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Understanding COVID-19 preventive behavior among health workers in Bali's referral hospitals: A socio-ecological approach

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ABSTRACT

Background and purpose: Coronavirus Disease (COVID-19) is one of global health problems which affect all aspects of people's life. Because hospitals are high-risk environments for COVID-19 transmission, healthcare workers' preventive behaviors are critical. These behaviors are shaped by the interaction of personal, interpersonal, and institutional factors. Therefore, this study aimed to explore the COVID-19 preventive behaviors of registration staff at three referral hospitals in Bali, utilizing the Socio-Ecological Model.

Methods: This qualitative study applied a phenomenological approach based on the Socio-Ecological Model of Health Behavior. The study was conducted in March 2021 at three COVID-19 referral hospitals in Bali (Sanglah, Wangaya, and Tabanan Hospitals). We purposely sampled 50 health workers from the registration section. Data were collected via online semi-structured interviews, observations and documentation, then analyzed using phenomenological techniques. Data validity was ensured through source triangulation (comparing insights from staff in outpatient, emergency, and COVID-19 registration posts, as well as the unit heads) and methods triangulation.

Results: The findings demonstrate that preventive behaviors at the personal level interacted dynamically with interpersonal and institutional dimensions. At personal level, workers adhered to standard protocols (masking, handwashing, and physical distancing), utilized hand sanitizer after patient registration, conducted routine disinfection, and wore appropriate personal protective equipment. Individual actions were reinforced through informational support from peers on how to safely interact with patients and their families. At the institutional level, the health facilities supported these personal and interpersonal efforts through official preventive policies and by physically modifying the environment in registration areas.

Conclusion: Preventing the transmission of infectious diseases in healthcare facilities requires a comprehensive approach that encompasses individual behavior, interpersonal support, a safety-oriented work culture, and robust institutional policies. These findings may serve as a reference for developing training programs, establishing standard operating procedures (SOPs), and strengthening a culture of safety among healthcare workers, thereby enhancing their preparedness to respond to future infectious disease outbreaks.

Keywords: *COVID-19, Socio-Ecological Model, health behavior, health workers, referral hospital*

INTRODUCTION

The 2019 Coronavirus Disease (COVID–19) has become a global pandemic.[1] The transmission and increase of the number of cases have occurred very quickly across countries. Based on WHO data as of May 31, 2021, COVID-19 has spread to 222 countries worldwide, with 169,597,415 confirmed positive cases and 3,530,582 confirmed deaths.[2] Human-to-human transmission of COVID-19 occurs through close contact, respiratory droplets, and airborne particles. This places people, including all healthcare workers who have close contact with COVID-19 patients, at a high risk of infection. WHO data as of April 8, 2020, showed that more than 22,000 healthcare workers across 52 countries had been diagnosed with COVID-19.[1]

Health workers at referral hospitals for COVID-19 patients are at increased risk of COVID-19 infection. They are at risk of contracting the virus both from patients and from cross-infection among colleagues who are close contacts. Medical records officers are particularly susceptible to this; because they handle patient registration, they are the first line of interaction when individuals arrive at the hospital. Therefore, enforcing strict preventive behaviors in the registration section is essential to minimize exposure and avoid further transmission.

Based on the Socio-Ecological Model of Health Behavior, human behavior both influences and is influenced by multi-level conditions, which then shape behavior, and the behavior shaped by the social environment shows a reciprocal causal relationship. This socio-ecological model consists of five interactive levels: personal behavior, interpersonal intervention, institutional, community and policy.[3] The model focuses on the dynamic relationship between individuals and their environments, operating on the fundamental premise that comprehensive, multi-level approaches are more effective than single-level interventions[3]. The socio-ecological model can also be applied in the context of pandemics.[4]

While many studies have investigated COVID-19 preventive behaviors among frontline clinical staff (such as doctors and nurses), there is a significant lack of research focusing specifically on registration officers. Despite serving as the initial point of contact and facing high exposure risks, the specific behavioral dynamics of these workers remain underexplored. To address this gap, this study aims to examine the COVID-19 preventive behaviors of healthcare workers in the registration sections of COVID-19 referral hospitals in Bali, specifically looking into the dynamic of personal, interpersonal, and institutional dimensions.

