

WILDERNESS MEDICAL SOCIETY ROUNDTABLE REPORT

Recommendations on the Use of Epinephrine in Outdoor Education and Wilderness Settings

The Epinephrine Roundtable took place on July 27, 2008 during the 25th Annual Meeting of the Wilderness Medical Society (WMS) in Snowmass, CO. The panelists were, in alphabetical order:

Flavio Gaudio, MD—Assistant Professor, Emergency Medicine, Weill Cornell Medical College, New York. Physician Advisor, Cornell Outdoor Education.

David Johnson, MD—Emergency Physician, Maine. President, Wilderness Medical Associates (WMA).

Jay Lemery, MD—Secretary, Wilderness Medical Society. Assistant Professor, Emergency Medicine, Weill Cornell Medical College, New York.

Frances Mock, JD—Attorney in recreation law, North Carolina.

Tod Schimelpfenig, EMT—Curriculum Director, Wilderness Medicine Institute, National Outdoor Leadership School (NOLS), Wyoming.

Joanne Vitanza, MD—Physician in Asthma, Allergy, and Immunology, Colorado.

Carl Weil, EMT—Director, Wilderness Medicine Outfitters, Colorado.

The WMS convened this roundtable to explore areas of consensus and uncertainty in the field treatment of anaphylaxis. There is a paucity of data that address the treatment of anaphylaxis in the wilderness. Anaphylaxis is a rare disease, with a sudden onset and drastic course that does not lend itself to study in randomized, controlled trials. Therefore, the panel endorsed the following position based on the limited available evidence, as well as expert consensus. The position represents the consensus of the panelists and is endorsed by the WMS.

The field treatment of anaphylaxis with injected epinephrine can be a life-saving procedure. This is true especially when access to standard medical care will be delayed due to weather or geography. We therefore support the concept that properly trained, non-medical professionals, whose work responsibilities require them to provide emergency medical care, be trained to appropriately administer epinephrine for the treatment of anaphylaxis.

Organizations that choose this expanded scope of practice for their staff should consult with legal counsel. The relevant laws and regulations vary from state to state. Where such practice is not supported by legislation, we encourage and support all efforts to change existing laws or introduce legislation supportive of this concept.

The following should be included in the organization's operating procedures and staff training curriculum:

1. Assure that all staff authorized to treat anaphylaxis be trained by qualified instructors or programs. Such training should occur at regular intervals, and include a review of the basic pathophysiology of anaphylaxis; assessment of the patient's signs and symptoms; methods of administering the treatment medications; and potential complications and relative contraindications of treatment.
2. Institutional authorization of staff to administer the patient's own medication or that provided by the organization.
3. Develop an organizational field treatment protocol.
4. Establish a quality-assurance program that includes the following functions:
 - protocol review process;
 - review every reported incident of anaphylaxis or allergic reaction;
 - a plan and chain of responsibility for the purchase, storage, and disposal of medication when the medications are provided by the organization, and for the disposal of all injection devices.
5. Oversight that includes a medical consultant/advisor or medical control.

Notable points of the roundtable discussion are presented below for general interest. We have included sample protocols from 3 outdoor schools on the field use of epinephrine and an edited transcript of the roundtable discussion as appendices to this article. They are available on line at www.wemjournal.org.

Legal Background

For decades, established schools in outdoor education have been carrying epinephrine into the field to treat the

rare but potentially life-threatening condition of anaphylaxis. Recently, the legality of this practice has been questioned. Is it legal for a physician to write a prescription for an organization rather than a specific individual? Moreover, is it legal for a non-medical professional with first-aid training to administer epinephrine, an injected medication, in a medical emergency? The law on these questions varies state by state. For example, in North Carolina, physicians legally may train lay people to administer epinephrine in the field.¹ In New York State, teachers and camp counselors may also administer epinephrine after appropriate training.² In other states, there are strict prohibitions on such administration. The prohibited administration of a prescription drug may be considered negligence even if the intent of the layperson was to help the patient. Furthermore, malpractice insurance excludes coverage of an illegal act.

