Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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The importance of fit testing in decontamination of N95 respirators: A cautionary note

To the Editor: The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) COVID-19 pandemic resulted in a critical shortage of personal protective equipment (PPE), particularly N95 filtering facepiece respirators (FFRs). Decontamination methods and reuse of FFRs, including ultraviolet germicidal irradiation (UVGI), hydrogen peroxide vaporization, microwave-generated steaming, and dry heating, have been rushed into implementation. However, if the treatment affects filtration or fit, decontamination is achieved but loss of integrity could be catastrophic to the wearer.

Our recent *JAAD* publication discusses research with a repurposed dermatology phototherapy desktop device to administer UVGI for N95 decontamination.[1] This letter highlights critical differences in fit testing performance collected for different respirator models treated with UVGI administered with this repurposed unit. The effects on respirators of using the suggested UVGI dose of 1 to 2 J/cm^2 were variable.[2]

The respirator fit testing was conducted by the Henry Ford Health System Department of Infection Prevention and Control according to the saccharin solution aerosol protocol laid out by the United States Occupational Safety and Health Administration (OSHA).[3] Irradiation of respirators with UVGI was conducted by the Henry Ford Health System Department of Dermatology Photomedicine Unit. A new, unused respirator served as the test respirator, and irradiation was performed after establishing that an unused respirator passed a baseline fit test. The outside-facing and wearer-facing surfaces of the respirators were irradiated by the Daavlin Desktop UVC Germicidal Lamp (Daavlin, Bryan, OH) with a dose of 1.5 J/cm^2 to each side. If the respirator passed this test, it was considered to have successfully completed 1 cycle. This process was then repeated to establish the number of irradiation cycles that the respirator would pass the fit test. Testing was ceased if a respirator did not pass the fit test. The results are reported in Table I.

The UVGI treatment may degrade polymers in the respirators themselves and impact the elasticity of the bands.[4] The myriad respirators available in this crisis react differently to a given UVGI dose and survive different numbers of decontamination cycles. This may hold true for other respirator treatment methods as well.

Our data strongly indicate that to protect the safety of the N95 respirator user, fit testing after decontamination must be done each time a new model is introduced to a health care system. This has significant safety implications, because varied decontamination methods are being used by different institutions.[5] In addition, N95 respirators should be physically examined before and after decontamination cycles to check for signs of degradation that may have occurred while removing and handling.

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Table I. Results of Henry Ford Health System respirator fit testing

FFR model*	Saccharin solution aerosol fit test performed	UVC cycles attempted/fit test cycles *passed*	Passing cumulative UVC dose (3 J/cm^2 = 1 cycle)
3M N95 Respirator—1860 NIOSH TC-84A-0006	Baseline, cycles 1-6, 15, 20 & 25	25/20	60 J/cm^2
3M N95 Respirator—9210 NIOSH TC-84A-2669	Baseline, cycles 1-2	2/2†	6 J/cm^2
3M N95 Respirator—8210 NIOSH TC-84A-0007	Baseline, cycles 1-2	2/*1*	3 J/cm^2
Cardinal Health USA N95 R/S Respirator—NIOSH TC-84A-5529 & 5527 (small/regular)	Baseline, cycles 1-2	2/*1*	3 J/cm^2
Moldex N95 Respirator #2300N95—NIOSH TC-84A-0328	This N95 respirator passed the baseline fit test on 1 individual. Owing to immediate breakage of straps upon user removal on 2 respirators, testing ceased.	0	N/A
Moldex N95 Respirator 1511 (small)—NIOSH TC-84A-0013	This N95 respirator failed the baseline fit test on 3 individuals.	0	N/A
Moldex N95 Respirator 1512 (medium)—NIOSH TC-84A-0013	Baseline, cycles 1-3	3/2	6 J/cm^2
3M N95 Respirator—9010 NIOSH TC-84A-4243	This N95 respirator failed the baseline fit test on 2 individuals.	0	N/A
Cardinal Health USA N95A-S Respirator—NIOSH TC-84A-5463	This N95 respirator failed the baseline fit test on 2 individuals.	0	N/A
GB2626-2206 KN95 Respirator—KN95-01-01	This N95 respirator failed the baseline fit test on 2 individuals.	0	N/A

FFR, Filtering facepiece respirator; *N/A*, not available; *NIOSH*, National Institute for Occupational Safety and Health; *UVC*, ultraviolet C.
*3M, St Paul, Minnesota; Cardinal Health, Dublin, Ohio; Moldex-Metric, Culver City, California.
†Limited resources prevented testing of additional UVC cycles.