METHOD

This research utilizes a qualitative design, referencing the Socio-Ecological Model of Health Behavior as its conceptual framework. The study settings included three COVID-19 referral hospitals: Sanglah Hospital (tertiary referral hospital in Denpasar-capital of Bali), Wangaya Hospital (secondary referral hospital in Denpasar City) and Tabanan Hospital (secondary referral hospital in Tabanan District). A total of 50 informants were selected via purposive sampling, which included healthcare workers from the Outpatient Registration, Emergency Room, and COVID-19 Post sections, alongside the Head of Medical Record Unit.

The researchers collected data in March 2021 utilizing a combination of online semi-structured interviews,

direct observations, and hospital documentation. The focus of data collection was exploring the complex, multi-layered nature of COVID-19 preventive behaviors through the lens of the Socio-Ecological Model that include personal, interpersonal and institutional level aspects that shaped their COVID-19 preventive behaviours.

The utilized study framework was the phenomenological approach to deeply understand the lived experiences of the healthcare workers. Ultimately, the analysis yielded 3 overarching themes, 5 sub-themes, and 34 distinct codes. The researchers performed the data analysis following systematic, step-by-step process: 1) Transcription and immersion: The researchers transcribed the interview audio verbatim into written transcripts. These documents were read multiple times to allow the researchers to become deeply familiar with the data; 2) Coding: The transcripts were carefully reviewed to highlight significant statements, words, and phrases that pertained directly to the research objective. This line-by-line extraction process generated the 34 distinct codes. 3) Clustering of meaning: The researchers then looked for patterns and similarities among the highlighted codes, grouping related concepts together to formulate the 5 sub-themes. 4) Thematic synthesis: Finally, the sub-themes were categorized and elevated into 3 overarching themes that effectively captured the core essence of the healthcare workers' COVID-19 preventive behaviors.

To improve data validity, the researchers employed two triangulation strategies: 1) source triangulation was achieved by cross-referencing insights from a diverse range of informants, including personnel from outpatient registration, the emergency room, the COVID-19 registration post, and the head of medical records unit; (2) method triangulation was applied by comparing data gathered through three different data collection techniques: semi-structured interviews, direct observations, and hospital documentation.

The study has been approved by the Research Ethics Commission of the Faculty of Medicine, Universitas Udayana/Sanglah Hospital Denpasar with number: 505/UN 14.2.2.VII. 14/L T/2021 dated 26 February 2021.

RESULT

Characteristics of the research informants

The majority of health workers involved in the study were stationed at the emergency room registration (44.0%) and out-patients registration (36.0%). More than 40% were between 24-35 years old, 61.0% were diploma graduates and a slightly higher proportion of those working at the hospitals for 1-10 years (54%) or above 10 years (46%).

Based on the exposure history to COVID-19 infection of 50 health workers, six had been infected, having contracted the virus from hospital co-workers or within their family environment. Eighteen informants had friends who were infected with four had infected family members. Twenty-two informants had absolutely no personal, familial, or social exposure to the virus.

Personal behavior of health workers in efforts to prevent COVID-19

The results of our research revealed that preventive behavior carried out by registration officers were implementing 3M health protocols, namely wearing masks, washing hands, maintaining distance or not being

in a crowd, using hand sanitizer, disinfecting rooms, and following applicable SOPs. Besides, all informants wore personal protective equipment, nurse caps or head covering, gown, handscoon, and face shield. The officers had been vaccinated, maintained their body immunity by taking vitamins, maintained a healthy lifestyle, and maintained a clean environment. At the hospital, officers also changed masks every few hours, and there was body temperature screening in front of the hospital entrance. After leaving the hospital, the officers took a bath, washed their hair, changed clothes, and washed their clothes.

