Joni Harvey: Good afternoon, everyone for those of you in Eastern Standard Time. Hello. My name is Joni Harvey, and I'm excited to welcome you to today's EMS focus webinar. Thank you for joining us. We have a really informative session for everybody's plan today. So we're gonna dive right in.

Joni Harvey: is it, making sure. My, there we go.

Joni Harvey: So

Joni Harvey: just an overview of the EMS focus webinar for today, as you likely know, since you're here, the EMS focus. Webinar Series is designed to bring you quarterly updates and insights about the EMS system improvement webinars, feature topics from NHTSA in the office of EMS, and along with contributors from our Federal Partners and our Federal Interagency Committee on EMS.

Joni Harvey: We address a variety of important topics on here, and I encourage you to register for future webinars. If you have not done so already, and don't forget to sign up for email notifications from ems.gov. To stay informed on everything that we're talking about today.

Joni Harvey: for let me try to remember to keep the slides moving here for zoom. So just some housekeeping just to cover a quick couple items here.

Joni Harvey: Please use the QA. Button on your zoom control panel to submit any questions throughout the session. We will address them during the last 15 min of the webinar, but feel free to submit questions as they come to mind that way. You're not forgetting them and trying to remember them later. Our facilitator is going to organize those for the Q&A portion and then close captioning is available for anyone who needs it. You just simply click on the show captions button at any time to enable that feature.

Joni Harvey: And before diving into today's topic, we're going to take just a couple moments to focus on the mission of NHTSA's office of EMS. Our office supports the improvement of patient care in the out of hospital setting

Joni Harvey: nationwide, and we do that in several ways. We bring together data and experts to identify critical issues in the EMS field. We collaborate with our partners. This is huge, a lot of collaboration, including Federal agencies and national organizations. And we address those issues that way and then promoting awareness and education and best practices and evidence-based guidelines.

Joni Harvey: and one of the ways that we achieve our mission is by providing resources to help our EMS leaders and our clinicians. So the resources hub on ems.gov makes it really simple to browse and search and download a wide variety of documents and reports and guidelines. So take a look at that. If you have not done so.

Joni Harvey: These resources are created by NHTSA's office of EMS and its partners, and this really helps us advance EMS practices and then to access these resources. You can scan the QR code that's on the slide, or you can visit the homepage@ems.gov.

Joni Harvey: I'll give you a second, just in case anybody wants to snap that QR code.

Joni Harvey: And if you need me to go back to anything with this code later, you can let us know as well.

Joni Harvey: So we're going to turn our attention to the safe systems. Approach and post crash Care is really a key component of this approach, and it's guided by 6 basic principles. The death and serious injuries are unacceptable. The aim here is to eliminate crashes that lead to death and serious injuries

Joni Harvey: and humans make mistakes. That's number 2. So mistakes are inevitable. But the system is designed, or that can be designed to accommodate them and reduce harm. And that's what we're working towards humans are vulnerable. Another principle. So systems should account for the physical limits of human tolerance in crashes

Joni Harvey: and responsibility for this is shared so preventing fatalities that requires collaboration among all stakeholders involved.

Joni Harvey: And then safety is proactive. So issues should be identified and addressed proactively rather than reactively, and then redundancy is crucial. Having a robust system ensures that everybody that if one part fails, then others are still protecting people. So we're not going without with our with our redundancy.

Joni Harvey: Okay, and it is now my pleasure to introduce our speakers, for today's webinar. We are honored to have Dr. Boston and Dr. Nutbeam with us. They bring a wealth of knowledge and experience to our discussion, and I am going to go ahead and turn this over to them. Thank you doctors for coming.

Nichole Bosson: I think I'm first. So I'm going to advance to my slides. A good day, everyone. I'm Nicole Basin. I'm the medical director for the Los Angeles County EMS Agency. And I'm really happy to talk to you today about the National Association of EMS Physicians, position, statement, and Resource document on management of the entrapped patient. You can get a copy of the article I'm speaking about through this QR. Code.

Nichole Bosson: I definitely want to acknowledge all of my collaborators listed at the bottom here. This was a huge effort on everyone's part, and I really appreciate all of them contributing, and especially Dr. John Ling, who has been leading the entire pre-hospital trauma compendium.