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Cutaneous manifestations related to coronavirus disease 2019 (COVID-19): A prospective study from China and Italy

To the Editor: We report the results of a binational, multicenter, prospective study to assess cutaneous involvement during the course of coronavirus disease 2019 (COVID-19). Between January 1 and March 15, 2020, we investigated the epidemiologic and clinical features of cutaneous manifestations in adult patients with COVID-19. The data were collected prospectively by experienced dermatologists in Wuhan, Hubei province, China, and Lecco, Lombardia region, Italy. Institutional Review Boards approved the study.

Four participating hospitals (3 in China, 1 in Italy) enrolled patients diagnosed with COVID-19, according to World Health Organization interim guidance.[1] Whenever possible, all new cutaneous findings and pre-existing dermatologic diagnoses were recorded at admission to assess the possible influence of hospital-based treatment and external factors. History and physical examinations were used to categorize all dermatologic conditions as pre-existing vs newly arising.

This observational cross-sectional study enrolled 678 patients with polymerase chain reaction-confirmed COVID-19. Patients were classified by disease severity based on *Chinese Diagnosis and Treatment Scheme for SARS-CoV-2*: 6.0% (41 patients) were considered "critically-ill," 17.5% (118 patients) "severe," 18.7% (127 patients) "common," and 57.8% (392 patients) "mild." In this cohort, 53 patients (7.8%) had new dermatologic conditions that were detected at admission or during hospitalization. This subgroup was a mean age of 55.9 years (range, 28-69 years), and 60% were men (Table I). Of the dermatologic conditions, 44% were present on the day of the COVID-19 diagnosis, roughly at the onset of the typical flu-like symptoms. The remaining 56% of dermatoses were observed at a mean of 11.7 days (range, 2-23 days after hospitalization).

Table I. Main epidemiologic and clinical characteristics of the study population

Variables	Patients*	Total
Patients with COVID-19 (pharyngeal swab-positive)		678
Italian patients		92
Chinese patients		586
Degree of disease severity†		
Critical types	41 (6)	
Severe types	118 (17.5)	
Common types	127 (18.7)	
Mild types	392 (57.8)	
Patients with COVID19 with skin manifestations		53 (7.8)
Male	32 (60)	
Female	21 (40)	
Age, y	55.9 (28-69)	
Chinese patients	53.2 (28-65)	
Italian patients	58.6 (35-69)	
Inflammatory skin manifestations related to COVID-19		53
Erythematous rash	37 (70)	
Diffuse urticaria	14 (26)	
Varicelliform rash with vesiculation	2 (4)	
Vascular skin manifestations in intensive care patients		
Diffuse petechiae, purpura, and acroischemia		13
Onset of inflammatory skin manifestations related to COVID-19		53
Before hospitalization	23 (44)	
After hospitalization	30 (56)	
Duration of inflammatory skin manifestations, d	3 (2-5)	

COVID-19, Coronavirus disease 2019.
*Patient data are presented as number (%) or mean (range).
†Degree of disease severity: For the mild type: slight clinical symptoms with no pneumonia presentation in imaging. For the common type: manifestations such as fever or respiratory presentation with pneumonia by radiography, or both. For the severe type (meeting any of the following conditions): (1) dyspnea, respiration rate 30 times/min; (2) finger oxygen saturation under resting 93%; (3) arterial partial pressure of arterial oxygen/fraction of inspired oxygen 300 mm Hg (1 mm Hg = 0.133 kPa). For the critical type (meeting any of the following conditions): (1) respiratory failure requiring mechanical ventilation; (2) shock; (3) combined with other organ failures requiring an intensive care unit.

Of the 53 patients with new inflammatory skin findings, the most common finding was erythematous rash (70%), seen over a wide spectrum of clinical appearances (macular, papular, maculopapular, and erythema multiforme-like eruptions), followed by diffuse urticaria (26%). Two patients (4%) had scattered vesicular, varicelliform eruptions[2]; in