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# Updating the Burn Center Referral Criteria: Results From the 2018 eDelphi Consensus Study

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Existing burn center referral criteria were developed several years ago, and subsequent innovations in burn care have occurred. Coupled with frequent errors in the estimation of extent of burn injury and depth by referring providers, patients are both over and under-triaged when the existing criteria are used to support patient care decisions. In the absence of compelling clinical trial data on appropriate burn patient triage, we convened a multidisciplinary panel of experts to execute an iterative eDelphi consensus process to facilitate a revision. The eDelphi process panel consisted of  $n = 61$  burn stakeholders and experts and progressed through four rounds before reaching consensus on key clinical domains. The major findings are that 1) burn center consultation is strongly recommended for all patients with deep partial-thickness or deeper burns  $\geq 10\%$  TBSA burned, for full-thickness burns  $\geq 5\%$  TBSA burned, for children and older adults with specific dressing and medical needs, and for special burn circumstances including electrical, chemical, and radiation injuries; 2) smaller burns are ideally followed in burn center outpatient settings as soon as possible after injury, preferably without delays of a week or more; 3) frostbite, Stevens–Johnson syndrome/TENS, and necrotizing soft-tissue infection patients benefit from burn center treatment; and 4) telemedicine and technological solutions are of likely benefit in achieving this standard. Unlike the original criteria, the revised consensus-based guidelines create a framework promoting communication so that triage and treatment are specifically tailored to individual patient characteristics, injury severity, geography, and the capabilities of referring institutions.

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During the past 50 years, expertise in burn care has progressively transitioned to burn centers in response to the complexity of providing multidisciplinary care to patients with severe burns. Such centers excel in acute resuscitation, critical care, wound care, surgical wound closure, acute and convalescent rehabilitation, social and psychiatric support for patients and families, peer support from survivor networks, and early and later reconstructive surgery. Provision of this type of multidisciplinary, longitudinal care is capital intensive, limited to less than 130 centers in North America, and sometimes at great geographic distance from a given patient. Although not every burn patient needs all that the burn center has to offer, providers at such centers are best qualified to judge a burn patient's acute needs and to predict future problems and, as such, constitute a resource for referring providers.

More than 20 years ago, in a first attempt to bring burn center expertise to patients that needed it, the American Burn Association (ABA) developed consensus recommendations for patient referral to a burn center. These "Burn Center Referral Criteria"<sup>1</sup> were intended both to assist referring providers with triage decisions and to improve delivery of burn expertise to burn patients. The digital revolution was in its infancy when the criteria were first publicized: voice communication was the most accessible way to immediately share information at a distance and prompt transmission of photographic and video images was practically impossible.

Now, 11 years after the debut of the first smartphones, the capacity for near-instantaneous image and information transfer

is widespread, and there is ample evidence in burn care that “telemedicine” is effective.<sup>2-4</sup> Smartphones are ubiquitous. Imaging technology is cheap, and HIPAA-compliant image transmission is possible. Digital photos can be transferred instantaneously, and secure communication can occur by voice, text, or email. These tools have the capacity to deliver burn expert consultation to any referring provider without transfer of a patient. Before transfer, an experienced eye can judge the need for ED/inpatient transfer, outpatient referral, or care in the community from which the referral comes, with a follow-up evaluation in the burn center. With this technological capacity, what role do the ABA Criteria have?

This question is particularly relevant in light of studies suggesting that the ABA Criteria have not been properly understood by the larger medical community. For example, a 2016 article from Nationwide Children’s Hospital suggested that only 8.2% of children meeting the existing American Burn Association Burn Center referral guidelines were transferred to a high-volume burn center for care.<sup>5</sup> The authors suggest that the existing guidelines were missing practical information about which patients need specialty follow-up care, and that making burn center referral decisions would have less room for error if the ABA clarified their guidance. Similarly, a 2010 study of adult patients noted that 52% of adults treated at non-burn centers met the existing criteria.<sup>6</sup>

On the other hand, the ABA Criteria are sometimes seen not as recommendations for communication with a burn center, but as yes/no TRANSFER criteria, resulting in significant over-triage to burn centers, consuming transportation and emergency department resources needlessly, and imposing inconvenience on patients with minor burns unnecessarily transferred to a burn center, sometimes at great distances from home.<sup>7</sup> This problem is not unique to the United States but has been observed in other countries with published burn referral guidelines.<sup>8</sup>

Another issue complicating burn patient triage is the difficulty that many providers have in determining the extent of partial- or full-thickness burn injury.<sup>9-11</sup> Multiple studies have demonstrated substantial difference in the extent of burn injury estimates between referring institution and burn center; and while both over and under-estimation are clinically relevant problems, overestimation is twice as common as under-estimation. Overestimates of the extent of burn injury, in the absence of image sharing between referring hospital and burn center, increase the likelihood that a patient will be inappropriately transferred based on the ABA criteria.

Recognizing that Burn Centers provide patient-centered care and are associated with good outcomes, and that technological tools offer the opportunity for a much more nuanced communication regarding patient referral that considers the balance between long-distance travel and its associated expenses and patient benefit, the ABA Board of Trustees (BOT) charged the Committee on the Organization and Delivery of Burn Care Committee (CODBC) with revision of current burn referral criteria to promote appropriate access to expert care and the triage of burned patients. Lacking sufficient published evidence to support such revision, we adopted an iterative expert consensus process (Delphi) to guide the revision. We present the results of this process and the newly proposed “Guidelines for Referral and Consultation,” intended as a framework within which 21st-century technology can enhance communication

between referring and burn providers and thus promote optimal triage and care of burn patients.

