AEMP Newsletter Winter 2025

President's Message

I hope everyone had a fantastic holiday season! Our first six months as the Academy of Emergency Medicine Pharmacists (AEMP) have been very busy and productive thanks to all of our amazing members! Right before the SAEM Annual Meeting in May 2025, we hit our membership target of 300 members to form an Academy and we have steadily grown from there, now with **over 400 members**! We are the first Academy in over 10 years and the fastest growing in the history of SAEM – and we're just getting started!

We are thrilled to welcome our new members, including over 100 new Pharmacy Student & Trainee Advancement Team (RxSTAT) chapters with the launch of our first seven chapters! They are as follows:

University of Connecticut
University of Toledo
The Ohio State University
University of Maryland
University of Arkansas
University of Iowa
University of Kentucky

These chapters have truly hit the ground running, already hosting an impressive number of events. Thank you to our inaugural RxSTAT leadership team: Russ Scarpa, PharmD, Daniel Radev, PharmD, Uzair Ali, PharmD, MA, Kami Fleming and Molly Evrard. And a special thanks to RxSTAT faculty leadership: Kevin Mercer, PharmD, MPH and Deepika Sivakumar, PharmD for launching and championing this group. The future is bright with RxSTAT and the emerging leaders it represents.

AEMP Awards & Scholarships are now open for nominations through February 6, 2026! Consider nominating yourself or a colleague for one of the following:

Emergency Medicine Pharmacist of the Year
Emergency Medicine Pharmacy New Practitioner of the Year
Emergency Medicine Pharmacy Resident of the Year
Emergency Medicine Pharmacy Advocate of the Year
Travel Scholarship (four available)

Mark your calendars to join us **May 18-21, 2026** (Monday - Thursday) in Atlanta, GA at the **Atlanta Marriott Marquis** for the **next SAEM and AEMP Annual Meeting!** Our Academy leaders and Program Committee have been working hard to prep for 2026 and have a number of exciting advancements planned for this year, including two additional hours of continuing pharmacist education and a new Opening Session! We want YOU to present at AEMP26! Consider submitting a proposal for one of the following:

SAEM/AEMP 2026 Submissions	
Submission Type	**Submission Dates**
IGNITE! (5 minute, auto-advancing pearls for pharmacy or medical residents)	November 3 – January 12
Innovations (AEMP or SAEM specific; anyone is welcome to submit to AEMP!)	November 3 – January 12
Clinical Images	November 3 – January 12

Save the date for the **AEMP Business Meeting Thursday, May 21, 2026 9-9:50 am** – open to everyone!

Finally, voting for the **AEMP elections** are open and we have a fantastic slate of AEMP leaders in our inaugural election! Cast your vote now through **February 23, 2026**.

We are more than halfway through our year, and I am preparing to transition the presidency to Kyle DeWitt in a few months. I am humbled and grateful for the opportunity to serve such a talented, diverse, and committed group of professionals. Please feel free to reach out any time with questions, concerns, or to share new ideas for our group (megan.a.rech@gmail.com).

Best,
Megan Rech, PharmD, MS, FCCM, FCCP, BCCCP
President, AEMP

Follow us on social media!
IG & X: @SAEM_AEMP
Bluesky: @saemaemp.bsky.social

Join us on Linkedin:
Academcy of Emergency Medicine Pharmacists (AEMP) - Society for Academic Emergency Medicine

Committee Updates

Treasurer's Report

Contact: Lance Ray (lanceray@gmail.com)

We were able to provide 2 hours of free CE this fall to our members!
The AEMP executive committee also approved funds from our budget for a few marketing and communications tools totaling ~$350.

We are looking forward to next year where our AEMP budget will increase to $10,000. Please email us with ideas for how to spend this to benefit AEMP members. We are thinking of funding scholarships, more free CEs for AEMP members, a social event at SAEM26 in Atlanta, and possibly ordering swag (e.g., sweat/headbands) to support our AEMP dodgeball team. (Email Ryan Feldman rfeldman@mcw.edu if you're interested in joining the pharmacy dodgeball team!)

Research Committee Updates

Chair: Kyle Weant (kweant@mailbox.sc.edu)

For EM pharmacy residents who plan to submit a research abstract for the SAEM26 annual meeting, the abstract submission portal opened November 3rd ! Make sure to indicate your submission is a resident abstract. Resident abstracts not accepted for the general SAEM conference will be considered for the AEMP pharmacy resident research session. Pharmacy residents will present once, either at the SAEM research presentation sessions or the AEMP pharmacy resident research sessions. We will include as many additional projects not initially selected for the general SAEM conference as we can! This process aims to provide more pharmacy residents with opportunities to attend and present at AEMP/SAEM, taking place May 18-21st, 2026. We hope to see you there! We are also working on developing some research education webinars with CPE-approval starting in early 2026! Stay tuned for more information on these upcoming events in the near future!