"In the registration room or work room, every 4 hours or 3 hours, we clean our work area, and then disinfect it with disinfectant or alcohol" (I-01)

"Preventive behavior is done through 3M, namely wearing a mask, washing hands using soap in running water, and maintaining distance. From our point of view, registration officers and patients must maintain their physical distance" (I-02)

"We also provide personal protective equipment (PPE) in the registration section... such as PPE uniforms or gowns..." (I-04)

Table 1. Characteristics of informants

Category	Frequency	Percentage (%)
Position		
Outpatient Registration Officer	18	36.0
Emergency Room Registration Officer	22	44.0
COVID-19 Post Registration Officer	7	14.0
Head of Medical Records Unit	3	6.0
Age (years)		
24-35	21	42.0
36-45	17	34.0
46-55	10	20.0
56-60	2	4.0
Education		
Senior high school/Vocational school	7	21.0
Diploma 1-3	6	18.0
Diploma 4/Bachelor	21	61,0
Years of service		
1–10	18	54.0
11-20	8	23.0
21-32	8	23.0
History of COVID -19 exposure		
Had been infected with COVID-19	6	12.0
Had friends/family infected with COVID-19	18	44.0
No history of COVID-19	22	44.0

Interpersonal supports in health workers preventive behavior

Our research revealed health workers in the registration section received informational support from friends in implementing 3M prevention behavior. They reminded each other to prevent transmission of COVID-19.

> *"Everyone here gives information and updates to each other, reminds each other among co-workers and from superiors. The main thing is that the information must be continuous as we remind each other. That is our spearhead before taking prevention for ourselves. Here, the information and the behavior of reminding each other is already good" (I -10)*

The protection carried out by informants at the interpersonal dimension when interacting with patients and patient families during registration process was by implementing health protocols with 3M: wearing masks, washing hands, and maintaining distance. After registering, the officers used hand sanitizer and decreased interactions with patients or with the patient's family.

> *"When the officers implement COVID-19 prevention, it will reduce the possibility. When we are being interviewed directly, we still wear a mask, then wash our hands with hand sanitizer as often as possible during registration. That's what is being done for now, so hopefully we won't be exposed" (i -12)*

> *"When we register, we do it normally. When we finish registering, we wash our hands using hand sanitizer. Every time we finish registering a patient, we hold the file. When we finished, we always use hand sanitizer" (i-45)*

Institutional supports in health workers preventive behavior

Hospital management's efforts to prevent the spread of COVID-19 for health workers are part of the hospital's transmission prevention policy. Informants also received preventive information from co-workers in the management of the hospital where they work, such as from PKRS (Health Promotion), K3RS (Hospital Occupational Health and Safety) and PPI (Infection Prevention and Control) in forming behavior and norms for implementing health protocols, namely by wearing masks, washing hands, using hand sanitizer, maintaining distance, decreasing physical contact with friends in different professions such as doctors, nurses and other professions by online communication via WhatsApp, internal telephone calls between hospitals, or by Zoom to reduce the risk of transmitting COVID-19.

> *"The information is there, we have the education from PKRS, there is a PR and management unit that always provides information." (i-03)*

> *"Yes, we remind each other. For example, from work health and safety, there is a group in which we are warned to wear PPE." (i-18)*

> *"We can get advice from officers, such as nurses. We are given advice on how to carry out health protocols. For instance, we have to wear a complete PPE, we also have to wear a complete mask and hat. PPI is the name, in which there are people who still give advice." (I-42)*

Based on the results of the research, we describe the interaction of preventive behavior against the

transmission of COVID-19 among registration officers, consisting of interpersonal, institutional behavior, and policy interventions from the three hospitals. Personal behavior in preventing transmission of COVID-19 among registration officers was supported by interpersonal, institutional, including institutional policies. The three referral hospitals provided support of policy and modification of the physical environment, in order to optimize the behavior to prevent the transmission of COVID-19. Internal policies implemented at the hospitals regarding preventing the transmission of COVID-19 followed guidelines from the Ministry of Health. The directors of the three hospitals issued hospital internal policies. The policies were in the form of Standard Operating Procedures (SOP). The following is the informant's quotes:

> *"The source of making regulations is a reference to government regulations starting from the Ministry of Health... From there we take rules that we can apply to the registration section in the form of SOPs. Every registration officer who works there works in accordance with standard operational procedures that have been determined."(i-12)*

