Global Medical and Health Communication

Online submission: https://ejournal.unisba.ac.id/index.php/gmhc
DOI: https://doi.org/10.29313/gmhc.v10i2.9882

GMHC. 2022;10(2):144–151
pISSN 2301-9123 | eISSN 2460-5441

RESEARCH ARTICLE

Perception of Health Workers on Preventing COVID-19 Transmission Behavior based on Work Area and Exposure

Rio Dananjaya,[1,2] Rudi Wisaksana,[1] Primal Sudjana,[1] Shelly Iskandar[3]

[1]Department of Internal Medicine, Faculty of Medicine, Universitas Padjadjaran/Dr. Hasan Sadikin General Hospital, Bandung, Indonesia, [2]Department of Biochemistry, Nutrition and Biomolecular, Faculty of Medicine, Universitas Islam Bandung, Bandung, Indonesia, [3]Department of Psychiatry, Faculty of Medicine, Universitas Padjadjaran/Dr. Hasan Sadikin General Hospital, Bandung, Indonesia

Abstract

Coronavirus disease 2019 (COVID-19) emerged at the end of 2019 and spread worldwide, becoming a pandemic on March 11, 2020. Agents, hosts, and the environment influence disease transmission. Perception influences healthy behavior in preventing disease transmission. This study aims to determine differences in the perception of health care workers (HCWs) on COVID-19 prevention behavior based on the area of work and exposure. This study is a cross-sectional study with a survey method using the health belief model questionnaire with research subjects who were HCWs on duty during the COVID-19 pandemic from May to July 2021 in Dr. Hasan Sadikin General Hospital. Statistical tests used were chi-square and Kruskal-Walis tests. From 346 subjects, it was found that the perception of susceptibility and self-efficacy of HCW in the yellow and red zones was higher than in the green zone (p=0.002). In comparison, the perception of barriers in the yellow zone was higher than in the red area (p=0.014). Health care workers had relatively similar mean scores in terms of knowledge (median 7 of 9), perceived benefits (median 27 of 30), cues to action (median 20 of 20), and perceived severity (median 19 of 30). Based on the history of exposure, the parameter of cues to the action of HCWs exposed to COVID-19 was better than those never exposed (p=0.009). HCW of Dr. Hasan Sadikin General Hospital has good knowledge and perception of the prevention of COVID-19. Differences in the perception of HCW between the work area and exposure history require more targeted and specific educational interventions and actions.

Keywords: COVID-19, exposure, perception, work area

Introduction

At the end of 2019, a mysterious case of pneumonia appeared, which was first reported in Wuhan, Hubei province of China.[1] This disease is called coronavirus disease 2019 (COVID-19) and has become a pandemic since March 11, 2020.[2] As of April 14, 2022, the total number of confirmed cases was 500,186,525 cases with 6,190,349 deaths.[3] The proportion of health workers affected by COVID-19 reached almost 10%. This proportion varies between countries, ranging from 4.2% in China and 17.8% in the United States.[4] These conditions can create depression, anxiety, and fear and distracts health workers' focus because they are at risk of infection and transmitting it to family.[5]

COVID-19 is a positive single-strain RNA virus encapsulated and unsegmented.[6] Epidemiologically, the transmission factor of the disease is influenced by agent, host, and environmental factors.[7] Previous studies on severe acute respiratory syndrome (SARS), ebola, and H1N1 stated that the host factor of perception and healthy behavior is essential in overcoming a pandemic.[8]

Knowledge is vital for health workers to have confidence in their attitude and behavior. The higher the knowledge, the higher the confidence to be able to fight COVID-19.[9] Good perception encourages people to implement healthy behavior, which is the behavior of a person with awareness to achieve the expected health condition.[10] Behavior tends to persist for up to 3 months from the presence of behavioral intervention.[11] Healthy behavior habits, such as hand hygiene and wearing masks, are influenced by the risk of exposure to COVID-19. If the risk of exposure is high, healthy behavior tends to be better.[12]

Dr. Hasan Sadikin General Hospital Bandung, the main referral hospital in West Java, has mobilized massive resources to handle the COVID-19 pandemic. Health workers are

Received: 2 June 2022; Revised: 5 August 2022; Accepted: 7 August 2022; Published: 28 August 2022

