การศึกษาภาคตัดขวางเกี่ยวกับปัญหาทางผิวหนังของบุคลากรทางการแพทย์ระหว่างการแพร่ระบาดของเชื้อไวรัส COVID-19 ที่ศูนย์ฉีดวัคซีนกลางบางซื่อ

จตกุล เกียรติก้องนที พ.บ., อรจุฑา ชยางศุ พ.บ.

สถาบันโรคผิวหนัง ถนนราชวิถี แขวงทุ่งพญาไท เขตราชเทวี กรุงเทพฯ 10400

Assessment of Skin Problems in Healthcare Personnel during COVID-19 Pandemic: A Cross-sectional Study from Central Vaccination Center

Jatakul Kietkhongnatee, M.D., Onjuta Chayangsu, M.D.

Institute of Dermatology, Ratchawithi Rd, Thung Phaya Thai, Ratchathewi, Bangkok 10400, Thailand

(E-mail: onjuta@gmail.com)

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Abstract

Background: During the coronavirus disease 2019 (COVID-19) pandemic, Thai government opened the Central Vaccination Center (CVC) for people to be vaccinated, so healthcare personnel had to apply extra personal protective equipment (PPE) during extended hours. This occurrence may be related to some dermatologic conditions. **Objective:** To determine the skin problems of healthcare workers operate at CVC and contributing factors. **Methods:** A cross-sectional descriptive study was performed by a random survey of healthcare personnel working at CVC from October 2021 to September 2022. Demographic data, job, hobby, type and duration of PPE usage, working hours, frequency and type of substance for hand washing, moisturizer application and dermatologic problems were collected from the questionnaire. The diagnosis of skin condition was performed by the researcher. **Results:** From a total of 406 healthcare personnel, the mean age was 34.8±10.8 years. Skin problems were observed in 291 persons (71.6%), the most common conditions were xerosis (66.7%), skin damage from pressure injury (63.9%), and acne vulgaris (60.1%), respectively. Younger age was a protective factor against skin problems (prevalence risk ratio; PRR = 0.98, p = .021). The vaccine injector had skin problems more than other jobs (PRR = 1.11, p = .038). N95 facial mask was a risk factor (PRR = 1.11, p = .004), whereas fabric mask was a protective factor for acne (PRR 0.84, p = .001). Using latex gloves with powder enhanced the risk of hand eczema (PRR = 1.15, p < .001). Hand washing with soap increased the risk of skin pruritus (PRR = 1.71, p = .022). **Conclusion:** Dermatologic problems in health workers are common during COVID-19 pandemic. The protective factors are younger age and wearing fabric mask. On the other hand, the risk factors include working as a vaccine injector, wearing an N95 mask, using latex gloves with powder, and hand wash with soap.

