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.

improve delabeling success and prescribing practices for children with PCN allergy. Existing but underused online education tools include the American Academy of Pediatrics toolbox,[9] practice parameters,[4] and PCN allergy literature.[10] At point of care, visual decision aids are a method to reinforce provider knowledge and deliver accurate PCN allergy facts to patients and families.

Our study findings are important to promote successful execution of delabeling efforts in pediatric EDs. Engagement of providers and additional stakeholders to create collaborative approaches to delabeling and antibiotic prescribing are feasible; our data can inform and guide approaches to implement effective PCN allergy delabeling.

Jessica K. Graham, MD*
Cheryl Yang, MD†
David Vyles, DO, MS‡
Jan Leonard, MSPH*
Rakesh D. Mistry, MD, MS*
* *Section of Emergency Medicine*
Children's Hospital of Colorado
AuroraColorado
† *Division of Pediatric Emergency Medicine*
Primary Children's Hospital
Salt Lake City, Utah
‡ *Section of Emergency Medicine*
Children's Hospital of Wisconsin
Milwaukee, Wisconsin

jmkraynik@gmail.com

References

1. Collins C. The low risks and high rewards of penicillin allergy delabeling: an algorithm to expedite the evaluation. *J Pediatr*. 2019;212:216–223.
2. Esposito S, Castellazzi L, Tagliabue C, Principi N. Allergy to antibiotics in children: an overestimated problem. *Int J Antimicrob Agents*. 2016;48(4):361–366.
3. Stone CA, Trubiano J, Coleman DT, Rukasin CRF, Phillips EJ. The challenge of delabeling penicillin allergy. *Allergy*. 2020;75(2):273–288.
4. Joint Task Force on Practice Parameters, American Academy of Allergy, Asthma and Immunology, American College of Allergy, Asthma and Immunology, Joint Council of Allergy, Asthma and Immunology. Drug allergy: an updated practice parameter. *Ann Allergy Asthma Immunol*. 2010;105(4):259–273.
5. Vyles D, Chiu A, Simpson P, Nimmer M, Adams J, Brousseau DC. Parent-reported penicillin allergy symptoms in the pediatric emergency department. *Acad Pediatr*. 2017;17(3):251–255.
6. Vyles D, Adams J, Chiu A, Simpson P, Nimmer M, Brousseau DC. Allergy testing in children with low-risk penicillin allergy symptoms. *Pediatrics*. 2017;140:(2) e20170471.
7. Mustafa SS, Conn K, Ramsey A. Comparing direct challenge to penicillin skin testing for the outpatient evaluation of penicillin allergy: a randomized controlled trial. *J Allergy Clin Immunol Pract*. 2019;7(7):2163–2170.
8. Gugkaeva Z, Crago JS, Yasnogorodsky M. Next step in antibiotic stewardship: pharmacist-provided penicillin allergy testing. *J Clin Pharm Ther*. 2017;42(4):509–512.
9. Norton AE, Konvinse K, Phillips EJ, Broyles AD. Antibiotic allergy in pediatrics. *Pediatrics*. 2018;141:(5) e20172497.
10. Trubiano JA, Adkinson NF, Phillips EJ. Penicillin allergy is not necessarily forever. *JAMA*. 2017;318(1):82–83.

Hand hygiene impact on the skin barrier in health care workers and individuals with atopic dermatitis

Hand washing and the use of hand sanitizers are important interventions in preventing the spread of viruses and bacteria.[1] With the onset of the coronavirus disease (COVID-19) pandemic, hand hygiene measures have intensified. Nevertheless, there are reports of increased dermatologic effects from increased hand washing, such as hand irritation.[2] This is especially notable in health care workers (HCWs) who already have an increased risk of irritant contact dermatitis.[2-4] Furthermore, individuals who have existing skin barrier dysfunction, such as atopic dermatitis (AD), may have magnified symptoms from increased hand hygiene.

