Knowledge of hand hygiene during COVID-19 pandemic

Thunpitcha Chatassawapreda, Andrew Shem, and Premjit Juntongjin*

Division of Dermatology, Chulabhorn International College of Medicine, Thammasat University, Pathum Thani, Thailand
*Corresponding author, E-mail: premjitvp@yahoo.com

Abstract

Coronavirus disease 2019 (COVID-19) became a pandemic in March 2020. Following this pandemic, people realized the importance of hand hygiene as one of the effective ways to prevent disease transmission. This study aims to measure the knowledge towards hand hygiene among the general population during this pandemic period. A cross-sectional online survey study was conducted from August to September 2020. The questionnaire that was mainly based on the WHO hand hygiene reference consisted of 2 parts; 12 items in demographic data and 10 items in the knowledge of hand hygiene. A total of 200 participants completed the questionnaire. More than half of the participants (61%) exhibited a "good" level of knowledge, whereas some participants (5%) had a "poor" level of knowledge. Moreover, many participants did not know the sufficient time duration required for effective hand rubbing and handwashing with soap and water. Approximately half of the non-healthcare providers did not recognize the association between frequent handwashing and incidence of hand eczema. This study demonstrated that most participants had good knowledge of hand hygiene for disease prevention. However, they still had a misconception of the appropriate time required for different types of handwashing. Education on proper hand hygiene is necessary to improve people's knowledge, especially in non-healthcare providers. Prospective studies with more participants and generalizability are required to assess the gap in people's knowledge and prepare for the next wave of the pandemic.

Keywords**:** *COVID-19, Hand hygiene, Handwashing, Knowledge, Thailand*

1. Introduction

The outbreak of emerging Coronavirus disease 2019 (COVID-19) in China was initiated in late December 2019 (Okada et al., 2020). The outbreak has been spreading across the world, even faster than any previous pandemics (Kolifarhood et al., 2020). The COVID-19 is highly infectious, caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (Hanna, Evans & Booth, 2020). The virus can spread human-to-human by respiratory droplets, direct contacts, and aerosol transmission (Adhikari et al., 2020; Lai, Shih, Ko, Tang & Hsueh, 2020). The disease has been brought to global attention and declared a pandemic by the World Health Organization (WHO) on March 11, 2020 (Jin et al., 2020). WHO also declared the outbreak of COVID-19 as a "Public Health Emergency of International Concern," and the outbreak is still spreading in Thailand, making a huge impact on people's lives and the country's economics (Assari & Habibzadeh, 2020).

Hand hygiene has been recognized as an effective and convenient way to interrupt the transmission of respiratory diseases in community settings and is also recommended by the WHO to prevent COVID-19 transmission (World Health Organization, 2020). Following the COVID-19 pandemic, people realized the importance of hand hygiene (Twinamasiko et al., 2021), and their knowledge of the protective role in hand hygiene was improved (Mahdi et al., 2020). Skin damage caused by enhanced infection-prevention measures leads to hand eczema, and the common risk factors include frequent hand hygiene (Lan et al., 2020).

The study of people's knowledge of hand hygiene in Thailand was limited. This study aims to measure the knowledge towards hand hygiene among the general population during the COVID-19 pandemic in Thailand. Results of this study would help support individual hand hygiene knowledge to improve hand hygiene practice, which is an effective way to slow down the COVID-19 transmission and may also prevent hand eczema, which is the consequence of hand hygiene.

2. Objectives

To determine knowledge of hand hygiene in the general population during the COVID-19 pandemic in Thailand.