Keywords: Skin problems, Healthcare personnel, COVID-19 pandemic

บทคัดย่อ

ภูมิหลัง: ในช่วงที่มีการแพร่ระบาดของไวรัส COVID-19 รัฐบาลไทยได้มีการจัดตั้งศูนย์ฉีดวัคซีนกลางบางซื่อ เพื่อฉีดวัคซีนให้กับประชาชน ดังนั้นบุคลากรทางการแพทย์จึงมีความจำเป็นต้องสวมใส่อุปกรณ์ป้องกันส่วนบุคคลเพิ่มมากขึ้น ซึ่งพฤติกรรมดังกล่าวอาจเป็นหนึ่งในสาเหตุที่ทำให้เกิดปัญหาทางผิวหนังได้ **วัตถุประสงค์:** เพื่อสำรวจปัญหาทางผิวหนังของบุคลากรทางการแพทย์ที่ปฏิบัติหน้าที่ที่ศูนย์วัคซีนกลางบางซื่อ และปัจจัยที่เกี่ยวข้อง **วิธีการ:** ใช้การศึกษาเชิงพรรณนาภาคตัดขวาง โดยทำการสุ่มสำรวจข้อมูลจากบุคลากรที่ปฏิบัติงานที่ศูนย์วัคซีนกลางบางซื่อ ระหว่างเดือนตุลาคม 2564 ถึงเดือนกันยายน 2565 ทำการเก็บข้อมูลประชากร ลักษณะการทำงาน งานอดิเรก การใช้อุปกรณ์ป้องกันส่วนบุคคล ระยะเวลาทำงาน พฤติกรรมการล้างมือ การใช้ครีมบำรุงผิว และปัญหาทางผิวหนัง ผ่านแบบสอบถาม จากนั้นแพทย์ผู้วิจัยเป็นผู้ให้การวินิจฉัยปัญหาทางผิวหนัง **ผล:** จากการสำรวจบุคลากรทางการแพทย์รวม 406 คน อายุเฉลี่ยอยู่ที่ 34.8±10.8 ปี พบมีปัญหาทางผิวหนัง 291 คน (71.6%) โดยปัญหาที่พบมากที่สุดได้แก่ ภาวะผิวแห้ง (66.7%) รอยกดทับบริเวณที่ใช้อุปกรณ์ (63.9%) และสิว (60.1%) ตามลำดับ จากการศึกษาพบว่า อายุน้อยเป็นปัจจัยป้องกันของการเกิดปัญหาทางผิวหนัง (prevalence risk ratio; PRR = 0.98, p = .021) ลักษณะการทำงานเป็นผู้ฉีดวัคซีนมีปัญหาทางผิวหนังมากกว่างานอื่น ๆ (PRR = 1.11, p = .038) การใส่หน้ากากอนามัยชนิด N95 เพิ่มโอกาส (PRR = 1.11, p = .004) ในขณะที่การใส่หน้ากากแบบผ้าพบเป็นปัจจัยป้องกันการเกิดสิว (PRR = 0.84, p = .001) นอกจากนี้การใส่ถุงมือยางชนิดมีแป้งเพิ่มโอกาสในการเกิดผื่นผิวหนังอักเสบที่มือ (PRR = 1.15, p < .001) ส่วนการล้างมือด้วยน้ำสบู่พบเป็นปัจจัยเสี่ยงของการเกิดอาการคันที่ผิวหนังบริเวณมือ (PRR = 1.71, p = .022). **สรุป:** ปัญหาทางผิวหนังพบได้บ่อยในบุคลากรทางการแพทย์ในช่วงที่มีการระบาดของไวรัส COVID-19 โดยจากการศึกษานี้พบว่าปัจจัยป้องกันของการเกิดปัญหาทางผิวหนัง คือ อายุน้อย และการใส่หน้ากากอนามัยแบบผ้า ส่วนปัจจัยเสี่ยงของการเกิดปัญหาทางผิวหนัง ได้แก่ การทำงานเป็นผู้ฉีดวัคซีน การใส่หน้ากากอนามัยชนิด N95 การใส่ถุงมือยางชนิดมีแป้ง และการล้างมือด้วยน้ำสบู่

คำสำคัญ: ปัญหาทางผิวหนัง, บุคลากรทางการแพทย์, การแพร่ระบาดของเชื้อ COVID-19

Introduction

Coronavirus disease 2019, or COVID-19, has been an emerging infectious disease since 2019. The COVID-19 pandemic was a problem that has led to many deaths worldwide in recent years.[1, 2] This virus causes respiratory infections in mammals through respiratory droplets, direct contact, fecal-oral route, fomites transmission, and from mother to child if infected during the third trimester of pregnancy.[3] Prevention and reduction of COVID-19 infection starts with social distancing, home quarantine, frequent hand washing with disinfectant substances, use of protective equipment: face mask or respirators, face shield or goggle, gloves, gown, and COVID-19 vaccine injection.[2]

Personal protective equipment (PPE) was applied to protect healthcare personnel from COVID-19 infection and transmission.[4] Some healthcare professionals, especially those taking care of COVID-19 infected patients or working in intensive care units, use many types of PPE during the working period. Respiratory protective equipment is the most important PPE to protect the respiratory tract from COVID-19 and other infectious diseases. Respiratory PPE is divided into many types due to different abilities to filter respiratory particles.[2] Goggles and face shields are the protective equipment for the eyes that World Health Organization (WHO) recommends using as barriers against body fluid which can transmit viral particles. The difference between a face shield and a goggle is the protective spectrum; a face shield covers all of the face, whereas the goggle cover only the eyes.[2] Gloves protect hands; wearing gloves decreases the risk of COVID-19 infection, and wearing a double layer of gloves has more protective effect against infection compared with a single layer.[5] Gown is used to shield the body skin. Finally, the boots are applied to cover the feet from any spreading secretion.[6]

During the COVID-19 pandemic, Thai government opened the Central Vaccination Center (CVC) to administer the COVID-19 vaccine for Thai populations and foreigners living in Thailand. The healthcare professionals who worked at CVC had to apply extra PPE for longer hours as demonstrated in figure 1, so this occurrence may be related to some dermatologic conditions. A previous study from Turkey and United Kingdom showed that frontline healthcare professionals had increased the risk of skin problems including dryness, itching, flaking, tingling and peeling. Wearing a complete set of PPE with longer hours, higher frequency of hand washing, and use of disinfectant to clean the hands were associated with those skin conditions.[7, 8]

The aim of this study was to evaluate the dermatologic problems occurring in healthcare professionals during COVID-19 pandemic and identify the relationship with associated factors.