## METHODS

### Consensus in the Absence of High-Level Evidence

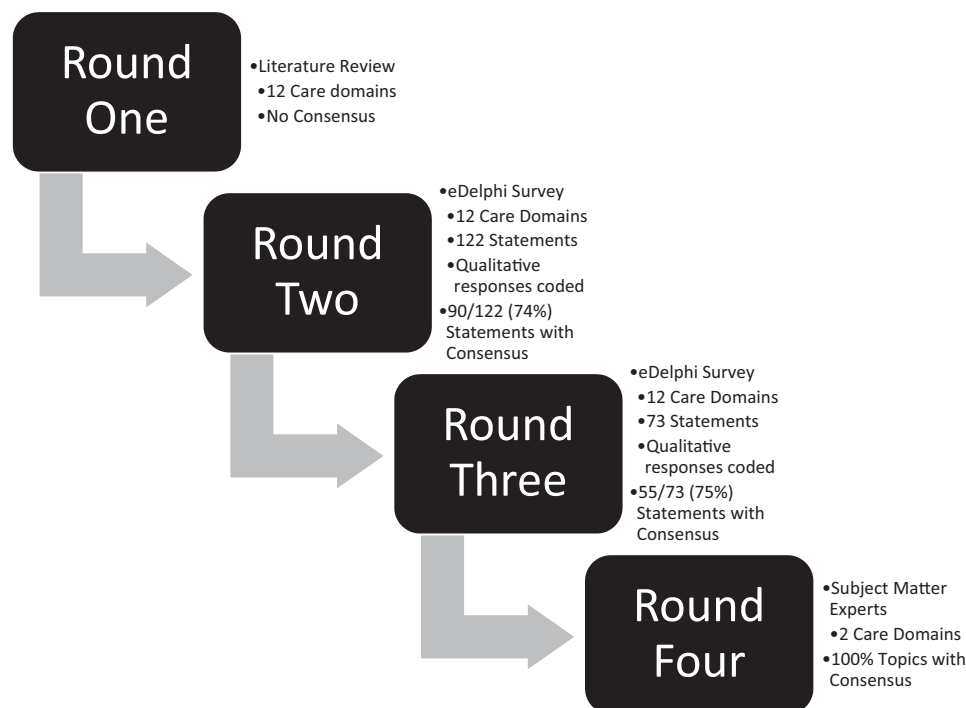
There are no existing systematic reviews of the evidence for burn center care and no studies with secondary data using causal inference or randomization of patients from which to design guidelines. Consequently, we turned to The Institute of Medicine’s (IOM) Standards for Developing Trustworthy Clinical Practice Guidelines<sup>12</sup> using these standards as a conceptual framework for our eDelphi consensus process. After an exhaustive literature examination, the committee determined that the Delphi method was justified and the most appropriate strategy due to the lack of randomized controlled trials related to burn center care/outcomes and emerging topics such as telemedicine and outpatient follow-up. In January of 2017, with the support of the ABA BOT, the CODBC subcommittee began using a reactive eDelphi process guided by the IOM standards to gain expert consensus statements for the guideline’s eventual revision. The Delphi method has gained popularity in recent years, and as such, there are recent recommendations for the Conducting and REporting of DELphi Studies (CREDES)<sup>13</sup> that will be used as the foundation for our methods and reporting of results.

### Justification for the Reactive eDelphi Method

The traditional form of the Delphi method was developed by Norman Dalkey and Olaf Helmer at the RAND Corporation in the 1950s and has since been used by the U.S. military and others interested in developing guidelines, making policy and resource utilization recommendations.<sup>14</sup> The Delphi method uses surveys to assess what *could* or *should be*, rather than what *is*.<sup>14</sup> The principal feature of any Delphi method is the performance of several iterations, or interconnected “rounds” of inquiry among a group of experts with the goal of gaining consensus among the group. There are several variations on the Delphi method, and based on the topic and available resources, we chose to pursue the reactive eDelphi technique. The reactive eDelphi technique uses electronic surveys and a formalized process of “reacting” to each round based on the previous round’s responses.<sup>15</sup> The rounds continue until consensus is achieved. Our Delphi study included four total rounds, consisting of two focus groups and two consensus statement electronic surveys (Figure 1).

### Round 1: Initial Expert Panel

The study protocol was submitted and granted exempt status from the institutional review board at the Massachusetts General Hospital in Boston, MA. The round 1 CODBC subcommittee established 15 care domains for the initial literature review based on the existing referral guideline content and identified knowledge gaps (Table 1). Then, experts in each domain from the round 1 panel developed statements to seek consensus on these domains in round 2 using a broad and larger group of burn care experts. The round 2 burn care experts were either self-identified members of the CODBC or ABA Board, or experts known to the CODBC or ABA



**Figure 1.** Reactive eDelphi process rounds and results.

BOT that had subject matter knowledge on at least one of the domains. According to the IOM, the guideline development group should consist of a variety of methodological experts and clinicians, be multidisciplinary and include populations that will be affected by the guideline, such as emergency department clinicians and patients. The CREDES recommendations suggest that the expert panel selection process is very transparent, with recruitment and criteria reported. For recruitment in each round of the Delphi process, each existing ABA-CODBC committee member or ABA BOT member was asked to recruit experts for the panel. We sought input from all regions of the United States and Canada, all professions involved in the burn care team, and outside stakeholders such as emergency medicine and primary care clinicians. We also recruited experts with a range of burn care experience. The demographics of the expert panels are described in [Table 2](#).

### Rounds 2 and 3: eDelphi Surveys

We created an initial round 2 electronic Delphi survey that was “reactive” to the first-round expert literature review. The extensive review conducted in round 1 suggested that the panel should consider 1) whether criteria or guidelines should be created 2) whether those criteria and guidelines should be for transfer, consultation, or both 3) which patients need burn center care of some kind 4) which patients would benefit from the use of telemedicine, and 5) which patients can be seen in inpatient vs outpatient clinic settings. Once an extensive list of questions had been developed by the workgroup members, the entire CODBC committee vetted and tested the survey, and after extensive feedback and revisions, the final round 2 survey instrument was agreed on.