Nichole Bosson: So what is the NAEMSP trauma compendium? It is a group of related articles. It is 16 topics on pre-hospital trauma management and the care of the entrapped patient is one of these topics.

Nichole Bosson: What the way in which the compendium is being organized is the author groups develop a PICO style questions related to the topic, and this has driven systematic reviews of the literature to inform recommendations based on those key questions. The QR Codes. Here take you to the introduction to the entire compendium, as well as the methodology that we used for each of these papers.

Nichole Bosson: So, in terms of the entrapped patient. The reason that we wanted to include this as its own topic in the compendium is because entrapped patients are at higher risk of injury and death, and given the limited access and the prolonged scene time. Their management is different than routine trauma care.

Nichole Bosson: and we do have specialty teams like urban search and rescue teams that specialize in response and extrication of patients who are entrapped. But the reality is that EMS clinicians encounter and trapped patients on a routine basis and need to have the knowledge and skills to manage these patients, especially in that early phase until those teams can arrive.

Nichole Bosson: Now, I want to frame this in that we are speaking in this manuscript on the totality of entrapped patients. So while motor vehicle accidents is one common way in which patients are entrapped. We are looking at this from all entrapped patients, so everything from collapse structures, disaster, events like earthquakes.

Nichole Bosson: industrial accidents, farming, equipment, accidents, and patients can be entombed, they can be crushed or entangled. And so all of these situations were addressed and considered. As we made these recommendations.

Nichole Bosson: so our author group initially identified. 5 PICO questions a priority. That was what initial assessment should be performed on the entrapped patient. What is the optimal fluid management for the entrapped patient. What is the optimal timing and frequency of medications for crush syndrome? Should tourniquets be applied to crushed limbs? And does physician care at the scene improve outcomes

Nichole Bosson: for entrapped patients, and as we performed our literature review we identified 3 additional themes that drove an additional 3 questions, and those were, What medical care? How does the medical care excuse me? Integrate with rescue for the extrication of the entrapped victim?

Nichole Bosson: What additional interventions are essential for the entrapped patients with prolonged field time, and what is the best approach to airway management for the entrapped patient.

Nichole Bosson: So we performed our systematic review of the literature. Our search strategy is available within the manuscript we identified over 750 initial manuscripts, including 3 from the gray literature, and ultimately excluded a number of papers based on several things. One, we only focused on papers that included medical care. So if

Nichole Bosson: the paper was entirely focused on extrication or rescue alone, or disaster response, without addressing medical care. We did not include that because we were focused on medical questions.

Nichole Bosson: We also excluded anything that did not answer any of our PICO questions as well as editorials and secondary reviews, things that were not primary literature.

Nichole Bosson: We ended up with 101 studies that informed one or more of our 8 topics.

Nichole Bosson: So what are our recommendations? First, for patient assessment? We recommend that EMS clinicians perform a timely and thorough primary and secondary assessment and reassessments in parallel with the dynamic extrication, planning.

Nichole Bosson: and this environment may require adaption of standard assessment, techniques and devices. And the importance here is that we want the medical assessments to support the patient, care as well as

Nichole Bosson: support the rescue and not hinder rescue. And I think we'll hear from our colleague here, Dr. Nutbeam on how important it is to prioritize rapid extrication. And so this patient assessment needs to adapt and integrate into that and not hinder it. And we've made some recommendations within this document to that effect.

Nichole Bosson: and importantly, coordination and communication is huge, not just communication between rescuers or with the hospitals, but also communication with the patient, and I want to credit Dr. Nutbeam being for this because a lot of his work has really informed this recommendation and really emphasized that EMS. Clinicians need to establish early, clear, and ongoing communications.

Nichole Bosson: and so not only with the rescue personnel to ensure coordinated, patient-centered, and medically directed approach, but also communication with the patient, and be frequently in communication, clear and reassuring with them. And so there's more information within our manuscript about the importance of these communications for the experience of the patient and also for the optimization

Nichole Bosson: of the extrication process.

Nichole Bosson: Hypothermia was a big theme amongst the articles that we reviewed, and

Nichole Bosson: it was really emphasized that once hypothermia sets in, it is very challenging to reverse, and so, taking early steps to mitigate hypothermia and prevent it from occurring, is really important. And the other thing that was emphasized and captured here is that it's not just when it's obviously cold. Outside.