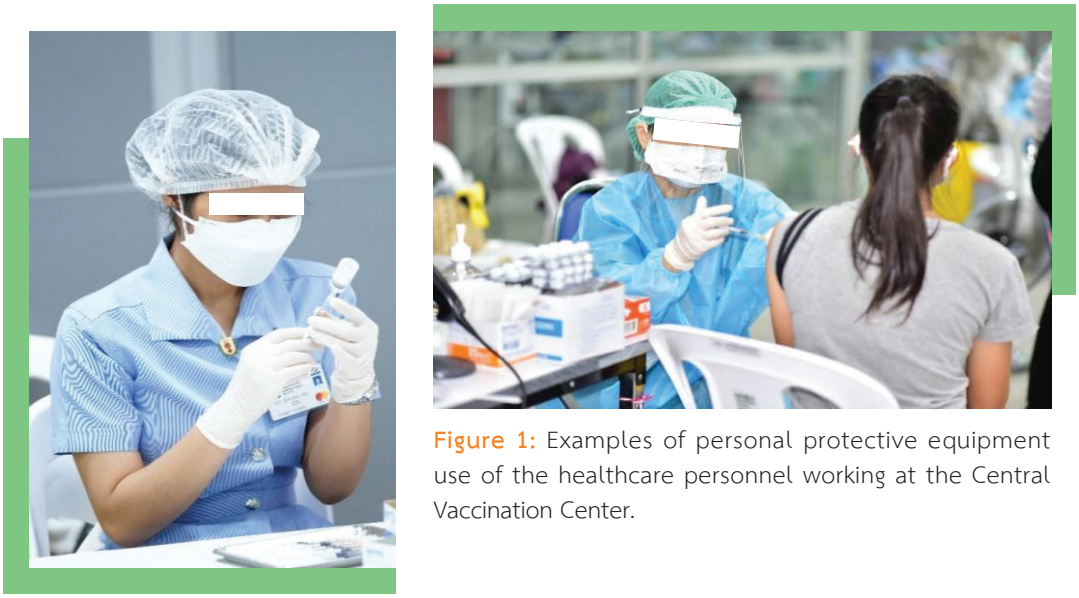

Figure 1: Examples of personal protective equipment use of the healthcare personnel working at the Central Vaccination Center.

Material and methods

The study was approved by Ethics Committee of the Institute of Dermatology, Bangkok, Thailand (IRB/IEB 026/2564) and was performed following the World Medical Association's Helsinki Declaration.

We surveyed 406 healthcare personnel who worked at CVC from October 2021 to September 2022. All of 406 participants were voluntary to be recruited to the study. A questionnaire about the demographic data, working hours, job description, moisturizer application, hobby, dermatologic problems, type and duration of PPE usage, frequency and type of products used for hand washing were recorded. And the diagnosis of cutaneous problem was made by the researcher. We included doctors, nurses, nursing assistances, pharmacists, patient helpers, medical secretaries, registration staff, cleaning staff, and volunteers over 18 years old who used PPE and worked at CVC at least one month before the survey. The exclusion criteria was the healthcare personnel who reject to do the questionnaire.

Descriptive data were summarized with mean, SD, median, minimum-maximum, numbers and percentage values. Logistic regression with cross-tabulation, Pearson chi-square and Fisher's exact test were used to compare categorical data. P value < .05 was determined as the limit value for significance. The statistical analysis was performed by SPSS version 26.

Results

The mean age of 406 participants was 34.8±10.8 (18-85) years. All healthcare workers used respiratory PPE, the most common types were surgical masks (73.6%), KF94 (41.6%) and fabric masks (22.4%), respectively. The hand PPE was applied by 37.9% of the participants, and other kinds of PPE usage were about 20% each. The demographic characteristics and PPE application of healthcare personnel in the study were listed in table 1.