Communication Committee Updates

Chair: Kimberly Won (kiwon@health.ucsd.edu)

Are you looking for ways to get more involved with AEMP? Consider joining the Communications Committee! There are opportunities to write and review articles for the SAEM Pulse Magazine and AEMP Newsletter, develop clinical pearls for social media posts and design infographics! Contact the Chair for questions and committee meetings.

Scan the QR code if you have any ideas or requests for a social media post.

Submit your ideas and requests

Membership Committee Updates

Chair: Tara Flack (tflack2@iuhealth.org)

If you haven't already, be sure to fill out the AEMP Membership Interest Survey to share more about yourself, vote on future topic presentations, and express interest and committees and opportunities, such as the mentee/mentor program.

AEMP Annual Awards – Nominations Open!

Nominations are open for the AEMP annual awards that will be presented at the annual meeting in May 2026. Awards include:

Emergency Medicine Pharmacist of the Year
Emergency Medicine Pharmacy New Practitioner of the Year
Emergency Medicine Pharmacy Resident of the Year
Emergency Medicine Pharmacy Advocate of the Year

For a description of each award and to submit your nomination, please visit the AEMP awards webpage.

Application Deadline: February 6, 2026

AEMP Travel Scholarship – Apply Now!

Are you attending AEMP26/SAEM26 in May? Do you want to attend but are hesitant due to financial constraints? If yes to either of those questions, consider applying for the AEMP Travel Scholarship for this year's annual meeting.

- AEMP Travel Scholarship Details
  - Travel scholarships cover registration to the annual meeting ($475)
  - Registration to AEMP26 includes registration to SAEM26
  - If already registered for the meeting prior to receiving the award, you will receive reimbursement for registration.
- Eligibility Requirements
  - Planning to attend the 2026 AEMP Conference and/or SAEM annual meeting
  - Current AEMP Member
  - Members of the AEMP Steering Committee, AEMP travel scholarship charge lead, and those on the selection committee are ineligible to receive a scholarship

How to Apply

Use the following link to apply: AEMP Travel Scholarship Application Form

Application Deadline: February 6, 2026

JOURNAL CLUB CORNER

TRANEXAMIC ACID TIMING AND MORTALITY IMPACT AFTER TRAUMA

AUTHOR: CHENEY GERTZ, PHARMD
EDITOR: HOLLY WESTERKAMP, PHARMD, MBA

BACKGROUND [1-5]

- Tranexamic acid forms a reversible complex displacing plasminogen from fibrin to inhibit fibrinolysis and stabilize clots. In adult trauma the recommended dosing is 1 gram IV over 10 minutes followed by 1 gram over the next 8 hours. CRASH-2 in 2013 & CRASH-3 in 2019, found treatment with tranexamic acid within 3 hours reduced the risk of death and use greater than 3 hours is unlikely to be effective. This trial's results shaped trauma guidance but has yet to have replicated results in further trials. Published in 2023 the PATCH-Trauma trial did not find statistical significance in favorable outcomes at six months.

STUDY DESIGN

- An exploratory analysis of the PATCH-Trauma Trial which randomized patients to pre-hospital 1g tranexamic acid bolus followed by 1g over eight hours following hospital arrival or placebo
- Inclusion Criteria: age 18 years or older with suspected severe trauma injuries, treated on scene by paramedics or physicians within 3 hours, transported to participating trauma centers, high risk for trauma-induced coagulopathy (Coagulopathy of Severe Trauma score ≥ 3)
- Exclusion Criteria: known/suspected to be pregnant, or live in a facility for older persons

OUTCOMES

- Primary Outcome: 28 day mortality after injury Secondary Outcomes: vascular occlusive events and sepsis prior to time of death, hospital discharge, or 28 days after injury (whichever occurred first)

STATISTICAL ANALYSIS

- All analysis examined on an intent-to-treat principle
- Statistical analyses determined the risk ratio at each time of administration where a risk ratio < 1 favored the TXA group
- Analyses was adjusted for Glasgow Coma Scale <9 and 9-15

RESULTS

	Tranexamic Acid (N=652)	Placebo (N=635)	Unadjusted Risk Ratio (95% CI)
Median Time to Administration	77 minutes (52-113)	80 minutes (56-111)	N/A
Death Within 28 Days			
< 90 minutes	67/393 (17%)	91/363 (25%)	0.68 (0.51-0.90)
≥ 90 minutes	46/259 (18%)	47/272 (17%)	1.03 (0.71-1.49)
Overall	113/652 (17%)	138/635 (22%)	0.80 (0.64-1.00)
Vascular Occlusive Conditions			
< 90 minutes	89/393 (23%)	62/363 (17%)	1.33 (0.99-1.77)
≥ 90 minutes	66/259 (25%)	63/272 (23%)	1.10 (0.81-1.49)
Overall	155/652 (24%)	125/635 (20%)	1.21 (0.98-1.49)
Sepsis			
< 90 minutes	133/393 (34%)	100/363 (28%)	1.23 (0.99-1.53)
≥ 90 minutes	92/259 (36%)	96/272 (35%)	1.23 (0.80-1.27)
Overall	225/652 (35%)	196/635 (31%)	1.12 (0.96-1.31)

RESULTS

Primary Outcome:

- The risk of death within 28 days of injury appears to be significantly lower when tranexamic acid is administered within 90 minutes of injury (CI <1). A first dose more than 120 minutes after injury appears to have negative impact on 28-day mortality but the confidence interval was not statistically significant.