Once the final survey instrument was developed, each expert was invited and agreed to participate via email by the chairs of the CODBC subcommittee. Only the experts that agreed to participate were included in the final ( $n = 47$ ) expert panel for the second-round survey. The final round 2 expert panel consisted of ABA and non-ABA member clinicians from several disciplines and represented each ABA region in the United States and Canada. The round 2 survey was transcribed into an online, secure, university-based survey database management program (REDCap), and the expert consensus panel was emailed an anonymous link to complete the survey. An *a priori* consensus threshold of >70% of experts responded that they “somewhat agree” or “agree” with the statements on the survey. The responses from the panelists were recorded over a 30-day survey window, and the data were exported to statistics software program (Stata IC, v.15) where statistical analysis was performed.

The survey responses were analyzed for consensus and shared with the round 1 (original) expert panel. There were open-ended questions with text responses from the round 2 experts that were analyzed qualitatively using conventional content analysis and Atlas.ti (v.8.0) data management software and two independent coders. Topics revealed in the qualitative analysis that had not been previously queried were added to the survey, such as frostbite. Then, the round 3 survey with both the round 2 non-consensus and additional clarifying questions from qualitative analysis was sent to the same panel to seek consensus on the items that had not reached consensus (>70% agreement) in round 2 as well as the new items. The same threshold, >70%, was used to determine consensus in round 3.

Table 1. Care domains identified by the round 1 expert panel (n = 12 participants)

Domain	Selected Relevant Literature	Number of Consensus Survey Statements Generated
General attitudes regarding the utility of the current criteria	Davis, J. S., Dearwater, S., Rosales, O., Varas, R., Quintana, O. D., Pizano, L., thSchulman, C. I. (2012a). Tracking non-burn center care: What you don't know may surprise you. <i>Journal of Burn Care and Research</i> . <a href="https://doi.org/10.1097/BCR.0b013e3182504450">https://doi.org/10.1097/BCR.0b013e3182504450</a>	N = 22
• Distance factors	Hranjec, T., Turrentine, F. E., Stukenborg, G., Young, J. S., Sawyer, R. G., & Calland, J. F. (2012). Burn-center quality improvement: Are burn outcomes dependent on admitting facilities and is there a volume-outcome "sweet-spot"? <i>American Surgeon</i> , 78(5), 559-563	
• Under-triage	Shi, J., Johnson, S. A., Xiang, H., Wheeler, K. K., Thakkar, R. K., Fabia, R., & Besner, G. E. (2016). Inter-facility transfer of pediatric burn patients from U.S. Emergency Departments. <i>Burns</i> . <a href="https://doi.org/10.1016/j.burns.2016.06.024">https://doi.org/10.1016/j.burns.2016.06.024</a>	
• Payer / Health System Factors	Vercruyse, G. A., Ingram, W. L., & Feliciano, D. V. (2011a). Overutilization of regional burn centers for pediatric patients—a healthcare system problem that should be corrected. In <i>American Journal of Surgery</i> . <a href="https://doi.org/10.1016/j.amjsurg.2011.06.036">https://doi.org/10.1016/j.amjsurg.2011.06.036</a>	
Preferred future of the ABA Burn Center Referral	Zonies, D., Mack, C., Kramer, B., Rivara, F., & Klein, M. (2010). Verified Centers, Nonverified Centers, or Other Facilities: A National Analysis of Burn Patient Treatment Location. <i>Journal of the American College of Surgeons</i> . <a href="https://doi.org/10.1016/j.jamcollsurg.2009.11.008">https://doi.org/10.1016/j.jamcollsurg.2009.11.008</a>	N = 5
Criteria	Davis, J. S., Dearwater, S., Rosales, O., Varas, R., Quintana, O. D., Pizano, L., Schulman, C. I. (2012a). Tracking non-burn center care: What you don't know may surprise you. <i>Journal of Burn Care and Research</i> . <a href="https://doi.org/10.1097/BCR.0b013e3182504450">https://doi.org/10.1097/BCR.0b013e3182504450</a>	
• Criteria	Field, M. J., & Lohr, K. N. (n.d.). <i>Clinical Practice Guidelines: Directions for a New Program</i> . Retrieved from <a href="http://www.nap.edu/catalog/1626.html">http://www.nap.edu/catalog/1626.html</a>	
• Guidelines	Kastenmeier, A., Faraklas, I., Cochran, A., Pham, T. N., Young, S. R., Gibran, N. S., huSaffle, J. R. (2010). The evolution of resource utilization in regional burn centers. <i>Journal of Burn Care and Research</i> . <a href="https://doi.org/10.1097/BCR.0b013e3181cb8ca2">https://doi.org/10.1097/BCR.0b013e3181cb8ca2</a>	
• Transfer vs Consultation	Reiband, H. K., Lundin, K., Alsbj13e3181cb8ca2ization in regiRasmussen, L. S. (2014). Optimization of burn referrals. <i>Burns</i> . <a href="https://doi.org/10.1016/j.burns.2013.08.001">https://doi.org/10.1016/j.burns.2013.08.001</a>	
• Reconstruction	Liodaki, E., Senyaman, and location013.08.0012ization in regional burn centers. . S., hulmanStang, F. (2014). Obese patients in a burn care unit: A major challenge. <i>Burns</i> . <a href="https://doi.org/10.1016/j.burns.2014.04.016">https://doi.org/10.1016/j.burns.2014.04.016</a>	N = 26
Burn Size Thresholds	Modern, I. N., Care, B., Finnerty, C. C., Gamelli, R. L., & Gibran, N. S. (2016). Morbidity and Survival Probability in Burn Patients, 43(4), 808–815. <a href="https://doi.org/10.1097/CCM.0000000000000790.MORBIDITY">https://doi.org/10.1097/CCM.0000000000000790.MORBIDITY</a>	
• All Ages, size, depth, and location	Shi, J., Johnson, S. A., Xiang, H., Wheeler, K. K., Thakkar, R. K., Fabia, R., & Besner, G. E. (2016). Inter-facility transfer of pediatric burn patients from U.S. Emergency Departments. <i>Burns</i> . <a href="https://doi.org/10.1016/j.burns.2016.06.024">https://doi.org/10.1016/j.burns.2016.06.024</a>	N = 15
• Age-specific concerns	Vercruyse, G. A., Ingram, W. L., & Feliciano, D. V. (2011). Overutilization of regional burn centers for pediatric patients—a healthcare system problem that should be corrected. In <i>American Journal of Surgery</i> .	
• Modified Baux Score		
Pediatric Burns		
• Depth		
• Size		
• Location		
• Outpatient follow-up		



