MEDICAL DIRECTION COMMITTEE
Embassy Suites by Hilton
2925 Emerywood Parkway, Richmond, VA 23294
Thursday, January 16, 2020
10:30 AM

Members Present:	Members Absent:	Staff:	Others:
Allen Yee, M.D. – Chair *	**Scott Weir, M.D. – Excused**	Debbie Akers	Donna Galganski Pabst
Asher Brand, M.D. *	**Lisa Dodd, D.O – Excused**	Cam Crittenden	Chris Beyerson
George Lindbeck, M.D. *	**Tania White, M.D. – Excused**	Ron Passmore	Cary Taylor
Stewart Martin, M.D. *		Chad Blosser	Chris Christensen
John Morgan, M.D. *		Wanda Street	R. Jason Ferguson
Christopher Turnbull, M.D.		Chris Vernovai	Jason Sweet
Wendy Wilcoxen, M.D.		Adam Harrell	Daniel Linkins
Paul Phillips, D.O.			Matt Lawler
Charles Lane, M.D.			Crystal Andrews
E. Reed Smith, M.D.			Marquita Whisonant
			Jeff Ferguson
			Eddie Ferguson

Topic/Subject	Discussion	Recommendations, Action/Follow-up; Responsible Person
I. Welcome	Dr. Yee called the meeting to order at 10:34 a.m.	
II. Introductions	Introductions were made.	
III. Approval of Agenda	Approval of agenda	**Approved by consensus**
IV. Approval of Minutes	Approval of the October 3, 2019 minutes	**Approved by consensus**
V. Drug Enforcement Administration (DEA) & Board of Pharmacy (BOP) Compliance Issues	No update on the DEA. Carilion is planning to get rid of the regional drug box. Each agency will be responsible for their controlled substances with agency licenses. Each agency will be a distributor of Carilion per Dr. Lindbeck. The committee had a lengthy discussion on this. Stay tuned for more information.	
VI. Old Business	**a. TR-90A – Dr. Charles Lane/R. Jason Ferguson** – (Deferred until after lunch) Mr. Ferguson stated that most of the changes were wordsmithing revisions. **A motion to adopt the TR-90A was made by Dr. Lane and seconded by Dr. Morgan.** **b. Evidence Based Guidelines for Blood – Dr. Morgan** – Dr. Morgan distributed a rough draft of evidence-based guidelines. This is a hot issue in EMS. He is open to thoughts and feedback on this. This is more of a white paper and not guidelines per Dr. E. Reed Smith. Many regions have whole blood now. Per George Lindbeck, it needs a position statement. Cam suggested sharing	**Motion by Dr. Lane, 2nd by Dr. Morgan. – Motion carried** **See: Attachment A**

Topic/Subject	Discussion	Recommendations, Action/Follow-up; Responsible Person
	this with the Prehospital meeting on February 3. John will email revised draft paper to Dr. Yee on February 1. The goal is to present for approval at the August Advisory Board meeting as a public health crisis. Do we want to invite the American Red Cross to next meeting? Dr. Lindbeck will work on meeting with Red Cross representative prior to the next meeting. The workgroup will consist of Dr. Lindbeck, Dr. Morgan, Dr. Yee, Dr. Brand and Dr. Smith. **c. White Paper on Vaccination Suggestions – Dr. Brand and Dr. Sullivan** (Tabled until the next meeting.) This is about how to encourage EMS providers to get vaccinated. The committee briefly discussed this topic. **d. CARES – Dr. Brand and Dr. Yee** – Dr. Brand believes that participating in a Cardiac Arrest Registry is a good thing. It provides real time benchmarking. Dr. Lindbeck would like to get back with Gary Brown on this. A state FTE will need to be created for this. **Dr. Brand made a motion for Virginia Department of Health to participate in CARES registry program and send to the Advisory Board for action. The motion was seconded by Dr. Morgan.** Dr. Yee and Dr. Brand will draft white paper. **e. MDC Projects – Dr. Yee – (RSI)** The idea is to add a preamble to Statewide Formulary and bring modified version to next meeting. It was suggested to tweak document, Dr. Martin stated it should be suggestions, not requirements. Per Dr. Yee, this should be two documents. The preamble should be separate from Attachment 1. Dr. Brand stressed the importance of not over ventilating patients. The discussion continued after lunch. A workgroup should be established. **Dr. Lane made a motion to create a workgroup. The motion was seconded by Dr. Brand.** The workgroup lead is Dr. Brand, other members of the workgroup include Dr. Reed, Dr. Charles Lane, Dr. John Morgan, Dr. Yee, Eddie Ferguson will appoint someone from prehospital side and an educator, R. Jason Ferguson will appoint someone.	**Dr. Lindbeck to meet with Red Cross rep prior to meeting.** **Workgroup established.** **Tabled until next meeting.** **CARES white paper to be drafted.** **RSI Workgroup established.**
VII. New Business	a. **Training and Certification Committee Report – Dr. Charles Lane** – No report. Dr. Lane was not in attendance at the TCC meeting. b. **Mobile Integrated Healthcare –Community Paramedicine (MIH-CP) White Paper and Letter of Intent – Dr. Yee, Mr. Tim Perkins** – The workgroup was formed years ago and was stopped for code language changes. It reconvened in September 2018. The workgroup has completed a white paper that shows what an MIH-CP program should look like. Basic concept is MIH-CP is moving faster than the state regulatory process**. A motion was made to accept the MIH-CP white paper and letter of intent by Dr. Martin The motion was seconded by Dr. Morgan.** Dr. Yee stated that Scott Weir has concerns. The committee discussed the concerns. Tim suggested that there should be significant OMD oversight for agencies who commit to MIH-CP programs. c. **State Certification for Assistant Medical Directors (PA and NPs) – Dr. E. Reed Smith –** There are Physician extenders and Nurse Practitioners, but should there be an Assistant OMD position? He wants to know how to grow the specialty. Ron Passmore said that code language states that an OMD must be a licensed physician. Physician is a requirement of OMD. After the committee discussion, it was decided to table this topic until the next meeting.	**Motion by Dr. Martin, 2nd by Dr. Morgan. Motion carried.**

Topic/Subject	Discussion	Recommendations, Action/Follow-up; Responsible Person
		Tabled until next MDC meeting.
VIII. Research Requests	1. Dr. Lindbeck TSC trial is underway.	
IX. State OMD Issues – George Lindbeck, MD	**a. Scope of Practice Changes** i. Nothing new since last meeting. This will need to be an action item for the next Advisory Board. ii. Dr. Lindbeck stated that Billy Fritz mentioned that everyone should be taught educational guidelines at a minimum. The question came up about local variation in education. Could a course coordinator, physician course director, and advisory committee add to the minimal education based on regional desires, etc.? Debbie stated that it is up to the program director, medical director or accredited programs' advisory boards to make those decisions. Dr. Lindbeck want to make sure Scope of practice gets on agenda at GAB. **A motion was made by Dr. Lane to support the educational minimum being taught to ensure adequate training and credentialing. Additional skills may be added as deemed necessary by the program director, medical director or accredited programs' advisory board. The motion was seconded by Dr. Morgan.** **b. HB 1147 – Dr. Asher Brand** i. There is a bill to provide Epinephrine pens in restaurants. Dr. Brand mentioned an article on fatal anaphylaxis. The committee agreed that it is indemnification. Dr. Yee stated that we can take a position that we do not support mandating Epinephrine in public places due to the low instances of anaphylaxis (Less than one per million). However, we do support indemnification. Tim Perkins pointed out that Medical Direction Committee cannot take a position on a bill. It is a subcommittee of the Advisory Board. Dr. Yee stated that we should take a position on the science. Cam recommended doing a letter that will come from each OMD. After the discussion, the committee decided to let this topic die.	**Motion by Dr. Lane, 2nd by Dr. Morgan. Motion carried. Scope of practice to be forwarded to the GAB.** **See Attachment B** **See Attachment C**
X. Office of EMS Reports	**a. Division of Accreditation, Certification and Education** i. Education Program Manager – Chad Blosser Chad has provided the committee a copy of the quarterly scholarship update which goes through December 31, 2020. Not much activity in that program. Scholarship applications have picked up over the last week for the spring classes. Chad strongly encouraged the OMDs to vet individuals to be education coordinators in Virginia. There are coordinator issues and ongoing investigations. There is a psychomotor exam workgroup to revise and update the exam. ii. Accreditation & Certification Manager – Debbie Akers National Registry statistics have been distributed to the committee and Virginia is now exceeding the National Registry first attempt pass rate. All intermediate programs have been moved to Advanced EMT. I-99 certification ended on December 31, 2019. If Intermediates allowed their certifications to expire, they will become EMTs and there is no path to get it back. Three new program directors and a new paramedic program (Henrico Fire). Three other programs are under letter of review. The interest continues to grow. Nationally, there is a question about the validation of accreditation. Virginia's AEMT pass rate exceeds the National Registries by greater	**See Attachment D** **See Attachment E** **See Attachment F**

Topic/Subject	Discussion	Recommendations, Action/Follow-up; Responsible Person
	than 27%. Symposium submissions closes January 31. Cam mentioned that there will be a Critical Care Track. National Registry is increasing testing fees 2021. Fees will be in the quarterly report. **b. Regulation & Compliance – Ron Passmore** i. Update on status of Critical Care No update. Please see quarterly report. **c. Associate Director – Adam Harrell** Adam gave an update on HB 1147; Health Professions and VDH are both opposing this bill. Gary sends out weekly updates on legislative bills and if you want to be included on the emails, let Debbie or Chad know. The legislative grid is posted on the OEMS website. Adam gave an update on the REPLICA database and Virginia will be the first state to come online with the database the end of the month. VDH will also become a research conglomerate with National Registry. They have a robust data fellowship program on EMS data. Ron Passmore sent a memo to agency super-users about being data compliant and there is also a data compliant tab under Regulation and Compliance on the OEMS website for agencies to check their reports. **d. Asst. Director – Scott Winston** No report. **e. Trauma Division – Cam Crittenden** There is a data-sharing bill on the legislative agenda and Cam clarified this. The committee discussed this briefly. **f. Other Office Staff** - None	
XI. PUBLIC COMMENT	None	
XII. Meeting Dates for 2020	~~a. January 16, 2020~~ b. April 2, 2020 c. July 2, 2020 d. October 8, 2020 Meetings for the remainder of 2020 will be held here at the Embassy Suites by Hilton.	
XIII. Adjournment	The meeting adjourned at 2:27 p.m.	

Respectfully submitted by:
Wanda L. Street
Executive Secretary
January 16, 2020

Attachment A

Prehospital Blood Administration

Commonwealth of Virginia Medical Direction Committee

Draft Guidelines/Position on Prehospital Blood Administration

Trauma is the leading cause of death for patients under 46 years old, and uncontrolled hemorrhage remains the number one cause of preventable death in trauma.[1] The use of blood products for the resuscitation of patients in hemorrhagic shock is a well-established practice in the hospital setting. The use of large volumes of crystalloid to resuscitate patients in hemorrhagic shock is associated with worse outcomes from dilutional coagulopathy and acidosis.[2-5]

Feasibility of blood transfusion in out-of-hospital settings has a long history with military programs since the First World War.

While component therapy with 1:1:1 ratio is superior to transfusion of packed cells alone, evidence suggests that whole blood is a better option for trauma resuscitation and can increase survival of severely injured patients.[6–8]

There are several published military and HEMS studies which demonstrate feasibility, safety and some positive outcomes.[9–13] A study of prehospital blood product transfusion in Afghanistan recently presented data that demonstrated a 20-fold survival benefit when blood is given within 34 minutes of injury.[14] Although combat data doesn't always correlate with civilian medicine, this data may still present some benefit for EMS. Recent data from the U.K. suggest prehospital blood may reduce transfusion requirements.[13]

Civilian prehospital transfusion programs have begun with many air medical programs both nationally and in Virginia. Nationally, there are few ground prehospital EMS programs utilizing blood. The experience in San Antonio, Texas (Southwest Texas Regional Advisory Council or STRAC) with Low Titer O positive Whole Blood (LTOWB) [15] found a 53% reduction in post-ED blood product transfusion and two-fold increase in likelihood of survival with whole blood compared to component therapy.[16, 17] This group also found that non-traumatic etiology accounted for 46.5% of prehospital whole blood recipients. Their accounting analysis suggests that the average cost to save a life will be approximately $5,000.00 which compares favorably with interventions such as cardiac monitor defibrillation.[18]

Most civilian prehospital blood programs have utilized a forward-deployed model, with a limited supply placed in strategic locations on air medical or ground response units. The FACT*R program in Northern Virginia involves a virtual supply, available to be brought from the hospital to an EMS scene such as a prolonged entrapment.[19]

The Virginia OEMS Scope of Practice allows blood transfusion initiation at the paramedic level, maintenance at the Intermediate level.

There are some barriers to the implementation of a prehospital blood program. Blood is tightly regulated and in short supply. Although generally considered safe, blood transfusion does bring some risks for transfusion reactions or exposure to infectious disease. There are equipment costs for storage and administration of blood as well as the expense of blood itself. Training of personnel and developing partnerships with regional blood suppliers and hospital systems are essential to a successful program. Nationally, very few blood services are offering whole blood with agencies in Virginia reaching out of state to purchase whole blood as of 2020 although this

appears to be changing. Properly stored and preserved, a unit of whole blood can last up to 35 days. The STRAC program has successfully recruited LTOWB donors in their region to build a consistent supply and created a model for rotation of product to minimize waste with the blood deployed in a prehospital vehicle for 14 days then rotated back to the trauma center if it is not used in the field.[15]

Lastly, active oversight by an EMS operational medical director (OMD) in partnership with EMS agency leadership is essential. Developing protocols and policies that address the many considerations of a prehospital blood program are a major undertaking. A robust quality assurance program must ensure proper indications for transfusion are met along with proper techniques for storage and administration.