Correspondence: Rio Dananjaya, dr., M.Kes. Department of Bichemistry, Nutrition and Biomolecular, Faculty of Medicine, Universitas Islam Bandung. Jln. Tamansari No. 22, Bandung 40116, West Java, Indonesia. E-mail: riodanan@gmail.com

vulnerable to being exposed to COVID-19 due to workplace risks, length of working hours, and hand hygiene that is not optimal after contact with patients.[8,13] In Dr. Hasan Sadikin General Hospital, HCWs infected with COVID-19 was 59% in the yellow zone than red zone (9%).[14] Health workers are assigned to several work areas in the red zone directly dealing with COVID-19 patients, such as the isolation ward and emergency room. The yellow zone does not deal directly with COVID-19 patients, such as non-isolation wards and outpatient departments, and the green zone does not deal with patients, such as the pharmacy and administration. As a result, more and more health workers are exposed to COVID-19 disease, which can disrupt health services and programs to handle the pandemic. As mentioned above, perception and healthy behavior are essential factors in preventing the transmission of COVID-19, especially among health workers, and overcoming a pandemic. Research is needed to see the differences in the perception of health workers on preventing COVID-19 transmission behavior based on work area and exposure.

Methods

This study is a cross-sectional study with a survey method using the health belief model questionnaire. The questionnaire was adapted and obtained permission from research conducted in Taiwan by Tsai et al.,[15] then translated by an official and certified translator. The results of the translated questionnaire were tested for validity and reliability to the respondents, and Cronbach's alpha score was calculated with a value >0.7 (acceptable).

The population of this study is all health workers who work in hospitals and health facilities that handle COVID-19. The affordable population is the health care workers of Dr. Hasan Sadikin General Hospital, who are on duty during the COVID-19 pandemic period from May to July 2021. The sample size is calculated based on the Slovin formula. The distribution of the number of samples was carried out by stratified proportional simple random sampling by dividing into three groups for each work area (red, yellow, and green) and exposure status according to the proportion of health workers on duty in the red, yellow and green of the population. The inclusion criteria are health care workers at Dr. Hasan Sadikin General Hospital who were on duty during the COVID-19 pandemic between May and July 2021. Exclusion criteria include unwilling participation in research, not returning the questionnaire form, and incomplete researched data. This study is part of joint research between the Division of Tropical Medicine and Infectious Diseases, the Department of Internal Medicine of Dr. Hasan Sadikin General Hospital and the Infection Prevention and Control Committee, and the New Emerging and Re-emerging Infectious Diseases (*PINERE*) Team of Dr. Hasan Sadikin General Hospital. This research has received ethical approval from the Health Research Ethics Committee of Dr. Hasan Sadikin General Hospital with the number LB.02.01/X.6.5/329/2020.

Variables in this study: demographics (age, gender, education, profession, work area, exposure status, vaccination history, health conditions, and comorbidities) and perceptions (knowledge, susceptibility, severity, benefits, barriers, self-efficacy, and cues to action). The work area is divided into three areas that are: green zone (no patient contact like administration, pharmacy, and nutrition department), yellow zone (contact with non-COVID-19 patients like in outpatient department, non-isolation ward), and red zone (COVID-19 patient contacts like in an emergency room, isolation ward). Exposure status is divided into three levels that are: exposed (confirmed positive for COVID-19 in the last three months), have been exposed (not verified positive for COVID-19 in the previous three months, but confirmed positive previously), never exposed (never confirmed positive).

The knowledge and perception variables were tested for normality and the nonparametric Kruskal-Wallis test was performed using the median value. Finally, the Pearson chi-square test analyzed the demographic data to see the significance value (p) and displayed it in the form of numbers and percentages. Analysis using SPSS version 26.0 software.

Results

A total of 346 subjects, with the distribution of health workers in the green zone of 31 people (8.96%), the yellow zone of 160 people (46.24%), and the red zone of 155 people (44.80%). Subject characteristics can be seen in Table 1 and Table 2.

The results of the statistical test in Table 1 show that the basic characteristic factors that were significantly different ($p<0.05$) in health