Secondary Outcomes:

- There is no evidence of an association between time from injury to tranexamic acid administration for vascular occlusive events or sepsis

Author's Conclusion

- Potentially, the optimal window for tranexamic acid is within 90 minutes of the trauma, however further research is recommended to confirm this window and determine the safety of delayed administration.

STRENGTHS

- Large sample sizes
- Intention to treat analysis
- Exact time measurements in the field to determine injury to tranexamic acid compared to estimations in previous studies
- Use of an out-of-hospital coagulopathy scoring tool to determine high-risk patients in the absence of physician assessment
- More applicable to advanced trauma centers given participating sites

LIMITATIONS

- Primary classification of trauma was blunt with 93% in the active arm and 92% in the palcebo arm
- Insufficient power for the subgroup analysis performed
- Potential confounding factors not addressed: distance to trauma center, other trauma associated risks and therapies
- Trial took place in Australia, New Zealand, and Germany
- Trial sites have different education requirements for first responders and in turn may have different practices from the United States

Applicability to Practice[6]

- When possible, encourage tranexamic acid administration within the first 90 minutes after a trauma. This expands the window when compared to the STAAMP Trial but shortens administration time by half the 3-hour window provided by CRASH-2 & 3. Ultimately early administration of tranexamic acid remains beneficial to patients and impact on mortality between 90 minutes to 3 hours may have mixed results. Pharmacists may assist in quick medication obtainment, preparation, and verbalize dosing recommendations.

REFERENCES

1. Ali A, Gruen RL, Bernard SA, et al. Tranexamic Acid Timing and Mortality Impact After Trauma. Ann Emerg Med. Published online August 1, 2025. doi:10.1016/j.annemergmed.2025.06.609
2. Callum JL, Yeh CH, Petrosoniak A, et al. A regional massive hemorrhage protocol developed through a modified Delphi technique. CMAJ Open. 2019;7(3):E546-E561. Published 2019 Sep 3. doi:10.9778/cmajo.20190042
3. CRASH-2 trial collaborators, Shakur, H., Roberts, I., Bautista, et al. Effects of tranexamic acid on death, vascular occlusive events, and blood transfusion in trauma patients with significant haemorrhage (CRASH-2): a randomised, placebo-controlled trial. Lancet. 2010; 376(9734), 23–32. https://doi.org/10.1016/S0140-6736(10)60835-5
4. CRASH-3 trial collaborators (2019). Effects of tranexamic acid on death, disability, vascular occlusive events and other morbidities in patients with acute traumatic brain injury (CRASH-3): a randomised, placebo-controlled trial. Lancet (London, England), 394(10210), 1713– 1723. https://doi.org/10.1016/S0140-6736(19)32233-0
5. PATCH-Trauma Investigators and the ANZICS Clinical Trials Group, Gruen RL, Mitra B, et al. Prehospital Tranexamic Acid for Severe Trauma. N Engl J Med. 2023;389(2):127-136. doi:10.1056/NEJMoa2215457
6. Li SR, Guyette F, Brown J, et al. Early Prehospital Tranexamic Acid Following Injury Is Associated With a 30-day Survival Benefit: A Secondary Analysis of a Randomized Clinical Trial. Ann Surg. 2021;274(3):419-426. doi:10.1097/SLA.0000000000005002

New and Notable: 2025 Updates to the AHA Guidelines for Cardiopulmonary Resuscitation

Author: Cecilia Schowe, PharmD, MS, BCPS, BCEMP
Editor: Lisa Hayes, PharmD, BCCCP, BCEMP

In October 2025, AHA released updates to the 2020 Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. The following details are notable updates in this version. No major changes to the standard ACLS algorithms for shockable or non-shockable rhythms were reported.