In conclusion, EMS has a proud history of bringing care that was at one time only available in the hospital setting to the scene. More recently, lessons from battlefield experiences with hemorrhage control have been brought into civilian practice. While the use of blood products in the prehospital setting needs further study, there are opportunities developing. Significant investments in system design, implementation and ongoing quality assurance are essential to success.

References:

1. Berwick D, Downey A, Cornett E, editors: A national trauma care system: Integrating military and civilian trauma systems to achieve zero preventable deaths after injury. The National Academies Press: Washington, D.C., 2016.

2. Cantle PM, Cotton BA. Balanced resuscitation in trauma management. Surg Clin North Am. 2017;97(5):999–1014.

3. Chang R, Holcomb JB. Optimal fluid therapy for traumatic hemorrhagic shock. Crit Care Clin. 2017;33(1):15–36.

4. Kaczynski J, Wilczynska M, Hilton J, et al. Impact of crystalloids and colloids on coagulation cascade during trauma resuscitation-a literature review. Emergency Medicine and Health Care. 2013;1(1).

5. Maegele M, Schöchl H, Cohen MJ. An update on the coagulopathy of trauma. Shock. 2014;41(Suppl):21–25.

6. Nessen SC, Eastridge BJ, Cronk D, et al. Fresh whole blood use by forward surgical teams in Afghanistan is associated with improved survival compared to component therapy without platelets. Transfusion. 2013;53(Suppl 1):107S–113S.

7. Repine TB, Perkins JG, Kauvar DS, et al. The use of fresh whole blood in massive transfusion. J Trauma. 2006;60(6 Suppl):S59–S69.

8. Spinella PC, Perkins JG, Grathwohl KW, et al. Warm fresh whole blood is independently associated with improved survival for patients with combat-related traumatic injuries. J Trauma. 2009;66(4 Suppl):S69–S76.

9. Chapman MP, Moore EE, Chin TL, et al. Combat: Initial experience with a randomized clinical trial of plasma-based resuscitation in the field for traumatic hemorrhagic shock. Shock. 2015; 44(Suppl 1):63–70.

10. Holcomb JB, Swartz MD, DeSantis SM, et al. Multicenter observational prehospital resuscitation on helicopter study. J Trauma Acute Care Surg. 2017;83(1 Suppl 1):S83–S91.

11. Kim BD, Zielinski MD, Jenkins DH, et al. The effects of prehospital plasma on patients with injury: A prehospital plasma resuscitation. J Trauma Acute Care Surg. 2012;73(2 Suppl 1):S49–S53.

12. Brown JB, Cohen MJ, Minei JP, et al. Pretrauma center red blood cell transfusion is associated with reduced mortality and coagulopathy in severely injured patients with blunt trauma. Ann Surg. 2015;261(5):997–1005.

13. Rehn M, Weaver AE, Eshelby S, et al. Pre-hospital transfusion of red blood cells in civilian trauma patients. Transfus Med. 2017. [Epub ahead of print.]

14. Shackelford SA, Del Junco DJ, Powell-Dunford N, et al. Association of prehospital blood product transfusion during medical evacuation of combat casualties in Afghanistan with acute and 30-day survival. JAMA. 2017;318(16):1581–1591.

15 Zhu, C.S., Pokorny, D.M., Eastridge, B.J., et al. Give the trauma patient what they bleed, when and where they need it: establishing a comprehensive regional system of resuscitation based on patient need utilizing cold-stored, low-titer O+ whole blood. Transfusion, 2019 April 59: 1429-1438.

16 Weymouth, Wells et al. Whole Blood in Trauma: A Review for Emergency Clinicians. J Emerg Med, 2019 May;56(5):491-498

17 Williams J, Merutka N et al. Safety profile and impact of low-titer group O whole blood for emergency use in trauma. Journal of Trauma and Acute Care Surgery. 2020 January 88(1):87–93,

18 Mapp JG, Bank EA, Osborn LA, Stringfellow ML, Reininger DW, Winckler CJ. Epidemiological and Accounting Analysis of Ground Ambulance Whole Blood Transfusion. Prehosp Disaster Med. 2019 Dec 18:1-6.

19 Avstreih D, Morgan J, Evans C. Blood on Demand: Designing an EMS Massive Transfusion Program. EMS World. 2019 May.

Attachment B

Scope of Practice:
Procedures and Formulary

Virginia Office of Emergency Medical Services
Scope of Practice - Formulary for EMS Personnel

This SOP represents ***practice maximums*** .

CATEGORY		EMR	EMT	AEMT	I	P	
Analgesics							
	Acetaminophen		●	●	●	●	
	Nonsteroidal anti-inflammatory		●	●	●	●	
	Opiates and related narcotics			●	●	●	
	Dissociative analgesics						
	Ketamine 0.5 mg/kg or less IV/IN/IM				●	●	Added IM as a route of administration 10-4-18
Anesthetics/Sedatives							
	Topical/Otic/Occular		●	●	●	●	
	Inhaled-self administered		●	●	●	●	
	Local (infiltration)			●	●	●	
	General - initiate					●	
	General - maintenance intubated patient				●	●	Added as a category and maintained at the I level, MDC 10-4-18
	Sedation for the violent/aggressive patient				●	●	Added as a category and maintained at the I level, MDC 10-4-18
	Antipsychotics				●	●	
	Benzodiazepines (for sedation)				●	●	
Anticonvulsants				●	●	●	
Glucose Altering Agents							
	Glucose Elevating Agents		●	●	●	●	
	Glucose Lowering Agents				●	●	
Antidotes							
	Anticholinergic Antagonists				●	●	
	Anticholenesterase Antagonists	●	●	●	●	●	
	Benzodiazepine Antagonists						
	Narcotic Antagonists	●	●	●	●	●	
	Nondepolarizing Muscle Relaxant Antagonist						
	Beta/Calcium Channel Blocker Antidote				●	●	
	Tricyclic Antidepressant Overdose				●	●	
	Cyanide Antidote				●	●	

"Investigational medications and procedures which have been reviewed and approved by an Institutional Review Board (IRB) will be considered to be approved by the Medical Direction Committee solely within the context of the approved study. Investigators involved in IRB approved research are asked to present their study plans to the MDC for informational purposes so that the committee can maintain an awareness of on-going pre-hospital research in the Commonwealth. Those who desire to conduct non-IRB reviewed pilot projects, demonstration projects, or research are asked to present those proposals to the MDC prior to their implementation for review and approval by the MDC."

Use of medication not listed which is indicated by medical control and/or the operational medical director due to the use of a weapon of mass destruction is exempt from this list.

Virginia Office of Emergency Medical Services
Scope of Practice - Formulary for EMS Personnel

This SOP represents ***practice maximums*** .

CATEGORY		EMR	EMT	AEMT	I	P	
	Cholinesterase Reactivator	●	●	●	●	●	
Antihistamines & Combinations			●	●	●	●	
Biologicals							
	Immune Serums				●	●	
	Antibiotics		●	●	●	●	
Blood/Blood products							
	Initiate					●	
	Maintain				●	●	
Blood Modifiers							
	Anticoagulants				●	●	
	Antiplatelet Agents		●	●	●	●	
	Hemostatic Agents		●	●	●	●	
	Thrombolytics					●	
	Anti-fibrinolytics (eg tranexamic acid)			●	●	●	Added at the AEMT level, MDC 10-4-18
Cardiovascular Agents							
	Alpha Adrenergic Blockers				●	●	
	Adrenergic Stimulants				●	●	
	Antiarrhythmics				●	●	
	Beta Adrenergic Blockers				●	●	
	Calcium Channel Blockers				●	●	
	Diuretics				●	●	
	Inotropic Agents				●	●	
	Vasodilatory Agents		●	●	●	●	
	Vasopressors				●	●	

"Investigational medications and procedures which have been reviewed and approved by an Institutional Review Board (IRB) will be considered to be approved by the Medical Direction Committee solely within the context of the approved study. Investigators involved in IRB approved research are asked to present their study plans to the MDC for informational purposes so that the committee can maintain an awareness of on-going pre-hospital research in the Commonwealth. Those who desire to conduct non-IRB reviewed pilot projects, demonstration projects, or research are asked to present those proposals to the MDC prior to their implementation for review and approval by the MDC."

Use of medication not listed which is indicated by medical control and/or the operational medical director due to the use of a weapon of mass destruction is exempt from this list.

Virginia Office of Emergency Medical Services
Scope of Practice - Formulary for EMS Personnel

This SOP represents ***practice maximums*** .

CATEGORY		EMR	EMT	AEMT	I	P	
	Epinephrine for allergic reaction		●	●	●	●	
	Epinephrine administration systems for allergic reaction (See note below)		●	●	●	●	Approved by MDC 1-3-19
Central Nervous System	Antipsychotic				●	●	
							Sedatives - Benzodiazepines removed from this section, MDC 10-4
Dietary Supplements/Electrolyte	Vitamins						
	Minerals - start at a health care facility	See section: Intravenous Fluids					
	Salts - start at a health care facility						
	Electrolytes Solutions - started at a health care facility						
	Hypertonic Saline				●	●	
Gas							
	Oxygen	●	●	●	●	●	
	Heliox				●	●	
Gastrointestinal							
	Antacids						
	OTC			●	●	●	
	Antidiarrheals		●	●	●	●	
	Antiemetics		●	●	●	●	
	EMT SL/PO route only						
	H2 Blockers		●	●	●	●	
Hormones	Corticosteroids, Mineralocorticoids			●	●	●	
	Other Hormones						
	pitocin, octreotide, prostaglandins					●	
Intravenous Fluids	isotonic		●	●	●	●	EMT may transport patient with IV fluids not requiring titration or adjustment, and without additives including electrolytes (e.g. potassium, magnesium)
* See note below)	hypotonic		●	●	●	●	
	hypertonic				●	●	
	M = Maintenance I = Initiate						
	Crystalloid, +/- Dextrose/Lactate		M	I/M	I/M	I/M	

"Investigational medications and procedures which have been reviewed and approved by an Institutional Review Board (IRB) will be considered to be approved by the Medical Direction Committee solely within the context of the approved study. Investigators involved in IRB approved research are asked to present their study plans to the MDC for informational purposes so that the committee can maintain an awareness of on-going pre-hospital research in the Commonwealth. Those who desire to conduct non-IRB reviewed pilot projects, demonstration projects, or research are asked to present those proposals to the MDC prior to their implementation for review and approval by the MDC."

Use of medication not listed which is indicated by medical control and/or the operational medical director due to the use of a weapon of mass destruction is exempt from this list.

Virginia Office of Emergency Medical Services
Scope of Practice - Formulary for EMS Personnel

This SOP represents ***practice maximums*** .

CATEGORY		EMR	EMT	AEMT	I	P	
	with Multi=vitamins		M	M	M	M	
	with Thiamine		M	M	M	M	
Neuromuscular Blockers						●	
Respiratory	Anticholinergics		●	●	●	●	
	Sympathomimetics						
	Beta agonists		●	●	●	●	
	Epinephrine (nebulized)				●	●	
Dosage and Concentration Calculation				●	●	●	
M = Maintenance							
I = Initiate							
	Note: EMT's may administer medications within their scope of practice in addition to assistance in administration of those medications. EMT's may access a drug kit to access those medications.						
	Note: Med-Math skills including dosage calculations and measurement of medication to be administered are outside EMT scope of practice. EMT's may draw epinephrine from vials or ampules for the treatment of acute allergic reactions using devices/systems using syringes with mechanical limiters or color-coded or other clearly marked indicators to allow accurate dose measurement.						
	EMT may transport patient with IV fluids not requiring titration or adjustment, and without additives including electrolytes (e.g. potassium, magnesium)						

"Investigational medications and procedures which have been reviewed and approved by an Institutional Review Board (IRB) will be considered to be approved by the Medical Direction Committee solely within the context of the approved study. Investigators involved in IRB approved research are asked to present their study plans to the MDC for informational purposes so that the committee can maintain an awareness of on-going pre-hospital research in the Commonwealth. Those who desire to conduct non-IRB reviewed pilot projects, demonstration projects, or research are asked to present those proposals to the MDC prior to their implementation for review and approval by the MDC."

Use of medication not listed which is indicated by medical control and/or the operational medical director due to the use of a weapon of mass destruction is exempt from this list.

Virginia Office of Emergency Medical Services
Scope of Practice - Formulary for EMS Personnel

This SOP represents ***practice maximums*** .