> *"There is a regulation in which the management always reminds us – in all areas of the hospital, in this pandemic situation – to implement health protocols, which becomes the main thing." (i-10)*

To enforce physical distancing in the registration area, the hospital implemented several spatial modifications. These included placing footprint marks, crosses, and red lines on the floor to manage patient queues and interactions. Seating for both staff and visitors was rearranged to maintain a distance of at least 1 to 1.5 meters, marked clearly with stickers or crosses. The modification at the registration desk, glass and plastic partitions were installed to protect informants from direct patient contact. Furthermore, the hospital imposed limits on the number of patient escorts and restricted overall capacity in the registration room to avoid crowding. The other modification was the addition of hand sanitizer and hand washing facilities. The hospital also put up written appeals requiring masks and significantly increased the routine disinfection of tables and chairs.

A screening team was stationed at the entrance to check body temperatures, only granting access to the registration room if a person's temperature was below 37°C. In response to the pandemic, a dedicated COVID-19 post was also created. Here, the registration officer and cashier shared a room but maintained separate desks, and all patient communication was mediated by a glass barrier. To register, patients pressed their ID cards against the glass for the officer to photograph with a mobile phone. If direct interaction was unavoidable, the officer took the photo while strictly maintaining physical distance and avoiding any physical contact.

> *"Certainly, this modification is very clear, indicated by... the installation of other attributes such as the line where we must have a maximum of one meter of interaction between the patient's escort." (i-10)*

> *"The modification is that the staff's seat in a room used to be close to each other, but now we have set a distance of 1-2 meters..." (i-8)*

> *"So during the pandemic, we modified the registration area with plastics, ... It's still there, but the holes are flexible, so when we open it, it closes again automatically, just like that" (i-34)*

> *"Yes, before the patient comes in or the visitor comes in... there is a screening team. If the temperature is below 37 they can come in, otherwise they can't come in" (i-19)*

The results of the observations also showed the compatibility between the informant's statements and the conditions in the hospital. The following table shows the results of observations done by the researchers at three COVID-19 referral hospitals which showed the same physical environment modification across hospitals to reduce cross-exposure between patients or families and health workers at the registration office (Table 2).

Table 2. Checklist of modifications to the physical environment

No	Modification of the environment in the Registration Section	Yes	No
1	Standing distance	√	
2	Sitting distance	√	
3	Red lines	√	
4	Cross marks on the seat	√	
5	Plastic and glass partitions on the registration desk	√	
6	Cleaning	√	
7	No clustering around	√	
8	Addition of hand sanitizer facilities	√	
9	Addition of facilities for washing hands	√	
10	A screening team	√	
11	COVID-19 Posts designed for Covid patients	√	
12	At the COVID-19 post communication is limited by glass	√	
13	An appeal to wear a mask	√	

In supporting preventive behavior against the transmission of COVID-19, the institutions provided support in the form of policies and modifications to the physical environment carried out by the three institutions in order to optimize behavior to prevent the transmission of COVID-19. The interaction of personal, interpersonal, and institutional behavior, including institutional policies, was carried out to prevent the transmission of COVID-19 in hospitals, especially in the registration section.

The officers in the registration section gave advice or suggestions to prevent the transmission of COVID-19, namely implementing personal prevention behavior by being more disciplined in applying 3M health protocols. Besides, the advice of maximizing online registration was also a solution to reduce direct contact and to avoid being infected with COVID-19 in the registration section. The following is a quote from the informants:

"We have to be more disciplined in doing 3M, by washing hands, wearing a mask, and maintaining distance. That's the only key." (i-27)

"In my opinion, to reduce the risk of being infected, we should reduce interaction and reduce direct contact. For example, if registration can be done in an online setting, I think it will have an effect on preventing infection of the COVID-19 virus." (i-06)

DISCUSSION

From an ecological behavioral perspective, safeguarding healthcare workers against COVID-19 transmission requires looking beyond individual actions to a dynamic, multi-layered system. Successful prevention ultimately relies on how personal behaviors, team-level support, and institutional protocols continuously reinforce one another.