Table 1. Continued

Domain	Selected Relevant Literature	Number of Consensus Survey Statements Generated
Older Adult (>55) Burns	Carter, J. E., Neff, L. P., & Holmes, J. H. (2010). Adherence to Burn Center Referral Criteria: Are Patients Appropriately Being Referred? <i>Journal of Burn Care &amp; Research</i> , 31(1), 26archR & Rm Care & RBeing RefBCR.0b013e3181cb8efb	N = 7
• Depth	Hsu, C.-C., & Sandford, B. A. (2010). Delphi Technique. In <i>SAGE Research Methods</i> (pp. 344-344). Methodstehdsi Technique, Inc.	
• Size	Jnc., S., Payne, S. A., Brine, J., Radbruch, L., & Brearley, S. G. (2017). Guidance on Conducting and Reporting DElphi Studies (CREDES) in palliative care: Recommendations based on a methodological systematic review. <i>Palliative Medicine</i> , 31(8), 684. <a href="https://doi.org/10.1177/1473122517708888">https://doi.org/10.1177/1473122517708888</a>	
• Location	Keeney, S., Hasson, F., & McKenna, H. (2011). <i>The Delphi Technique in Nursing and Health Research</i> . (S. Kenney, Ed.). Ames: Wiley. <a href="https://doi.org/10.1002/9781444392029">https://doi.org/10.1002/9781444392029</a>	
• Outpatient follow-up	Preidt, R. (2016). Few Young U.S. Burn Patients Transferred to Specialized Centers. Retrieved from <a href="https://consumer.healthday.com/general-health-information-16/burn-health-news-87/few-young-u-s-burn-patients-transferred-to-specialized-centers-714276.html">https://consumer.healthday.com/general-health-information-16/burn-health-news-87/few-young-u-s-burn-patients-transferred-to-specialized-centers-714276.html</a>	
• Presence of geriatric and palliative care	Sheridan, R. L., & Greenhalgh, D. (2014). Special problems in burns. <i>The Surgical Clinics of North America</i> , 94(4), 781-791. <a href="https://doi.org/10.1016/j.suc.2014.05.002">https://doi.org/10.1016/j.suc.2014.05.002</a>	N = 4
Chemical Injuries		
• Management location	Davis, J. S., Pandya, R. K., Pizano, L. R., Namias, N., Dearwater, S., & Schulman, C. I. (2013). Examining triage patterns of inhalation injury and toxic epidermal necrolysis-Stevens-Johnson Syndrome. <i>Journal of Burn Care and Research</i> . <a href="https://doi.org/10.1097/BCR.0b013e3182a2ad17">https://doi.org/10.1097/BCR.0b013e3182a2ad17</a>	N = 5
• Provider types	Endorf, F. W., & Gamelli, R. L. (2007). Inhalation injury, pulmonary perturbations, and fluid resuscitation. <i>Journal of Burn Care and Research</i> . <a href="https://doi.org/10.1097/BCR.0b013e31802c889f">https://doi.org/10.1097/BCR.0b013e31802c889f</a>	
Inhalation Injury	Ahrenholz, D., & Mohr, W. (2013). Burns, Electrical Injury and Hypothermia and Frostbite. In <i>Surgical Critical Care, Second Edition</i> . <a href="https://doi.org/10.1201/b14532-10">https://doi.org/10.1201/b14532-10</a>	N = 3
• Management Location		
• Provider types		
Electrical Injury		
• Management location	Davis, J. S., Pandya, R. K., Pizano, L. R., Namias, N., Dearwater, S., & Schulman, C. I. (2013). Examining triage patterns of inhalation injury and toxic epidermal necrolysis-Stevens-Johnson Syndrome. <i>Journal of Burn Care and Research</i> . <a href="https://doi.org/10.1097/BCR.0b013e3182a2ad17">https://doi.org/10.1097/BCR.0b013e3182a2ad17</a>	N = 11
• Provider types	Sheridan, R. L., & Greenhalgh, D. (2014). Special problems in burns. <i>The Surgical Clinics of North America</i> , 94(4), 781-791. <a href="https://doi.org/10.1016/j.suc.2014.05.002">https://doi.org/10.1016/j.suc.2014.05.002</a>	
• High vs Low Voltage		
• Outpatient follow-up		
Exfoliative Skin Disorders (SJS/TENS) and Necrotizing Soft-Tissue Injury		
• Management location	Field, M. J., & Lohr, K. N. (n.d.). <i>Clinical Practice Guidelines: Directions for a New Program</i> . Retrieved from <a href="http://www.nap.edu/catalog/1626.html">http://www.nap.edu/catalog/1626.html</a>	N = 10
• Provider types		
• Role of burn centers		
• Role of burn nurses		
Risks / Benefits of the revision labeled as a "Guideline" or "Criteria" or both		