Table 1 Respondents' Characteristics based on Work Area

Characteristics	Green Zone (n=31)	Yellow Zone (n=160)	Red Zone (n=155)	p
Age (year)				
Median (min–max)	39 (30–59)	35 (25–65)	32 (27–58)	0.000*
Gender				
Male	9 (29.0%)	41 (25.6%)	81 (52.3%)	0.000*
Female	22 (71.0%)	119 (74.4)	74 (47.7%)	
Education				
Bachelor and above	17 (54.8%)	116 (72.5%)	133 (85.2%)	0.000*
Associate's degree	14 (45.2%)	44 (27.5%)	22 (14.8%)	
Profession				
Specialist/subspecialist	1 (3.2%)	19 (5.6%)	5 (3.2%)	0.000*
Resident doctor	6 (19.4%)	72 (45.0%)	106 (68.4%)	
Nurse	2 (6.5%)	49 (30.6%)	36 (23.2%)	
Other (pharmacist, nutritionist)	22 (70.9%)	30 (18.8%)	8 (5.2%)	
Vaccination history				
Never	3 (9.7%)	18 (11.3%)	7 (4.5%)	0.070
Have been	18 (90.3%)	142 (88.7%)	148 (95.5%)	
Patient contact history				
Nothing	16 (51.6%)	62 (38.8%)	43 (27.7%)	0.015*
Contact	15 (48.4%)	98 (61.2%)	112 (72.3%)	
Comorbid conditions				
Nothing	19 (61.3%)	113 (70.6%)	129 (83.2%)	0.005*
Having comorbid	12 (38.7%)	47 (29.4%)	26 (16.8%)	
Exposure history				
Never	21 (67.7%)	102 (63.8%)	96 (61.9%)	0.040*
Been exposed	2 (6.5%)	19 (11.9%)	34 (21.9%)	
Exposed	8 (25.8%)	39 (24.3%)	25 (16.1%)	
Health condition				
Good	30 (96.8%)	159 (99.4%)	152 (96.8%)	0.042*
Not good	1 (3.2%)	1 (0.6%)	5 (3.2%)	

Note: *p<0.05 significant

care workers based on the area of work were age, gender, education, profession, patient contact history, presence of comorbidities, exposure status, and health conditions.

In general, health care workers from the three groups have relatively similar characteristics. The only significant difference was from vaccination status, where health workers who were not exposed to COVID-19 were more dominant, having received three doses of vaccine, and from the work area where the most exposed health workers were those who served in the yellow zone.

Data from the questionnaire can be seen in Table 3 and Table 4. From Table 3, the parameters of perception of susceptibility, barriers, and self-efficacy have significant differences (p<0.05). Health care workers in the red zone tend to have a better perception of susceptibility and self-efficacy than in the green and yellow zones, but have a poor perception of barriers. From Table 4, that is a significant difference in cues to action (p<0.05).

Discussion

Dr. Hasan Sadikin General Hospital HCW characteristics in the green zone which does not contact patients have a median age of 39 years. Most are women with a bachelor's education level, as supporting health workers (laboratorian, nutritionist, pharmacist), have no contact with COVID-19 patients, have no comorbidities, never suffered COVID-19, and are in good health

Table 2 Respondents' Characteristics based on Exposure Status

Characteristics	Exposed (n=72)	Been Exposed (n=55)	Never Exposed (n=219)	p
Age (year)				
Median (min–max)	34 (26–58)	32 (27–56)	34 (25–65)	0.243
Gender				
Male	26 (36.1%)	26 (47.3%)	79 (36.1%)	0.170
Female	46 (63.9%)	29 (52.7%)	140 (63.9%)	
Education				
Bachelor and above	52 (72.2%)	46 (84.6%)	168 (76.7%)	0.600
Associate's degree	20 (27.8%)	9 (16.4%)	51 (23.3%)	
Profession				
Specialist/subspecialist	3 (4.2%)	1 (1.8%)	11 (5.1%)	0.439
Resident doctor	34 (47.2%)	38 (69.1%)	112 (51.1%)	
Nurse	22 (30.6%)	12 (21.8%)	53 (24.2%)	
Other (pharmacist, nutritionist)	13 (18.0%)	4 (7.3%)	43 (19.6%)	
Vaccination history				
Never	9 (12.5%)	7 (12.7%)	12 (5.5%)	0.000*
Have been	63 (87.5%)	48 (87.3%)	207 (94.5%)	
Patient contact history				
Nothing	26 (36.1%)	17 (30.9%)	78 (35.6%)	0.935
Contact	46 (63.9%)	38 (69.1%)	141 (64.4%)	
Comorbid conditions				
Nothing	56 (77.8%)	43 (78.2%)	162 (74.0%)	0.304
Having comorbid	16 (22.2%)	12 (21.8%)	57 (26.0%)	
Work area				
Green zone	8 (11.1%)	2 (3.6%)	21(9.6%)	0.040*
Yellow zone	39 (54.2%)	19 (34.5.%)	102 (46.6%)	
Red zone	25 (34.7%)	34 (61.9%)	96 (43.8%)	
Health condition				
Good	70 (97.2%)	54 (98.2%)	215 (98.2%)	0.201
Not good	2 (2.8%)	1 (1.8%)	4 (1.8%)	

Note: *p<0.05 significant

condition. Meanwhile, in the yellow zone, those who come into contact with non-COVID-19 patients have similar characteristics to the green zone, but the median age is younger (35 years) and sometimes contact with COVID-19 patients. The red zone HCW, which directly handles COVID-19 patients, has a younger median age (32 years), and males dominate (52.26%). Although the dominant percentage of education level, profession, and comorbid HCW in the red zone and other zones is similar, the percentage is higher.