Adult Basic Life Support[1,2]:

- Adult patients with head and neck trauma in whom the airway cannot be opened with a jaw thrust and adjunct insertion, a head lilt-chin lift should be utilized
  - A new algorithm for foreign body airway obstruction (FBAO) for adults is included and based on additional evidence. The use of back blows in adults is now recommended as an initial step for conscious adults.
- In patients with obesity who are in cardiac arrest, the same techniques should be utilized for patients without obesity.
  - A 2024 scoping review found no evidence to suggest changing standard CPR algorithms in patients with obesity (typically BMI ≥ 30 kg/m^2)[3]
- The routine use of mechanical CPR devices is not recommended, but the use of mechanical CPR devices may be considered when high-quality manual compressions may be challenging or dangerous.
  - Studies have found no difference in patient survival when comparing manual CPR vs mechanical CPR.[4-8]

Adult Advanced Life Support[1,2,9]:

- Heads-up CPR in adults is not recommended outside of clinical trials.
- It is recommended that IV access first be attempted for adults in cardiac arrest. IO administration is reasonable if initial IV attempts fail.
  - A 2025 systematic review and meta-analysis showed no difference in outcomes when comparing IO to IV access.[10] The review also noted lower odds of achieving sustained ROSC for the IO route compared to the IV route.
- Vasopressin alone or in combination with epinephrine should not be substituted for epinephrine alone due to no advantages found in outcomes.
- For adult patients in cardiac arrest with a shockable rhythm, it is reasonable to administer epinephrine after initial defibrillation attempts have failed.
  - There have been no updates in the guidelines regarding earlier use of epinephrine or anti-arrhythmic agents prior to initial defibrillation.
- The use of beta-blockers (e.g. esmolol), bretylium, procainamide, or sotalol for shockable rhythms unresponsive to defibrillation remains of uncertain benefit.
- The usefulness of vector change or double sequential defibrillation in adults with **shock-refractory VF** (3 or more consecutive traditional shocks) needs further investigation prior to being recommended as a standard of care.
- In adult patients in **unstable atrial fibrillation**, an initial energy setting of at least 200 J is reasonable for synchronized cardioversion.
  - Randomized trials have found higher rates of cardioversion when using 200 J for cardioversion.[11,12]
- In patients with persistent **hemodynamically unstable bradycardia** refractory to medical therapy, the use of temporary transvenous pacing is reasonable to increase heart rate and improve symptoms.

Pediatric Advanced Life Support [1,2,13]:

- The 2-thumb-encircling hands technique was reported as a superior technique compared to 2-finger compression in infants and is now recommended over the 2-finger technique to optimize compression depth.
- In children with initial non-shockable rhythms, administration of the initial dose of epinephrine as early as possible is reasonable and may be associated with more favorable outcomes.
- A specific ETCO2 cutoff alone should **not** be utilized as an indication to end resuscitative efforts.
- For children who have arterial blood pressure monitoring available during CPR, it may be reasonable to target a diastolic blood pressure of 25 mmHg in infants or 30 mmHg in children >1 years.
- Following cardiac arrest in infants and children, it is recommended to maintain systolic and MAP greater than the 10th percentile for age.

Post-Cardiac Arrest Care [1,2,14]:

- Hypotension should be avoided following ROSC and should maintain a minimum MAP of 65 mmHg. No large-scale RCTs are currently available for the comparison of clinical outcomes based on vasopressor choice.
- Temperature control for at least 36 hours following ROSC is reasonable in patients who remain unresponsive to verbal commands with a temperature range between 32-37.5 °C is recommended.
- Treatment to suppress myoclonus without EEG results is not recommended due to the risk of medication side effects coupled with an unknown benefit of treating myoclonus not related to seizure.

Cardiac Arrest Due to Special Circumstances [1,2,15]:

- Treatment with volatile anesthetics for adults and children with asthma refractory to standard therapies may be considered
    - Observational studies have demonstrated use in adults and children with asthma refractory to standard therapies including bronchodilators, steroids, intubation, mechanical ventilation, sedation, and neuromuscular blockade.[16]
    - Volatile anesthetics, such as isoflurane and sevoflurane, relax bronchial smooth muscle by lowering intracellular calcium levels.
- The administration of IV calcium or sodium bicarbonate administration in cardiac arrest from suspected hyperkalemia is not well established and remains uncertain if either of these improve survival or favorable neurological outcomes.
- In adults and children with severe hypothermia (<28 °C) and not in cardiac arrest, it may be reasonable to rewarm utilizing ECLS.
- In adults and children with life-threatening hyperthermia, it is reasonable to choose immersion in ice water over other cooling methods and to target a goal of 0.15°C/min lowering core temperature.
- In unresponsive patients with durable LVADs and impaired perfusion, it may be reasonable to start chest compressions immediately while assessing device related reversible causes.
- For lay and trained rescuers, administration of opioid antagonists may be reasonable for those with suspected opioid overdose given that it does not interfere with the delivery of standard resuscitation.

Scan me for references!