Nichole Bosson: patients can become hypothermic. Given their entrapment exposure for a long time, even in ambient temperatures that seem relatively benign

Nichole Bosson: in regards to airway management. I don't think I need to tell you that it is challenging in patients who are entrapped.

Nichole Bosson: and the literature was a bit mixed on how to mitigate the challenges. But what we've recommended is that when required. Advanced airway placement should be performed by the most experienced operator with proficiency in multiple modalities and alternative techniques. Given the limited access situation, so thinking about your alternative techniques, whether it's supraglottic airways, lighted stylets.

Nichole Bosson: video laryngoscopy, it will depend on the entrapment and the situation that patient and you need to be facile with all of these techniques to optimize airway management

Nichole Bosson: in regards to fluid resuscitation, I want to emphasize that our recommendation is specific to entrapped patients. There's an entire other trauma compendium article about fluid management in the trauma patient. This was specific to entrapped patients who are experiencing or at risk for crust syndrome, and we recommend that EMS clinicians should initiate large volume fluid resuscitation in these patients

Nichole Bosson: which equates to one to one and a half liters per hour in adults with crystalloid, and that's preferably normal saline without potassium as early as possible, and importantly prior to extrication. And again, this is for patients who are at significant risk for crush syndrome, and the idea being that early initiation of fluids reduces their risk of the acidemia as well as renal failure that can lead to poor outcomes in these patients.

Nichole Bosson: We also looked at what medications should be administered for crush treatment, and I will say that there is quite a dearth of literature. There's no studies actually looking at the exact timing or the efficacy of these medications. But there is a lot of support for administration of medications in patients at risk for crush syndrome to prevent the concern for cardiovascular collapse upon extrication

Nichole Bosson: as well as later renal issues. So we recommend that EMS clinicians should administer medications, to mitigate the risk of hyperkalemia, infection, and renal failure early and prior to extrication, and again emphasizing that these are patients who are actually at risk for crush syndrome, which means they've been in trapped for a significant amount of time. We state in our recommendation that it's at least one

Nichole Bosson: hour, but that also relates to the amount of crushed tissue muscle mass involved, as well as the duration and the extent of the compression, all relating to how concerned the EMS clinician is for crush syndrome

Nichole Bosson: as far as the recommendations. They're highlighted in yellow here, sodium bicarbonate calcium, either gluconate or chloride depending on what's available to you and Albuterol should be administered to patients who are experiencing, or at high risk for crush syndrome. If within scope of practice.

Nichole Bosson: insulin and dextrose may also be administered important to monitor, that to cause no harm, what is not recommended is Mannitol or Oxalate. In most cases

Nichole Bosson: those would be in rare circumstances of very prolonged care where additional monitoring can be administered, and 4 cases of prolonged entrapment antibiotics are also recommended, and we've made some specific recommendations for those antibiotics here.

Nichole Bosson: and this table is available within the manuscript.

Nichole Bosson: So for tourniquet placement, this is highly controversial in the crushed patient, I think we all agree. There's ample evidence that if a patient is hemorrhaging we should apply a tourniquet that is agreed upon, and patients who are entrapped are at risk for hemorrhage. But we also wanted to understand the role of the tourniquet for patients with potential crushed injury, especially if medications may be delayed.

Nichole Bosson: and what we recommended was that tourniquet application should be considered in the setting of a crushed extremity as a potential adjunct to medical optimization

Nichole Bosson: before extrication. In some patients, and we recognize this is controversial. We get into the balance of the literature on this topic within the compendium, and we used some of the literature from, say, military and austere environments with prolonged tourniquet placement to help inform this recommendation, but recognize that the crushed limb is an already damaged limb, and it does complicate the decision to place a tourniquet.

Nichole Bosson: And finally, in regards to physician response, we recommend that patients with prolonged entrapment, with potential severe injuries that require complex resuscitation may benefit from EMS physician management on the scene, and therefore EMS systems should consider an early EMS physician response to entrapped patients.

Nichole Bosson: So in terms of our key principles, these just summarize our recommendations that EMS clinicians should perform a timely assessment, establish clear communications, and a patient-centered approach to the extrication.

Nichole Bosson: prevent hypothermia, recognize that airway management is challenging and optimize advanced airway management when it is needed. Initiate early fluid resuscitation for

crush syndrome. Treat, crush syndrome with medications when indicated prior to release of the patient, apply tourniquets in only select cases and consider physician seen response in these cases.