CATEGORY		EMR	EMT	AEMT	I	P	
Analgesics							
	Acetaminophen		●	●	●	●	
	Nonsteroidal anti-inflammatory		●	●	●	●	
	Opiates and related narcotics			●	●	●	
	Dissociative analgesics						
	Ketamine 0.5 mg/kg or less IV/IN/IM				●	●	Added IM as a route of administration 10-4-18
Anesthetics/Sedatives							
	Topical/Otic/Occular		●	●	●	●	
	Inhaled-self administered		●	●	●	●	
	Local (infiltration)			●	●	●	
	General - initiate					●	
	General - maintenance intubated patient				●	●	Added as a category and maintained at the I level, MDC 10-4-18
	Sedation for the violent/aggressive patient				●	●	Added as a category and maintained at the I level, MDC 10-4-18
	Antipsychotics				●	●	
	Benzodiazepines (for sedation)				●	●	
Anticonvulsants				●	●	●	
Glucose Altering Agents							
	Glucose Elevating Agents		●	●	●	●	
	Glucose Lowering Agents				●	●	
Antidotes							
	Anticholinergic Antagonists				●	●	
	Anticholenesterase Antagonists	●	●	●	●	●	
	Benzodiazepine Antagonists						
	Narcotic Antagonists	●	●	●	●	●	
	Nondepolarizing Muscle Relaxant Antagonist						
	Beta/Calcium Channel Blocker Antidote				●	●	
	Tricyclic Antidepressant Overdose				●	●	
	Cyanide Antidote				●	●	

"Investigational medications and procedures which have been reviewed and approved by an Institutional Review Board (IRB) will be considered to be approved by the Medical Direction Committee solely within the context of the approved study. Investigators involved in IRB approved research are asked to present their study plans to the MDC for informational purposes so that the committee can maintain an awareness of on-going pre-hospital research in the Commonwealth. Those who desire to conduct non-IRB reviewed pilot projects, demonstration projects, or research are asked to present those proposals to the MDC prior to their implementation for review and approval by the MDC."

Use of medication not listed which is indicated by medical control and/or the operational medical director due to the use of a weapon of mass destruction is exempt from this list.

Virginia Office of Emergency Medical Services
Scope of Practice - Formulary for EMS Personnel

This SOP represents ***practice maximums*** .

CATEGORY		EMR	EMT	AEMT	I	P	
	Cholinesterase Reactivator	●	●	●	●	●	
Antihistamines & Combinations			●	●	●	●	
Biologicals							
	Immune Serums				●	●	
	Antibiotics		●	●	●	●	
Blood/Blood products							
	Initiate					●	
	Maintain				●	●	
Blood Modifiers							
	Anticoagulants				●	●	
	Antiplatelet Agents		●	●	●	●	
	Hemostatic Agents		●	●	●	●	
	Thrombolytics					●	
	Anti-fibrinolytics (eg tranexamic acid)			●	●	●	Added at the AEMT level, MDC 10-4-18
Cardiovascular Agents							
	Alpha Adrenergic Blockers				●	●	
	Adrenergic Stimulants				●	●	
	Antiarrhythmics				●	●	
	Beta Adrenergic Blockers				●	●	
	Calcium Channel Blockers				●	●	
	Diuretics				●	●	
	Inotropic Agents				●	●	
	Vasodilatory Agents		●	●	●	●	
	Vasopressors				●	●	

"Investigational medications and procedures which have been reviewed and approved by an Institutional Review Board (IRB) will be considered to be approved by the Medical Direction Committee solely within the context of the approved study. Investigators involved in IRB approved research are asked to present their study plans to the MDC for informational purposes so that the committee can maintain an awareness of on-going pre-hospital research in the Commonwealth. Those who desire to conduct non-IRB reviewed pilot projects, demonstration projects, or research are asked to present those proposals to the MDC prior to their implementation for review and approval by the MDC."

Use of medication not listed which is indicated by medical control and/or the operational medical director due to the use of a weapon of mass destruction is exempt from this list.

Virginia Office of Emergency Medical Services
Scope of Practice - Formulary for EMS Personnel

This SOP represents ***practice maximums*** .

CATEGORY		EMR	EMT	AEMT	I	P	
	Epinephrine for allergic reaction		●	●	●	●	
	Epinephrine administration systems for allergic reaction (See note below)		●	●	●	●	Approved by MDC 1-3-19
Central Nervous System	Antipsychotic				●	●	
							Sedatives - Benzodiazepines removed from this section, MDC 10-4
Dietary Supplements/Electrolyte	Vitamins						
	Minerals - start at a health care facility	See section: Intravenous Fluids					
	Salts - start at a health care facility						
	Electrolytes Solutions - started at a health care facility						
	Hypertonic Saline				●	●	
Gas							
	Oxygen	●	●	●	●	●	
	Heliox				●	●	
Gastrointestinal							
	Antacids						
	OTC			●	●	●	
	Antidiarrheals		●	●	●	●	
	Antiemetics		●	●	●	●	
	EMT SL/PO route only						
	H2 Blockers		●	●	●	●	
Hormones	Corticosteroids, Mineralocorticoids			●	●	●	
	Other Hormones						
	pitocin, octreotide, prostaglandins					●	
Intravenous Fluids	isotonic		●	●	●	●	EMT may transport patient with IV fluids not requiring titration or adjustment, and without additives including electrolytes (e.g. potassium, magnesium)
* See note below)	hypotonic		●	●	●	●	
	hypertonic				●	●	
	M = Maintenance I = Initiate						
	Crystalloid, +/- Dextrose/Lactate		M	I/M	I/M	I/M	

"Investigational medications and procedures which have been reviewed and approved by an Institutional Review Board (IRB) will be considered to be approved by the Medical Direction Committee solely within the context of the approved study. Investigators involved in IRB approved research are asked to present their study plans to the MDC for informational purposes so that the committee can maintain an awareness of on-going pre-hospital research in the Commonwealth. Those who desire to conduct non-IRB reviewed pilot projects, demonstration projects, or research are asked to present those proposals to the MDC prior to their implementation for review and approval by the MDC."

Use of medication not listed which is indicated by medical control and/or the operational medical director due to the use of a weapon of mass destruction is exempt from this list.

Virginia Office of Emergency Medical Services
Scope of Practice - Formulary for EMS Personnel

This SOP represents ***practice maximums*** .

CATEGORY		EMR	EMT	AEMT	I	P	
	with Multi=vitamins		M	M	M	M	
	with Thiamine		M	M	M	M	
Neuromuscular Blockers						●	
Respiratory	Anticholinergics		●	●	●	●	
	Sympathomimetics						
	Beta agonists		●	●	●	●	
	Epinephrine (nebulized)				●	●	
Dosage and Concentration Calculation				●	●	●	
M = Maintenance							
I = Initiate							
	Note: EMT's may administer medications within their scope of practice in addition to assistance in administration of those medications. EMT's may access a drug kit to access those medications.						
	Note: Med-Math skills including dosage calculations and measurement of medication to be administered are outside EMT scope of practice. EMT's may draw epinephrine from vials or ampules for the treatment of acute allergic reactions using devices/systems using syringes with mechanical limiters or color-coded or other clearly marked indicators to allow accurate dose measurement.						
	EMT may transport patient with IV fluids not requiring titration or adjustment, and without additives including electrolytes (e.g. potassium, magnesium)						

"Investigational medications and procedures which have been reviewed and approved by an Institutional Review Board (IRB) will be considered to be approved by the Medical Direction Committee solely within the context of the approved study. Investigators involved in IRB approved research are asked to present their study plans to the MDC for informational purposes so that the committee can maintain an awareness of on-going pre-hospital research in the Commonwealth. Those who desire to conduct non-IRB reviewed pilot projects, demonstration projects, or research are asked to present those proposals to the MDC prior to their implementation for review and approval by the MDC."

Use of medication not listed which is indicated by medical control and/or the operational medical director due to the use of a weapon of mass destruction is exempt from this list.

Attachment C

Fatal Anaphylaxis: Mortality Rate and Risk Factors

Clinical Commentary Review

Fatal Anaphylaxis: Mortality Rate and Risk Factors

Paul J. Turner, MD, PhD[a,b], Elina Jerschow, MD[c], Thisanayagam Umasunthar, MD[a], Robert Lin, MD[d], Dianne E. Campbell, MD, PhD[b,e], and Robert J. Boyle, MB, ChB, PhD[a] *London, United Kingdom; Bronx, New York, NY; and Sydney, Australia*

INFORMATION FOR CATEGORY 1 CME CREDIT

Credit can now be obtained, free for a limited time, by reading the review articles in this issue. Please note the following instructions.

Method of Physician Participation in Learning Process: The core material for these activities can be read in this issue of the Journal or online at the *JACI: In Practice* Web site: www.jaci-inpractice.org/. The accompanying tests may only be submitted online at www.jaci-inpractice.org/. Fax or other copies will not be accepted.

Date of Original Release: September 1, 2017. Credit may be obtained for these courses until August 31, 2018.

Overall Purpose/Goal: To provide excellent reviews on key aspects of allergic disease to those who research, treat, or manage allergic disease.

Target Audience: Physicians and researchers within the field of allergic disease.

Accreditation/Provider Statements and Credit Designation: The American Academy of Allergy, Asthma & Immunology (AAAAI) is accredited by the Accreditation Council for Continuing Medical Education (ACCME) to provide continuing medical education for physicians. The AAAAI designates this journal-based CME activity for 1.00 *AMA PRA Category 1 Credit*™. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

List of Design Committee Members: Paul J. Turner, MD, PhD, Elina Jerschow, MD, Thisanayagam Umasunthar, MD, Robert Lin, MD, Dianne E. Campbell, MD, PhD, and Robert J. Boyle, MB, ChB, PhD (authors); Scott H. Sicherer, MD (editor)

Learning objectives:

1. To communicate risk estimates for fatal or near-fatal anaphylaxis to patients and caregivers.
2. To evaluate a patient's risk for fatal or near-fatal anaphylaxis.
3. To discuss the uncertainties in understanding fatal anaphylaxis.

Recognition of Commercial Support: This CME has not received external commercial support.

Disclosure of Relevant Financial Relationships with Commercial Interests: P. J. Turner has received research support from the Medical Research Council, NIHR/Imperial BRC, and EU FP7 Programme; and has received consultancy fees from UK Food Standards Agency. T. Umasunthar has received research support from Lincoln Medical. D. E. Campbell is employed by NSW Health; has received research support from the National Health and Medical Research Council, Australian Food Allergy Foundation, and the Allergy and Immunology Foundation of Australasia; and has received travel support from DBV. R. J. Boyle has received consultancy fees from Oval Technoloties and ALK Abello; and has provided expert testimony for Squitieri and Fearon. The rest of the authors declare that they have no relevant conflicts of interest. S. H. Sicherer disclosed no relevant financial relationships.

Up to 5% of the US population has suffered anaphylaxis. Fatal outcome is rare, such that even for people with known venom or food allergy, fatal anaphylaxis constitutes less than 1% of total mortality risk. The incidence of fatal anaphylaxis has not increased in line with hospital admissions for anaphylaxis. Fatal drug anaphylaxis may be increasing, but rates of fatal anaphylaxis to venom and food are stable. Risk factors for fatal anaphylaxis vary according to cause. For fatal drug anaphylaxis, previous cardiovascular morbidity and older age are risk factors, with beta-lactam antibiotics, general anesthetic agents, and

[a]Department of Paediatric Allergy, Imperial College London, London, United Kingdom
[b]Department of Allergy and Immunology, University of Sydney, Sydney, Australia
[c]Division of Allergy and Immunology, Albert Einstein College of Medicine, Bronx, NY
[d]Department of Medicine, Weill Cornell Medical College, New York, NY
[e]Department of Allergy and Immunology, Children's Hospital at Westmead, Sydney, Australia

PJT is in receipt of a Clinician Scientist award funded by the UK Medical Research Council (reference MR/K010468/1). Both PJT and RJB are supported by the National Institute for Health Research (NIHR) Biomedical Research Centre (BRC) based at Imperial College Healthcare NHS Trust and Imperial College London. The views expressed are those of the author(s) and not necessarily those of the NHS, NIHR, or the Department of Health.

Conflicts of interest: P. J. Turner has received research support from the Medical Research Council, NIHR/Imperial BRC, and EU FP7 Programme; and has received consultancy fees from UK Food Standards Agency. T. Umasunthar has received research support from Lincoln Medical. D. E. Campbell is employed by NSW Health; has received research support from the National Health and Medical Research Council, Australian Food Allergy Foundation, and the Allergy and Immunology Foundation of Australasia; and has received travel support from DBV. R. J. Boyle has received consultancy fees from Oval Technoloties and ALK Abello; and has provided expert testimony for Squitieri and Fearon. The rest of the authors declare that they have no relevant conflicts of interest.

Received for publication March 20, 2017; revised June 1, 2017; accepted for publication June 20, 2017.

Corresponding author: Robert J. Boyle, MB, ChB, PhD, Section of Paediatrics, Wright Fleming Building, Norfolk Place, London W2 1PG, United Kingdom. E-mail: r.boyle@imperial.ac.uk.