Laughing Gas with Lasting Harm: Chronic Nitrous Oxide Toxicity

Authors: Jamie Sterr, PharmD; Kevin Mercer, PharmD; Laura Walsh, PharmD

Background

Nitrous oxide (N_2O) is a colorless, sweet-smelling gas that acts primarily as a non-competitive N-methyl-D-aspartate (NMDA) receptor antagonist, generating anxiolysis, anesthesia, and analgesia with acute use.[1,2] In 1799, N_2O was noted to have euphoric and pleasant dissociative properties and has become increasingly present in popular culture over the last two centuries.[3] Today, N_2O remains a familiar agent in dentistry, labor and delivery, and procedural sedation, commonly referred to as "laughing gas". In these controlled conditions, it is valued for its rapid onset and short half-life, predictable analgesia, and favorable safety profile. Outside of healthcare, N_2O is also widely available in food and industrial products, including whipped cream chargers, large cylinders intended for catering or automotive use, and flavored canisters creatively marketed to target recreational purchase (Figure 1).

Figure 1. Recreationally Used N_2O Products

Whipped Cream Cartridge	Flavored Canister	Medical-Grade Tank
		
8 g	Up to 2 Kg	9 Kg

The recreational misuse of N_2O gained traction in nightclubs throughout the 1970s-1990s and has recently regained popularity due to its perceived safety and ease of access during the COVID-19 lockdown.[1,2] Alongside the rising popularity, trends in recreational use have shifted from small, intermittent "whippets" to large-dose, frequent inhalation. Purchasing trends mirror these findings, with continued high-volume sales of whipped cream chargers and a growing demand for larger canisters marketed for "party" or entertainment use, which can be found in vape shops, convenience stores, or sold online.[4] Consistent with the increasing heavy use and product demand, surveillance data demonstrate a marked rise in N_2O-associated harm and emergency department (ED) presentations.[1] National Poison Data System data from 2019-2024 show a greater than four-fold increase in reported N_2O exposures, while other inhalant exposures have declined.[5] Young adults aged 20–29 years demonstrate the highest prevalence of misuse, with rates higher among males than females.

While acute inhalational injury can occur from active N_2O misuse, most presentations to the ED are the result of sequelae from chronic toxicity.[2] Chronic heavy N_2O exposure leads to vitamin B_{12} (cobalamin) inactivation, causing functional deficiency and subsequent subacute combined degenerative-like myeloneuropathy, hematologic cytopenias, and thromboembolic events. For emergency clinicians, N_2O toxicity now occupies an important intersection of substance use, neurology, and toxicology.

Acute Toxicity

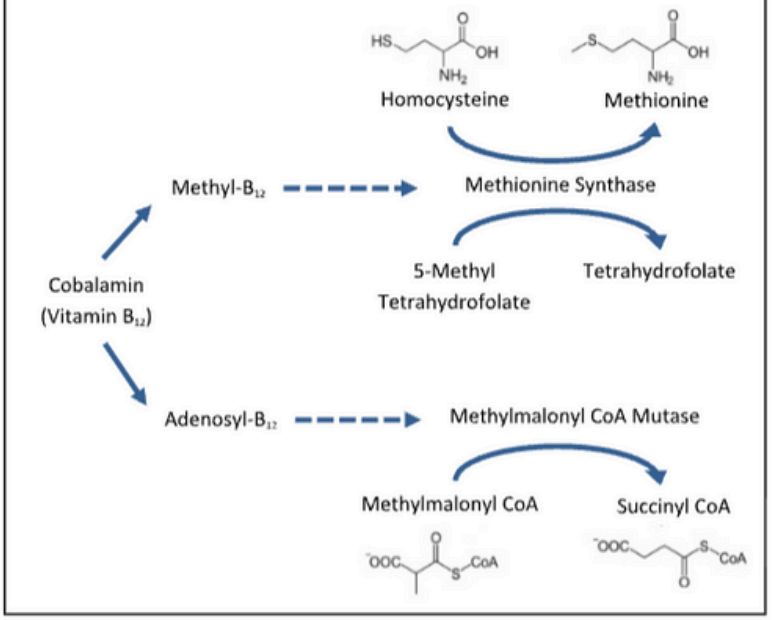
Acute N_2O intoxication typically presents with lightheadedness, euphoria, laughter, depersonalization, and altered perception, with symptoms occurring within minutes of use and rapidly resolving once exposure ceases.[1] More severe acute presentations can include vomiting, aspiration, agitation or confusion, syncope, asphyxia, and hypoxia, particularly when N_2O is inhaled in enclosed spaces or via balloons.[6,7] Direct inhalation from pressurized canisters can cause frostbite of the lips, face, and hands, and gas expansion can result in barotrauma (e.g., pneumomediastinum or pneumothorax). Trauma from high-risk behaviors while intoxicated is common, and polysubstance use (e.g., alcohol, cannabis, MDMA) often complicates the clinical picture. There are no specific toxicologic management strategies for acute harms from N_2O, and patients should receive standard supportive and trauma-related care as necessary.

Chronic Toxicity

While chronic N_2O toxicity typically develops with sustained and frequent use, similar manifestations have also been reported following brief episodes of high-volume inhalation.[2,5] Consequences of chronic toxicity manifest as either neurologic or hematologic and in clinical practice, commonly present in one of three ways:

1. developing subacute gait disturbances and sensory change;
2. unexplained macrocytic anemia, agranulocytosis, or pancytopenia; or
3. thromboembolic events in a young, otherwise healthy patient.