Table 1: Demographic and PPE usage data of healthcare personnel working at CVC

Characteristics	N	%
Gender		
Female	261	64.3
Male	145	35.7
Education		
Primary education or lesser	14	3.4
Secondary education	37	9.1
Diploma	62	15.3
Bachelor's degree or higher	293	72.2
Job description		
Client helper and evaluator	334	82.3
Vaccine preparer	99	18.7
Vaccine injector	76	24.4
Paper work	58	14.3
Others	20	4.9
Type of PPE usage		
Respiratory PPE	406	100.0
N95/KN95	84	20.7
KF94	169	41.6
N90	8	2.0
FFP2	8	2.0
Surgical mask	299	73.6
Fabric mask	91	22.4
Hand PPE	154	37.9
Latex gloves with powder	57	37.0
Latex gloves without powder	105	68.2
Nitrile gloves	6	3.9
Plastic gloves	9	5.8
Body PPE	104	25.6
Gown	52	50.0
Laboratory coat	1	1.0
Protective coverall	6	5.8
Disposable hair cap	89	85.6
Face and eyes PPE	88	21.7
Safety glasses	2	2.2
Face shield	86	97.7

Dermatologic problems were observed in 291 (71.6%) of healthcare personnel; the most common were xerosis, pressure injury (Figure 2) and acne vulgaris, as shown in Table 2. Some of the participants (9.8%) had previous skin conditions including xerosis, acne vulgaris, and eczema. And most of them (77.1%) reported the worsening of their skin problems while working at CVC.

From table 2, regarding the relationship between demographic data and skin problems, we found that the skin problems were significantly presented in senior staff more than junior staff (prevalence risk ratio; PRR = 0.98, p = .021). Health professionals who worked as vaccine injector had

skin problems more than other jobs (PRR 1.11, p = .038). Moreover, concerning the relationship between skin problems and PPE, we noticed that the use of N95 facial mask was one of the risk factors for skin pruritus (PRR 1.11, p = .030) and acne (PRR 1.11, p =.004); on the other hand, fabric mask was a protective factor for acne (PRR 0.84, p =.001). Another PPE that increase risk of skin problems was latex gloves with powder, which increased the risk of hand pruritus (PRR 1.21, p = .015) and hand eczema (PRR 1.15, p < .001). Use of latex gloves without powder was also a risk factor for hand pruritus (PRR 1.71, p = .031). However, the use of other types of PPE and more working hours did not relate to skin problem occurrence from this study.

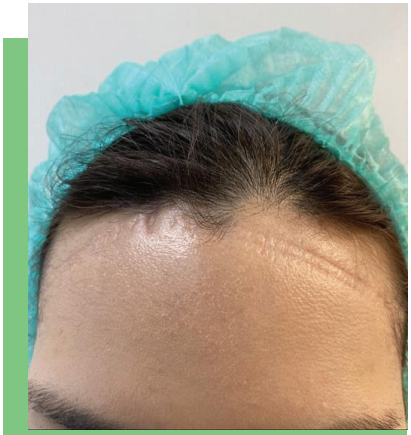

Figure 2: Pressure injury and dryness of the skin observed in healthcare provider at CVC.

Table 2: Skin problems observed in health professionals working at CVC and related factors.

Characteristics	n	%	Factors	Prevalence risk ratio, PRR (95% confidence Interval)	p-value
Skin problems					
Present	291	71.6	Age	0.98 (0.96, 0.99)	.021*
			Vaccine injector	1.11 (1.01, 1.22)	.038*
Absent	115	28.3			
Type of skin problems					
Xerosis	194	66.7	Age	0.69 (0.44, 1.00)	.915
			Gender	1.00 (0.98, 1.02)	.054
			Moisturizer use	0.92 (0.60, 1.42)	.718
Pressure injury	186	63.9	N95 mask	0.57 (0.29, 1.10)	.093
			KF94 mask	1.00 (0.67, 1.50)	.990
Acne vulgaris	175	60.1	N95 mask	1.11 (1.03, 1.29)	.004*
			Fabric mask	0.84 (0.64, 0.87)	.001*
Pruritus	166	57.0	N95 mask	1.11 (1.07, 4.79)	.030*
			Latex gloves with powder	1.21 (1.00, 1.47)	.015*
			Latex gloves without powder	1.71 (1.02, 2.86)	.031*
			Hand wash with soap and water	1.71 (1.06, 2.75)	.022*
Eczema	121	41.6	Latex gloves with powder	1.15 (1.03, 1.29)	<.001*
Pain	50	17.2	N95 mask	0.43 (0.17, 1.08)	.072
			KF94 mask	0.74 (0.35, 1.60)	.445
			Face and eye PPE	3.68 (0.23, 26.46)	.196
Erosion	40	13.7	Face and eye PPE	0.09 (0.01, 0.87)	.068
Edema	21	7.2	Face and eye PPE	7.37 (0.66, 82.27)	.105
Lichenification	20	6.9	Gloves	0.62 (0.31, 1.24)	.178
			Body PPE	2.92 (0.18, 47.14)	.450