Table 1. Continued

Domain	Selected Relevant Literature	Number of Consensus Survey Statements Generated
Telemedicine	Medford-Davis, L. N., Holena, D. N., Karp, D., Kallan, M. J., & Delgado, M. K. (2017). Which transfers can we avoid: Multi-state analysis of factors associated with discharge home without procedure after ED to ED transfer for traumatic injury. <i>American Journal of Emergency Medicine</i> . <a href="https://doi.org/10.1016/j.ajem.2017.10.024">https://doi.org/10.1016/j.ajem.2017.10.024</a>	N = 11
<ul style="list-style-type: none"> <li>• Role of telemedicine</li> <li>• Current challenges</li> <li>• Over-triage reduction</li> <li>• Types available</li> </ul>	Reiband, H. K., Lundin, K., Alsbj2017.10.024ge home without pRasmussen, L. S. (2014b). Optimization of burn referrals. <i>Burns</i> , 40(3), 397frals. Is. Optimization of burmburns.2013.08.001	
<ul style="list-style-type: none"> <li>• Role in primary care, emergency departments, and follow-up care</li> </ul>	Warner, P. M., Coffee, T. L., & Yowler, C. J. (2014). Outpatient burn management. <i>Surgical Clinics of North America</i> . <a href="https://doi.org/10.1016/j.suc.2014.05.009">https://doi.org/10.1016/j.suc.2014.05.009</a>	
Frostbite	Ahrenholz, D., & Mohr, W. (2013). Burns, Electrical Injury and Hypothermia and Frostbite. In <i>Surgical Critical Care, Second Edition</i> . <a href="https://doi.org/10.1201/b14532-10">https://doi.org/10.1201/b14532-10</a>	N = 1
<ul style="list-style-type: none"> <li>• Management location</li> <li>• Role of burn centers</li> </ul>	Gonzaga, T., Jenabzadeh, K., Anderson, C. P., Mohr, W. J., Endorf, F. W., & Ahrenholz, D. H. (2016). Use of intra-arterial thrombolytic therapy for acute treatment of frostbite in 62 patients with review of thrombolytic therapy in frostbite. In <i>Journal of Burn Care and Research</i> . <a href="https://doi.org/10.1097/BCR.0000000000000245">doi.org/10.1097/BCR.0000000000000245</a> Mohr, W. J., Jenabzadeh, K., & Ahrenholz, D. H. (2009). Cold Injury. <i>Hand Clinics</i> . <a href="https://doi.org/10.1016/j.hcl.2009.06.004">https://doi.org/10.1016/j.hcl.2009.06.004</a>	
Total	Nygaard, R. M., & Endorf, F. W. (2018). Frostbite vs burns: Increased cost of care and use of hospital resources. <i>Journal of Burn Care and Research</i> . <a href="https://doi.org/10.1093/jbcr/iry033">https://doi.org/10.1093/jbcr/iry033</a> Nygaard, R. M., Lacey, A. M., Lemere, A., Dole, M., Gayken, J. R., Lambert Wagner, A. L., & Fey, R. M. (2017). Time Matters in Severe Frostbite: Assessment of Limb/Digit Salvage on the Individual Patient Level. <i>Journal of Burn Care and Research</i> . <a href="https://doi.org/10.1097/BCR.0000000000000426">https://doi.org/10.1097/BCR.0000000000000426</a>	N = 120 statements

ABA, American Burn Association.

**Table 2.** Criteria revision panel eDelphi survey respondent characteristics (rounds 2 and 3)

	Round 2 Survey	Round 3 Survey
Characteristic, N (%)		
Number, response rate (%)	47 (90%)	62 (100%)
ABA region		
Northeast	16 (34)	17 (27)
Eastern Great Lakes	1 (2)	3 (5)
Midwest	5 (11)	3 (5)
Southern	19 (40)	26 (42)
Western	4 (9)	10 (16)
Canada	2 (4)	3 (5)
Years of burn experience		
0expyr	6 (13)	6 (10)
610)syr	6 (13)	10 (16)
116)syr	9 (19)	15 (24)
164)syr	4 (8)	3 (5)
>20 yr	23 (48)	28 (45)
Years of overall clinical experience		
0expyr	2 (4)	1 (2)
62)rsyr	3 (6)	9 (15)
115)syr	9 (19)	14 (24)
164)syr	7 (15)	7 (11)
>20 yr	27 (56)	20 (48)
Provider type		
Physician-Surgeon	31 (66)	32 (52)
Physician-Critical Care	1 (2)	2 (3)
Physician-Medicine	3 (6)	3 (5)
Physician-Pediatrics	0 (0)	0 (0)
Physician-Emergency Medicine	0 (0)	6 (10)
Advanced Practice Nurse/ Physician Assistant	3 (6)	6 (10)
Registered Nurse	7 (15)	8 (13)
Rehabilitation Therapist	1 (2)	3 (5)
Other	1 (2)	2 (3)
Type of facility		
Hospital	38 (81)	47 (76)
Ambulatory Care	0 (0)	0 (0)
Emergency Department	0 (0)	5 (9)
Academic/Research	9 (19)	8 (13)
Other	0 (0)	2 (3)
Participates in the Education of Burn Care Providers	45 (96)	62 (100)
Participates in the Education of Referring Care Providers	47 (100)	62 (100)

ABA, American Burn Association.

#### Round 4: Focus Group of Key Experts

There were some statements and topics that had been through each round of the process and not reached consensus, or the expert group requested an outside expert review and recommendation, including pediatric primary care and emergency medicine experts. The final round of the Delphi process consisted of a focus group of experts asked to comment and make recommendations in areas in which the panel lacked specific expertise or requested outside consultation.