2213-2198

http://dx.doi.org/10.1016/j.jaip.2017.06.031

Abbreviation used
ICD- International Classification of Diseases

radiocontrast injections the commonest triggers. Fatal food anaphylaxis most commonly occurs during the second and third decades. Delayed epinephrine administration is a risk factor; common triggers are nuts, seafood, and in children, milk. For fatal venom anaphylaxis, risk factors include middle age, male sex, white race, cardiovascular disease, and possibly mastocytosis; insect triggers vary by region. Upright posture is a feature of fatal anaphylaxis to both food and venom. The rarity of fatal anaphylaxis and the significant quality of life impact of allergic conditions suggest that quality of life impairment should be a key consideration when making treatment decisions in patients at risk for anaphylaxis. **(J Allergy Clin Immunol Pract 2017;5:1169-78)**

Key words: *Anaphylaxis; Mortality; Insect sting; Food allergy; Drug allergy*

Between 1.6% and 5.1% of US citizens are estimated to have experienced anaphylaxis,[1] a systemic hypersensitivity reaction that can be rapidly fatal. An estimated, 1% of hospitalizations and 0.1% of emergency department attendances for anaphylaxis have a fatal outcome.[2] Groups at risk of anaphylaxis include those with IgE-mediated food allergy (approximately 5% to 8% of US children and 2% to 3% of adults) and those with IgE-mediated drug or insect venom allergy.[3,4] For these at-risk groups, the unpredictable possibility of fatal anaphylaxis can lead to significant anxiety and restriction of daily activities. The aim of this review is to provide clinicians with information that can be used to identify and counsel those individuals at risk of fatal anaphylaxis. We review the incidence and time trends of fatal anaphylaxis due to the 3 main causes (drugs, food, and insect venom) from recent studies and summarize risk factors for fatal anaphylaxis associated with these triggers.

FATAL DRUG ANAPHYLAXIS

Epidemiology

Drugs are the most common reported cause of fatal anaphylaxis in several countries, including Australia, New Zealand, United Kingdom, Brazil, and United States.[5-10] Recent epidemiological data are summarized in Table I. Rates of fatal drug-induced anaphylaxis estimated from national death certification data,[15] or defined anaphylaxis registries,[14,16,17] show inconsistent evidence of increasing incidence, in contrast to other causes of fatal anaphylaxis. In the United States, using International Classification of Diseases-10 (ICD-10) categorization, the estimated fatal drug anaphylaxis rate increased significantly from 0.27 per million population in 1999-2001 to 0.51 per million population in 2008-2010.[6] The year 1999 was the first year when ICD-10 codes were used to record deaths in the US National Mortality database, raising the possibility of a code shift underlying the reporting increase.[6] A significant increase was also noted in an Australian ICD-10-based report, between 1997 and 2005,[7] and an overall rate of increase of 5.6% per year over the period 1997-2013.[18] In contrast, an increase has not been reported in the United Kingdom, according to data from a national fatal anaphylaxis registry.[14] Problems with current ICD-10-based anaphylaxis mortality coding have been recently detailed.[15] Fig 1 shows the range of estimates for fatal drug anaphylaxis incidence. The risk of fatal drug anaphylaxis is seen to be low compared with other population mortality risks.

Not all drug anaphylaxis studies report fatalities, and it is unclear whether the drugs causing nonfatal anaphylaxis are the same as those causing fatal or near-fatal anaphylaxis. Hospitalization could be viewed as a marker of anaphylaxis severity, but fatal drug anaphylaxis events may occur because of inpatient use of medication rather than as a consequence of drug-induced anaphylaxis in the community; and even for hospitalized anaphylaxis, fatalities are uncommon.[14,19,20] In Australia, the ratio of deaths to hospitalizations relating to non-food anaphylaxis was 11:1000.[7] The precise proportion of drug anaphylaxis that results in a fatal outcome is not known. In Denmark, the 30-day mortality of patients admitted for anaphylactic shock (any cause) was less than 1%, and vasopressor use or mechanical ventilation was reported in less than 3% of admissions.[20] The latter interventions can be considered as evidence for severe anaphylaxis[21] (and possibly "near-fatal" anaphylaxis, but there is no consensus over these definitions).

The causative agent in drug-induced anaphylaxis may differ by country and method of data collection. Antibiotics (predominantly penicillins and cephalosporins)[6,22-24] are often the most common drugs associated with fatal drug anaphylaxis, although in the United Kingdom general anesthetics are the most common identified group, of which neuromuscular blocking agents are the leading trigger.[10,14] Radiocontrast agents are the leading cause in at least one hospital-based study in South Korea, and also feature prominently in recent studies from Australia and Canada.[25-35] Similarly, a recent US report found that radiocontrast agents caused more fatal drug anaphylaxis than penicillin and cephalosporins combined.[6] This suggested that radiocontrast administration may carry a relatively high "per injection" fatality risk compared with these frequently used antibiotics.[36] Although nonsteroidal anti-inflammatory drugs are frequently associated with anaphylaxis, they do not appear to be a common trigger of fatal anaphylaxis.[18]

Risk factors

Older age has been consistently associated with higher fatal drug anaphylaxis rates.[6,7,14] In the United Kingdom, the mean age for fatal drug anaphylaxis was 58 years,[14] and in Australia, most drug anaphylactic fatalities occurred between 55 and 85 years.[7] This may be related to increased prevalence of drug allergy due to increased drug exposure, and increased cardiovascular vulnerability, in older age groups. No consistent gender predilection has been noted in studies on drug-associated anaphylaxis; however in the United States, a significant association with African American ethnicity has been noted.[6] The role of comorbidities as a purported risk for fatal drug anaphylaxis has not been supported in many studies, and such morbidities are of course common in older people. However, one recent study reported 71% of fatal drug anaphylaxis occurred in people with known cardiovascular disease, and 39% in those with known asthma or emphysema.[11] In a French study of neuromuscular blocker-associated severe anaphylaxis (N = 1247), male gender, hypertension, cardiovascular

TABLE I. Population-based data for rate of fatal anaphylaxis triggered by drugs

Region	Data Source	Time period	Total deaths	Rate of fatal drug anaphylaxis (per million/year)	Age	Gender predominance	Leading causal drugs	Risk factors identified	Authors
Australia	Australian Bureau of Statistics and National Coroners Information System	1997-2013	147 cases in total 84 (57%) triggered by drugs ICD code T88.6	1997: 0.05 2013: 0.13	Median 66 (IQR 52-73; range 26-94)	Male > female	Antibiotics 43% General anesthetic 35% Radiocontrast 18%	Age Cardiovascular disease 71% Known penicillin allergy 11% (33% of beta-lactam fatalities)	Mullins et al 2016[11]
Canada (Ontario)	Ontario Coroner's database	1986-2011	92 total 16 (17%) drugs Coroner reports searched; ICD codes not used	0.1	Mean 65 (range 39-86)	38% male	Antibiotics 44% Radiocontrast 25%	Age Known allergy to the drug in 1 of 5 cases with data available (20%)	Xu et al 2014[12]
France	French National Pharmacovigilance Database*	2000-2011	84 (0.04% of total anaphylaxis cases) Pharmacovigilance Database	Not calculated	Mean age 59	Male > female	Not stated	Male gender Hypertension and cardiovascular comorbidities Obesity Beta-blocker use	Reitter et al 2014[13]
United Kingdom	National fatal anaphylaxis registry	1992-2012	479 total 263 drugs (55% of total) ICD code T88.6	1992: 0.24 2012: 0.24	Median 58 (range 56-61)	Not stated	Not stated	Older age	Turner et al 2015[14]
United States	National Center for Health Statistics MCDD	1999-2010	2458 total 1446 (59% of total) ICD codes T78.2 or T88.6	1999: 0.27 2010: 0.51	Median 60 (IQR 47-73)	None	Antibiotics (mostly beta-lactams) Contrast agents Antineoplastic drugs	African American ethnicity Older age	Jerschow et al 2014[6]

ICD, International Classification of Diseases; *IQR*, interquartile range; *MCDD*, National Center for Health Statistics' Multiple Cause of Death Data.
*Reported data were only on neuromuscular blocking agents.

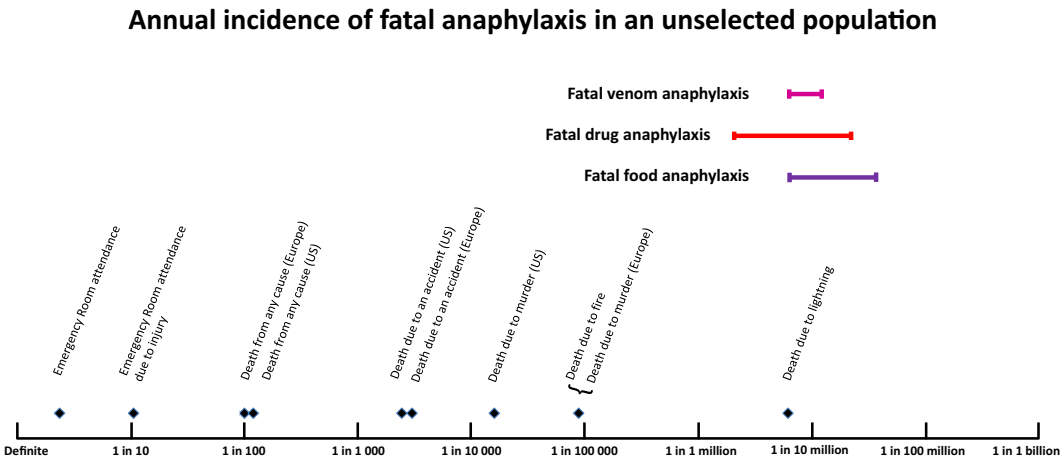


FIGURE 1. Estimated rates of fatal drug, food, and venom anaphylaxis compared with other risks for the general population. Reference risks are for the US population, unless otherwise stated. Bars represent the range of estimates from recent population-based studies of fatal anaphylaxis.

disease, obesity, and beta-blocker use were all associated with fatal outcome, and respiratory disorders were not associated with fatal outcome.[13] Neuromuscular blocking agent anaphylaxis may be promoted by cross-sensitization induced by the use of a cough medicine, pholcodine.[37-41] This hypothesis is supported by the reduction of general anesthetic anaphylaxis in Norway after pholcodine was removed from the market.[39] Although antihypertensive drugs are considered risk factors for severe anaphylaxis,[42-44] this class of drugs was not prominent among confirmed fatal drug anaphylaxis cases.[6,11,14]

A small but significant number of fatalities occur due to a drug administration error, that is, the patient was already known to be allergic to the relevant drug, or a closely related drug.[45] This was most clearly reported in Australia, where 9 of 27 cases of fatal penicillin or cephalosporin anaphylaxis were known to be penicillin-allergic.[11]

Practical implications of fatal drug anaphylaxis data

- Drug-induced anaphylaxis is the most common cause of fatal anaphylaxis in most regions where data are available, but is rare relative to nonanaphylactic causes of mortality.
- The incidence of fatal drug anaphylaxis may be increasing, in contrast to other causes of fatal anaphylaxis.
- People older than 50 years with pre-existing cardiovascular morbidity appear to be at highest risk for fatal drug anaphylaxis, and drug administration errors account for a significant proportion of cases.
- Beta-lactam antibiotics, muscle relaxants given at general anesthesia, and injected radiocontrast medium are the commonest reported triggers of fatal drug anaphylaxis.

FATAL FOOD ANAPHYLAXIS

Epidemiology

Despite consistent reports of increased incidence in nonfatal food anaphylaxis over recent decades, a parallel increase in fatalities has not, in general, been reported,[2,6,11,12,14] with the exception of one recent Australian study.[18] Recent epidemiological data are summarized in Table II. There are unexplained regional variations, with United Kingdom and Australia reporting almost double the rate of fatal, food-related anaphylaxis to that in the United States. Overall, although food-related anaphylaxis is relatively common, fatalities remain rare with a reported range of approximately 0.03 to 0.3 deaths per million person years in the general population (Fig 1). Case fatality rate is up to 1%, for medically coded food anaphylaxis, but varies significantly according to the definition of anaphylaxis used.[46,47] The estimated incidence of fatal food anaphylaxis for an individual with food allergy (Fig 2) is low and adds little to overall mortality risk.[46] This low level of risk may nevertheless be important for individuals with food allergy and their carers.[49]

Regional variations are also seen in the precise triggers responsible: peanut and tree nuts are the most common reported triggers in most series; however, recent data suggest that seafood is a more common cause in Australia.[11] In children, cow's milk is one of the most common causes in the United Kingdom, perhaps due to its ubiquitous role in the diet.[14] Despite egg being the most common food allergy in young children in Australia,[50] United Kingdom,[51] and possibly the United States, it is underrepresented in documented anaphylaxis fatalities.