With the COVID-19 pandemic, there are reports of increased hand irritation and dryness.[1-3] Previous studies on both healthy controls and subjects with AD have revealed that exposure to alcohol in hand sanitizers and detergents in soaps causes decreased natural moisturizing factor and increased transepidermal water loss (TEWL).[5,6] Nevertheless, another study did not reveal significant changes in TEWL after repeated exposure of healthy skin to alcohol irritants.[7] In addition, there are no data available on skin barrier response with skin tape strip (STS) provocation after the use of these agents, which is a useful tool for the evaluation of skin barrier integrity. In this study, we evaluated the impact of increased hand hygiene practices as a result of the COVID-19 pandemic on HCWs and patients with AD.

This institutional review board–approved study took place at National Jewish Health in Denver. Questionnaires were administered to inquire on allergy history, hand hygiene practices, and skin symptoms related to hand hygiene. Skin barrier assessment was performed by TEWL as an objective way to measure skin barrier function.[8] In addition, TEWL was measured using the GPSkin Pro device (GPOWER Inc, Seoul, Republic of Korea) in an examination room with a controlled microclimate, first at baseline and then again after 5 STS to assess water loss in the skin. Next, the subjects used hand sanitizer provided by the study team. Finally, subjects washed their hands with soap and water, and TEWL was measured before and after 5 STS, with both TEWL and STS obtained on the dorsal surface of 1 hand. The hand sanitizer product was Symmetry Foaming Hand Sanitizer (Buckeye International, Maryland Heights, Missouri), containing ethyl alcohol, water, and polydimethylsiloxane. The soap was Symmetry Green Certified Foaming Hand Wash Unscented (Buckeye International), containing cocamide monoethanolamine and bio-terge AS-40/sodium olefin sulfonate. The TEWL area under the curve (AUC) was calculated to reveal the cumulative water loss after 5 STS for 3 treatment conditions (ie, baseline, after hand sanitizer, after hand washing). Furthermore, TEWL data were summarized as a box and whisker plot, with the box margins representing the 25th percentile to 75th percentile interquartile range, whisker lines extend for 1.5 times the interquartile range, and observations outside the whisker were marked by an open circle. The horizontal line within each box represents the median. Unpaired *t* test was used for the selected group comparisons. GraphPad Prism (version 9.0.2; GraphPad Prism, San Diego, California) and JMP (version 13.1.0) were used for data visualization and statistical analysis. Differences between the groups were considered significant with P value <.05.

A total of 36 adults (18-60 years) were enrolled. Subjects had either a history of AD (n = 17) or were without atopy with no history of

Disclosures: The authors have no conflicts of interest to report.
Funding: This study is funded by The Edelstein Family Chair of Pediatric Allergy-Immunology, National Jewish Health.