From this study we found COVID-19 transmission can be prevented through basic protective measures like wearing masks, physical distancing, and frequent handwashing, particularly in crowded or high-risk areas. To protect themselves, registration staff first practice the "3M" preventive measures: wearing masks, washing hands, and maintaining physical distance or avoiding crowds. The spread of COVID-19 can be prevented by adopting basic protective measures—such as wearing masks, maintaining physical distance, and frequently washing hands—when in crowded areas or locations with a risk of COVID-19 transmissions.[5]

Registration staff use hand sanitizer after processing patient registrations; additionally, disinfectant is sprayed in the staff workspace and on the registration desk every few hours. The use of antiseptics and disinfectants is effective in preventing COVID-19 transmission. Disinfectant spraying can be applied to inanimate objects and carried out throughout the room covering door handles and any items or equipment frequently touched by people.[6] Within hospitals, transmission is minimized by handling patients according to strict health protocols, conducting temperature screenings, and properly utilizing PPE.[7] On a personal level, individuals can prevent infection by maintaining good hygiene and eating nutritious foods to boost their immunity.[8]

Social support from friends also significantly influences COVID-19 preventive behaviors. A 2020 study in Greater Jakarta *(Jabodetabek)* showed that peer support heavily impacts safety practices because close friendships shape individual lifestyles and habits. During the pandemic, friends played a vital role in keeping one another accountable for following health protocols. Sharing accurate information, encouraging reduced social interactions, and motivating each other to stay healthy are all ways that peer support actively drives behaviors to prevent COVID-19 transmissions.[9]

Healthcare workers play a role in prevention by administering vaccinations. Vaccination is a crucial measure for preventing COVID-19 infection; 61.5% of healthcare workers agree that COVID-19 vaccination can reduce mortality.[10] The vaccine demonstrates 65.9% effectiveness in preventing COVID-19 infection, 87.5% effectiveness in preventing hospitalization, 90.3% effectiveness in preventing ICU admission, and 86.3% effectiveness in preventing death due to COVID-19.[11]

This study found that medical record staff in the registration department received informational support from their colleagues and reminded one another about COVID-19 prevention measures, such as maintaining physical distance; informants also obtained prevention-related information from colleagues within the hospital management. Efforts to maintain and improve the health status of hospital staff were carried out through health promotion initiatives, which were effectively supported by both internal and external parties to protect staff handling COVID-19 patients; furthermore, peer support among healthcare workers fostered mutual reminders and reinforcement regarding health protocols.[12]

In response to the COVID-19 pandemic, the hospital implemented several modifications in the registration area, such as designated standing positions for patients registering—indicated by footprints or 'X' marks—to

define where patients or visitors should stand. In the patient waiting area, seating for patients' families has been arranged with 'X' marks or stickers to encourage social distancing. Hand sanitizer is also available at the registration desk and in various corners of the room, in sufficient quantities for both staff and patients.[13]

Within the registration section, health workers developed strict behavioral norms for interacting with colleagues across different professions. They consistently enforced health protocols like mask-wearing, hand hygiene, and physical distancing. Additionally, to lower the risk of transmission, informants minimized direct contact with other hospital staff—such as doctors and nurses—by utilizing online communication platforms like WhatsApp, Zoom, and internal hospital phone systems.

A key limitation of this study was the constraints to conduct the study during COVID-19 pandemic. To reduce direct interaction and minimize transmission risk, interviews were conducted online via WhatsApp video calls. Consequently, researchers were unable to clearly observe informants' facial expressions and non-verbal cues. Furthermore, unstable internet connectivity during certain interviews occasionally disrupted communication quality.

CONCLUSION

This study concludes that preventing the transmission of infectious diseases in healthcare facilities demands a comprehensive approach encompassing individual behavior, interpersonal support, a safety-oriented work culture, and robust institutional policies. Registration workers' adherence to personal preventive measures—such as the 3M protocols—is reinforced by interpersonal support from family and friends, community-level peer norms among hospital staff, and crucial institutional backing through physical workspace modifications and strict safety policies.