Figure 2. Metabolic Pathway of Vitamin B_{12}



The underlying mechanism of chronic N_2O toxicity involves oxidization of the cobalt atom in cobalamin, leading to an irreversible inactivation of two key vitamin B_{12}-dependent enzymes: methionine synthase (MS) and methylmalonyl-CoA (MMA-CoA) mutase (Figure 2).[8] Inactivation of MS prevents the conversion of homocysteine to methionine and 5-methyltetrahydrofolate to tetrahydrofolate, while MMA-CoA mutase inhibition halts conversion of MMA-CoA to Succinyl-CoA. Additionally, oxidized cobalamin serves as a cofactor of methionine synthase reductase leading to an amplification of homocysteine production. These processes produce a functional vitamin B_{12} deficiency, where serum B_{12} concentrations can be within reference range while methylmalonic acid (MMA) and homocysteine elevate in patients who chronically misuse N_2O.

A hallmark for the neurologic impact of chronic N_2O toxicity is the presence of subacute combined degenerative-like myeloneuropathy, characterized by simultaneous damage to both the spinal cord (myelo-) and peripheral nerves (-neuropathy), which typically develops over days to weeks.[8] Methionine is essential for the maintenance and stability of myelin sheath within the central and peripheral nervous systems and demyelination leads to symptoms of stocking-glove pattern paresthesia and numbness, proprioceptive ataxia, fine motor deficits, and weakness. Additionally, signs of myelopathy may result from depletion of succinyl-CoA, an essential product involved in lipid synthesis of myelin sheath.

Downstream hematologic abnormalities of this functional B_{12} deficiency occur from tetrahydrofolate depletion and disruption of the de novo DNA synthesis pathway, resulting in rapid blood cell turnover.[8] These abnormalities include leukopenia, thrombocytopenia, pernicious anemia, and myelosuppression.[6,8] In addition, elevated homocysteine levels contribute to a prothrombotic state, with case reports and series describing deep vein thrombosis, pulmonary embolism, and ischemic stroke in young nitrous users.[1]

Workup and Diagnosis: Thromboembolic[2,6,8]

Standard diagnostic and therapeutic approaches to thromboembolic events should be followed, including guideline-directed anticoagulation or reperfusion therapy where appropriate. Given the elevated thrombotic risk, extended anticoagulation may be considered on an individual basis, particularly when ongoing N_2O use or other risk factors are present. However, there are no N_2O-specific recommendations aside from standard of care and close follow up.

Workup and Diagnosis: Neurologic and Other Hematologic[1,2,6,8]

History	• Collect a **targeted N_2O exposure history** including duration, frequency, specific product details, and quantity of use • Patients **may not recognize or disclose N_2O as a drug** when asked about use; absence in reporting use does not rule out toxicity from exposure • Be aware of **common street names** such as whippets, balloons, Galaxy Gas, nangs, etc. • Screen for other **concurrent substance use disorders**
Physical Examination	• A **focused neurologic assessment** should evaluate for sensory deficits, paresthesias, numbness, impaired vibration and proprioception, muscle weakness, and fine motor deficits; severe cases may present with gait ataxia and bowel or bladder dysfunction
Labs	• **Complete blood count with differential:** macrocytosis, anemia, hypersegmented neutrophils, and pancytopenia may be present • **Vitamin B_{12}**: expect low-to-normal; because N_2O oxidizes cobalamin without destroying it, normal serum B_{12} levels should not exclude the possibility of N_2O-related neurotoxicity • **Methylmalonic acid**: expect elevation; high specificity but low sensitivity for N_2O toxicity • **Homocysteine**: expect elevation; high sensitivity but low specificity for N_2O toxicity • **Folate, copper, vitamin E**: consider obtaining when the differential diagnosis includes other nutritional deficiencies or metabolic myeloneuropathies that mimic N_2O toxicity
Imaging	• **MRI of the spine** is indicated in patients for suspected N_2O-related myeloneuropathy, sensory ataxia, or focal neurological deficits and may show dorsal column T2 hyperintensity, though early imaging can be normal and does not exclude toxicity • **CT imaging** may be used initially to assess for alternative acute etiologies, but imaging results are unlikely to have clinical utility in identifying N_2O toxicity
Procedures	• A **lumbar puncture** may be considered to evaluate alternative causes of myelopathy or neuropathy, including infectious, inflammatory, or demyelinating etiologies
Consult Services	• **Neurology** involvement should occur early in clinical course • **Physical/occupational therapy** for neuropathies and motor dysfunction • **Addiction services** may assist with substance use cessation

Management

The mainstay of treatment for suspected chronic N_2O neurotoxicity includes immediate cessation of N_2O use and administration of intramuscular (IM) vitamin B_{12} supplementation.[2,8]