Incidence of Anaphylaxis in the General Public and in Outdoor Education

There are approximately 150 recognized anaphylactic deaths from food allergies or insect stings per year in the United States.³ Lack of recognition may be associated with underdiagnosis of anaphylaxis. The majority of anaphylaxis fatalities are due to food allergies, especially those in adolescents and young adults, and asthma is a risk factor for fatal anaphylaxis.⁴ If medications are considered along with food allergies and insect stings as causes of fatal anaphylaxis, then there are about 1500 deaths per year.⁵ Medication-induced fatal anaphylaxis on average occurs in an older, adult population—often in hospital or healthcare settings. Besides medications, foods, and insect stings, anaphylaxis may also be induced by cold temperatures and by exercise. Overall, the risk of anaphylaxis in the general population is estimated at .05% to 2%, with a smaller percentage at risk for fatal anaphylaxis.⁶ In life-threatening anaphylaxis, there is no absolute contraindication to properly dosed epinephrine from a vial or ampoule. The NOLS database records 2 cases of anaphylaxis in 20 years (2.5 million participant-days). In contrast, during the same period, NOLS also records 149 cases of acute allergic reactions. Retrospective review of the NOLS data reveals that instructors appropriately administered epinephrine in the 2 cases of anaphylaxis and an anti-histamine in the 149 cases of acute allergic reactions.⁷ There were no deaths among the cases of anaphylaxis or acute allergic reactions.

Methods of Epinephrine Administration

Epinephrine may be administered by auto-injector into the anterior-lateral, mid-thigh. This method minimizes the pos-

sibility of dosage error and reliably achieves effective serum drug concentration; 0.3 to 0.5 ml of the 1:1000 concentration of epinephrine may also be manually drawn from a vial or ampoule into a syringe with an attached needle and administered intramuscularly over the anterior-lateral, mid-thigh. This method is far less expensive than using an auto-injector and also achieves effective serum drug concentration but is more prone to operator error. Injection into the anterior-lateral, mid-thigh by either method achieves higher serum drug concentration than intramuscular or subcutaneous injection into the deltoid.⁸ In addition, auto-injectors can administer epinephrine through clothing. Regardless of the delivery method, 25% to 35% of anaphylaxis victims require a second dose.⁹

Adverse Outcomes From Field Administration of Epinephrine

There are reports of arrhythmias, stroke, and myocardial infarctions in people who received epinephrine for anaphylaxis.¹⁰ Most of these adverse events occurred in the elderly, in individuals with pre-existing heart disease, in patients who did not actually have anaphylaxis, or in overdose situations. Indeed, a Colorado youth experienced ventricular dysrhythmias and myocardial ischemia from an overdose of epinephrine after 2 emergency medical technicians drew 9 times the recommended dose into a syringe.¹¹ In this respect, auto-injectors or prepackaged medication kits should decrease the possibility of overdose. On the other hand, in life-threatening anaphylaxis, there is no absolute contraindication to properly dosed epinephrine. It should also be noted that there is an increased awareness of anaphylactic sequelae on the heart itself and that ischemic electrocardiographic changes and dysrhythmias can occur in the absence of epinephrine administration.¹²

Future Directions

An outdoor organization with responsibility for students at risk for anaphylaxis—particularly children with asthma or food allergies, who may also be a long way from help—should require that such students carry personal auto-injectors. However, a back-up system is necessary because even the simple auto-injector is not so simple to use when a patient is *in extremis*. Therefore, outdoor instructors also should be trained to administer epinephrine. Legal protection for this rests on having each state legislature or medical board approve the field administration of epinephrine by trained outdoor instructors. In time, legislative change on the federal level should establish uniform protection in all 50 states. It may take parents who have lost a child to anaphylaxis because

epinephrine was not available to push through changes in state and federal laws, as happened in the Canadian school system with Sabrina's Law.¹³

The relevant law need only say that field administration of epinephrine is an approved practice and that physicians may train others to administer it. In North Carolina, for example, the law specifies that a physician must provide training on matters such as the definition, causes, symptoms, and treatment of anaphylaxis. The law need not require one method of administration over another—it may leave this issue to the discretion of the physician providing the training. Furthermore, the law would specify that a layperson may provide treatment only if a licensed medical provider is not on scene.

In summary, the roundtable panel endorsed the field administration of epinephrine under emergency conditions by wilderness instructors who have received adequate training in the field recognition and treatment of anaphylaxis.

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Appendix

Online resources available through *Wilderness and Environmental Medicine* www.wemjournal.org.

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APPENDIX A: Wilderness Medical Associates (DJ).