Risk factors—food

Several risk factors or "coassociations" reported in fatal food anaphylaxis series are specific to food-triggered cases (Tables I-III). Risk factors are often identified by individual case reviews, but variable recording of mortality data, and the absence of suitable controls limits the ability to reliably distinguish associations from risk factors, and thus stratify food-allergic individuals according to risk. Although infants and young children have the highest reported rates of food-related anaphylaxis and subsequent hospitalization, fatal food anaphylaxis in this age group is very rare indeed.[2,6,11,14] Overall, there appears to be an age-related predisposition to fatal outcomes in the second and third decade in some but not all studies, which is currently unexplained, and is specific to fatal food anaphylaxis. Most fatal food anaphylaxis occurs in people with known food allergy, but in many cases prior reactions were not severe.[14] This may partly be because initial reactions usually occur during the first decade, when reaction severity

TABLE II. Population-based data for rate of fatal anaphylaxis triggered by food

Region	Data Source	Time period	Total deaths	Rate of fatal food anaphylaxis (per million/year)	Age	Gender predominance	Leading causal foods	Risk factors identified	Authors
Australia	Australian Bureau of S tatistics and National Coronial Information System (NCIS)	1997-2013	324 (119 with known cause) 23 (19%) food ICD codes 995.6, T78	1997: 0 2014: 0.09	Median 28 (range 4-66)	No	Seafood 50% Nuts 32%	Known food allergy 91% Asthma 68% Alcohol or recreational drugs 27% Upright posture 68% Delayed use of epinephrine	Mullins et al 2016[11]
Canada (Ontario)	Ontario Coroner's database	1986-2011	92 total 40 (43%) food Coroner reports searched; ICD codes not used	1986: 0.32 2011: 0.08	Mean 32 (range 9-78)	No	Peanut	Delayed use of epinephrine Known allergy to the culprit food in all 34 cases where this information was available (100%)	Xu et al 2014[12]
United Kingdom	National fatal anaphylaxis registry	1992-2008	479 total 124 (26%) food ICD codes T78, and registry	1992: 0.10 2012: 0.12	Mean 25 Median 20 (range 4-85)	Male (under 15 y) Female (over 15 y)	Peanut or Tree nut 73%	Known food allergy 69% Asthma 78% Change in posture	Turner et al 2015[14]
United States	3 national databases (NIS, NEDS, MCDD)	1999-2009	2229 total approximately 122 (5%) food ICD codes 995.6, T78	1999: 0.03 2009: 0.04	Not stated	Not stated	Not stated	Not stated	Ma et al 2014[2]
United States	National Center for Health Statistics MCDD	1999-2010	2458 total 164 (7%) food ICD codes T78	0.05	Median 40 (IQR 20-60)	Male > female	Not stated	African American ethnicity	Jerschow et al 2014[6]

ICD, International Classification of Diseases; *IQR*, interquartile range; *MCDD*, National Center for Health Statistics' Multiple Cause of Death Data; *NCIS*, Australian National Coronial Information System; *NEDS*, Nationwide Emergency Department Sample, from the Healthcare Cost and Utilization Project; *NIS*, Nationwide Inpatient Sample, from the Healthcare Cost and Utilization Project.

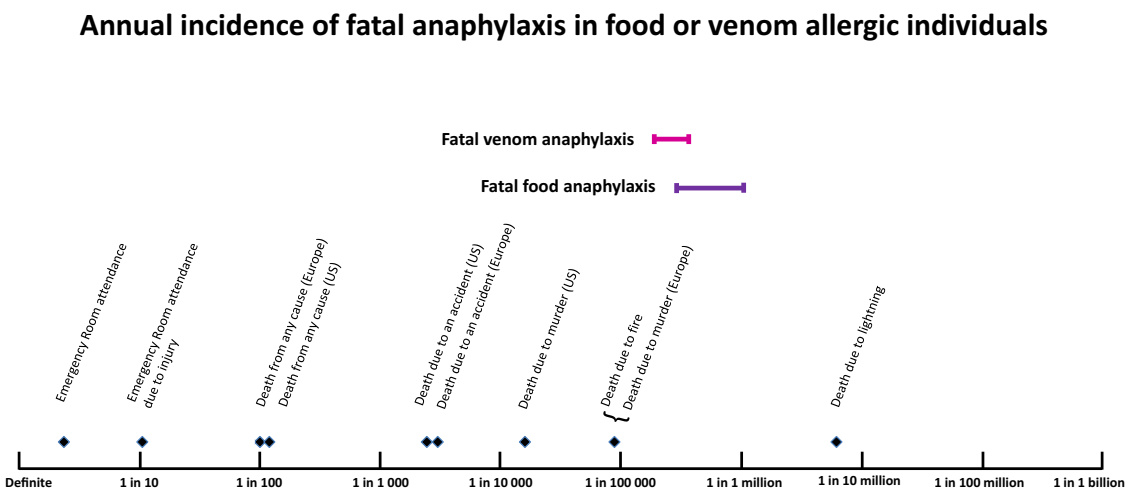


FIGURE 2. Estimated rates of fatal food and venom anaphylaxis for people with known food allergy or insect venom allergy. Reference risks are for the US population, unless otherwise stated. Data shown for individuals with food allergy are the 95% confidence interval of fatal food anaphylaxis risk, derived from the systematic review of Umasunthar et al.[46] Data shown for individuals with insect venom allergy were calculated using the range of estimates from recent population-based studies of fatal venom anaphylaxis, and an estimated 3% population prevalence of insect venom allergy.[48]

appears to be lower than in the second and third decades. The delayed use of epinephrine, identified as a significant feature in several reports of fatal food anaphylaxis,[11,12,52-54] is perhaps the risk factor most amenable to modification. This has, in part, driven the widespread provision of epinephrine autoinjectors for the management of anaphylaxis, although controversy exists as to their use in less severe, nonanaphylactic allergic reactions.[55] Although epinephrine is an essential treatment modality in anaphylaxis, there is no formal controlled trial evidence that epinephrine or epinephrine autoinjectors effectively prevent fatal outcome.[56] Fatal reactions occur despite timely epinephrine administration,[16] which may relate to the need for more intensive administration in severe reactions beyond that which can be administered by autoinjector devices.[57,58]

Asthma is a well-documented feature in fatal food anaphylaxis series, affecting approximately 70% to 75% of fatalities in recent UK and Australian series.[11,14] Most fatal food anaphylaxis is associated with severe respiratory symptoms, with cardiovascular compromise thought to be secondary to respiratory failure.[18] For example, acute dyspnea was noted in 64% of cases in one study.[11] It therefore seems sensible to optimize asthma management in individuals at risk of food anaphylaxis. However, asthma is common in food-allergic individuals, and there are no good data to differentiate risk on the basis of asthma control. Indeed, in the UK registry, there is little evidence for an association with poor asthma control or worsening asthma symptoms leading up to the fatal event.

The presence of ethanol or recreational drugs and upright posture (eg, during assessment or while in transit to a health care facility) have been reported as potential risk factors in Australia, and the latter in the United Kingdom.[11,59] Both are biologically plausible: ethanol or recreational drugs may, through disinhibition, increase the likelihood of accidental allergen exposure, mask the early warning signs of anaphylaxis, or suppress physiological responses to hypotension.[60] Ethanol may also increase absorption of food allergens through increased intestinal permeability, a mechanism that may also be relevant to the effects of exercise. Upright posture has been associated with both fatal food and fatal venom anaphylaxis, suggesting significant cardiovascular compromise in both cases.

Other proposed risk factors, although lacking consistent evidence, are race (increased risk in African Americans, and UK-resident South Asians),[6,14] allergy to multiple foods,[61,62] exercise, and intercurrent illness.[60] Low serum platelet-activating factor acetyl hydrolase activity was associated with fatal outcome in acute samples analyzed in one study of peanut allergy.[63] However, this finding has not be replicated elsewhere, and may reflect increased levels of platelet-activating factor release during severe reactions.

Practical implications of fatal food anaphylaxis data

- Fatal food anaphylaxis is rare, such that it adds little to overall mortality risk, even in young people known to have food allergy.
- Reliable identification of patients at increased risk of fatal food anaphylaxis is not currently possible, but patients with isolated egg allergy or no asthma appear to be at lowest risk, and risk is highest in the second and third decades of life.
- Features of food anaphylaxis and its management associated with fatal outcome are upright posture and delayed use of epinephrine.
- Given the rarity of fatal food anaphylaxis, our inability to reliably stratify risk, and the limited evidence that specific interventions reduce fatality risk—quality of life considerations should play a key role in driving treatment decisions for people with food allergy.

FATAL VENOM ANAPHYLAXIS

Epidemiology

In common with food- and drug-induced anaphylaxis, hospital admission rates for venom anaphylaxis have increased over

TABLE III. Population-based data for rate of fatal anaphylaxis triggered by insect venom

Region	Data Source	Time period	Total deaths	Rate of fatal venom anaphylaxis (per million/year)	Age	Gender predominance	Leading causal insects	Risk factors identified	Authors
Australia	Australian Bureau of Statistics and National Coronial Information System (NCIS)	1997-2013	324 (119 with known cause) 41 (13%) insect X23, X25	0.09	Median 50 (range 19-79)	90% male	Honeybee 73% Ants 9% Ticks 9% Wasp 6%	Age Male sex Cardiovascular disease 45% Upright posture 30% Known venom allergy 48% Squeezing tick bites associated with death in all tick cases	Mullins et al 2016[11]
Canada (Ontario)	Ontario Coroner's database	1986-2011	92 total 30 (33%) insect Coroner reports searched; ICD codes not used.	0.1	Mean 54 (range 25 to 77)	80% male	Not stated	Age Male sex Known venom allergy in 11 of 21 (52%) cases where this information was available	Xu et al 2014[12]
United Kingdom	National fatal anaphylaxis registry	1992-2008	479 total 92 (19%) insect X23	0.09	Mean 59 (95% CI 56-63)	Not stated	Not stated	Not stated	Turner et al 2015[14]
United States	3 national databases (NIS, NEDS, MCDD)	1999-2009	2229 total 295 (13%) insect X23	0.09	Not stated	Not stated	Not stated	Not stated	Ma et al 2014[2]
United States	National Center for Health Statistics MCDD	1999-2010	2458 total 374 (15%) insect X23, X25, T63.4	0.17 in Southern states 0.11 to 0.13 in other areas	Median 52 y	80% male 88% white	Not stated	Age White race Male sex	Jerschow et al 2014[6]

ICD, International Classification of Diseases; *MCDD*, National Center for Health Statistics' Multiple Cause of Death Data; *NCIS*, Australian National Coronial Information System; *NEDS*, Nationwide Emergency Department Sample, from the Healthcare Cost and Utilization Project; *NIS*, Nationwide Inpatient Sample, from the Healthcare Cost and Utilization Project.

the last decade in most regions where data are available. There was an overall 12% increase per annum in the United Kingdom between 1998 and 2012,[14] and data from Rochester, Minnesota, showed a significant 59% increase in emergency department visits for venom anaphylaxis between 2005 and 2014.[64] Overall insect stings account for 10% to 20% of anaphylaxis in these and other studies,[35,65] but up to 50% in a European registry of severe anaphylaxis.[17] Population rates of fatal insect venom anaphylaxis in recent studies from 4 geographic regions[6,11,12,14] are summarized in Table III. A consistent finding is that fatal insect venom anaphylaxis occurs at a rate of approximately 0.1 cases per million population in Australia, Canada (Ontario), United Kingdom, and United States. Some geographic variation was noted in the United States, with a higher rate in Southern states,[6] something that was not reported for fatal food or drug anaphylaxis. Another consistent finding across these studies is the absence of a significant change in the rate of fatal venom anaphylaxis over time, despite the increases in emergency department attendance and hospitalizations noted above. This is consistent with an earlier report of stable fatal venom anaphylaxis rates from the 1960s to the 1980s in the United States.[66] The estimated incidence of fatal venom anaphylaxis for an individual with venom allergy (Fig 2) is low and adds little to overall mortality risk. However, this risk may be higher for specific groups, as discussed below. Mullins et al[11] reported honeybee to be the dominant cause of fatal insect venom anaphylaxis, although this may relate to the relatively high prevalence of allergy to this insect in Australia. Wasps were the commonest cause of fatal venom anaphylaxis in the United Kingdom,[10] and in a large European registry of nonfatal anaphylaxis.[17]

Risk factors—venom

Key risk factors from recent studies of fatal venom anaphylaxis, including a total of 535 cases, are summarized in Table III. Consistent findings are that fatal insect venom allergy is a disease of adult males, with 80% to 90% of cases occurring in men, at an average age of 50 to 60 years. Two studies reported that only half of cases occur in people known to have had a prior systemic allergic reaction to the same insect. This may limit the impact that venom immunotherapy can have on fatal venom anaphylaxis rates. White race appears to be a risk factor for fatal venom anaphylaxis in the United States. In Australia, upright posture and pre-existing cardiovascular disease were cited as common features. For anaphylaxis triggered by tick bites, as opposed to insect venom, squeezing ticks for removal was a common feature. This has led to Australian recommendations to freeze ticks with an ether-containing spray, rather than remove them by squeezing. Cardiovascular disease is thought to be an important risk factor for fatal venom anaphylaxis, and consistent with this postural changes have been reported in fatal cases.[14,67]

Other cofactors such as exercise, alcohol, nonsteroidal anti-inflammatory drugs, acute infections, stress, and perimenstrual status are thought to increase the risk for anaphylaxis and severe anaphylaxis in general. Little direct evidence for these risk factors is available in relation to insect venom anaphylaxis, and alcohol use was not found to be a risk factor in one study.[14] Mastocytosis is associated with nonfatal insect venom anaphylaxis,[68] and has been associated with a specific clinical presentation of hypotensive anaphylaxis in the absence of skin symptoms.[69] Although there is particular interest in the relationship between systemic mastocytosis and reaction severity, systemic mastocytosis has only been specifically identified as a risk factor for fatal venom anaphylaxis in case reports.[70] Low platelet-activating factor acetyl hydrolase has been associated with increased risk,[71] but these data require further validation.

A health economic analysis undertaken for the UK National Institute for Health and Care Excellence found that a highly effective treatment for venom allergy, subcutaneous venom immunotherapy, was only cost effective if quality of life improvement occurred, or in specific high-risk groups with frequent stings and frequent reactions, such as beekeepers.[72-74] This was due to the rarity of costly outcomes such as death or disability in patients with known venom allergy. Disability is not widely reported as an outcome of venom anaphylaxis, but anecdotal evidence suggests that persistent vegetative state after hypoxic encephalopathy in near-fatal venom anaphylaxis is a significant risk, and this may impact on health economic analyses. The UK health economic analysis does suggest that quality of life impact is an important factor to consider when making treatment decisions with venom allergic patients.[75]

Practical implications of fatal venom anaphylaxis data

- The risk of fatal venom anaphylaxis for venom allergic individuals is low, approximately 3 to 6 cases per million person years.
- Risk factors for fatal venom anaphylaxis are middle age, male sex, white race, pre-existing cardiovascular disease, and possibly specific immunological disorders such as mastocytosis.
- Fatal venom anaphylaxis is associated with upright posture, and fatal tick bite anaphylaxis is associated with squeezing ticks for removal.
- These risk factors should be considered, together with quality of life impairment, when making treatment decisions in venom allergic patients.