3. Materials and Methods

A questionnaire-based cross-sectional online survey study was conducted in 200 general inhabitants from August 2020 to September 2020 in Thailand. The study included a population of age 18 years or above who lived in Thailand and could understand the Thai language. The exclusion criteria were individuals who declined to participate in the study. The online questionnaire was created using Google Forms and distributed to the participants in the form of a link and a Quick Response Code (QR Code). The questionnaire was closed-ended self-administered and consisted of 2 parts; demographics data and knowledge of hand hygiene. The demographics data included gender, age, marital status, occupation, monthly income, educational level, province of current address, and atopic history. The knowledge of hand hygiene questionnaire was developed and adjusted based on Hand Hygiene Knowledge Questionnaire for Health-Care Providers (revised August 2009) by WHO (World Health Organization, 2009), COVID-19's hand hygiene recommendation from the Department of Disease Control, Thailand (Thailand Department of disease control, 2020), and Dry skin relief from COVID-19 hand washing (American Academy of Dermatology, 2020). The content validity of the questionnaire was reviewed and evaluated by 5 specialists in dermatology. The index of item-objective congruence (IOC) was 0.8 to 1 for each question. The questionnaire was tested for internal consistency reliability in 30 general inhabitants who were not involved in the participant group. The calculated Cronbach alpha value was 0.8, which indicated a good internal consistency. The participants earned one point for each correct answer. The maximum knowledge score was 10, which a higher score means better knowledge. The participant's level of knowledge regarding hand hygiene was classified as good (score 7-10), moderate (score 4-6), and poor (score 1-3).

The study was approved by the Human Research Ethics Committee of Thammasat University. All participants were informed about the study's purpose before taking part in the questionnaire.

4. Results and Discussion

Demographic characteristics

A total of 200 participants completed an online questionnaire. The majority of the participants were female (80.5%) and single (62.5%). The mean age was 36.66 ± 11.12 years, ranging from 18-80 years. 29% were healthcare providers and 60% held a bachelor's degree. Most of the participant's lived in Bangkok and the vicinity (90%). The demographic characteristics of the participants are detailed in Table 1.

Knowledge about hand hygiene

Results regarding knowledge about hand hygiene are shown in Table 3. The study revealed an overall mean knowledge score (SD) of 6.77 (1.71). As expected, the healthcare providers had significantly ($P < 0.001$) better knowledge than the non-healthcare providers with a mean score (SD) of 7.69 (1.34) and 6.39 (1.70) respectively. The healthcare providers had significantly better knowledge concerning hand hygiene than the non-healthcare providers ($P<0.001$), and the majority of the healthcare providers (84.48%) were classified as having a "good" level of knowledge, whereas only 51.41% of the non-healthcare providers were.

The majority of the participants responded correctly on the COVID-19 transmission that it could be prevented by effective hand hygiene and use of 70% alcohol or more in alcohol-based hand rub to effectively kill the virus. However, only 8% of all participants recognized that 40 seconds was the minimal time required for handwashing with soap and water to kill most germs on their hands. Accordingly, less than half of all participants (41.5%) knew that the minimal time needed for an effective alcohol-based hand rub is at least 20 seconds, whereas the healthcare providers had significantly more correct answer than the non-healthcare providers for this question (55.17% and 35.92% respectively, $P=0.012$).

Table 1 Demographic characteristics of the participants

Demographic characteristics		Healthcare providers n=58 (29%)		Non-healthcare providers n=142 (71%)		P-value
Gender	Male	14	24.14%	25	17.61%	0.290[1]
	Female	44	75.86%	117	82.39%	
Age (mean ± SD)		33.57 ± 7.52 years		37.92 ± 12.09 years		0.027[2]
Marital status	Single	36	62.07%	89	62.68%	
	Married	22	37.93%	51	35.92%	0.936[3]
	Divorced	0	0%	2	1.4%	
Monthly income	< 15,000 THB	2	3.45%	17	11.97%	
	15,000-50,000 THB	21	36.21%	66	46.48%	0.011[1]
	50,001-100,000 THB	15	25.86%	37	26.06%	
	> 100,000 THB	20	34.48%	22	15.49%	
Educational level	Below bachelor degree	2	3.45%	82	57.75%	
	Bachelor degree	37	63.79%	43	30.28%	0.008[1]
	Master degree	9	15.52%	7	4.93%	
	Doctor degree	10	17.24%	10	7.04%	
Province	Bangkok and vicinity	47	81.03%	133	93.66%	0.007[1]
	Others	11	18.97%	9	6.34%	

[1] Chi-square test, [2] Mann-Whitney U test, [3] Fisher's exact test. P < 0.05 (significant)