*p < .05, considered statistically significant

Information about hand washing and moisturizer use was described in Table 3. The frequency of hand washing and moisturizer application were not related to skin problems, but using soap and water for hand wash enhanced the risk of skin pruritus (PRR = 1.71, p = .022), as shown in table 2.

Table 3: Behavior of hand washing and moisturizer use of healthcare personnel at CVC.

Characteristics	N	%
Frequency of hand washing		
Less than 5 times/day	33	8.1
5-10 times/day	171	42.1
11-20 times/day	125	30.8
More than 20 times/day	77	19
Hand wash substance		
Soap and water	277	68.2
Alcohol gel	296	72.9
Alcohol	229	56.4
Moisturizer		
Used	216	53.2
Not used	31	7.6

Discussion

During the COVID-19 pandemic, personal protective equipment (PPE) is necessary for healthcare personnel to protect themselves from infection. The previous study reported that the healthcare providers who used PPE had a greater risk of skin problems, about 74.5%, the most common skin problems were contact dermatitis, dryness and scale, erythema, and maceration. The most common locations were hand, cheek, and nose, respectively.[9] Other prior studies also reported that most of healthcare personnel, ranging from 80.3-90.2%, experienced skin problems during the pandemic. The risk factors were female and nurse occupation, but the staffs who always used moisturizer had lower risk of skin problems.[7] Furthermore, longer working hours and more extended use of PPE were considered as strong factors that caused these dermatologic problems.[8-10]

From this study, we found that most of the healthcare personnel (71.6%) had skin conditions and the most common problems were xerosis, pressure injury, and acne vulgaris, which was not different from the result of previous studies. However, the working hours were not related to the development of skin problems in our research, which is different from prior report, maybe because our healthcare personnel did not use a complete set of PPE.

The younger age was a protective factor against skin problems in this research. The plausible explanation is that the aged people have a change of skin barrier function, for example, increase sensitivity to irritants, aggravation of xerosis, development of pruritus and decrease of tight junction components such as claudin-1 and occludin.[11]

Working as a vaccine injector was one of the risk factors causing skin disorders from current study. This may be due to the observation that vaccine injectors have closer contact with the clients than other groups of occupation, so they strictly used more types of PPE.[12]

Wearing N95 mask was another risk factor for skin pruritus and acne vulgaris, or maskne, which is a form of mechanical acne caused by continuous textile-skin adherence and friction. The pathogenesis of maskne is divided into three major factors: microbiota, microenvironment and mask characteristics. The use of facial mask can produce the situation of higher temperature

and increased humidity due to area restriction and sweat retention. FFP2 and KN95 masks have a greater risk of acne development than surgical mask due to higher humidity, occlusion and temperature.[13, 14] As previous information, using N95 can be associated with facial pruritus and maskne. Fabric mask was a protective factor for maskne in our study. The prior study also reported a similar result that wearing a cloth mask has a lower risk of adverse skin reaction when compared with a surgical mask and a surgical mask covered with a cloth.[15]

According to the result of this research that using latex gloves with powder was a risk factor for hand pruritus and hand eczema, and wearing latex gloves without powder increased a risk of hand pruritus. Previous report had a similar finding and described that the cause of adverse skin reaction due to latex gloves is irritation, allergic contact dermatitis, improper air circulation inside the glove and excessive sweat.[16]

Furthermore, hand washing with soap and water was considered to be a risk factor for hand pruritus in our study, this might be because hand washing with soap and water could disrupt the hydro-lipid cover of the skin surface and caused irritation.[17]

Limitation

This study is cross-sectional design, so it is limited by the nature of the analysis type and the lack of a comparison group. Besides, we cannot confirm or differentiate the diagnosis of irritant and allergic contact dermatitis on health workers who had hand eczema since we did not perform a patch test. Moreover, the healthcare personnel working at CVC may not be the representatives of all health providers during the COVID-19 pandemic.