CONCLUSIONS

We have summarized key clinical indicators of increased risk for fatal anaphylaxis and highlighted information that might be used for stratifying risk and making treatment decisions in at-risk patients. Published reports of fatal anaphylaxis have generally been obtained from national registers of death certificate data, and these data are subject to underreporting, miscoding, and significant discrepancies in coronial notification and subsequent investigation of suspected fatal anaphylaxis. In some regions, death from food or insect anaphylaxis may be coded as due to "natural causes." In most published datasets, a significant proportion of fatal anaphylaxis cases are classified as "unspecified cause." Improved diagnostic codes for anaphylaxis, and the maintenance of fatal anaphylaxis registries, are important to ensure data quality. With these caveats in mind, the available data do suggest that fatal anaphylaxis is a very rare event, and although fatal drug anaphylaxis may be increasing, data do not consistently support a change in incidence of fatal food or venom anaphylaxis in recent years. This may in part be due to improved delivery of emergency medical care and increased availability of epinephrine autoinjectors limiting any potential increase in anaphylaxis fatalities.[14] Risk factors for fatal anaphylaxis are mainly cause-specific, although increased age and cardiovascular comorbidity are common risk factors for fatal venom and drug anaphylaxis, and upright posture during anaphylaxis is a feature

of fatal venom and food reactions. Further work should focus on improving our ability to identify those at risk and prevent fatal anaphylaxis, amongst populations with known allergy to drugs, food, and venom.

REFERENCES

1. Wood RA, Camargo CA Jr, Lieberman P, Sampson HA, Schwartz LB, Zitt M, et al. Anaphylaxis in America: the prevalence and characteristics of anaphylaxis in the United States. J Allergy Clin Immunol 2014;133:461-7.
2. Ma L, Danoff TM, Borish L. Case fatality and population mortality associated with anaphylaxis in the United States. J Allergy Clin Immunol 2014;133: 1075-83.
3. Rona RJ, Keil T, Summers C, Gislason D, Zuidmeer L, Sodergren E, et al. The prevalence of food allergy: a meta-analysis. J Allergy Clin Immunol 2007;120: 638-46.
4. Branum AM, Lukacs SL. Food allergy among children in the United States. Pediatrics 2009;124:1549-55.
5. Tanno LK, Ganem F, Demoly P, Toscano CM, Bierrenbach AL. Under-notification of anaphylaxis deaths in Brazil due to difficult coding under the ICD-10. Allergy 2012;67:783-9.
6. Jerschow E, Lin RY, Scaperotti MM, McGinn AP. Fatal anaphylaxis in the United States, 1999-2010: temporal patterns and demographic associations. J Allergy Clin Immunol 2014;134:1318-1328.e1317.
7. Liew WK, Williamson E, Tang ML. Anaphylaxis fatalities and admissions in Australia. J Allergy Clin Immunol 2009;123:434-42.
8. Low I, Stables S. Anaphylactic deaths in Auckland, New Zealand: a review of coronial autopsies from 1985 to 2005. Pathology 2006;38:328-32.
9. Poulos LM, Waters AM, Correll PK, Loblay RH, Marks GB. Trends in hospitalizations for anaphylaxis, angioedema, and urticaria in Australia, 1993-1994 to 2004-2005. J Allergy Clin Immunol 2007;120:878-84.
10. Pumphrey RS. Lessons for management of anaphylaxis from a study of fatal reactions. Clin Exp Allergy 2000;30:1144-50.
11. Mullins RJ, Wainstein BK, Barnes EH, Liew WK, Campbell DE. Increases in anaphylaxis fatalities in Australia from 1997 to 2013. Clin Exp Allergy 2016; 46:1099-110.
12. Xu YS, Kastner M, Harada L, Xu A, Salter J, Waserman S. Anaphylaxis-related deaths in Ontario: a retrospective review of cases from 1986 to 2011. Allergy Asthma Clin Immunol 2014;10:38.
13. Reitter M, Petitpain N, Latarche C, Cottin J, Massy N, Demoly P, et al. Fatal anaphylaxis with neuromuscular blocking agents: a risk factor and management analysis. Allergy 2014;69:954-9.
14. Turner PJ, Gowland MH, Sharma V, Ierodiakonou D, Harper N, Garcez T, et al. Increase in anaphylaxis-related hospitalizations but no increase in fatalities: an analysis of United Kingdom national anaphylaxis data, 1992-2012. J Allergy Clin Immunol 2015;135:956-63.
15. Tanno LK, Simons FER, Annesi-Maesano I, Calderon MA, Aymé S, Demoly P. Fatal anaphylaxis registries data support changes in the WHO anaphylaxis mortality coding rules. Orphanet J Rare Dis 2017;12:8.
16. Grabenhenrich LB, Dölle S, Moneret-Vautrin A, Köhli A, Lange L, Spindler T, et al. Anaphylaxis in children and adolescents: the European Anaphylaxis Registry. J Allergy Clin Immunol 2016;137:1128-1137.e1.
17. Worm M, Moneret-Vautrin A, Scherer K, Lang R, Fernandez-Rivas M, Cardona V, et al. First European data from the network of severe allergic reactions (NORA). Allergy 2014;69:1397-404.
18. Turner PJ, Campbell DE. Epidemiology of severe anaphylaxis: can we use population-based data to understand anaphylaxis? Curr Opin Allergy Clin Immunol 2016;16:441-50.
19. Lin RY, Anderson AS, Shah SN, Nurruzzaman F. Increasing anaphylaxis hospitalizations in the first 2 decades of life: New York State, 1990-2006. Ann Allergy Asthma Immunol 2008;101:387-93.
20. Jeppesen AN, Christiansen CF, Froslev T, Sorensen HT. Hospitalization rates and prognosis of patients with anaphylactic shock in Denmark from 1995 through 2012. J Allergy Clin Immunol 2016;137:1143-7.
21. Ring J, Messmer K. Incidence and severity of anaphylactoid reactions to colloid volume substitutes. Lancet 1977;1:466-9.
22. Li ZD, Liu WG, Zhao ZQ, Shen YW, Chen YJ. Analysis of 59 anaphylactic death cases. Fa Yi Xue Za Zhi 2015;31:206-10.
23. Shen Y, Li L, Grant J, Rubio A, Zhao Z, Zhang X, et al. Anaphylactic deaths in Maryland (United States) and Shanghai (China): a review of forensic autopsy cases from 2004 to 2006. Forensic Sci Int 2009;186:1-5.
24. Yilmaz R, Yuksekbas O, Erkol Z, Bulut ER, Arslan MN. Postmortem findings after anaphylactic reactions to drugs in Turkey. Am J Forensic Med Pathol 2009;30:346-9.
25. Gurrieri C, Weingarten TN, Martin DP, Babovic N, Narr BJ, Sprung J, et al. Allergic reactions during anesthesia at a large United States referral center. Anesth Analg 2011;113:1202-12.
26. Hitti EA, Zaitoun F, Harmouche E, Saliba M, Mufarrij A. Acute allergic reactions in the emergency department: characteristics and management practices. Eur J Emerg Med 2015;22:253-9.
27. Jares EJ, Baena-Cagnani CE, Sánchez-Borges M, Ensina LF, Arias-Cruz A, Gómez M, et al. Drug-induced anaphylaxis in Latin American Countries. J Allergy Clin Immunol Pract 2015;3:780-8.
28. Kuhlen JL Jr, Camargo CA Jr, Balekian DS, Blumenthal KG, Guyer A, Morris T, et al. Antibiotics are the most commonly identified cause of perioperative hypersensitivity reactions. J Allergy Clin Immunol Pract 2016;4: 697-704.
29. Renaudin JM, Beaudouin E, Ponvert C, Demoly P, Moneret-Vautrin DA. Severe drug-induced anaphylaxis: analysis of 333 cases recorded by the Allergy Vigilance Network from 2002 to 2010. Allergy 2013;68:929-37.
30. Saff RR, Camargo CA Jr, Clark S, Rudders SA, Long AA, Banerji A. Utility of ICD-9-CM codes for identification of allergic drug reactions. J Allergy Clin Immunol Pract 2016;4:114-119.e111.
31. Smit DV, Cameron PA, Rainer TH. Anaphylaxis presentations to an emergency department in Hong Kong: incidence and predictors of biphasic reactions. J Emerg Med 2005;28:381-8.
32. Tang R, Xu H-Y, Cao J, Chen S, Sun J-L, Hu H, et al. Clinical characteristics of inpatients with anaphylaxis in China. Biomed Res Int 2015;2015:429534.
33. Worm M, Eckermann O, Dölle S, Aberer W, Beyer K, Hawranek T, et al. Triggers and treatment of anaphylaxis: an analysis of 4,000 cases from Germany, Austria and Switzerland. Dtsch Arztebl Int 2014;111:367-75.
34. Yang MS, Lee SH, Kim TW, Kwon JW, Lee SM, Kim SH, et al. Epidemiologic and clinical features of anaphylaxis in Korea. Ann Allergy Asthma Immunol 2008;100:31-6.
35. Ye YM, Kim MK, Kang HR, Kim TB, Sohn SW, Koh YI, et al. Predictors of the severity and serious outcomes of anaphylaxis in Korean adults: a multicenter retrospective case study. Ann Allergy Asthma Immunol Res 2015;7:22-9.
36. Scheinfeld MH, Sprayregen S, Jerschow E, Dym RJ. Contrast is the new penicillin, and possibly worse. J Am Coll Radiol 2015;12:942-3.
37. Florvaag E, Johansson SG. The pholcodine story. Immunol Allergy Clin North Am 2009;29:419-27.
38. Florvaag E, Johansson SG. Pholcodine in cough medicines and IgE-sensitization in the EU: an urgent task. Allergy 2012;67:581-2.
39. Florvaag E, Johansson SG, Irgens A, de Pater GH. IgE-sensitization to the cough suppressant pholcodine and the effects of its withdrawal from the Norwegian market. Allergy 2011;66:955-60.
40. Johansson SG, Florvaag E, Oman H, Poulsen LK, Mertes PM, Harper NJ, et al. National pholcodine consumption and prevalence of IgE-sensitization: a multicentre study. Allergy 2010;65:498-502.
41. Johansson SG, Oman H, Nopp A, Florvaag E. Pholcodine caused anaphylaxis in Sweden 30 years ago. Allergy 2009;64:820-1.
42. Greenberger PA. Fatal and near-fatal anaphylaxis: factors that can worsen or contribute to fatal outcomes. Immunol Allergy Clin North Am 2015;35:375-86.
43. Lee S, Hess EP, Nestler DM, Bellamkonda Athmaram VR, Bellolio MF, Decker WW, et al. Antihypertensive medication use is associated with increased organ system involvement and hospitalization in emergency department patients with anaphylaxis. J Allergy Clin Immunol 2013;131:1103-8.
44. Nassiri M, Babina M, Dolle S, Edenharter G, Rueff F, Worm M. Ramipril and metoprolol intake aggravate human and murine anaphylaxis: evidence for direct mast cell priming. J Allergy Clin Immunol 2015;135:491-9.
45. Corre KA, Spielberg TE. Adverse drug reaction processing in the United States and its dependence on physician reporting: zomepirac (Zomax) as a case in point. Ann Emerg Med 1988;17:145-9.
46. Umasunthar T, Leonardi-Bee J, Hodes M, Turner PJ, Gore C, Habibi P, et al. Incidence of fatal food anaphylaxis in people with food allergy: a systematic review and meta-analysis. Clin Exp Allergy 2013;43:1333-41.
47. Umasunthar T, Leonardi-Bee J, Turner PJ, Hodes M, Gore C, Warner JO, et al. Incidence of food anaphylaxis in people with food allergy: a systematic review and meta-analysis. Clin Exp Allergy 2015;45:1621-36.
48. Golden DB. Anaphylaxis to insect stings. Immunol Allergy Clin North Am 2015;35:287-302.
49. Hu W, Grbich C, Kemp A. When doctors disagree: a qualitative study of doctors' and parents' views on the risks of childhood food allergy. Health Expect 2008;11:208-19.
50. Osborne NJ, Koplin JJ, Martin PE, Gurrin LC, Lowe AJ, Matheson MC, et al. Prevalence of challenge-proven IgE-mediated food allergy using population-based sampling and predetermined challenge criteria in infants. J Allergy Clin Immunol 2011;127:668-676.e1-2.