WILDERNESS MEDICINE FIELD PROTOCOLS

PURPOSE

Conventional First Aid and EMT curricula are designed for an urban environment, and assume the availability of 911 communications and rapid ambulance transport to a hospital. Outdoor professionals have found the conventional medical protocols do not address the specialized wilderness context of delayed rescue transport in remote areas, prolonged exposure to severe environments, and the limited availability of medical equipment.

These protocols have been developed for use by appropriately trained individuals that regularly work in remote environments. They are based on the principles taught by Wilderness Medical Associates in Wilderness Advanced Life Support, Wilderness EMT, Wilderness First Responder, Wilderness Advanced First Aid, and Wilderness First Aid Courses.

AUTHORIZATION

Because the specialized nature of these protocols, it is generally recommended that the integration of these procedures into the emergency response field practices of outdoor and adventure education programs be specifically authorized by the management of the program, preferably with the guidance of an appropriate consulting medical professional. (See the Wilderness Medical Associates document entitled 'Consulting Physicians for Backcountry Outfitters and Experiential Education Organizations' for more information.)

The following conditions are recommended by Wilderness Medical Associates, and should be considered in establishing authorization of the use of these protocols into a program's emergency response plans:

1. The employee is on the job for the above named employer.
2. The transportation time to a hospital exceeds two hours except in the case of an anaphylactic reaction in which no minimum transport time is required.
3. The employee holds an unexpired Wilderness Advanced Life Support (WALS®), Wilderness and Rescue Medicine (WRM), Wilderness EMT (WEMT), Wilderness First Responder (WFR), Wilderness Advanced First Aid (WAFA), or Wilderness First Aid (WFA) certification from Wilderness Medical Associates, and the employee follows the specific procedures and techniques followed in that course. WAFA certified employees may only use protocols 1, 2, 3 and 4. WFA certified employees may only use protocols 1 and 2. (Careful review of the medical training background of employees is recommended to ensure complete understanding of these protocols by all employees.)

IMPORTANT NOTE

This document is not designed to be used as a reference for wilderness medical providers. Providers should refer to their original course textbooks for complete information on the use of these protocols.

The above specified protocol has been authorized for use by those employees who are trained and certified in this skill as specified above.

Organization

Date

Authorized Representative

Position

Physician Advisor

PROTOCOL 1: ANAPHYLAXIS

Anaphylaxis is an allergic reaction that has life-endangering effects on the circulatory and respiratory systems. Anaphylaxis can result from an exposure to a foreign protein injected into the body by stinging and biting insects, snakes, and sea creatures as well as from the ingestion of food, chemicals, and medications. Early recognition and prompt treatment, particularly in a wilderness setting, is essential to preserve life. The onset of symptoms usually follows quickly after an exposure, often within minutes. The signs and symptoms reflect the resulting consequences of generalized vascular dilation, fluid leakage and lower airway constriction. Biphasic or recurrent reactions can occur within 24 hours of the original episode.

In addition to shortness of breath, weakness and dizziness, patients also frequently complain of generalized itching (particularly in the armpits and groin area). Physical findings include rapid heart rate, low blood pressure, and other evidence of shock, upper airway obstruction (stridor) and lower airway obstructions (wheezes) with labored breathing, generalized skin redness, urticaria (hives), and swelling of the mouth and face. Epinephrine should only be administered to patients having symptoms suggestive of acute anaphylaxis, an allergic reaction with systemic components.

1. Maintaining an open airway, put patient in a position of comfort. Initiate either positive pressure ventilations (PPV) or cardiopulmonary resuscitation (CPR) as indicated by clinical signs.
 2. Inject 0.01 mg/kilogram (up to 0.3 mg) of 1:1000 solution of epinephrine* intramuscularly into the lateral aspect of the thigh or deltoid.
 3. Repeat injections as soon as every 5 minutes if needed. More than 3 injections are rarely necessary.
 4. Administer 25–50 mg of diphenhydramine by mouth every 4-6 hours if the patient is awake and can swallow.
 5. Consider prednisone 40–60 mg/day (or equivalent dose of an oral corticosteroid).
 6. Because a biphasic reaction can occur within the subsequent 24 hours, all patients experiencing an anaphylactic reaction should be evacuated to definitive care. Biphasic reactions should be treated in the same manner as the initial reaction, using epinephrine in the same dosage.
 7. Arrange for transport to hospital
 8. Consider an advanced life support intercept (ALS) if possible
 9. The patient should remain out of the field for at least 24 hours and may not return without the examining healthcare professional's approval.
- * -There is 1 mg of epinephrine in 1 mL of epinephrine 1/1000; there are 0.3 mg in 0.3 mL of 1/1000. Preloaded commercially available autoinjectors deliver either 0.3 mg (standard adult dose) or 0.15 mg (standard pediatric dose).
- If the person weighs less than 66 lbs (30 kg), the doses are: epinephrine is 0.01 mg/kg; diphenhydramine is 1mg/kg; and prednisone is 1-2 mg/kg.
- When using lbs, multiply the weight times 0.45 to get the weight/mass in kilograms.