A commonly used regimen, adapted from pernicious anemia, **includes vitamin B_{12} 1 mg IM daily for 1-2 weeks, followed by 1 mg IM weekly for 4-6 weeks**, with longer-term dosing individualized in collaboration with neurology or hematology.[8] It is reasonable for ED teams to administer the first dose when there is high clinical suspicion, even before serum B_{12}, MMA, and homocysteine levels result, as delays in treatment while waiting confirmatory testing may result in worsening neurologic injury. While parenteral therapy is most effective early in the disease course, transition to oral vitamin B_{12} may be considered after initial IM therapy if ongoing parenteral treatment compromises patient adherence.[6,8] Adjunctive therapies often include folic acid and methionine. Folic acid 5 mg orally daily is frequently used to support remethylation pathways and erythropoiesis, although optimal dosing and duration are not well defined. Folate supplementation should not be used as a substitute for B_{12} repletion, as high-dose folate alone can improve hematologic indices while allowing neurologic injury to progress. Addition of oral methionine 1 g three times daily may further promote remethylation of homocysteine. However, evidence is limited and practice patterns vary.

References

1. Vohra V, Matthews H, Stroh-Steiner G. Notes from the field: recreational nitrous oxide misuse - Michigan, 2019-2023. *MMWR Morb Mortal Wkly Rep.* 2025;74(12):210-212. PMID:40208841.
2. Guo C, Kaufman BS. Inhalational anesthetics. In: Nelson LS, Howland MA, Lewin NA, Smith SW, Goldfrank LR, Hoffman RS, eds. *Goldfrank's Toxicologic Emergencies.* 11th ed. McGraw Hill; 2019.
3. West JB. Humphry Davy, nitrous oxide, the Pneumatic Institution, and the Royal Institution. *Am J Physiol Lung Cell Mol Physiol.* 2014;307(9):L661-L667. PMID:25172910.
4. Nixon S, Poole N, Michienzi A, Farah R, Charlton N. Tracking inhalant access online: sales trends of nitrous oxide cartridges vs. canisters. *Clinical Toxicology.* 2025;63(sup3):1-191. Doi:10.1080/15563650.2025.2532975
5. Zweerink K, Wahl M. From duster to cartridges: shifting patterns of inhalant abuse in halogenated hydrocarbons and nitrous oxide. *Clinical Toxicology.* 2025;63(sup3):1-191. Doi:10.1080/15563650.2025.2532975
6. Long H. Inhalants. In: Nelson LS, Howland MA, Lewin NA, Smith SW, Goldfrank LR, Hoffman RS, eds. *Goldfrank's Toxicologic Emergencies.* 11th ed. McGraw Hill; 2019.
7. Oussalah A, Julien M, Levy J, et al. Global burden related to nitrous oxide exposure in medical and recreational settings: a systematic review and individual patient data meta-analysis. *J Clin Med.* 2019;8(4):551. PMID:31018613.
8. Gernez E, Lee GR, Niguet JP, Zerimech F, Bennis A, Grzych G. Nitrous oxide abuse: clinical outcomes, pharmacology, pharmacokinetics, toxicity and impact on metabolism. *Toxics.* 2023;11(12):962. PMID:38133363

Hook, Summarize, Impress: Writing Abstracts That Work

Author: Liz Uttaro, PharmD, BCEMP

Editors: Elise Metts, PharmD, BCCCP & Kimberly Won, PharmD, APh, BCCCP

Writing a captivating abstract is essential to entice readers and to provide the essence of the study. An abstract is a short summary of the research paper that becomes the face of research and is the first step in ensnaring a larger audience. Abstracts allow readers to have a small insight into the research and should be designed to catch the readers' interest in reading the full research paper, engage in presentations, and potentially utilize the research in the readers' practice.

Contents of an abstract may vary depending on where the abstract is being submitted. The most common components include title, background, methods, results, and conclusion. However, authors should always check the submission guidelines of the specific journal they are submitting to and follow the directions provided. The title of the abstract should be concise and summarize the essence of the research while incorporating key terms the reader should know. Abbreviations and acronyms should be avoided, and each word should be fully written out. The first section of the abstract is the background. The background is used to introduce the research question in a way to pique the interest of the reader. Following the research question, the writer should provide the existing gaps in literature and how the research fills the existing gaps. The last sentence of the background usually contains the hypothesis to the study's research question, and/or the study's specific aims/objectives. Within the methods section, the author should clearly describe the research study, including study design, setting, study population, selection criteria, interventions, and outcomes. Additionally, statistical methods should be concisely stated for data variables discussed. The results section should begin by stating the number of subjects included, as well as reasons for patient exclusion if space allows. The primary endpoint(s) and most relevant results should be included in this section, but not all statistically significant findings need to be reported. Data should be written as frequency distributions and confidence intervals, and level of significance should be added to numerical outcomes. The power of the study can be reported if the main variables are not statistically significant, possibly due to a type II error. Finally, the conclusion needs to state the objective implication(s) supported by the presented data and is usually only 1-2 sentences. The conclusion should not repeat the results of the study. Generalizability of the study results and limitations can be discussed if space allows. Graphs, figures, and illustrations should not be included unless requested in submission guidelines. Prior to submission of an abstract, all members of the research team should review the abstract for content accurateness, readability, and spelling/grammatical errors.