51. Perkin MR, Logan K, Tseng A, Raji B, Ayis S, Peacock J, et al. Randomized trial of introduction of allergenic foods in breast-fed infants. N Engl J Med 2016;374:1733-43.
52. Sampson HA, Mendelson L, Rosen JP. Fatal and near-fatal anaphylactic reactions to food in children and adolescents. N Engl J Med 1992;327:380-4.
53. Bock SA, Muñoz-Furlong A, Sampson HA. Further fatalities caused by anaphylactic reactions to food, 2001-2006. J Allergy Clin Immunol 2007;119:1016-8.
54. Pumphrey RS, Gowland MH. Further fatal allergic reactions to food in the United Kingdom, 1999-2006. J Allergy Clin Immunol 2007;119:1018-9.
55. Turner PJ, DunnGalvin A, Hourihane JO. The emperor has no symptoms: the risks of a blanket approach to using epinephrine autoinjectors for all allergic reactions. J Allergy Clin Immunol Pract 2016;4:1143-6.
56. Sheikh A, Shehata YA, Brown SG, Simons FE. Adrenaline for the treatment of anaphylaxis: cochrane systematic review. Allergy 2009;64:204-12.
57. Brown SG. Anaphylaxis: clinical concepts and research priorities. Emerg Med Australas 2006;18:155-69.
58. Smith PL, Kagey-Sobotka A, Bleecker ER, Traystman R, Kaplan AP, Gralnick H, et al. Physiologic manifestations of human anaphylaxis. J Clin Invest 1980;66:1072-80.
59. Pumphrey R, Sturm G. Risk factors for fatal anaphylaxis. In: Moneret-Vautrin DA, editor. Advances in Anaphylaxis Management. London: Future Medicine; 2014:32-48.
60. Turner PJ, Baumert JL, Beyer K, Boyle RJ, Chan CH, Clark AT, et al. Can we identify patients at risk of life-threatening allergic reactions to food? Allergy 2016;71:1241-55.
61. Mehr S, Turner PJ, Joshi P, Wong M, Campbell DE. Safety and clinical predictors of reacting to extensively heated cow's milk challenge in cow's milk-allergic children. Ann Allergy Asthma Immunol 2014;113:425-9.
62. Turner PJ, Mehr S, Joshi P, Tan J, Wong M, Kakakios A, et al. Safety of food challenges to extensively heated egg in egg-allergic children: a prospective cohort study. Pediatric Allergy Immunol 2013;24:450-5.
63. Vadas P, Gold M, Perelman B, Liss GM, Lack G, Blyth T, et al. Platelet-activating factor, PAF acetylhydrolase, and severe anaphylaxis. N Engl J Med 2008;358:28-35.
64. Motosue MS, Bellolio MF, Van Houten HK, Shah ND, Campbell RL. Increasing emergency department visits for anaphylaxis, 2005-2014. J Allergy Clin Immunol Pract 2017;5:171-175.e3.
65. Manuyakorn W, Benjaponpitak S, Kamchaisatian W, Vilaiyuk S, Sasisakulporn C, Jotikasthira W. Pediatric anaphylaxis: triggers, clinical features, and treatment in a tertiary-care hospital. Asian Pac J Allergy Immunol 2015;33:281-8.
66. Graft DF. Insect sting allergy. Med Clin North Am 2006;90:211-32.
67. Lieberman P, Simons FE. Anaphylaxis and cardiovascular disease: therapeutic dilemmas. Clin Exp Allergy 2015;45:1288-95.
68. Alvarez-Twose I, Zanotti R, Gonzalez-de-Olano D, Bonadonna P, Vega A, Matito A, et al. Nonaggressive systemic mastocytosis (SM) without skin lesions associated with insect-induced anaphylaxis shows unique features versus other indolent SM. J Allergy Clin Immunol 2014;133:520-8.
69. Zanotti R, Lombardo C, Passalacqua G, Caimmi C, Bonifacio M, De Matteis D, et al. Clonal mast cell disorders in patients with severe Hymenoptera venom allergy and normal serum tryptase levels. J Allergy Clin Immunol 2015;136:135-9.
70. Vos BJPR, van Anrooij B, van Doormaal JJ, Dubois AEJ, Oude-Elberink JNG. Fatal anaphylaxis to yellow jacket stings in mastocytosis: options for identification and treatment of at risk patients. J Allergy Clin Immunol Pract 2017;5:1264-71.
71. Pravettoni V, Piantanida M, Primavesi L, Forti S, Pastorello EA. Basal platelet-activating factor acetylhydrolase: prognostic marker of severe Hymenoptera venom anaphylaxis. J Allergy Clin Immunol 2014;133:1218-20.
72. Boyle RJ, Dickson R, Hockenhull J, Cherry MG, Elremeli M. Immunotherapy for hymenoptera venom allergy: too expensive for European health care? Allergy 2013;68:1341-2.
73. Boyle RJ, Elremeli M, Hockenhull J, Cherry MG, Bulsara MK, Daniels M, et al. Venom immunotherapy for preventing allergic reactions to insect stings. Cochrane Database Syst Rev 2012;10:CD008838.
74. Hockenhull J, Elremeli M, Cherry MG, Mahon J, Lai M, Darroch J, et al. A systematic review of the clinical effectiveness and cost-effectiveness of Pharmalgen for the treatment of bee and wasp venom allergy. Health Technol Assess 2012;16. III-IV,1-110.
75. Oude Elberink JN, De Monchy JG, Van Der Heide S, Guyatt GH, Dubois AE. Venom immunotherapy improves health-related quality of life in patients allergic to yellow jacket venom. J Allergy Clin Immunol 2002;110:174-82.

Attachment D

EMSSP Report

Virginia
OFFICE OF EMERGENCY MEDICAL SERVICES
Virginia Department of Health

Quarterly Report

Virginia EMS Scholarship Program

Q2 – FY20

Division of Educational Development

Background & Initial Launch

The Virginia EMS Scholarship Program (EMSSP) is managed by the Virginia Office of Emergency Medical Services providing scholarship awards to current Virginia EMS Providers and those seeking to become EMS providers in the Commonwealth.

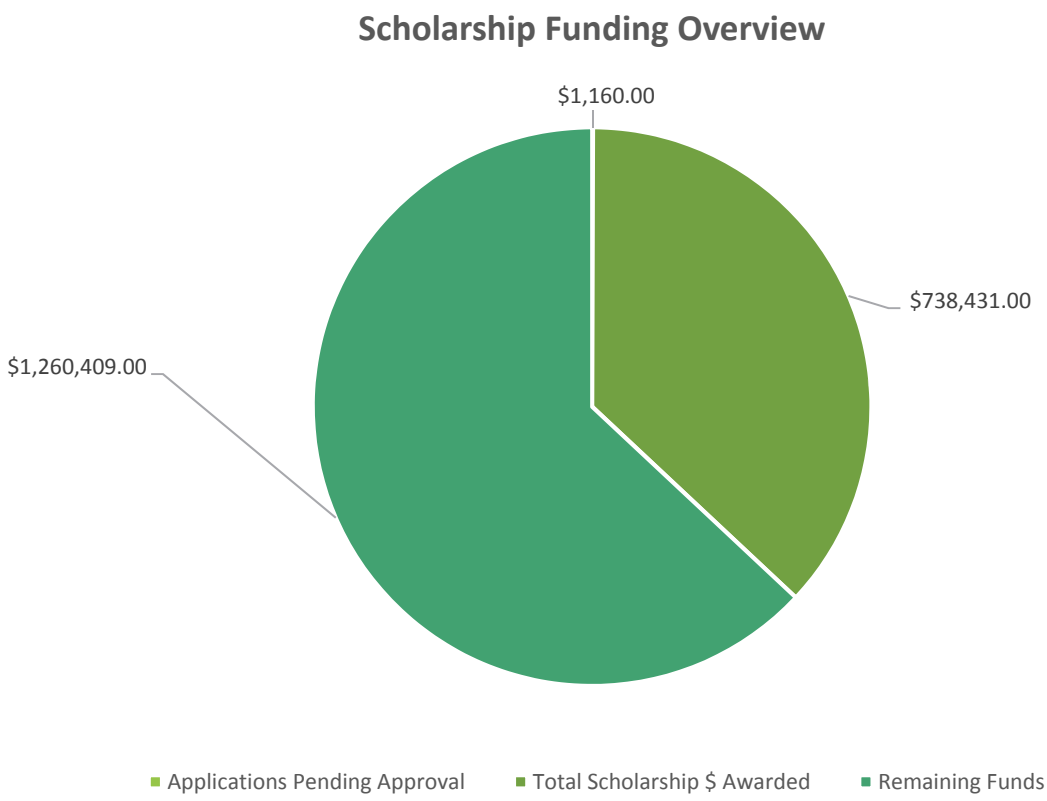
The EMSSP supports students who are accepted into an eligible Virginia approved initial certification program– EMR, EMT, AEMT and Paramedic.

The scholarship program is not designed to provide 100% funding for a training program.

FY20 Scholarship Budget

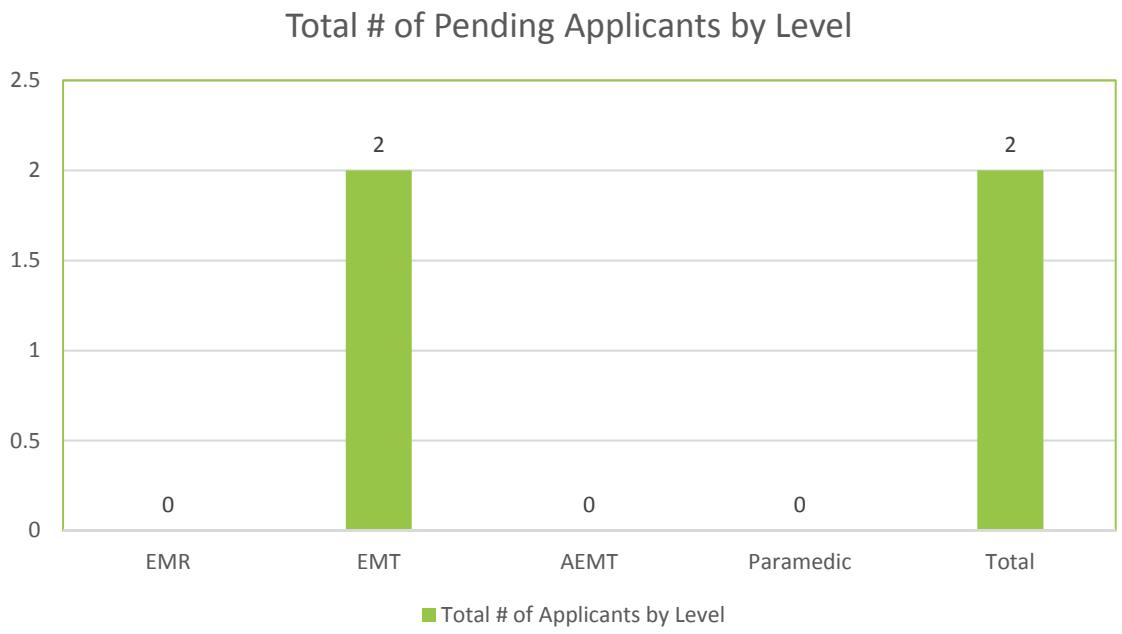
The FY20 budget for the Virginia EMS Scholarship Program is $2,000,000.00. The following chart shows a breakdown of funding based on three (3) categories: 1) Applications Pending Approval, 2) Total Scholarship $ Awarded, and Remaining Funds.

- **Application Pending Approval** – this category includes the total dollar value for all applications received from June 5, 2019 through December 31, 2019. This covers the first and second quarter of FY20.
- **Total Scholarship $ Awarded** – this category is the total dollar value for all scholarship applications which have been approved and are in the process of being paid. Since the Virginia EMS Scholarship module is new, OEMS staff have only approved a small group of test applications as we work through the payment processes with the VDH Office of Financial Management.
- **Remaining Funds** – this category is the total dollar value of funds remaining in the scholarship program and available for to students for the remainder of the fiscal year.

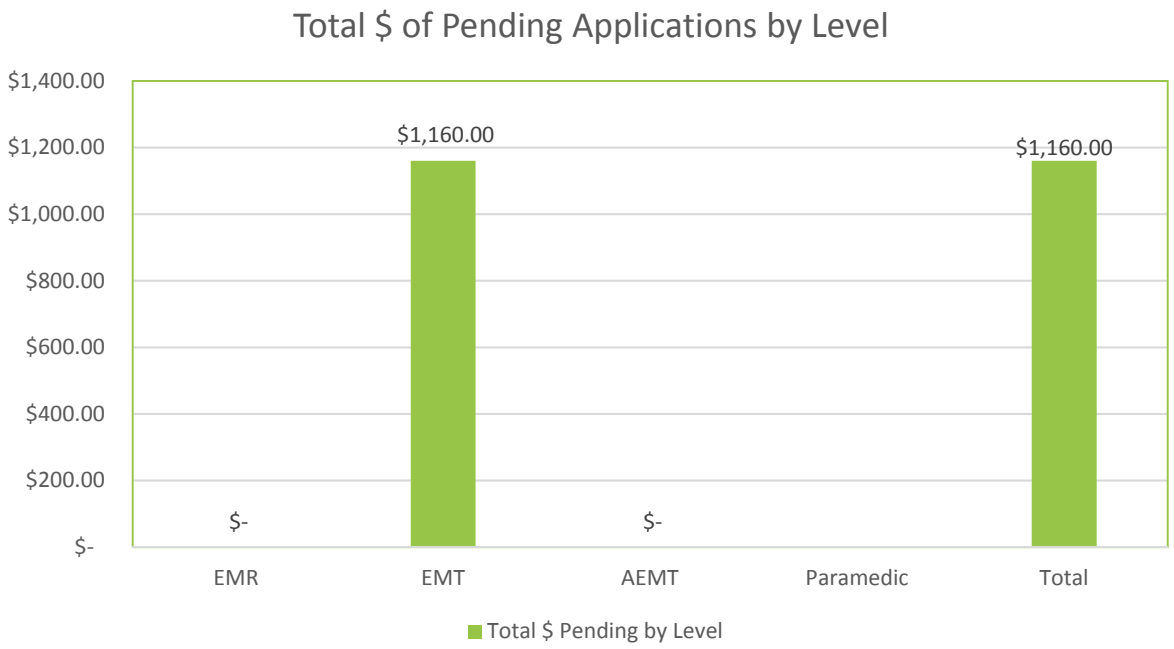


Breakdown of Pending Applications

The following chart show of pending scholarship applications by training level. This includes all pending applications for students enrolled in eligible initial certification courses from June 5, 2019 through December 31, 2019.