Nichole Bosson: I am available for any questions after we're going to take some here. But if you don't get a chance, this is my email, and please feel free to reach out. And I'd be happy to discuss more.

Nichole Bosson: Thank you very much, and I'm going to turn it over to Dr. Natim for his presentation.

Tim Nutbeam: Now I understand that it's been played automatically. If it's not, I can speak to slides, but I think it's pre-recorded.

Tim Nutbeam: Here we go there. My name's Tim Nutbeam. I'm a consultant in emergency medicine from the UK. And I also work in pre-hospital emergency medicine.

Tim Nutbeam: I've worked on those environments for the last 20 or so years and have had an interest in extrication and motor vehicle collisions for the last 15 or so.

Tim Nutbeam: I'm the research director for impact, which is a research center which focuses on post collision care and how we offer our patients absolute optimal outcomes.

Tim Nutbeam: I've been on

Tim Nutbeam: asked to come today to talk about extrication and how we optimize patient outcomes. We're going to be talking about a series of research papers that we've produced as part of a project called the Exit Project.

Tim Nutbeam: So what is the background for this? So in my role as an emergency medicine attending and pre-hospital emergency medicine attending, I saw this disconnect between what was occurring at the roadside, so prolonged extrications focused on absolute movement minimization and the injuries that I've seen my patients

Tim Nutbeam: with in the emergency department and also succumbing to. And there seemed to be this mismatch between the time that we were spending on scene we did a prospective piece of work in the UK and demonstrated that was a median of 32 min

Tim Nutbeam: and the rush to get patients to damage control surgery or to blood products or to other interventions when they came to the emergency department, and we decided to challenge this and try and do an evidence-based project around extrication.

Tim Nutbeam: We use the lens of evidence-based medicine. And that's using a combination of scientific evidence and generating more if you need it, patients values and preferences. So what do our casualties, want and need, and also expert clinical judgment.

Tim Nutbeam: And we use those free domains to map out our project. So we looked at the science for a systematic scoping review, and then added our own bits where there was missing science.

Tim Nutbeam: We interviewed patients who had undergone extrication patients both with and without a spinal cord injury and asked them about their experience.

Tim Nutbeam: And then we've gone on to develop consensus and Delphi type guidance. And I'm going to show you the latest iteration of this at the end of these slides.

Tim Nutbeam: This is the project mapped out in a slightly different way. You can see how it all ends up with consensus expert guidance.

Tim Nutbeam: So we're going to quickly look at each aspect of this project. So a systematic scoping review.

Tim Nutbeam: So this is where you go. And you look at many, many records, and we looked about 7,000 records, and could, as a result, track how the evolution of extrication has occurred through the decades from the first, st vehicles from the involvement of rescue services, the 1st roof off type extrication and the 1st tools being developed.

Tim Nutbeam: And over time you do see a change, we see a change from extrication being applied to just those who are anatomically trapped to extrication, being applied to those with a suspicious mechanism of injury, and we see more and more patients as a proportion to the total number of accidents being extricated. As a result.

Tim Nutbeam: the interesting thing is, when you look back through these papers, there's never been a scientific evaluation of extrication or a test that it works, or that it's proportionate. And it's really interesting to look at

Tim Nutbeam: accidents which occurred before things such as safety belts, sorry seat belts, central safety zones, crumple zones, and those sorts of things, and it's fascinating to see the rate of spinal injury and spinal cord injury which occurs before this time.

Tim Nutbeam: So what was our take-home messages from looking at these 7,000 papers. So we found that previous extrication studies strategies do not have a scientific base

Tim Nutbeam: is.

Tim Nutbeam: and therefore we need to do some work to help provide that scientific basis. And as a result of that, we move on to the 1st 3 of our publications, we need to work on developing that primary literature.

Tim Nutbeam: So 1st publication. These are all free and open access, so you can have a look at them yourselves.

Tim Nutbeam: But all of these papers look at the UK based trauma audit research network data. This is from all major trauma centers in the UK. And we've got really good data capture. Essentially, the hospitals need to submit or they don't get paid. And that's a good driver for high quality data. And we looked at just over 60,000 road traffic collisions, and we found a big difference in mortality.