Following submission of an abstract, there is often a scoring criterion used to evaluate the abstract for acceptance. Specifically for Society for Academic Emergency Medicine (SAEM), the abstracting scoring rubric includes ratings for the clarity of objectives, appropriateness of methods, outcome measures, data analysis, generalizability, relevance and importance, innovation strategies, quality of writing, and lastly, strength of conclusion. When evaluating the clarity of objectives, abstracts that have a clearly stated and testable hypothesis and well-thought-out study objectives score highest on the rubric. and straightforward, allowing evaluators to best understand the research design. An important piece of research is controlling potential confounders, as well as biases. Each type of study design is evaluated for how well these items are controlled in the research design, which should be described in the methods section. Statistical methods are reviewed for appropriate tests for each outcome, and conclusions are correct based on the statistical tests used. Not all statistical analysis will be reported in the abstract, but the writer should report the most relevant results related to the study objectives, even if they are not statistically significant. Generalizability is evaluated to determine the impact of the research in a broader scope. Smaller studies that are single center and retrospective are likely to score low on generalizability. Importance and relevance of the research topic are also evaluated, and research that is generalizable to other specialties beyond emergency medicine are scored higher. Abstracts highlighting a niche research topic which is only relevant to a small group of people will score low on this criterion. When writers are designing a research study, innovation should be considered to bring new ideas and new methods to questions that have yet to be answered. Novel approaches to research questions will score high in this section. should be clear and concise and tie back to the study objective(s) and stated results. The writer should be careful not to over- or understate the findings. The overall quality of writing is assessed by reviewing grammar as well as conciseness. Well-written abstracts that are clear, organized, and avoid verbose language will achieve a higher score for this rubric criterion.

Following abstract submissions, each organization will have its own way to process abstracts and notify writers of acceptance or rejection. Writers should not be discouraged if an abstract is rejected and should use it as an opportunity to refine skills for the next abstract submission. If feedback is not automatically given as to why an abstract was rejected, it is appropriate to reach out to the organization to ask for feedback and rubric gradings. Abstracts are the first look at new research and can determine whether or not a reader reviews the whole study. Writing a well-written abstract can not only further science but create networking and educational opportunities.

References:

- Society for Academic Emergency Medicine. Abstract Formatting Best Practices and Guidelines. https://www.saem.org/meetings-and-events/annual-meeting/annual-meeting-navigation/education/pdf%27s/abstract-formatting-best-practices-and-guidelines. Accessed October 24, 2025.
- Society for Academic Emergency Medicine. Annual Meeting Abstract Scoring Rubric [PDF]. https://www.saem.org/docs/default-source/saem24/am-abstract-scoring- rubric.pdf?sfvrsn=80e54868_2. Accessed October 24, 2025.
- International Committee of Medical Journal Editors. Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly Work in Medical Journals [PDF]. http://www.icmje.org/icmje-recommendations.pdf. Accessed October 24, 2025

AEMP Pharmacotherapy Crossword

Created By: Cecilia Schowe, PharmD, MS, BCPS, BCEMP &
Sejal Patel-Francis, PharmD, MS, BCPS, BCCCP

Across

[2]I am the acronym commonly used to remember which medications can be given via an endotracheal tube

[5] I am a common ACLS drug that can be used in various indications at same dose but no benefit found in higher doses

[8] Prophylaxis medication whenever someone says “I stepped on something rusty”

[10] Anti-seizure agent preferred for status epilepticus thanks to efficacy and minimal drug interactions

[11] You may have to call this place if a patient presents with a snake bite due to an exotic snake they aren't supposed to have at home

[12] I am considered a failure for my burning GU pain compared to my first cousins

Down

[1]I’m bright orange and may be needed after an intubation with succinylcholine

[3] Remember to start low and go slow as I can cause a pretty severe rash when titrated too quickly

[4] I can be used to treat pseudomonas or may help decrease levels of valproic acid following an overdose [6] I have a side effect that is characterized by elevated ketones, metabolic acidosis, an anion gap, but normal glucose

[7] Alternative route for ACLS drugs when venous cannulation is unobtainable or delayed

[9] Anti arrhythmic drug for refractory VF/pulseless VT when stand-alone defibrillation fails

Answers:
Across: 2. NAVEL 5. Epinephrine 8. Tetanus 10. Levetiracetam 11. Zoo 12. Cefdinir
Down: 1. Dantrolene 3. Lamotrigine 4. Meropenem 6. Empagliflozin 7. Intraosseous 9. Lidocaine