## RESULTS

### Expert Panel

There was a total of 61 clinicians that met participant inclusion criteria for the eDelphi surveys administered in rounds 2 and 3. The demographics of each panelist are described in detail in Table 2. We achieved a 90% response rate for round 2, and a 100% response rate from round 3. Each of the five United States American Burn Association regions was represented, along with Canada. The clinicians participating in the panel ranged from 0 to >20 years of experience and represented diverse clinical specialties, including referring providers. We were initially unsuccessful in recruiting a panelist from ambulatory care, and the emergency department participation was added in round 3 based on the results of rounds 1 and 2. Roughly half of the panelists in each round participate in the education of burn care providers, and all panelists participate in provider education in general.

The fourth Delphi round, which consisted of a select group of subject matter experts was recruited by the existing Delphi panel members. These experts focused on electrical injury and pediatrics, and consensus among those experts was achieved at 100%.

### General Recommendations

There were both general and domain-specific statements that were presented to the panel that achieved >70% consensus. Given that our directive was to review and update the existing ABA burn center referral criteria, Table 3 describes each domain with respect to the existing criteria, and the statements reaching consensus in our Delphi process. In the broad category of general attitudes regarding the existing criteria, the Delphi process determined that *the criteria should be renamed to "Recommended Guidelines for Transfer and Consultation" and should include three tiers of information, such as immediate transfer, telemedicine consultation, and outpatient referral.* Additionally, the panel felt that the new recommendations should be *easily understood by referring providers and should be accompanied by educational efforts supporting their appropriate implementation in various clinical settings.*

### Extent of Burn Injury and Depth

There were several statements in the Delphi process regarding the depth and extent of burn injury and referral / consultation recommendations. The panel recommends that *all full-thickness burns >5% TBSA would benefit from immediate transfer, and all full-thickness burns of any extent would benefit from burn center consultation.* Concomitant trauma was not addressed separately in this update. Rather, to be consistent with existing guidelines, existing trauma guidelines are recommended to supersede burn-related recommendations when traumatic injury is present.

### Burns in Older Adults

There was no prior recommendation regarding burns in older adults, which we defined as >55 years of age, consistent with prior research. The panel determined that *the older adult burn patient benefits from the multidisciplinary expertise available in a burn center.* In burn centers that care for older adult



**Table 3.** Summary of recommendations for the burn patient transfer and consultation guideline

	Patient Transfer Potentially Indicated*†‡	Telemedicine Consultation Recommended†	Outpatient Burn Center Referral Recommended†,‡
Thermal burns	<ul style="list-style-type: none"> <li>■ Full thickness &gt;5% TBSA</li> <li>■ Partial thickness &gt;10% TBSA</li> <li>■ Any deep partial- or full-thickness burns involving the face, hands, genitalia, feet, perineum, or over any joints</li> </ul>	<ul style="list-style-type: none"> <li>■ Recommended for all potentially deep burns of any size</li> </ul>	<ul style="list-style-type: none"> <li>■ Full-thickness burns &lt;5% TBSA</li> <li>■ Partial-thickness burns &lt;10% TBSA</li> </ul>
Inhalation injury	<ul style="list-style-type: none"> <li>■ All patients with true inhalation injury</li> <li>■ Patients smoking on oxygen with other comorbidities such as COPD may benefit from burn center admission</li> <li>■ Facial flash burns do not need burn center admission unless they have thermal burns meeting above criteria</li> </ul>	<ul style="list-style-type: none"> <li>■ Recommended for flash burns to the face without inhalation injury</li> </ul>	<ul style="list-style-type: none"> <li>■ Not specifically indicated</li> </ul>
Pediatrics (≤16 yr)	<ul style="list-style-type: none"> <li>■ Same %TBSA thresholds as adults</li> <li>■ Children with &lt;10%TBSA full or partial thickness burns may benefit from burn center admission due to dressing change, rehabilitation, or parent / caregiver needs</li> </ul>	<ul style="list-style-type: none"> <li>■ Recommended for all potentially deep burns of any size</li> </ul>	<ul style="list-style-type: none"> <li>■ Same thresholds as adults</li> <li>■ Outpatient consultation at a burn center should occur within 7 days of injury</li> </ul>
Older adults (≥55 yr)	<ul style="list-style-type: none"> <li>■ Same %TBSA thresholds as other adults</li> <li>■ Older adult (&gt;55y) burn patients may particularly benefit from the multidisciplinary team resources available at a burn center</li> </ul>	<ul style="list-style-type: none"> <li>■ Recommended for all potentially deep burns of any size</li> </ul>	<ul style="list-style-type: none"> <li>■ Same thresholds as other adults</li> </ul>
Chemical injuries	<ul style="list-style-type: none"> <li>■ All chemical injuries should be cared for in a burn center</li> </ul>	<ul style="list-style-type: none"> <li>■ Recommended if available</li> </ul>	<ul style="list-style-type: none"> <li>■ Not specifically indicated</li> </ul>
Electrical injuries	<ul style="list-style-type: none"> <li>■ All high voltage electrical injuries</li> <li>■ Lightning injury</li> </ul>	<ul style="list-style-type: none"> <li>■ Recommended if available</li> </ul>	<ul style="list-style-type: none"> <li>■ Low voltage electrical injuries should receive, at minimum, one follow-up visit to a burn center to screen for delayed symptom onset and vision problems</li> <li>■ Not specifically indicated</li> </ul>
Cold injury	<ul style="list-style-type: none"> <li>■ Grades II–IV frostbite</li> <li>■ All cold injured patients may benefit from the multidisciplinary team resources available in a burn center</li> </ul>	<ul style="list-style-type: none"> <li>■ Recommended if available</li> </ul>	<ul style="list-style-type: none"> <li>■ Not specifically indicated</li> </ul>
Non-burn skin disorders	<ul style="list-style-type: none"> <li>■ Stevens–Johnson syndrome (SJS) or Toxic Epidermal Necrolysis (TENs) with epidermal slough</li> <li>■ Necrotizing Soft-Tissue Injury (NSTI)                             <ul style="list-style-type: none"> <li>o These patients benefit from the wound care, rehabilitation, and healing expertise of the multidisciplinary burn team.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>■ Recommended if available</li> </ul>	<ul style="list-style-type: none"> <li>■ Not specifically indicated</li> </ul>