APPENDIX B: National Outdoor Leadership School (TS).

NOLS Field Epinephrine Protocol

Moderate allergic reactions

- Urticaria and hives (localized blotches and welts on the skin which may itch intensely)
- NO respiratory compromise, shock, or systemic swelling
- Treat with an oral antihistamine (e.g. Benadryl)

Severe reactions/Anaphylaxis

Any symptoms of angioedema (large areas of swelling, typically involving face, lips, hands and feet), or respiratory compromise, or shock should be treated with epinephrine.

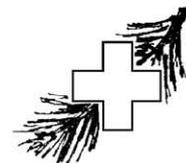
- Administer epinephrine 1:1000 0.3 mg subcutaneous as needed every 5-15 minutes.
- Treat shock if necessary. Arrange for evacuation.

In treating anaphylaxis, multiple dosing of epinephrine may be required to maintain airway and blood pressure - there is no definite endpoint. Adjunctive treatment with antihistamines and steroids (if available) should be given concurrently. Benadryl (50-75) mg orally every 5-6 hrs as needed) for rash/urticaria, itching and sedation can be used for adjunctive treatment of anaphylaxis after emergent treatment and stabilization with epinephrine, and while awaiting or performing evacuation.

Evacuation Guidelines: Severe Allergic Reaction/Anaphylaxis

- Expedite Evacuation for any patient with a severe allergic reaction. Secondary reactions can occur within 12 to 24 hrs.

APPENDIX C: Wilderness Medicine Outfitters (CW).



BASIC CARE GIVER EPINEPHRINE PROTOCOL FOR

_____ **who is
trained in epinephrine administration**

First obtain patient / client consent.

1. Assist clients/patients taking their medications by oral, inhaler, or auto injector when requested. These medications should be in recognizable original packaging. If they are prescription, they should be in the client’s/patient’s name. Caregiver should check twice that care giver has the correct medication and amount for the patient and check the same with a third party when possible.
2. Two 25mg Benadryl (diphenhydramine) capsules to be offered to patient/client after first checking previous history and if showing noticeable allergy reaction.
3. EPI prescribed in the name of _____ may be given by auto-injector in the mid thigh, on the out side, for allergic systemic respiratory or cardiac distress. EPI may also be given by inhaler IF auto injector is not available or has already been used and another dose is not available.
4. A second dose of EPI may be given if relief is not occurring after 5 to 10 minutes, patient is worsening, or new symptoms have appeared including respiratory or cardiac distress especially BP falling below systolic of 90.
5. The recommended auto injector is Twinject™ since it alone has two doses in one device that is both easily, safely carried in minimal space. Twinject™ literature has been review by _____ - along with receiving instruction in anaphalics and allergies as well as testing in this subject.

This protocol is approved by

_____ MD _____ date

1. Note in many states physician can NOT extend EMT’s authority
2. This form may be used by others if credit to WMO is left at bottom

APPENDIX D: Edited transcript of the “Panel Discussion on the Use of Epinephrine in Outdoor Education and Wilderness Settings” at the 25th Wilderness Medical Society Annual Meeting.

Proceedings of the 25th Wilderness Medical Society Annual Meeting. Roundtable Panel Discussion on the Use of Epinephrine in a Wilderness Environment. July 27, 2008 at Snowmass CO.

Transcript

The Epinephrine Roundtable took place on July 27, 2008 during the 25th Annual Meeting of the Wilderness Medical Society (WMS) in Snowmass, Colorado. A transcript of the roundtable discussion follows below. The discussion has been edited for succinctness, clarity, and style; while striving to remain true to the original content and meaning (F.G.).