Tim Nutbeam: So those were trapped 8.9% and those which weren't trapped about half around about 5%.

Tim Nutbeam: Interestingly, being trapped was an independent risk factor for death.

Tim Nutbeam: So this took into account

Tim Nutbeam: age, sex injuries, type of injuries, physiology, Charles from comorbidity, index all of the data that we had on these patients, and still being tracked, was an independent predictor of death.

Tim Nutbeam: We also found that when we looked at those patients who required an extrication.

Tim Nutbeam: spinal cord. Injury was relatively low. I'm not at all saying it wasn't important, but it was about 0 point 7% of patients who we were extricating had a spinal cord. Injury

Tim Nutbeam: of those patients with a spinal cord. Injury more than half had another severe ais greater than 3 time dependent injury.

Tim Nutbeam: Also, many patients look the same, and this is a finding that we can dig into more in the questions. But once you exclude patients who are obviously sick, so those who are unconscious, or those without any pulses, and you have those who are injured.

Tim Nutbeam: But you don't know who are sick and who aren't actually clinical observations were a really poor discriminator to work out who was really sick, going to be dead within 24 h, and those who are actually really quite well. So we do need to take that into context. The fidelity of our clinical examination with these patients

Tim Nutbeam: study 2. So this looked at age, and we stratified patients patients by their age, and then adjusted for confounders, and we found that those who were elderly were much more likely to die if they were trapped, and we found that if you were interested in self extrication, so

people getting themselves out the vehicle, then the propensity for this was going to be about the same across the decades of life.

Tim Nutbeam: So older people should be offered self extrication. And we'll come onto that in more detail later on as well as younger people. There were differences statistically significant differences in the frequency of things like chest injury and spinal cord injury. But they weren't significant enough to

Tim Nutbeam: kind of dictator change. In practice they were more statistically different rather than clinical difference in findings.

Tim Nutbeam: Study 3 does biological sex matter, and we could spend a long time discussing this, so females, particularly younger females, were much more likely to be trapped. And we've got some follow up work looking at that, trying to work out why that happened. There were different injury patterns, so the female sex pelvis does seem to be more likely to be injured, but they're also much more likely to have side impact collisions. So perhaps that's part of this picture.

Tim Nutbeam: Females were also more likely to have spinal injuries. But once again, with the mechanisms of injury that might explain some of this, but we know that there are anatomical differences in terms of things like spinal, ligamentous structures.

Tim Nutbeam: So some take home messages from this aspect of the work that we did. So we've already touched previous extrication strategies don't have a scientific basis. Trapped patients die more frequently. 0 point 7% of those patients who require extrication have a spinal cord injury, and of course the others are likely to have other significant injuries.

Tim Nutbeam: Clinical observations can be and are falsely reassuring.

Tim Nutbeam: Most patients do not have injuries which prevent self extrication, and there are some differences between ages between the ages and decades of life and biological sex, but probably not enough to dictate a different extrication strategy.

Tim Nutbeam: This is a paper that has been submitted for publication in Bmj. Public health, and it looks at the ratio of spinal cord injuries across the world, and you can see the percentage of spinal cord injuries is roughly similar across the continents, regardless of

Tim Nutbeam: types of vehicles, driving styles, all the other things, all the pillars which might affect road injury, and you can see that the highest rate of spinal cord. Injury is kind of 1.7 1.8%, and the lowest is kind of, as we saw in the UK around about 0 point 7%. But across motor vehicle collisions with major injury. The rate of spinal cord injury is

Tim Nutbeam: whichever way you look at it is is relatively low.

Tim Nutbeam: So we're going to move on to this next bit now, which looks at biomechanical analysis.

Tim Nutbeam: So what we did here is that we studied healthy volunteers of different ages, males and females, different body mass indexes, and we extricated them again and again and again, and when you extricate enough people enough times, you can build up these 3D biomechanical models of a standardized extrication. And we looked at different extrication techniques. And then you can take measurements from these models.

Tim Nutbeam: Here, I've shown you one method of capturing data. I think it's important to say at this stage that we looked at other methods of capturing data, and the result is consistent. Since our work as well study groups in Spain, parts of South America, in all other parts of the world, have done similar experiments and found very similar results.