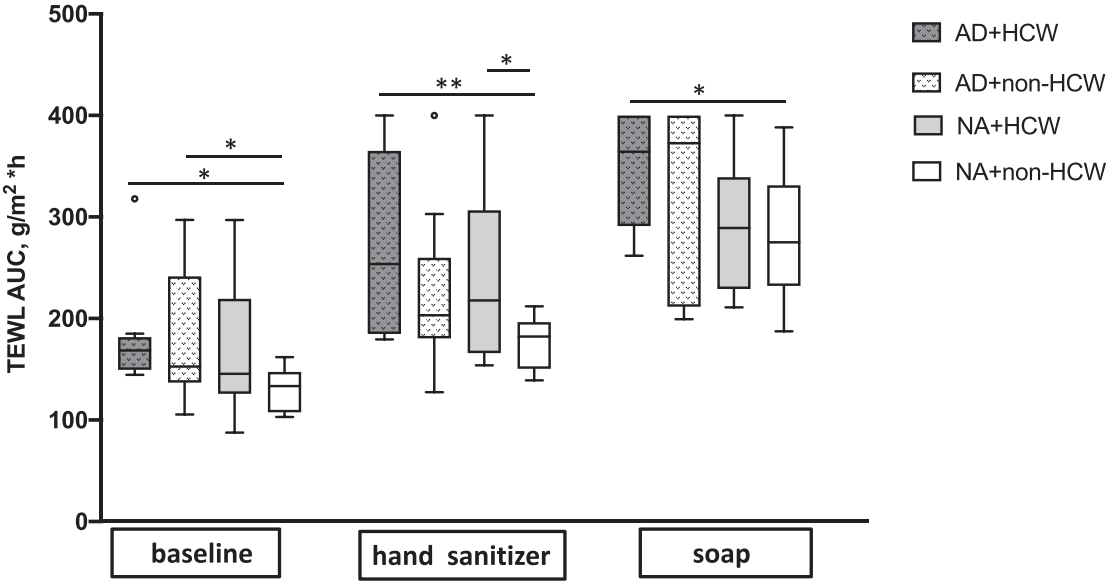

Figure 1. TEWL in subjects with AD and healthy NA controls. Study subjects were stratified as HCW or subjects with no patient contact (non-HCW). The box margins are the 25th percentile to 75th percentile interquartile range. Horizontal lines within each box represent the median. *$P < .05$, **$P < .01$. AD, atopic dermatitis; AUC, area under the curve; HCW, health care worker; NA, nonatopic; TEWL, transepidermal water loss.

allergies (n = 19). The groups were also stratified according to whether they were a HCW with patient contact (n = 17) or not a HCW (n = 19). There were 8 subjects with AD who were HCWs (AD + HCW), 9 subjects with AD who were not HCWs (AD + non-HCW), 9 subjects who were HCWs without atopy (NA + HCW), and 10 subjects who were without atopy and not HCWs (NA + non-HCW). There was no significant difference in age, sex, or race among the groups. All subjects with AD had mild AD skin severity. The mean eczema area and severity index (EASI) score of the AD plus HCW group was 0.7; the mean EASI score of the AD plus non-HCW group was 1.7 (EASI score: 0-72). A skin examination was completed by a physician, with the AD group having greater evidence of xerosis, erythema, and lichenification; abnormal skin findings were found in 10 subjects with AD compared with 4 subjects without AD. Of the subjects with AD, 7 reported history of contact dermatitis but none noted sensitization to the ingredients used in this study. The subjects withheld topical medications to the area sampled for 7 days previously, moisturizers were withheld for 24 hours, and they did not bathe on the day of the visit. For HCWs, study visits were scheduled at the start of the shift when applicable.

Most of the subjects in all groups reported increased hand dryness and irritation since the pandemic onset. The HCW group had significantly increased frequency of hand sanitizer use per day compared with the non-HCW group (on average 9-18 times per day in the HCW group, as compared with 2-3 times per day in the non-HCW group, $P = .008$). There was no difference in the use of soap and water among the groups.

Before treatment with hand sanitizer and soap, baseline TEWL AUC was significantly higher in AD + HCW and AD + non-HCW subjects as compared with NA + non-HCW subjects (Fig 1) ($P < .05$). In all 4 groups, the TEWL AUC increased after hand sanitizer use, with even greater increase after soap and water use. Both HCW groups (AD + HCW, NA + HCW) had an increased TEWL response after hand sanitizer use as compared with NA + non-HCW group ($P < .01$ and $P < .05$, respectively). Within the broader AD group, there was a significantly higher increase in the TEWL AUC after hand washing with soap and water compared with the subjects without atopy (TEWL AUC, mean ± SD, 337 ± 75 g/m^2 * h vs 282 ± 62 g/m^2 * h, respectively, $P < .05$). In a 4-group comparison, a significantly greater TEWL AUC after the use of soap was noted in AD + HCW workers than NA + non-HCW subjects ($P < .05$) (Fig 1).