Moderator:

Jay Lemery, M.D. Secretary, Wilderness Medical Society. Assistant Professor, Emergency Medicine, Weill Cornell Medical College, New York.

Panelists:

Flavio Gaudio, M.D. Assistant Professor, Emergency Medicine, Weill Cornell Medical College, New York. Physician Advisor, Risk Management, Cornell Outdoor Education.

David Johnson, M.D. Physician in Emergency Medicine, Maine. President, Wilderness Medical Associates (WMA).

Frances Mock, J.D. Attorney in recreation law, North Carolina. Former professional guide.

Tod Schimelpfenig, EMT. Curriculum Director, Wilderness Medicine Institute of the National Outdoor Leadership School (NOLS), Wyoming.

Joanne Vitanza, M.D. Physician in Asthma, Allergy, and Immunology, Colorado. Consultant and educator in the pharmaceutical sector.

Carl Weil, EMT. Director, Wilderness Medicine Outfitters, Colorado. Legal expert witness and risk-management consultant. Former professional guide.

JL: I invite our six esteemed panelists to begin by summarizing their position on this topic.

DJ: At WMA, we've been training first responders to administer epinephrine for anaphylaxis since the early 1980's. I've also comfortably written many epinephrine prescriptions for organizations. Recently, however, there are certain individuals in our field questioning the legality and appropriateness of such actions. I believe that training and enabling first-responders to administer epinephrine in the field is both safe and reasonable.

TS: At NOLS, for over 30 years, we've supported the ability to treat a patient in the field with anaphylaxis. Given the media's attention to acute allergic responses, food allergies, and anaphylaxis, parents and the public expect that we be able to manage anaphylaxis in the field. Still, despite such expectations and our own standard of care, recently we've realized that legal support for treating anaphylaxis in the field may be lacking.

FM: The law on using epinephrine in the field varies state by state. In my home state of North Carolina, physicians legally may train lay people to administer epinephrine in the field. In other states, there are strict prohibitions on such administration. I am concerned that an organization like NOLS, which presumably is trying to do what is in the best interest of its clients, may be putting itself in legal peril. It risks facing legal consequences from any bad outcome potentially arising from the administration of epinephrine. On the other hand, I am also concerned for people in the field who truly may need epinephrine, but who don't receive it because of state prohibition. So, I am here to advocate that the WMS and other organizations represented here work toward a consensus on this problem and toward change in the legislatures or local boards.

JV: I am concerned that epinephrine is markedly under-utilized in the treatment of anaphylaxis. Once anaphylaxis is diagnosed, it should

be treated with epinephrine as first-line therapy. The fear of over-utilizing epinephrine or causing side effects may be the least of our problems.

CW: Wilderness Medicine Outfitters has trained thousands of students to deliver epinephrine. Epinephrine, preferably in the form of auto-injectors, should be used when there is any possibility of anaphylaxis to prevent unnecessary deaths.

FG: I support the ability of well-trained lay persons to administer epinephrine in the field for presumed anaphylaxis. But I don't think we have enough evidence to propose a mandate that every outdoor school, regardless of its size, ages of its students, and geographic area of its trips, should carry epinephrine.

JL: We'll have time at the end of the panel discussion for questions. Let's start now by asking Dave Johnson to clarify why some people might think administering epinephrine in the backcountry is inappropriate.

DJ: There are potentially legal issues. Is it legal for a physician to write a prescription for an organization rather than a specific individual? Moreover, is it legal to write a prescription for an individual to use on a third party? In other words, is it legal for a non-medical professional with first-aid training to administer epinephrine, an injected medication, in a medical emergency? Finally, from a perspective other than legal, there are people who feel that a first-responder couldn't possibly get enough training to safely and appropriately administer epinephrine for presumed anaphylaxis. These are the main issues. In this regard, I believe that the Wilderness Medical Society could support a broad-based, general consensus statement or call for a change in legislation – similar to positions the American Heart Association or American Academy of Allergy, Asthma, and Immunology has taken.

JL: Frances Mock, is there liability in a physician writing prescription for an organization rather than an individual?