Tim Nutbeam: So

Tim Nutbeam: so what did we find so? Oh, sorry. This is another example of an extrication using an imu. And you can see, this is a roof off type extrication. So the patient has been rocked back. They've had a spinal board inserted beneath them. They get gently lifted up out of the footwell, and then they go out the back of the car, and then finally, at the end of the extrication, the board gets laid down

Tim Nutbeam: clearly we can't see the board in the car, so I apologize for that. But hopefully, from this you can see how we can take measurements from the spine and then use those measurements for scientific purposes

Tim Nutbeam: jeez

Tim Nutbeam: so quickly looking at some of this work. So this one looks at the value of collars and instructions and essentially collars do restrict movement. I know there's some controversy around collars at the moment, particularly in the UK. Europe and in Australia, but they do restrict movement.

Tim Nutbeam: Whether they strip them by enough is a different matter.

Tim Nutbeam: It's important to know that actually, the process of applying a collar also causes quite a bit of movement. So if you're interested in total movement which might contribute to spinal cord inflammation, then the total travel time is about the same, whether you use a collar or not. Once again we could dig into the weeds of this for a long time. We don't have time today.

Tim Nutbeam: so I think this is one of the most important papers we looked at the commonly used extrication methods in the UK. And I suspect there's some similarities between the methods which are used in the UK and the US. But the number may well be different. So we

looked at roof off type extrication cutting through the A B and C. Pillars, lifting the roof off and then taking the patients out on a board normally rocking back the driver's seat.

Tim Nutbeam: and we looked at A B post Rip type extrication. So a lateral extrication process. And we looked at a rapid, no cut extrication technique where a patient was brought out of the driver's door onto a spinal board or a scoop type structure

Tim Nutbeam: without the use of tools.

Tim Nutbeam: So what did we find? So we found that all 3 extrication techniques performed very similarly from a scientific analysis perspective. And this was the same, regardless of movement type that we looked at. So whether you looked at forward, backwards movement where you looked at yaw, whether you looked at rotation.

Tim Nutbeam: This was a very similar finding. So roof off extrication, which in the UK takes about 30, 32 min, performed the same as A. B post rip, in terms of spinal movement, which perform the same as rapid extrication

Tim Nutbeam: and rapid extrication. We know we can do in a couple of minutes compared to 30 min, and that's a long time if you're bleeding to death.

Tim Nutbeam: So this really turns our extrication practice on its head. So we thought starting this project. That roof off extrication was slow and gentle, and as a result, would lead to minimal spinal movement. That isn't the case. It causes about the same amount of spinal movement as rapid extrication.

Tim Nutbeam: very interestingly, and again, a very consistent result across our experiments and those of others. Self extrication causes less than half the movement at the C-spine or lumbar spine. Compared to the formal extrication techniques.

Tim Nutbeam: We also looked at chain cabling, which is a Scandinavian technique. I'm not sure it's used in the US. Very much outside of heavy vehicle rescue. But you can have a look at this paper, if it's relevant to your practice.

Tim Nutbeam: So some additional take home messages.

Tim Nutbeam: Collars do reduce movement during extrication, but the clinical importance is unclear self extrication consistently produces less spinal movement than other extrication. Techniques and all other extrication techniques produce statistically similar results.

Tim Nutbeam: So we then moved on to ask patients what they wanted from extrication, and we interviewed those with and with

Tim Nutbeam: outer spinal cord injury.

Tim Nutbeam: I expected this to be about pain, temperature, noise, but it wasn't. It was about communication and companionship.

Tim Nutbeam: Please hold your patient's hand. Explain what's going on. Tell them what's going on throughout the extrication process, and they will have a much, much better experience.

Tim Nutbeam: Don't treat them like a sack of potatoes. Treat them like a human being, and they will. Yeah, they will thank you for it. And it's very likely we're doing some follow up work. As a result they will have better return to work less. Ptsd, a much better experience at 6 months down the line.

Tim Nutbeam: So take home messages. Patients value communication and a dedicated extrication.

Tim Nutbeam: Got it

Tim Nutbeam: finally, study 9 lots and lots to cover here. But this was a Delphi type technique. So a consensus finding technique, asking experts in fire and rescue and clinical care in the UK. And between us we realised some themes. Once again, this is free and open access. I encourage you to go and have a look at it. 92 statements, which were condensed into a series of statements which were adopted by

Tim Nutbeam: our UK rescue organization, our National Fire Chief Council, our Jr. Calc, who set the standards for paramedics, our College of Paramedics, the factory pre-hospital emergency care so widely accepted across the board.