Table 2 Knowledge level of hand hygiene

Knowledge level	Healthcare providers (n=58)		Non-healthcare providers (n=142)		P-value
	(n)	(%)	(n)	(%)	
Good	49	84.48%	73	51.41%	
Moderate	8	13.79%	60	42.25%	<0.001
Poor	1	1.71%	9	6.34%	

Chi-square test. P < 0.001 (highly significant)

Interestingly, due to the lack of knowledge concerning hand rubbing and handwashing, only 53.53% of the non-healthcare providers did not know that hand rubbing was not more effective against germs than handwashing, whereas 74.14% of the healthcare providers answered this question more correctly (P=0.007). However, 73.24% of them could respond to the other question correctly that handwashing and hand-rubbing were not recommended to be performed in sequence, whereas the healthcare providers got significantly more correct answers from both questions (74.14% and 89.66% respectively, P=0.011). Most of the participants (173/200 subjects, 86.5%) could answer that wearing jewelry is associated with an increased risk of colonization of harmful germs on their hands.

Furthermore, the healthcare providers could answer more correctly that frequent handwashing causes skin dryness and is also associated with hand eczema than the non-healthcare providers (96.55% vs. 86.62% and 75.86% vs. 56.34%, respectively); the difference was statistically significant (P=0.038 and P=0.010 respectively). The healthcare providers also recognized that hand eczema can be prevented by regular use of hand cream, significantly more than the non-healthcare providers did (81.04% and 55.63% respectively, P=0.001).

The Coronavirus disease 2019 (COVID-19) has been declared a pandemic by the world health organization (WHO) on 11 March 2020 (Putrino, Raso, Magazzino & Galluccio, 2020). The disease is highly transmissible by direct contact, respiratory droplets, and aerosol (Adhikari et al., 2020; Lai et al., 2020). Recently, controlling and interrupting transmission routes are effective measures to limit the disease spreading. Proper hand hygiene has been recognized as one of the most important measures of respiratory

infection control. In 2009, Influenza A (H1N1) pandemic made an impact on knowledge of infection control (Hsu, Jin, Ang, Kurup & Tambyah, 2011) and also during the recent COVID-19 pandemic (Cavanagh & Wambier, 2020).

Table 3 Hand hygiene knowledge in healthcare providers and non-healthcare providers on each question

Question no.	Questions	Answer	Healthcare providers (n=58)		Non-healthcare providers (n=142)		P-value
			Correct (n)	(%)	Correct (n)	(%)	
1	Can effective hand hygiene prevent COVID-19 transmission?	Yes	56	96.55	129	90.85	0.164
2	How much percentage of alcohol in alcohol-based hand rub can kill the COVID-19 virus?	70% or more	56	96.55	135	95.07	0.647
3	What is the minimal time needed for an alcohol-based hand rub to kill most germs on your hands?	20 seconds	32	55.17	51	35.92	0.012
4	What is the minimal time needed for handwashing with soap and water to kill most germs on your hands?	40 seconds	6	10.35	10	7.04	0.435
5	Is hand rubbing more effective against germs than handwashing?	No	43	74.14	76	53.53	0.007
6	Are handwashing and hand rubbing recommended to be performed in sequence?	No	52	89.66	104	73.24	0.011
7	Is wearing jewelry associated with an increased likelihood of colonization of hands with harmful germs?	Yes	54	93.10	119	83.8	0.081
8	Is frequent handwashing or rubbing cause skin dryness?	Yes	56	96.55	123	86.62	0.038
9	Is frequent handwashing or rubbing associated with the incidence of hand eczema?	Yes	44	75.86	80	56.34	0.010
10	Is regular use of a hand cream can prevent hand eczema?	Yes	47	81.04	79	55.63	0.001

Chi-square test. $P < 0.05$ (significant)

This study showed that more than half of the participants (61%) had good knowledge regarding hand hygiene. A study by Shari et al (2016) reported that only most of the nurses (74.5%) had good knowledge of hand hygiene whereas most of the medical and nursing students rarely had good knowledge (Nair, Hanumantappa, Hiremath, Siraj, & Raghunath, 2014). In this study, although the overall healthcare providers had good knowledge (84.5%), which is more than the previous study that only half of the non-healthcare providers had good knowledge (51.4%), the result is consistent with the previous study, indicating that the

non-healthcare providers tended to have lower knowledge regarding hand hygiene (Perez-Perez et al., 2015). The healthcare providers had more knowledge scores than the non-healthcare providers with a mean (SD) of 7.69/10 (1.34) and 6.39/10 (1.7), respectively.