FM: This varies state by state. North Carolina, for example, allows a doctor to train lay people to administer epinephrine. In some states,

certain lay people – such as teachers – may administer epinephrine even without having received training from a doctor. National organizations such as the AMA have supported this. But such support does not make it legal. Indeed, there are two problems with illegally administering epinephrine. First is the violation of the law itself: the prohibited administration of a prescription drug is considered negligence per se even if the intent of the lay person was to help the patient. Second is the loss of liability insurance: very often insurance companies exclude coverage of an illegal act. Of course, the likelihood of a lawsuit over a really bad outcome resulting from epinephrine administration is very low. Still, I don't think any of you should be taking this risk; and hence, the imperative for changing the law.

JL: What are the issues with diagnosing anaphylaxis?

JV: Anaphylaxis is rare; and fatal anaphylaxis is very rare. You will probably see anaphylaxis in your practice; but probably not fatal anaphylaxis. Still, the incidence of anaphylaxis is rising, especially in children; and especially because of an increasing incidence of food allergies – peanut allergy in particular. Only very recently has there been an attempt to have a consensus definition or diagnostic criteria for anaphylaxis. Therefore, because of different diagnostic criteria, the true incidence of anaphylaxis is unknown; and treatment of anaphylaxis may vary. There are now national and international symposia aimed specifically at creating a consensus in both the diagnostic criteria and treatment for anaphylaxis. Consider, for example, the child who eats a peanut and then has hives all over the body. Although this doesn't meet the diagnostic criteria for anaphylaxis, some people might still give epinephrine – which would be a problem of over-utilization of the drug. On the other hand, if the same child with hives were also to cough, vomit, or have diarrhea; then diagnostic criteria for anaphylaxis are met and the child would be a candidate for epinephrine. But, in this second scenario, epinephrine is commonly under-utilized by doctors, teachers, parents, and patients. So, first we must reach a consensus on properly diagnosing and treating anaphylaxis before we can talk about changing or creating relevant laws.

JL: How prevalent is allergic reaction versus anaphylaxis based on actual experiences in outdoor education?

TS: There are tales that circulate among outdoor instructors and guides about anaphylaxis in the field. These tales have an emotional hook and dramatic aspect. But, looking at the NOLS experience, we have had 2 cases in the last 20 years – or 2.5 million participant-days – in which epinephrine was administered. In contrast, we have had 149 incidents of acute allergic reactions – almost all of which were treated with diphenhydramine. The overall picture is that our staff made wise, appropriate decisions. In retrospect, the administration of epinephrine to the 2 patients seemed justified; and there was no patient who should have gotten epinephrine but didn't. So, I think educated, well-trained lay people can make appropriate decisions in these situations.

CW: I agree that well-trained lay people can make such decisions. Indeed, New York State recently has required that camp counselors be trained to deliver epinephrine. In fact, just this camping season in New York, there were already 14 recorded cases of epinephrine delivery. Moreover, several years ago, the American Camping Association drafted a similar requirement for camp counselors – within the context of a 16-hour wilderness first-aid course. Finally, this year, the Boy Scouts required training in epinephrine delivery for some 7,000 scout leaders. While the risk of anaphylaxis in the general population varies from 0.1% – 3% depending on the study quoted, the New York statistics alone from this year convince me that if you're not carrying epinephrine, then you're putting your head in the sand.

JL: Have there been bad outcomes from field administration of epinephrine?

CW: One youth in Colorado died from an overdose of epinephrine. In this case, which I found during a literature search, two EMTs injected 9 times the recommended dose of epinephrine, using a needle to draw the medication into a syringe. For this reason, I prefer the auto-injector – it assures the proper dose.

JV: There are several reports in the literature of arrhythmias, stroke, and MI's in people who received epinephrine for anaphylaxis. Most of these adverse events occurred in the elderly; in individuals with pre-existing heart disease; in patients who did not actually have anaphylaxis; or in overdose situations. There are only a handful of appropriately-dosed anaphylaxis patients who had serious adverse reactions to epinephrine. On the other hand, the number one reason people die from anaphylaxis is because epinephrine was not administered. In reasonable doses, delivered intramuscularly or subcutaneously, epinephrine is quite safe. There is no absolute contraindication to giving it in anaphylaxis, and the benefits outweigh the risks.

FG: I agree that auto-injectors are easier to use. They are also expensive. An Epi-pen™, for example, costs up to \$100, wholesale.

