al., 2020 and Yap, et al., 2023). This shows that there are similar risk factors in the Southeast Asia region, which shows that the average age of health workers infected with Covid-19 is 33-35 years. In line with research conducted by Putri, et al., 2021, those aged  $< 50$  years can be infected with Covid-19 more often due to the high mobility of productive age residents and non-compliance with the implementation of health protocols compared to residents aged  $> 50$  years.

### Type of job/profession

Research conducted in Malaysia revealed that Covid-19 transmission was highest among nurses (39.6%), with an infectivity rate of 13.8 % of a total of 2382 nurses in hospitals (Yap, et al, 2023). Meanwhile, research by Chua, 2021 in 10 countries in the Southeast Asia region, stated that health workers had a significant influence on the transmission of Covid-19 with  $p < 0.01$ . Another study stated that Covid-19 infected 15.9% of doctors, 11.4% of nurses and 44.3% of medical assistants (Wong et al, 2020). In line with research conducted by Nguyen et al, 2022; Ismawati, et al, 2022; and Sirijatuphat et al, 2022, researchers Harits et al, 2022 also stated that health workers have a risk ratio 2.9 times higher to contract COVID-19 infection compared to the general population. The nursing profession is the occupational group most frequently infected (40.5%), followed by general practitioners and specialists (24.1%), and health assistants (9.7%).

### Comorbid History

A history of comorbidities is one of the risk factors for transmitting Covid-19 to health workers in the Southeast Asia region, this was explained in research conducted in Indonesia by Setyarini et al (2021) and in Thailand by Sirijatuphat et al (2022) which stated the results Statistical tests show that the risk factor for transmitting Covid-19 to health workers is a history of comorbidities with a p-value of 0.000 ( $< 0.05$ ) (OR = 33.0). Comorbidity with upper respiratory tract infection significantly influences the transmission of COVID 19 ( $P < 0.05$ ) in health workers.

Other research in Thailand also showed similar things, hypertension, diabetes, cardiovascular disease and chronic kidney disease were the most common comorbidities found in Covid-19 patients (Naorungroj et al. , 2023) .

### **Workload and stress levels**

The workload and stress experienced by health workers when providing services to Covid-19 patients is one of the risk factors for transmitting Covid-19 to officers due to decreased immunity of officers if anxiety occurs while on duty. Based on the results of a systematic review conducted, this is explained in research by Nguyen et al., 2022; and Tanti et al., 2022 where research results showed that there was a relationship between workload and the incidence of Covid-19 at the UPTD LAB KESDA of the Lampung Provincial Health Service with a p value of 0.000 and there was a relationship between stress levels and the incidence of Covid-19 at the UPTD LAB KESDA of the Provincial Health Service Lampung with a p value of 0.001.

### **Travel History and Community Contacts**

What the research results in Indonesia and other Southeast Asian countries have in common is that health workers' travel history and community contact in the form of eating with colleagues, social interactions with the community, social interactions in the workplace are significant factors in the transmission of Covid-19 among staff. health. This was revealed by analysis of bivariate relationships with the results of interacting with many people having a significant influence on the transmission of Covid-19 with a p value <0.01 (Banjarnahor, et al., 2021; Chua, et al., 2021; Nguyen, et al., 2021; Nguyen, et al., 2021; Chua, et al., 2021; Nguyen, et al., 2022; Wong, et al., 2020, Harits et al., 2022 and Yap, et al., 2023).

### **Compliance with the use of PPE and implementation of health protocols**

Compliance with the use of PPE and implementation of health protocols are risk factors for Covid-19 transmission in 3 articles by Chua et al., 2021; Hestanti et al., 2022; and Sirijatuphat, 2022. This shows that the transmission of Covid-19 to health workers in the Southeast Asia region is influenced by compliance with the use of PPE and the implementation of health protocols when providing services to patients with confirmed Covid-19. This is in line with research conducted by Theopilus et al. (2020) which states that using PPE correctly and implementing health protocols can reduce the risk of contracting Covid-19 in health workers, such as using masks, face shields and gloves is very important in preventing the transmission of COVID -19.

### **Contact with confirmed Covid-19 patients**

Seven articles based on the results of a systematic review discuss the significant influence of contact with confirmed Covid- 19 patients on health workers in the Southeast Asia region. Health workers as the front guard providing treatment services for Covid-19 patients will of course always be in contact with patients. The research results show that contact with Covid-19 sufferers has a significant influence on the transmission of Covid-19 with a p value <0.01 (Chua.et al., 2021). Transmission of covid-19 can be through droplets that come out the respiratory air when the patient coughs and sneezes. Therefore, officers who frequently come into contact with Covid-19 patients are at greater risk of contracting Covid-19 than officers who do not have direct contact with Covid-19 patients.

### **Immunization Status**

Low immunity can cause the body to be susceptible to diseases including Covid-19. This is in line with research conducted by Yap, et al. (2023), Tanti et al. (2022) and Sirijatuphat et al. (2022). Among the 509 health workers who were fully vaccinated, the average number of workers given the second dose of vaccine until they were infected with COVID-19 was 103.9 workers. Regarding Covid-19 vaccination, Pramita, et al. (2020) stated that it was given in

four stages and the first stage of Covid-19 vaccination was given to health workers to increase the body's immunity against the Covid-19 virus.

## **CONCLUSION**

Based on the results and discussion of the systematic review, it can be concluded that the factors that influence the transmission of Covid-19 to health workers in the Southeast Asia region are average age, type of profession, history of comorbidities, travel history, community contact at work, contact with Covid-19 patients, compliance with the use of PPE and implementing health protocols, workload and stress levels and immunization status among health workers.

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