Most of the participants (92.5%) knew the COVID-19 transmission can be prevented by effective hand hygiene, including hand rubbing, similar to a previous study in Iran (Taghrir, Borazjani & Shiraly, 2020). The alcohol-based hand rub that contains at least 70% of alcohol has been recommended by the Department of Disease Control, Thailand (Thailand Department of disease control, 2020), as an infection prevention measure for COVID-19. Positively, nearly all participants (95.5%) could answer this correctly.

According to WHO Guidelines on Hand Hygiene in Health Care (World Health Organization, 2009), 20 seconds for alcohol-based hand rub and 40 seconds for handwashing with soap and water are the minimal time needed to kill most microorganisms on our hands. In contrast, only 41.5% of the participants knew the appropriate time required for effective alcohol-based hand rubbing, and only 8% responded correctly that 40 seconds is the minimum time required for handwashing with soap and water to kill most microorganisms on our hands. This finding is important since an inadequate handwashing or rubbing duration possibly leads to decreased efficacy of disinfection and increased risk of being infected. The reason why most of the participants, even the healthcare providers, got the wrong answers was possibly due to lack of knowledge provided by WHO or because they did not realize the importance of correct hand hygiene. Although most of the participants knew that handwashing and hand rubbing should not be performed in sequence, only 59.5% of them knew that hand rubbing is not more effective against microorganisms than handwashing. However, most of the participants recognized that wearing jewelry is associated with an increased likelihood of colonization of hands with harmful microorganisms, so this could affect their behaviors during the pandemic to avoid wearing these accessories.

In the previous study in South Korea in 2019 (Oh, 2019), approximately half of nurses (54.4%) recognized that hand rubbing can cause skin dryness more than handwashing. Nevertheless, in this study, nearly all healthcare providers could answer this correctly, which implies that the healthcare providers in our country are more likely to realize the hand eczema problem. Apart from hand rubbing, frequent handwashing is also the risk factor of hand eczema (Flyvholm, Bach, Rose, & Jepsen, 2007; Hamnerius et al., 2018; Keegel & Nixon, 2018). The application of hand cream or moisturizers after hand washing has been suggested to prevent hand eczema (Cavanagh & Wambier, 2020). In this study, only approximately half of the non-healthcare providers recognized this association and knew that it can be prevented with regular use of the hand cream whereas the healthcare providers responded more correctly.

Hand hygiene has been suggested as an effective and convenient way to interrupt the transmission of respiratory disease in community settings, including COVID-19 (Fung & Cairncross, 2006; Kaewchana et al., 2012). Frequent handwashing is also an important cause of hand eczema (Halm & Sandau, 2018). Education on hand hygiene was reported to effectively increase knowledge among dental students in Saudi Arabia (Lingawi, Maher & Afifi, 2017). Therefore, the scores and level of knowledge of hand hygiene in this study showed a defect in people's knowledge, which suggests that education on hand hygiene is necessary to stop the disease transmission while maintaining a good hand skin condition, especially in the non-healthcare providers.

However, this study has some limitations. The online questionnaire-based design could affect the accuracy of score assessment as the participants may search for information before answering the questions. Another limitation was a small sample size that may affect the generalizability of the results.

5. Conclusion

This study demonstrated that the majority of the participants had good knowledge regarding hand hygiene. However, they had a misconception of the appropriate time required for different types of handwashing. Since the correct knowledge contributes to good attitudes and appropriate practices, education on hand hygiene is necessary to improve people's knowledge, especially in non-healthcare providers. Prospective studies with more participants and generalizability are required to assess the gap in people's knowledge and prepare for the next wave of the pandemic.

6. Acknowledgements

I would like to express my great appreciation to all participants and my adviser for the valuable data and constructive suggestions during the planning and development of this research.