Conclusion

Dermatological problems in healthcare workers are common during the COVID-19 pandemic. The protective factors against skin problems are younger age, and wearing the fabric mask (for acne). The risk factors of dermatologic conditions are working as a vaccine injector, using an N95 mask (for acne and facial pruritus), wearing latex gloves with powder (for hand pruritus and hand eczema), latex gloves without powder (for hand pruritus) and hand wash with soap (for hand pruritus). The awareness and educational campaign about health prevention regarding skin problems among health professionals should be carried on.

Conflict of interest

The authors declare no conflict of interest.

References

1. Mehta OP, Bhandari P, Raut A, Kacimi SE, Huy NT. Coronavirus disease (COVID-19): comprehensive review of clinical presentation. Front Public Health 2021;8:582932.
2. Lotfi M, Hamblin MR, Rezaei N. Covid-19: Transmission, prevention, and potential therapeutic opportunities. Clin Chim Acta 2020;508:254–66.
3. Sharma A, Ahmad Farouk I, Lal SK. Covid-19: A review on the novel coronavirus disease evolution, transmission, detection, control and prevention. Viruses 2021;13(2): 202.
4. Personal Protective Equipment (PPE) Classification Systems. Personal Protective Equipment (PPE) Classification Systems - radiation emergency medical management. [Internet]. [cited 2023 Mar 21]. Available from: https://remm.hhs.gov/ppe_classification.htm
5. de Oliveira e Silva AC, Nogueira WP, Gir E, de Almeida SA, de Lima Barroso BI, Freire MEM. Limiting factors of face shield use for health professionals during the COVID-19 pandemic. Work 2021;70(2):355–63.
6. Hirschmann MT, Hart A, Henckel J, Sadoghi P, Seil R, Mouton C. Covid-19 coronavirus: Recommended personal protective equipment for the orthopaedic and trauma surgeon. Knee Surg Sports Traumatol Arthrosc 2020;28(6):1690–8.
7. Daye M, Cihan FG, Durduran Y. Evaluation of skin problems and dermatology life quality index in health care workers who use personal protection measures during COVID-19 pandemic. Dermatol Ther 2020;33:e14346.
8. Abiakam N, Worsley P, Jayabal H, Mitchell K, Jones M, Fletcher J, et al. Personal protective equipment related skin reaction in healthcare professionals during COVID-19. Int Wound J 2021;18(3):312-22.
9. Lin P, Zhu S, Huang Y, Li L, Tao J, Lei T, et al. Adverse skin reactions among healthcare workers during the coronavirus disease 2019 outbreak: a survey in Wuhan and its surrounding regions. Br J Dermatol 2020;183(1):190-2.
10. Battista RA, Ferraro M, Piccioni LO, Malzanni GE, Bussi M. Personal Protective Equipment (PPE) in COVID 19 pandemic: related symptoms and adverse reactions in healthcare workers and general population. J Occup Environ Med 2021;63(2):e80-5.
11. Choi EH. Aging of the skin barrier. Clin Dermatol 2019;37(4):336–45.
12. Gürlek Kısacık Ö, Özyürek P. Skin-related problems associated with the use of personal protective equipment among health care workers during the COVID-19 pandemic: A online survey study. J Tissue Viability 2022;31(1):112–8.
13. Spigariolo CB, Giacalone S, Nazzaro G. Maskne: The epidemic within the pandemic: From diagnosis to therapy. J Clinical Med 2022;11(3):618.
14. Teo WL. Diagnostic and management considerations for “maskne” in the era of covid-19. J Am Acad Dermatol 2021;84(2):520–1.
15. Techasatian L, Lebsing S, Uppala R, Thaowandee W, Chaiyarit J, Supakunpinyo C, et al. The effects of the face mask on the skin underneath: A prospective survey during the COVID-19 pandemic. J Prim Care Community Health 2020;11:1-7.
16. Jose S, Cyriac MC, Dhandapani M. Health problems and skin damages caused by personal protective equipment: Experience of frontline nurses caring for critical COVID-19 patients in Intensive Care Units. Indian J Crit Care Med 2021;25(2):134–9.
17. Cebeci D, Karasel S, Rıfkı D, Yesildağlı H, Kalfaoglu M. The effect of Personal Protective Equipment (PPE) and disinfectants on skin health during covid 19 pandemia. Med Arch 2021;75(5):361-5.