Placement of health workers with proportions as above, following the workload and risks. Valiathan et al.[16] stated that being older will lower your immune system and make you more susceptible to disease exposure. Physiological aging is followed by decreased function and damage to the immune system, including the role of lymphocytes, CD4 helper T cells, CD8 cytotoxic T cells, B cells, and natural killer cells, where which will increase the susceptibility to the disease.

The exciting thing from the data shown in Table 1, although overall, most of them have never been exposed to COVID-19 (green zone 67.74%, yellow zone 63.75%, and red zone 61.94%), the percentage of HCW exposed to COVID-19 was more significant in the green zone (25.81%) and yellow zone (24.38%) than the red zone (16.13%). It is interesting because the red zone should have a higher risk of being exposed to COVID-19 than the yellow zone or green zone. This result is almost similar to the research conducted by Wang

Table 3 Knowledge and Perception Analysis based on Work Area

Perception Parameter	Question Item	Score Range Reference	Green Zone (n=31) Median (Min–Max)	Yellow Zone (n=160) Median (Min–Max)	Red Zone (n=155) Median (Min–Max)	p
Knowledge	9	0–9	7 (6–9)	7 (5–9)	7 (5–9)	0.948
Susceptibility	5	5–25	20 (11–25)	22 (14–25)	23 (16–25)	0.002*
Severity	6	6–30	19 (10–27)	19 (6–30)	19 (8–30)	0.962
Benefit	6	6–30	27 (20–30)	26 (14–30)	26 (14–30)	0.567
Barrier	6	6–30	24 (14–30)	24 (6–30)	22 (6–30)	0.014*
Self-efficacy	4	4–20	18 (13–20)	20 (8–20)	20 (12–20)	0.003*
Cues to action	4	4–20	20 (12–20)	20 (8–20)	20 (12–20)	0.081

Note: Kruskal-Wallis test, *p<0.05, barrier value is a reverse value

Table 4 Knowledge and Perception Analysis based on Exposure Status

Perception Parameter	Question Item	Score Range Reference	Exposed (n=72) Median (Min–Max)	Been Exposed (n=55) Median (Min–Max)	Never Exposed (n=219) Median (Min–Max)	p
Knowledge	9	0–9	7 (5–9)	7 (5–9)	7 (5–9)	0.617
Susceptibility	5	5–25	22 (11–25)	22 (16–25)	22 (14–25)	0.967
Severity	6	6–30	20 (8–28)	20 (9–30)	19 (6–30)	0.398
Benefit	6	6–30	26 (19–30)	27 (14–30)	26 (14–30)	0.486
Barrier	6	6–30	24 (6–30)	22 (6–30)	24 (6–30)	0.718
Self-efficacy	4	4–20	20 (13–20)	20 (16–20)	20 (8–20)	0.534
Cues to action	4	4–20	20 (12–20)	20 (16–20)	20 (8–20)	0.009*

Note: Kruskal-Wallis test, *p<0.05, barrier value is a reverse value

et al.,[17] which stated that more health workers exposed to COVID-19 were not in the red zone, which dealt directly with COVID-19 patients, but in the general care department (yellow area).

Another thing that can cause HCWs in yellow and green zones to be more exposed than in red zone is the possibility of transmission outside the workplace. When exposure occurs at the place of duty, health workers in the red area are more susceptible to exposure and have the highest number of people exposed to COVID-19. The result was similar to research by Lepak et al.[18] It concluded that health workers who are exposed to COVID-19 are those who are in contact with family and communities. Therefore, their exposure often comes from outside the place of work. Moreover, data on the perception of barriers appears that avoiding eating out together, having large gatherings or activities, and keeping the distance, seems complicated to do so it becomes a risk factor for transmission.

Suitable knowledge parameters based on the work area and exposure status, there were no significant differences (p=0.948 and p=0.617). Furthermore, knowledge between the green, yellow and red zones and between the exposed, been exposed, and unexposed groups have the same score of 7 with a range of 5–9. It shows that the knowledge of HCW about COVID-19 is relatively evenly equal in the green, yellow, and red zones and among been exposed, exposed, and never exposed groups.