\*This document represents the consensus of burn care stakeholders' experience and opinion on which patients likely benefit from burn center care. It is NOT intended to replace thoughtful provider-to-provider conversation based on the individual needs of each patient and is not prescriptive. Many factors, including geography and patient preferences, must be considered when making triage decisions.  
 †Telemedicine is an effective tool to improve the triage and care of burn patients. It should be used to support the triage and transfer decision-making process between providers whenever possible and is particularly helpful in reducing over-triage of small deep burns and in promoting accurate %TBSA estimation.  
 ‡Burn centers contain specialist providers of all kinds, including specialty trained nurses, rehabilitation therapists, dietitians, physicians, and psychosocial support staff. The availability of these resources should be a factor in all patient triage decisions, based on the patient's needs.

patients, the panel determined that older adult burn patients would benefit from geriatric and palliative care services.

### Burns in Children

Children with burns that are superficial (first degree; ie, red in color and blanches with pressure) do not differentially benefit from burn center referral. The panel reached consensus that children with >10% TBSA deep partial-thickness or full-thickness burns should be managed in a burn center, and that children with <10% TBSA deep partial to full-thickness burns may benefit from burn center admission on a case-by-case basis due to dressing change complexity, rehabilitation needs, or parental comfort level. Outpatient consultation with a burn center should ideally occur as soon as possible, without delays of 7 days or more from the date of the child's injury. Burn centers provide long-term follow-up and psychosocial support for children and families, and are critical in the identification of the need for additional services or interventions after the acute injury period as the child grows.

### Chemical Injuries

There were no recommended changes to the recommendations regarding chemical injuries. The panel reached consensus that *all chemical injuries should be cared for in a burn center.*

### Inhalation Injury

The existing criteria recommended burn center care for all inhalation injuries but did not provide specific guidance for those individuals burned while smoking using home oxygen or patients with flash burns to the face. The panel reached consensus that these unique situations should be provided in the updated guideline. The updated recommendation is that *patients with inhalation injuries benefit from burn center admission, and patients that were smoking on oxygen may benefit from burn center admission due to co-morbid COPD. Patients with flash burns to the face not resulting from electrical injury may benefit from burn center care due to the facial burns, not inhalation injury.*

### Electrical Injury

The existing guideline suggests that all patients with electrical injuries benefit from burn center admission. The Delphi expert panel determined that more guidance is necessary regarding electrical injury voltage, and lightning injury. Expert consensus was achieved that *high voltage injured patients and those with lightning injury benefit from burn center admission, and low voltage injured patients should receive, at minimum, one follow-up visit at a burn center to screen for delayed symptom onset and vision problems.*

### Exfoliative Skin Disorders

There was no guidance regarding exfoliative skin disorders, such as Stevens–Johnson syndrome (SJS), Toxic Epidermal Necrolysis (TEN), or Necrotizing Soft-Tissue Injury (NSTI) in the existing criteria. *The panel reached consensus that patients with SJS or TEN and any epidermal slough benefit from burn center care, largely due to the nursing and multidisciplinary support resources available in burn centers. Similarly, the*

*panel agreed that NSTI patients benefit from burn center care due to the team's wound care expertise.*

### Telemedicine

Telemedicine emerged after the existing criteria document was written, and thus no recommendations for its use in burn care currently exist in the criteria document. The Delphi panel agreed that *telemedicine is effective as a consultation medium, and further delineated the patients that benefit from telemedicine consultation. Specifically, the panel determined that whenever possible, telemedicine should be incorporated into burn center consultation, as it improves triage accuracy and reduces unnecessary transportation and the costs associated with it. All full-thickness burns should receive a telemedicine consultation, as well as all patients that are not determined to not need immediate transfer to a burn center. Further, the panel determined that a secure and accessible telemedicine platform for burn and referring provider interaction would improve patient outcomes and reduce costs.*

### Frostbite

Many burn centers treat patients with cold injuries, yet the existing criteria did not address frostbite specifically. The Delphi panel determined that *patients with frostbite benefit from the multidisciplinary team available in burn centers, and those with grades 2 (cyanosis isolated to distal phalanx), 3 (intermediate and proximal phalangeal cyanosis), and 4 (cyanosis over the carpal or tarsal bones) cold injury should receive a telemedicine consultation with a burn center for further care and management, at minimum.*

## DISCUSSION

The primary goal of criteria or guidelines, whether considered for triage, transfer, or referral, is to ensure that patients receive efficient and effective care. As mentioned previously, an initial effort over 20 years ago to meet this need by the ABA resulted in the development of consensus recommendations for patient referral to a burn center. The literature has reported both over and under triage of burn patients. Questions have been posed as to whether the current ABA Criteria lack the granularity to provide proper guidance to referring providers and/or whether the criteria are being properly interpreted. The eDelphi process described here has produced the next iteration of the ABA Criteria with the hopes of improving their effectiveness for referring providers, burn centers, and most importantly, patients.

As described in [Table 3](#), while there are many similarities between the former “ABA Criteria” and the proposed “Guidelines for Referral and Consultation” there are also some significant changes. The first major change is the renaming to change the criteria to guidelines. Criterion is defined as “a criterion on which a judgment or decision may be based,<sup>16</sup> while a guideline is meant to be “a piece of advice on how to act in a given situation that is recommended but non-mandatory.<sup>17</sup> While this difference is subtle, it is one of the critical changes that comes with this revision. The goal with creating a guideline was to focus on fostering the communication between burn unit staff and referring care providers.