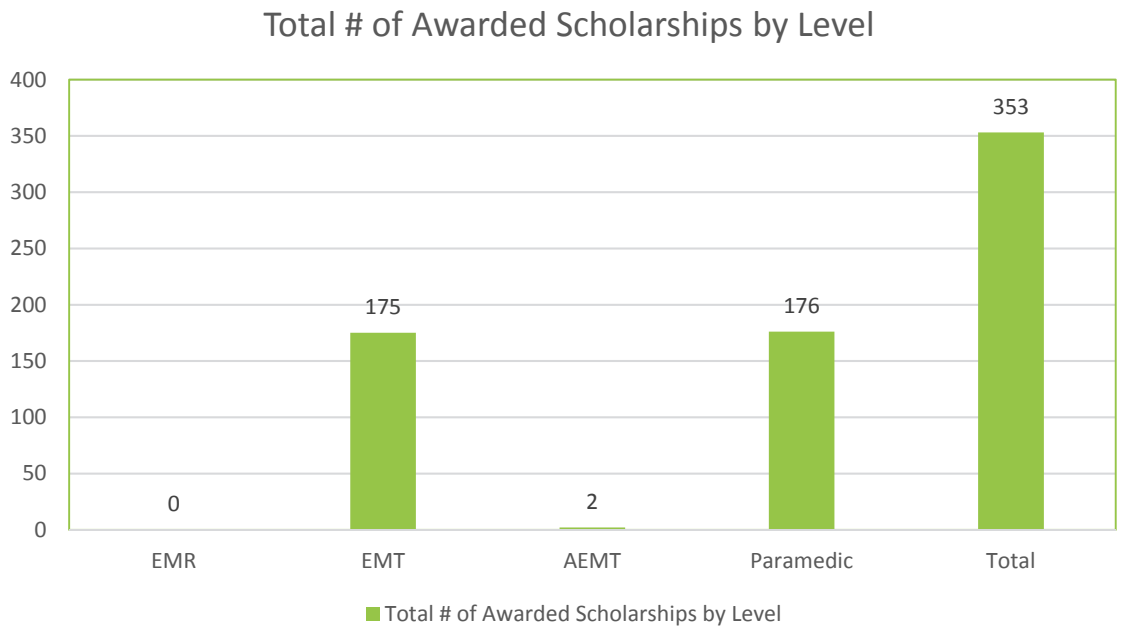


The following chart show of pending scholarship applications by training level. This includes all pending applications for students enrolled in eligible initial certification courses from June 5, 2019 through December 31, 2019.

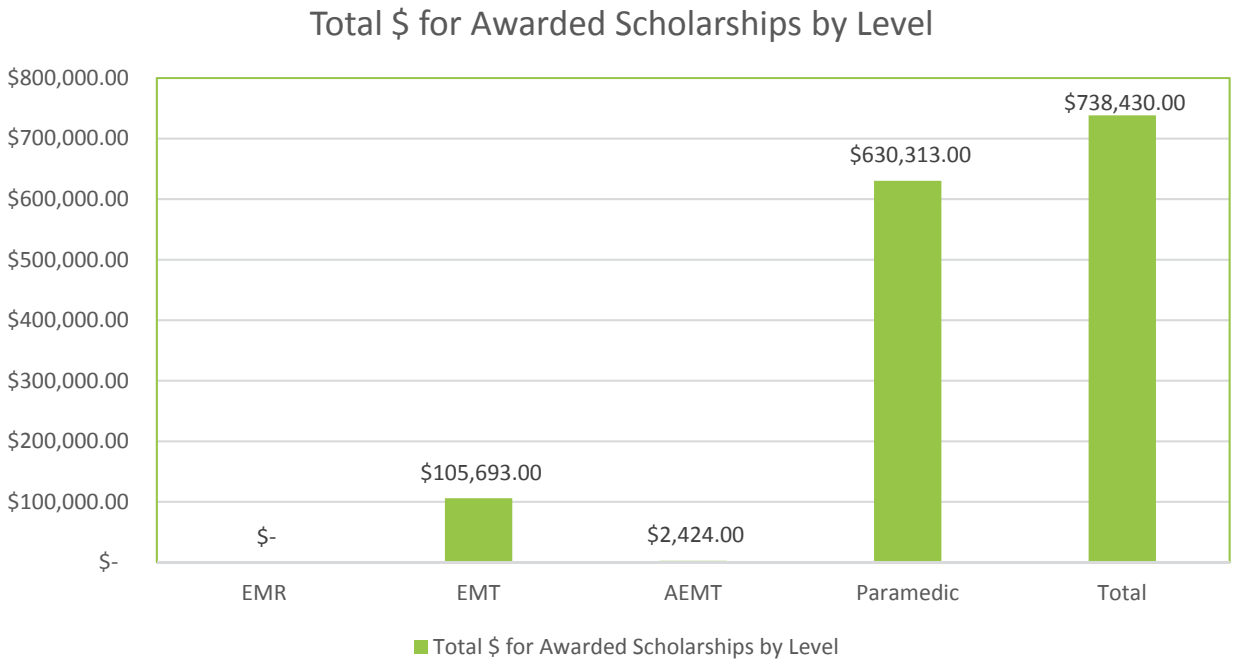


Breakdown of Awarded Scholarships

The following chart shows data for all scholarship applications which have been awarded by training level. This includes all awarded applications for students enrolled in eligible initial certification courses from June 5, 2019 through December 31, 2019.



The following chart shows data for all scholarship applications which have been awarded by training level. This includes all pending applications for students enrolled in eligible initial certification courses from June 5, 2019 through December 31, 2019.



Attachment E

EMT Statistics

EMT Statistics
As of 01/14/2020

Virginia:

Report Date:	1/14/2020 9:14:50 AM
Report Type:	State Report (VA)
Registration Level:	EMT
Course Completion Date:	1st Quarter 2017 to 1st Quarter 2020
Training Program:	All

View Legend | Printer-Friendly Version

Show All | Show Only Percentages | Show Only Numbers

The results of your report request are as follows:

Attempted The Exam	First Attempt Pass	Cumulative Pass Within 3 Attempts	Cumulative Pass Within 6 Attempts	Failed All 6 Attempts	Eligible For Retest	Did Not Complete Within 2 Years
8461	71% (5991)	80% (6783)	81% (6826)	0% (4)	13% (1126)	6% (508)

National Registry Statistics:

Report Date:	1/14/2020 9:33:52 AM
Report Type:	National Report
Registration Level:	EMT
Course Completion Date:	1st Quarter 2017 to 1st Quarter 2020
Training Program:	All

View Legend | Printer-Friendly Version

Show All | Show Only Percentages | Show Only Numbers

The results of your report request are as follows:

Attempted The Exam	First Attempt Pass	Cumulative Pass Within 3 Attempts	Cumulative Pass Within 6 Attempts	Failed All 6 Attempts	Eligible For Retest	Did Not Complete Within 2 Years
231114	69% (160122)	80% (185147)	81% (186604)	0% (219)	13% (29792)	6% (14614)

Individual Instructor Statistics are available on the OEMS webpage at the following link: http://www.vdh.virginia.gov/emergency-medical-services/education-certification/program-rankings-based-on-16th-percentile-peer-to-peer-benchmarking/

Attachment F

Accreditation Report

Accredited Training Site Directory

As of January 14, 2020

This Page

Intentionally

Left Blank

Accredited Paramedic Training Programs in the Commonwealth

Site Name	Site Number	BLS Accredited	# of Alternate Sites	Accreditation Status	Expiration Date
Blue Ridge Community College	79005	Yes**	--	CoAEMSP - LOR	
Central Virginia Community College	68006	Yes*	--	National – Continuing	CoAEMSP
ECPI University	70017	Yes*	--	CoAEMSP - LOR	
Henrico County Division of Fire	08718	Yes*	--	CoAEMSP – LOR	
J. Sargeant Reynolds Community College	08709	No	1	National – Continuing	CoAEMSP
John Tyler Community College	04115	Yes*	--	National - Initial	CoAEMSP
Lord Fairfax Community College	06903	Yes**	--	National – Continuing	CoAEMSP
Loudoun County Fire & Rescue	10704	Yes*	--	National – Continuing	CoAEMSP
Northern Virginia Community College	05906	Yes*	--	National – Continuing	CoAEMSP
Patrick Henry Community College	08908	No	--	CoAEMSP – Initial	CoAEMSP
Piedmont Virginia Community College	54006	Yes	1	National – Continuing	CoAEMSP
Prince William County Dept. of Fire and Rescue	15312	Yes*	--	CoAEMSP – Initial	CoAEMSP
Radford University Carilion	77007	Yes*	---	National – Continuing	CoAEMSP
Rappahannock Community College	11903	Yes	--	CoAEMSP – Initial	CoAEMSP
Southside Virginia Community College	18507	Yes**	--	National – Continuing	CoAEMSP
Southwest Virginia Community College	11709	Yes*	4	National – Continuing	CoAEMSP
Stafford County & Associates in Emergency Care	15319	Yes*	6	National – Continuing	CoAEMSP
Thomas Nelson Community College	83012	Yes*	1	CoAEMSP – LOR	
Tidewater Community College	81016	Yes*	--	National – Continuing	CoAEMSP
VCU School of Medicine Paramedic Program	76011	Yes	1	National – Continuing	CoAEMSP

Programs accredited at the Paramedic level may also offer instruction at AEMT, EMT, and EMR, as well as teach continuing education and auxiliary courses.

- ECPI had their CoAEMSP initial site visit in June, 2019. Still awaiting the report from CoAEMSP.
- Thomas Nelson Community College under Letter of Review to conduct their first cohort class.
- Blue Ridge Community College under Letter of Review to conduct their first cohort class.
- Henrico County Division of Fire under Letter of Review to conduct their first cohort class.
- New program directors have been hired at J. Sargeant Reynolds CC, John Tyler CC and Piedmont VA CC.

*** Indicates program has been approved for in-house psychomotor competency verification.**

.

Accredited AEMT Training Programs in the Commonwealth

Site Name	Site Number	BLS Accredited	# of Alternate Sites	Accreditation Status	Expiration Date
Accomack County Dept. of Public Safety	00121	No	--	State – LOR	August 31, 2020
Danville Area Training Center	69009	No	--	State – Full	December 31, 2020
Fauquier County Fire & Rescue – Warrenton	06125	Yes	--	State – LOR	June 30, 2020
Frederick County Fire & Rescue	06906	Yes*	--	State – Full	July 31, 2020
Hampton Fire & EMS	83002	No	--	State – Full	December 31, 2020
Hampton Roads Regional EMS Academy (HRREMSA)	74039	Yes	--	State – LOR	August 31, 2020
James City County Fire Rescue	83002	Yes	--	State – Full	December 31, 2020
Newport News Fire Training	70007	No	--	State – LOR	June 30, 2020
Norfolk Fire and Rescue	71008	Yes *	--	State – Full	July 31, 2021
Paul D. Camp Community College	62003	Yes	--	State – Full	May 31, 2021
Rockingham County Fire and Rescue	16536	No	--	State – LOR	November 1, 2019
Southwest Virginia EMS Council	52003	Yes*	--	State – Full	December 31, 2020
UVA Prehospital Program	54008	No	--	State – Full	December 31, 2020
WVEMS – New River Valley Training Center	75004	No	--	State – Full	June 30, 2022

*** Indicates program has been approved for in-house psychomotor competency verification.**

Site Name	Site Number	BLS Accredited	# of Alternate Sites	Accreditation Status	Expiration Date
Augusta County Fire Training			--		
C-Trans – Abingdon Ambulance Service					
Commonwealth Criminal Justice Academy					

Above Programs are under review for the issuance of a Letter of Review for the initial cohort.

Accredited EMT Training Programs in the Commonwealth

Site Name	*Site Number*	*# of Alternate Sites*	*Accreditation Status*	*Expiration Date*
Arlington County Fire Training	01305	-	State – Letter of Review	July 31, 2020
Augusta County Fire and Rescue	01521	--	State – Letter of Review	August 31, 2020
City of Virginia Beach Fire and EMS	81004*	--	State – Full	July 31, 2020
Chesterfield Fire & EMS	04103*	--	State – Full	July 31, 2020
Gloucester Volunteer Fire & Rescue	07302	--	State – Letter of Review	November 30, 2020
Navy Region Mid-Atlantic Fire EMS	71006	--	State – Full	July 31, 2020
Roanoke Valley Regional Fire/EMS Training	77505	--	State – Letter of Review	December 31, 2020

*** Indicates program has been approved for in-house psychomotor competency verification.**

Site Name	Site Number	# of Alternate Sites	Accreditation Status	Expiration Date
Rockingham County Dept of Fire & Rescue		-		

- Awaiting commitment letter for TR-90A for Rockingham County Dept. of Fire & Rescue.