7. References

Adhikari, S. P., Meng, S., Wu, Y. J., Mao, Y. P., Ye, R. X., Wang, Q. Z., Sun, C., Sylvia,S., Rozelle, S., Raat, H. & Zhou, H. (2020). Epidemiology, causes, clinical manifestation and diagnosis, prevention and control of coronavirus disease (COVID-19) during the early outbreak period: a scoping review. *Infectious diseases of poverty*, *9*(1), 1-12. doi:10.1186/s40249-020-00646-x

American Academy of Dermatology. (2020). *Dry skin relief from COVID-19 handwashing*. Retrieved from https://www.aad.org/public/everyday-care/skin-care-basics/dry/coronavirus-handwashing

Assari, S., & Habibzadeh, P. (2020). The COVID-19 Emergency Response Should Include a Mental Health Component. *Arch Iran Med*, *23*(4), 281-282. doi:10.34172/aim.2020.12

Cavanagh, G., & Wambier, C. (2020). Rational hand hygiene during COVID-19 pandemic. *J Am Acad Dermatol*. doi:10.1016/j.jaad.2020.03.090

Flyvholm, M. A., Bach, B., Rose, M., & Jepsen, K. F. (2007). Self-reported hand eczema in a hospital population. *Contact Dermatitis*, *57*(2), 110-115. doi:10.1111/j.1600-0536.2007.01134.x

Fung, I. C., & Cairncross, S. (2006). Effectiveness of handwashing in preventing SARS: a review. *Trop Med Int Health*, *11*(11), 1749-1758. doi:10.1111/j.1365-3156.2006.01734.x

Halm, M., & Sandau, K. (2018). Skin Impact of Alcohol-Based Hand Rubs vs Handwashing. *Am J Crit Care*, *27*(4), 334-337. doi:10.4037/ajcc2018727

Hamnerius, N., Svedman, C., Bergendorff, O., Bjork, J., Bruze, M., & Ponten, A. (2018). Wet work exposure and hand eczema among healthcare workers: a cross-sectional study. *Br J Dermatol*, *178*(2), 452-461. doi:10.1111/bjd.15813

Hanna, T. P., Evans, G. A., & Booth, C. M. (2020). Cancer, COVID-19 and the precautionary principle: prioritizing treatment during a global pandemic. *Nat Rev Clin Oncol*. doi:10.1038/s41571-020-0362-6

Hsu, L. Y., Jin, J., Ang, B. S., Kurup, A., & Tambyah, P. A. (2011). Hand hygiene and infection control survey pre- and peri-H1N1-2009 pandemic: knowledge and perceptions of final year medical students in Singapore. *Singapore Med J*, *52*(7), 486-490. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/21808958

Jin, Y., Yang, H., Ji, W., Wu, W., Chen, S., Zhang, W., & Duan, G. (2020). Virology, Epidemiology, Pathogenesis, and Control of COVID-19. *Viruses*, *12*(4). doi:10.3390/v12040372

Kaewchana, S., Simmerman, M., Somrongthong, R., Suntarattiwong, P., Lertmaharit, S., & Chotipitayasunondh, T. (2012). Effect of intensive hand washing education on hand washing behaviors in thai households with an influenza-positive child in urban Thailand. *Asia Pac J Public Health*, *24*(4), 577-585. doi:10.1177/1010539510393728

Keegel, T., & Nixon, R. L. (2018). Wet work and healthcare workers: use of hand disinfectants not associated with self-reported eczema. *Br J Dermatol*, *178*(2), 324-325. doi:10.1111/bjd.16166

Kolifarhood, G., Aghaali, M., Mozafar Saadati, H., Taherpour, N., Rahimi, S., Izadi, N., & Hashemi Nazari, S. S. (2020). Epidemiological and Clinical Aspects of COVID-19; a Narrative Review. *Arch Acad Emerg Med*, *8*(1), e41. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/32259130

Lai, C. C., Shih, T. P., Ko, W. C., Tang, H. J., & Hsueh, P. R. (2020). Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and coronavirus disease-2019 (COVID-19): The epidemic and the challenges. *Int J Antimicrob Agents*, *55*(3), 105924. doi:10.1016/j.ijantimicag.2020.105924