Rather than simply being a list of conditions that prompt a request for transfer, the new guidelines serve as the starting point for a conversation. The hope in creating these guidelines is that the conversation will go beyond the treatment of a particular patient to teaching referring care providers about basic wound care as well as about resources that are available at the local burn center.

Beyond the name change, one of the general changes that was instituted was the development of three tiers of recommendations for burn center involvement with the patient, as opposed the former criteria that were binary (ie, yes vs no). In the new guidelines, the discussion between the burn unit provider and the referring provider will result in three possible outcomes: immediate transfer, telemedicine consultation, and outpatient follow-up. Through providing graded options for burn center involvement, the hope was that burn-injured patients receive the care that they need while avoiding both the over-triage and under-triage.<sup>6,18-20</sup>

Many of the specific changes related to specific populations, injury types, and referring conditions that are found in this set of guidelines are focused on making sure that patients receive the care that they need. This is with the expressed understanding that sometimes the critical aspect of that care is not only the burn physician that is treating the patient but also the multidisciplinary team that surrounds them.<sup>21</sup> found that outcomes for burn patients who were treated on specialized burn care services had the best outcomes.<sup>21</sup> They hypothesize that this improvement is in part due to the fully integrated multidisciplinary teams on these services. It is our belief that the multidisciplinary team is critical to the care of burn-injured patients, especially those with full-thickness burns greater than 5%, pediatric patients, older adult patients, and those with chemical burns, electrical injuries, and inhalation injuries. These findings were concurrent with our statements resulting from the Delphi process that created the new guidelines. In addition to the standard burn conditions, the Delphi process also determined that frostbite, SJS/TENS, and Necrotizing Soft-Tissue Injury may benefit from treatment by a multidisciplinary burn team. In particular, patients with these conditions benefit from the specialized nursing and wound care that can be provided in a burn center, even if the role of the burn surgeon in these conditions is not as straightforward.

Telemedicine is already an effective component of burn care, both in North America and elsewhere. Digital still images and video conferencing are used in triage, inpatient rehab follow-up, and outpatient follow-up. Increased use of telemedicine has come as burn expertise has become more centralized and community understanding of burn care has declined. It seems reasonable that the next step in evolution of telemedicine should be a single smartphone-accessible platform connecting burn experts to the medical community at large. Such a platform would be indispensable in a major burn disaster and, as such, might be created via collaboration between the ABA and federal disaster agencies. More mundanely, such a platform would provide referring providers with an educational benefit, burn providers with invaluable information about referred patients, and burned patients with a better chance of appropriate triage and best treatment, including access to long-term follow-up with burn care providers.

## LIMITATIONS

The results presented here describe the statements that a diverse expert panel agreed (>70%) on with respect to whether certain types of burn patients experience benefits from care in specific locations. The assumption of normal standard of care was made, and it is recognized that these recommendations might not be appropriate to apply during disaster or austere situations. The burden of transportation to a regional burn center, both personal and financial, are well-documented. It is important, however, that experts in the care of burn patients help determine whether the benefits for patients from care in burn centers outweigh the burdens associated with the transfer. This study's expert panel contained a diverse group of stakeholders, including those not working in regional burn centers. Therefore, the results presented here reflect the expert opinions of those clinicians. All transfer, admission, and consultation decisions regarding burn patients should be made with the patient and provider team. Burn center providers routinely serve as consultation partners in these decisions, and this article reflects a robust and accepted practice of collecting, analyzing, and interpreting those opinions. The statements presented here are not intended to be absolute; they reflect expert consensus at the time of the panel, and should be interpreted as such. Future research should further examine the effects of co-morbid conditions on burn patient outcomes and explore the importance of functional status and frailty in older adults with respect to burn center admission decisions. Further, future recommendations should ideally include the opinions of burn patients and their families, potentially using patient-reported outcome performance measures as benchmarks of long-term clinical outcomes.

The development of new guidelines to govern the referral and transfer of burn patients allows us the unique opportunity to study the relationship between burn centers and the referring hospitals. In this eDelphi process, consensus was defined as 70% agreement. Therefore, there is not complete unanimity, and ongoing research is needed to produce future guidelines that can be increasingly based on evidence rather than consensus. The first steps of future research will focus on the dissemination of the guidelines and their implementation into practice. We plan to work with the ABA to determine the best manner of dissemination of the new guidelines that use the resources of the ABA as well as social media and other technology, as appropriate. Following dissemination and implementation of the guidelines, we plan to study the way these guidelines are applied and examine the regional differences in their application. Additionally, as a community, we will examine patient outcomes following implementation to determine whether there are any differences. The transfer criteria that are currently in use are 20 years old, and a lot has changed in the way medicine is practiced and burn care delivered in that time (eg, telemedicine, electronic medical record, development of surgical and critical care innovations directed at burn care, the aging of the population). With the pace of research and changes in technology, it is unlikely that the guidelines suggested here will be as lasting, and they are purposefully designed to be re-evaluated on a regular basis. We recommend re-evaluating the guidelines as new significant data becomes available, and to do a more comprehensive re-evaluation at least every 5 years.

It is nearly impossible to account for the numerous permutations of burn patient presentation, and no set of guidelines can reflect the multitude of clinical scenarios that occur. Local and regional infrastructure, resources, and relationships also play an important role, as they affect not only which patients need to be seen by a multidisciplinary burn team, but also how urgently. These recommendations and guidelines should be applied with these factors in mind and help to facilitate dialog, not only on a case-by-case basis but to build relationships and networks within the local healthcare community. The National Academy of Sciences, Engineering, and Medicine (NAEM) promotes a framework for healthcare quality that is safe, effective, patient-centered, timely, efficient, and equitable. The hope is that these guidelines may be used at a local, regional, and national level to attain these goals.

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