These findings provide a critical framework for developing targeted training programs, establishing strict SOPs, and reinforcing a culture of safety among healthcare workers, thereby maximizing their preparedness for future outbreaks.

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AUTHOR CONTRIBUTION

PC composed the research, collected and analyzed data, and drafted the manuscript. DL and CB developed the research concept and design, assisted in data analysis, provided suggestions, input, and improvements to the manuscript.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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REFERENCES

1. World Health Organization. Report of the WHO-China Joint Mission on Coronavirus Disease 2019 (COVID-19). Geneva: World Health Organization; 2020. Available from: https://www.who.int/docs/default-source/coronaviruse/who-china-joint-mission-on-covid-19-final-report.pdf
2. Ketchaji A, Fokam J, Assah F, Ateba F, Wandji ML, Pamen JNB, et al. The impact of short message service reminders or peer home visits on adherence to antiretroviral therapy and viral load suppression among HIV-Infected adolescents in Cameroon: a randomized controlled trial. *AIDS Res Ther*. 2025;22:1–8
3. Sumarni S. Model sosio ekologi perilaku kesehatan dan pendekatan. *Indones J Public Heal*. 2017;12(1):129–41. https://doi.org/10.20473/ijph.v12i1.2017.129
4. Kumar S, Quinn SC, Kim KH, Musa D, Hilyard KM, Freimuth VS. The social ecological model as a framework for determinants of 2009 H1N1 influenza vaccine uptake in the United States. *Health Educ Behav*. 2012;39(2):229–43. https://doi.org/10.1177/1090198111415105
5. Howard J, Huang A, Li Z, Tufekci Z, Zdimal V, van der Westhuizen HM, et al. An evidence review of face masks against COVID-19. *Proc Natl Acad Sci U S A*. 2021;118(4):e2014564118. https://doi.org/10.1073/pnas.2014564118
6. Larasati AL, Gozali D, Haribowo C. Penggunaan desinfektan dan antiseptik pada pencegahan penularan COVID-19 di masyarakat. *Maj Farmasetika*. 2020;5(3):137–45.
7. Susanti M. Metode pengelompokan jenis APD di berbagai area Instalasi Radiologi Universitas Airlangga sebagai upaya pencegahan penularan COVID-19 [Laporan Penelitian]. Surabaya: Universitas Airlangga; 2020.
8. Gannika L, Sembiring EE. Tingkat pengetahuan dan perilaku pencegahan Coronavirus Disease 2019 (COVID-19) pada masyarakat Sulawesi Utara. *NERS J Keperawatan*. 2020;16(2):83–9. https://doi.org/10.25077/njk.v16i2.150
9. Kundari NF, Hanifah W, Azzahra GA, Islam NRQ, Nisa H. Hubungan dukungan sosial dan keterpaparan media sosial terhadap perilaku pencegahan COVID-19 pada komunitas wilayah Jabodetabek tahun 2020. *Media Penelit dan Pengemb Kesehat*. 2020;30(4):281–94. https://doi.org/10.22435/mpk.v30i4.3463
10. Sudiman D. Persepsi petugas Puskesmas terhadap pelaksanaan vaksinasi COVID-19 pada era new normal. *J Inspirasi*. 2021;12(1):29–41. https://doi.org/10.35880/INSPIRASI.V12I1.172
11. Jara A, Undurraga EA, González C, Paredes F, Fontecilla T, Jara G, et al. Effectiveness of an inactivated SARS-CoV-2 vaccine in Chile. *N Engl J Med*. 2021;385(10):875–84. https://doi.org/10.1056/NEJMoa2107715.
12. Onikananda AK. Pelaksanaan promosi kesehatan pada perawat yang menangani pasien COVID-19 di ruang isolasi Rumah Sakit X. J Ilm Permas: *J Ilm STIKES Kendal*. 2021;11(1):123–32. https://doi.org/10.32583/PSKM.V11I1.1161.
13. Sari LAP, Dhamanti I. Comparison of hospital emergency room management regulations in Indonesia before and during the COVID-19 pandemic: literature study. *Media Kesehat Masy*. 2022;4(3):426–36. https://doi.org/10.35508/mkm