It was found that HCWs have chronic use of hand sanitizer and a higher incidence of irritant contact dermatitis.[4] This may explain the significantly higher TEWL AUC after the use of hand sanitizer among HCWs because they have an already compromised skin barrier. Moreover, HCWs also reported the use of skin emollients, most being unscented creams and lotions. Despite this, their TEWL was increased. Future studies on effects of specific emollients would be of interest because it has been found that emollients are not equally effective.[9]

The subjects with AD in our study had a significantly higher baseline TEWL AUC and highest TEWL AUC response after hand washing. It is known that individuals with AD have less natural moisturizing factor in the outer skin layers, which is needed for skin hydration.[10] These data support the underlying skin barrier dysfunction present in AD. Hand washing with soap and water leads to the removal of the healthy skin products, which is congruent with previous studies.[7]

Regarding the limitations of this study, the subjects with AD had mild disease at the time of evaluation. Future studies will be useful in assessing subjects with moderate-to-severe AD. Overall, our study objectively displays the insults that occur to the skin barrier from hand sanitizer and soap products. Although frequent hand hygiene is important, this study reveals that clinicians should be mindful of counseling their patients of skin care after use of hand sanitizers and soaps.

Acknowledgment

The authors acknowledge Nicole Meiklejohn for her assistance in preparing this manuscript.

Jessica Hui-Beckman, MD
Donald Y.M. Leung, MD, PhD
Elena Goleva, PhD

Department of Pediatrics
National Jewish Health
Denver, Colorado
huij@njhealth.org

References

1. Assefa D, Melaku T, Bayisa B, Alemu S. Knowledge, attitude and self-reported performance and challenges of hand hygiene using alcohol-based hand sanitizers among healthcare workers during COVID-19 pandemic at a tertiary hospital: a cross-sectional study. *Infect Drug Resist*. 2021;14:303–313.
2. Rundle CW, Presley CL, Militello M, et al. Hand hygiene during COVID-19: recommendations from the American Contact Dermatitis Society. *J Am Acad Dermatol*. 2020;83(6):1730–1737.
3. Guertler A, Moellhoff N, Schenck TL, et al. Onset of occupational hand eczema among healthcare workers during the SARS-CoV-2 pandemic: comparing a single surgical site with a COVID-19 intensive care unit. *Contact Dermatitis*. 2020;83(2):108–114.
4. Pacheco KA. Occupational dermatitis: how to identify the exposures, make the diagnosis, and treat the disease. *Ann Allergy Asthma Immunol*. 2018;120(6):583–591.
5. Angelova-Fischer I, Stilla T, Kezic S, Fischer TW, Zillikens D. Barrier function and natural moisturizing factor levels after cumula-tive exposure to short-chain aliphatic alcohols and detergents: results of occlusion-modified tandem repeated irritation test. *Acta Derm Venereol*. 2016;96(7):880–884.
6. Angelova-Fischer I, Soltanipoor M, Stilla T, Fischer TW, Kezic S, Jakasa I. Barrier damaging effects of n-propanol in occlusion-modified tandem repeated irritation test: modulation by exposure factors and atopic skin disease. *Contact Dermatitis*. 2020;82(1):1–9.
7. Loffler H, Kamof G, Schmermund D, Maibach HI. How irritant is alcohol? *Br J Dermatol*. 2006;157(1):74–81.
8. Alexander H, Brown S, Danby S, Flohr C. Research techniques made simple: transepidermal water loss measurement as a research tool. *J Invest Dermatol*. 2018;138(11):2295–2300.e1.
9. Sindher S, Alkotob SS, Shojinaga MN, et al. Pilot study measuring transepidermal water loss (TEWL) in children suggests trilipid cream is more effective than a paraffin-based emollient. *Allergy*. 2020;75(10):2662–2664.
10. Leung DYM, Berdyshev E, Goleva E. Cutaneous barrier dysfunction in allergic diseases. *J Allergy Clin Immunol*. 2020;145(6):1485–1497.