According to Table 3, the susceptibility perception parameter statistical test based on the work area showed a significant difference (p=0.002) between HCW in the green, yellow, and red zones. In addition, HCW in the red and yellow zones had a higher median score than in the green zone (median: 23 vs 22 vs 20). Table 4 shows the perception of susceptibility based

on exposure status is not significantly different. Hameed[10] states that the susceptibility parameter assesses a person's perception of the belief in the susceptibility to contracting a disease which is usually associated with the idea that there will be a severe impact (severity) due to being infected. A person with a firm belief in this perception will lead to an understanding of dangerous and life-threatening conditions. It will lead to self-motivation to save his life by changing his behavior even to the point of being radical. Conversely, suppose a person believes he is not susceptible to being infected by a disease and does not feel it would be dangerous to suffer it. In that case, he will have a behavior that does not try to avoid being exposed to a disease.

The analysis results of perceived barriers based on the work area (Table 3) showed that health workers in the green zone and yellow zone had a higher median score than the red zone (median: 24 vs 24 vs 22) with p=0.014 which indicated there was a significant difference. A significant difference was found in the subjects' yellow and red zone groups. Meanwhile, based on exposure status (Table 4), there was no significant difference (p=0.718), with a median value between the been exposed group of 22, 24 exposed, and not exposed 24 with a scale range of up to 30. This result is a reverse value of the original answer value to the questionnaire to make the answers to the questionnaire unidirectional so that a good response is higher the value, which means lower the barriers to healthy behavior. The results of this study align with the results of Tsai et al.'s[15] research, which states that the average value of perceived barriers is 15.17 on a scale of 30, indicating that the barriers to healthy behavior are insignificant. Hameed[10] says that perceived barriers are beliefs about barriers that can prevent healthy behavior and disease transmission. For example, suppose someone believes there is no difficulty in carrying out a healthy behavior such as washing hands. In that case, it will be implemented and prevent someone from being exposed to the disease.

Conversely, if someone feels a lot of difficulty in carrying out a healthy behavior, such as if someone is going to apply hand hygiene but is constrained by the absence of adequate hand washing facilities, the unavailability of hand sanitizer at the location of exposure to the disease, it will prevent someone from having healthy behavior and will increase the risk of exposure to disease. The barrier perception parameter average value shows that health workers in the red zone have relatively low average scores on several activities. For example, they avoid eating together, gathering at the outside workplace, then too much-measuring body temperature, and keeping their distance compared to other zones. What can be evaluated is that health workers find it difficult to avoid eating together outside or avoiding meetings, so facilities to facilitate this, such as the availability of safe dining areas and meeting areas and establishing health protocols, need to be considered.

Parameter of self-efficacy, Hameed[10] states that this perception is a belief in oneself to be able to take action or healthy behavior to avoid exposure to a disease. After believing in the susceptibility and severity of exposure to the disease, the advantages and barriers to healthy behavior, and encouragement to perform healthy behaviors, self-efficacy is needed to carry out these healthy behaviors. The better the self-efficacy in the ability to perform a healthy behavior, the better a person's behavior in carrying out the healthy behavior will be.

The analysis of the cues to action based on the work areas listed in Table 3 does not show any significant differences, with the median value equivalent to the maximum upper limit of 20. Meanwhile, based on exposure status, p=0.009 indicates a substantial difference between the group that had been exposed to the group not exposed. Hameed[10] states that the principle of cues to action is a sign or encouragement to perform a specific behavior manifested through socialization. They could be through mass media, invitations or encouragement from colleagues or people around, education or personal doctor advice, and the occurrence of illness that afflicts family or friends who provide a lesson about unpleasant conditions if it happened to him. If you look at the theory of behavior formation presented by Khanal[19] and Bakanauskas et al.,[20] one of the factors that shape behavior is the cognitive component. The mental part can be influenced by factors of information, memory, and experience, causing positive and negative reactions to shape behavior. The exposed group whose experience is exposure to COVID-19 gives better information than those who have never been exposed and have no experience. This information and knowledge can lead to a better will to act.

Conclusions

Health care workers (HCWs) who work in the green, yellow and red zones have relatively equal knowledge, perception of severity, benefits, and cues to action. HCWs who work in the yellow and red zones have a better perception of susceptibility and self-efficacy than HCWs in the green zones. At the same time, HCWs who work in the yellow zone have a better perception of barriers than HCWs in the red zone. HCWs who have been exposed to COVID-19 have better cues to action than those who have never been exposed to COVID-19. Periodic education is needed and considering the differences in HCWs based on work areas and exposure history to be more specific and on target. Also, it is essential to facilitate gathering places for worship activities, meetings, praying, or breaks for HCWs, especially HCWs in the red zone, following the health protocol requirements.

Conflict of Interest

There is not any conflict of interest in this research.

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