Lan, J., Song, Z., Miao, X., Li, H., Li, Y., Dong, L., ... & Tao, J. (2020). Skin damage among health care workers managing coronavirus disease-2019. *Journal of the American Academy of Dermatology*, *82*(5), 1215-1216. doi:10.1016/j.jaad.2020.03.014

Lingawi, H., Maher, Y., & Afifi, I. (2017). Impact of Educational Intervention for Hand Hygiene on Dental Students' Knowledge, Attitude, and Bacterial Contamination Level on Hands. *J Contemp Dent Pract, 18*(12), 1164-1172. doi:10.5005/jp-journals-10024-2193

Mahdi, H., Alqahtani, A., Barasheed, O., Alemam, A., Alhakami, M., Gadah, I., Alkediwi, H., Alzahrani, K., Fatani, L., Dahlawi, L., Alsharif, S., Shaban, R., Booy, R., & Rashid, H. (2020). Hand Hygiene Knowledge and Practices among Domestic Hajj Pilgrims: Implications for Future Mass Gatherings Amidst COVID-19. *Trop Med Infect Dis, 5*(4). doi:10.3390/tropicalmed5040160

Nair, S. S., Hanumantappa, R., Hiremath, S. G., Siraj, M. A., & Raghunath, P. (2014). Knowledge, Attitude, and Practice of Hand Hygiene among Medical and Nursing Students at a Tertiary Health Care Centre in Raichur, India. *ISRN Prev Med, 2014*, 608927. doi:10.1155/2014/608927

Oh, H. S. (2019). Knowledge, perception, performance, and attitude regarding hand hygiene and related factors among infection control nurses in South Korea: A cross-sectional study. *Am J Infect Control, 47*(3), 258-263. doi:10.1016/j.ajic.2018.09.006

Okada, P., Buathong, R., Phuygun, S., Thanadachakul, T., Parnmen, S., Wongboot, W., Waicharoen, S., Wacharapluesadee, S., Uttayamakul, S., Vachiraphan, A., Chittaganpitch, M., Mekha, N., Janejai, N., Iamsirithaworn, S., Lee, R. TC., & Maurer-Stroh, S. (2020). Early transmission patterns of coronavirus disease 2019 (COVID-19) in travellers from Wuhan to Thailand, January 2020. *Euro Surveill, 25*(8). doi:10.2807/1560-7917.ES.2020.25.8.2000097

Perez-Perez, P., Herrera-Usagre, M., Bueno-Cavanillas, A., Alonso-Humada, M. S., Buiza-Camacho, B., & Vazquez-Vazquez, M. (2015). [Hand hygiene: health professionals' knowledge and areas for improvement]. *Cad Saude Publica, 31*(1), 149-160. doi:10.1590/0102-311x00106913

Putrino, A., Raso, M., Magazzino, C., & Galluccio, G. (2020). Coronavirus (COVID-19) in Italy: knowledge, management of patients and clinical experience of Italian dentists during the spread of contagion. *BMC Oral Health, 20*(1), 200. doi:10.1186/s12903-020-01187-3

Taghrir, M. H., Borazjani, R., & Shiraly, R. (2020). COVID-19 and Iranian Medical Students; A Survey on Their Related-Knowledge, Preventive Behaviors and Risk Perception. *Arch Iran Med, 23*(4), 249-254. doi:10.34172/aim.2020.06

Thailand Department of disease control. (2020). *Recommendations for Self-protection*. Retrieved from https://ddc.moph.go.th/viralpneumonia/eng/file/recommendation/01self_protection.pdf

Twinamasiko, N., Olum, R., Gwokyalya, A. M., Nakityo, I., Wasswa, E., & Sserunjogi, E. (2021). Assessing Knowledge, Attitudes and Practices Towards COVID-19 Public Health Preventive Measures Among Patients at Mulago National Referral Hospital. *Risk Manag Healthc Policy, 14*, 221-230. doi:10.2147/RMHP.S287379

World Health Organization. (2009). *WHO guidelines on hand hygiene in health care* (1st ed.): World Health Organization.

World Health Organization. (2020). *Coronavirus*. Retrieved from https://www.who.int/health-topics/coronavirus#tab=tab_2