CW: The Twin-ject™ auto-injector, which gives 2 doses, may be purchased for \$72, which is less expensive. But we must balance cost with accuracy. In experimental conditions, not actual patient care, Dr. Estelle Simons in Canada found that emergency department and general nurses had a two and three- fold error in dosing epinephrine using a needle, syringe, and ampule. Physicians had a forty-fold error. Parents had a sixty-fold error. So accuracy is extremely problematic. In my own school – a good school, I might add, where we train well – we found that students had an 80% accuracy rate in drawing up the correct epinephrine dose using a needle and syringe. That's not bad, but is it good enough?

FG: What is the perspective of large schools like NOLS on the cost of auto-injectors?

TS: We don't carry auto-injectors routinely. We have auto-injectors available to staff who specifically request them; otherwise, we carry epinephrine in ampules. We use a half-cc syringe to avoid over-dosage. With 200 instructors in the field on a typical day, the price of auto-injectors becomes prohibitive. So we have a little package with a syringe and a couple of ampules of adrenaline.

DJ: An ampule of epinephrine costs about 55 cents. To help ensure the correct dose, you can use an insulin syringe, either 30 units or 50

units (one-half cc). This is much less expensive. Graduates of our training programs have administered epinephrine with a syringe and ampule in actual patients without a problem.

JV: From a practical standpoint, I would add that auto-injectors can administer epinephrine through clothing. They are designed to be used over the thigh, which provides the highest and most rapidly-achieved plasma concentrations. Using a needle and syringe to deliver epinephrine in the deltoid, whether intramuscularly or subcutaneously, requires first that the patient be unclothed.

CW: Indeed, Dr. Simons in Canada also found that needle and syringe administration of epinephrine in the deltoid resulted in 2,000 serum units; in the anterior-lateral mid-thigh, 9,000 serum units. Using an auto-injector in the anterior-lateral mid-thigh resulted in 12,000 serum units. So, it's important to recognize the effectiveness of different delivery locations. To me, the auto-injector represents ease of delivery, accuracy of delivery, and higher serum levels of epinephrine.

DJ: I think we can all agree that epinephrine is the treatment of choice for anaphylaxis – particularly in the high-risk population of children with asthma or food allergies. An outdoor organization with responsibility for such children – who may also be a long way from help – at least should require that they carry their own auto-injector. But I think that also the guide should be trained to administer epinephrine. A back-up system is necessary; because even the simple auto-injector is not so simple to use when a patient is in extremis. We train staff to use all methods of epinephrine delivery: vial, ampule, and auto-injector. The majority of organizations that carry epinephrine also provide yearly re-training. In addition, there must be a system of medical control and quality-assurance – to review and learn from each case of epinephrine administration –; as well as a system for overseeing medication storage, disposal, and expiration date.

FM: There seems to be consensus of the use of epinephrine in anaphylaxis; with discussion instead on the best method of administration. I propose solving this problem incrementally. First, we must address the basic issue of legality; it is not necessary to have a

consensus yet on the best method of administration. To use my home state of North Carolina as an example again, the law specifies that a physician must provide training on matters such as the definition, causes, symptoms, and treatment of anaphylaxis. Furthermore, the law specifies that a lay person may provide treatment only if a licensed medical provider is not on scene. The law does not require one method of administration over another – it leaves this issue to the discretion of the physician providing the training. The law needs to say only that field administration of epinephrine is an approved practice and that physicians may train others to administer it.

JL: When might an outdoor group not want to carry epinephrine?

FG: According to the American Academy of Allergy, Asthma, and Immunology, there are up to 150 anaphylactic deaths from food allergies or insect stings per year in the United States. (The lowest estimate I read was 20 deaths per year.) About 80% of these cases occurred in children under 18 years old. Moreover, almost all of the fatal cases occurred in patients with a known history of asthma, food allergy, or atopy. So, if an outdoor group includes children with such a history, then an anaphylaxis care plan which makes epinephrine available must be in place. On the other hand, if an outdoor group includes only adult or geriatric participants without asthma or significant allergies, then the risk-benefit analysis for carrying epinephrine will be different. Furthermore, the potential harm in older patients from mistaken administration of epinephrine – for example, for urticaria instead of anaphylaxis – may be greater.

JV: By the way, if you consider medications along with food allergies and insect stings as causes of fatal anaphylaxis, then the allergy literature states that there are about 1,500 deaths per year.