Can allergists provide adequate asthma care in the setting of a school-based health center?

School-based health centers (SBHCs) are clinics within schools that facilitate access to health care for students. Health care accessed in school decreases time away from school owing to illnesses or appointments and should lead to fewer absences, improvements in performance, and decreases in dropout rates.[1] Asthma is a common chronic condition of childhood; asthma management is a logical area on which SBHCs should focus to improve school attendance and performance.[2]

Advantages to working within SBHC are longitudinal access to patients and the ability to bill for services rendered; one can create a sustainable community partnership that does not rely on grants. Nevertheless, a cross-sectional chart review study done in the Bronx, New York, in 2003, found that clinicians (physicians or nurse practitioners) working in SBHCs at elementary schools did not provide care consistent with national asthma guidelines.[3] Using this model, an allergist partnered with a local school system to provide asthma care at SBHCs. We investigated whether an allergist working in SBHCs adequately met standard of care for asthma.

From 2016 to 2019, an allergist partnered with a local school system and spent 1 half-day each week seeing students with asthma or suspected asthma. At the beginning of each school year, parents or guardians gave consent for their child to receive services in the SBHC. The allergist rotated among 3 different SBHCs, including 2 at high schools and 1 at a combined high school and middle school. Fellows, residents, and medical students intermittently participated. The team focused on asthma education and optimization of medications based on asthma severity and asthma control.

In Spring 2019, we conducted a retrospective chart review to investigate adherence with certain asthma process measures.[4] Data were extracted from the electronic medical records of the SBHCs. Data were collected by visit from charts of students seen by the allergist for asthma or suspected asthma. We excluded visits with children not ultimately diagnosed with having asthma. We focused on process measures rather than health outcome measures as an assessment of our model. The following items were scored as either present or absent for each clinic visit: asthma control documented; last spirometry documented and performed within the past 12 months; documentation that inhaler technique was assessed and reviewed; documentation that an asthma action plan (AAP) was created/reviewed/updated; asthma severity documented; whether medications needed to be stepped up, stepped down, or continued; whether the annual flu shot was recommended; and whether the follow-up visit was recommended to take place at the appropriate interval.

This retrospective chart review was approved as an exempt study by the Tulane University Institutional Review Board and supported by the school system.

Summary of results is provided in Table 1. The results suggest that dedicated asthma visits conducted by an allergist in a SBHC successfully incorporate guideline-based process measures. Measures of special interest to our team were grouped into those affecting medication management and those pertaining to asthma education.

Medication management: The decision to continue or change asthma medications is influenced by asthma control and severity. We assessed this using spirometry (incorporated into decision making in 91.9% of encounters), the asthma control test (incorporated into decision making in 98.7% of encounters), and severity (per the guidelines of the National Heart, Lung, and Blood Institute, documented 83.5% of the time). Together, these measures explain our successful documentation of medication management 98.7% of the time. The number of visits considering spirometry was notable. A chart review of patients with asthma of all ages found that spirometry was performed only 14.9% of the time in the primary care setting.[5] All clinicians underuse spirometry, but allergists order spirometry more than primary care counterparts.[6]

Asthma education: For our process measures, we focused on the following 3 variables important in asthma education: (1) assessment/review of inhaler technique; (2) use of an AAP; and (3) recommendation of an annual influenza immunization.[4] Review of inhaler technique was documented in less than half of the visits. We suspect that most cases did receive this, but documentation did not reflect that. This represents an opportunity for improvement. The school system required that all students with asthma have an AAP on file; our team completed an AAP for any student without one so that the school system met this metric. This was a substantial motivator for the creation of our partnership. An annual AAP was on file in 94.9% of visits; previously created AAPs were reviewed at subsequent visits 80.2% of the time. In a primary care study of patients with asthma of all ages,

Disclosures: The authors have no conflicts of interest to report.
Funding: The authors have no funding sources to report.