CW: Indeed, if you include anaphylactic deaths from medications, the average age for the fatalities is 63 according to studies I just read today. Furthermore, besides anaphylaxis from medications, foods, and insect stings, there are cold-induced anaphylaxis and exercise-induced anaphylaxis. So, the picture of anaphylaxis today is much broader than the narrow one we used to think.

JL: Let us turn now to questions and comments from the audience.

Question: Given our national epidemic of obesity, even among children, should the standard method of epinephrine administration be an auto-injector in the thigh? In obese children, the auto-injector's tiny needle would deliver epinephrine subcutaneously. My understanding is that in anaphylaxis, epinephrine is better mobilized when injected intramuscularly rather than subcutaneously. Therefore, it would be logical to administer epinephrine in the deltoid, not in the thigh.

JV: Unfortunately, you don't even have to be obese for the auto-injector to deliver epinephrine subcutaneously – you just have to be a woman. This is true for both the Epi-pen™ and Twinject™ needles which are about 1/2 inch long. So, in the majority of females and obese males, an auto-injector delivers epinephrine into the subcutaneous tissue – although the force of the auto-injector may deliver some of the medication more deeply. Nonetheless, the Canadian study mentioned earlier showed that an Epi-pen™ administered in the thigh gives a higher plasma concentration of medication than epinephrine administered intramuscularly in either the thigh or the deltoid with a needle and syringe. Granted, the subjects in this small study were not actually in anaphylaxis.

Question: What if all students on an outdoor trip had their doctors write a standardized prescription for the administration of epinephrine, by self or trained surrogate, in case of an emergency? Would this provide some legal protection for both the outdoor organization and the physician?

FM: This might help; but the real answer to the problem still lies in changing the relevant laws.

Comment: I'm a physician with a very personal belief in epinephrine and auto-injectors, since epinephrine saved my life from an anaphylactic reaction to latex. Indeed, I always carry two doses of epinephrine with me because 25-35% of anaphylaxis victims require a second dose in 5-7 minutes. On the other hand, I wouldn't want our momentum for a consensus statement supporting the use of epinephrine to produce a backlash of medical liability for lay people.

For example, a school bus driver is sued for not administering epinephrine to a kid on the bus.

FM: I don't think that this would happen. Supporting a controlled process for physicians to train people to administer epinephrine does not equal an increased obligation for lay individuals. Legally, these are different issues. On the other hand, if carrying epinephrine becomes the industry standard for wilderness programs; then I would be concerned about the legal implications for any program that decides not to carry it.

Question: How might the WMS draft a position statement supporting the field use of epinephrine?

Various panelists and audience participants: The WMS would endorse the field administration of epinephrine under emergency conditions by wilderness instructors who have received adequate training in the field recognition and treatment of anaphylaxis. "Adequate training" may be defined by a minimum number of classroom hours; or by a core curriculum; or by a physician's attestation of the instructor's credentials.

JL: Let us end our roundtable today with a closing comment by each of the panelists.

FG: I support outdoor organizations that make a risk assessment and decide to carry epinephrine into the field. I am against an across the board mandate for all outdoor groups – as the data and experience to develop such a mandate are still lacking.

CW: I agree with the concept of "adequate training" described above as a foundation for the consensus we are building.

JV: I would advocate that we promote anaphylaxis education. Pick your epinephrine delivery method, know it well, and be prepared to use it.

FM: Investigate what the applicable laws are in your state. If need be, go to the state legislature or medical board to approve the field administration of epinephrine by trained outdoor instructors. In time,

work also for legislative change on the federal level, for uniformity of practice in all 50 states.

TS: We want to be able to treat anaphylaxis if it arises in one of our programs. This has been our standard at NOLS for over 30 years. We believe that trained people can manage anaphylaxis in the field. When NOLS became aware that we didn't have the legal support we assumed we had, we actually made a conscious decision that we would continue with our standard of care despite the legal risk, because our purpose is to serve our students. The legal system will sort itself out at some point. A statement by the WMS, the leading organization in wilderness medicine, will help move this process along.

DJ: It may take parents who have lost a child to anaphylaxis because epinephrine wasn't available to push through changes in state and federal laws, as happened in the Canadian school system with Sabrina's Law. Before then, as a leader in wilderness medicine, the WMS should endorse as both safe and reasonable the field administration of epinephrine for anaphylaxis.

JL: Thank you all for coming.

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