Tim Nutbeam: We developed some tools to help people with this. So this is the you step out tool.

Tim Nutbeam: We've not got time to delve into it now, but hopefully, during questions. We can spend a bit of time on this. But this is designed for non-clinicians to risk, stratify patients to see who can step out of the car, perhaps following a release rather than coming out through a formal extrication process.

Tim Nutbeam: and we came up with an extrication decision tool which prioritized casualty, self extrication above other methods of extrication.

Tim Nutbeam: And we've come up with some new factory pre-hospital emergency care, guidance which has been released just in the last few weeks, and this prioritises a focus on time rather than a focus on absolutely minimizing movements. It empowers fire and rescue services to make decisions around extrication technique prior to clinician arrival.

Tim Nutbeam: It focuses on enabling self-extrication.

Tim Nutbeam: It also takes away from some of the manual inland stabilization that we've done historically and says for fully conscious patients without neurology, that's not relevant or required. And it talks about how patients who do have neurology are time critical and need to come out quickly.

Tim Nutbeam: It talks about vehicle relocation, which I know is done in some parts of the States, and that rescuers should be aware that clinical observations prolong entrapment time and are a poor predictor of patient outcome.

Tim Nutbeam: also focuses on minimizing the clinical care, just the critical interventions to expedite safe extra care station.

Tim Nutbeam: We've moved away from applying pelvic binders in the car that's now contraindicated. And we need to focus on psychological impact of extrications and body care.

Tim Nutbeam: We also talked about the value of regular joint, multidisciplinary training, learning, sharing, and case review.

Tim Nutbeam: So that brings me towards the end of our talk or the end of our talk. Sorry I couldn't be there myself today. Rob is available to take some questions. I hope this has been useful to you. Please do visit us@www.postcollision.com. We would very much like to know about your projects. We'd very much like to help. We see ourselves as an enabler of joined up research in this area.

Tim Nutbeam: We do welcome any questions. Thank you very much.

Joni Harvey: Thank you. Dr. Boston and Dr. Nutbeam being. That was some really great information. I know we have a lot of questions that are coming in on the chat, which is fantastic, many of them I know you've gotten to answer some already.

Joni Harvey: but I will go ahead and just read a couple of them out here that if we don't have time to get to everything today, just so everyone is aware we will compile a document with responses and share it along with the archived recordings of today's session. So you will have access to those.

Joni Harvey: So let's see 1st one here. Dr. Boston.

Joni Harvey: from looks like from Megan. She wants to find out if there is no medication at the time of the incident, what are possible alternatives during entrapment.

Nichole Bosson: Thanks for that question. So I do want to emphasize that the evidence behind administration of the medications that we've recommended is pretty minimal, while authors

pretty much universally agree that these medications should be administered to patients with crush. And we're really talking about patients who are

Nichole Bosson: crushed right? So we define that as at least 1 hour with a significant muscle mass involved. I think most of, you know, you know, to recognize those patients. Most authors recommend the use of these medications due to anecdotal.

Nichole Bosson: You know patients extricated and died right. We know that they can have cardiovascular collapse, severe dysrhythmias acidemia and go on to have renal failure, and these have been described in numerous situations, especially coming out of major disasters. So that's what's driven this recommendation. And if you look across organizations

Nichole Bosson: such as INSARAG. So I'm coming from this perspective of a USAR, Doc, right? So I work for California task force 2 U.S.A. 2, the USAR team and our international organization. The International Search and Rescue Advisory Group strongly recommends treatment of these of crush to prevent extrication to prevent cardiovascular collapse after extrication. And we're talking about patients that have been trapped for some significant amount of time.

Nichole Bosson: So it's going to depend on the circumstances that you're encountering this patient, and if they have crush, and if they've been entrapped for a significant amount of time, and at least at least 1 hour and muscle mass is involved.

Nichole Bosson: If so, we do recommend getting those medications there and thinking about how you can forward deploy resources to treat the patient and support them during the extrication process if you can get them out quick. I think Dr. Nutbeam a great case for just get them out quick, right? And then you won't have to worry about this. What if you don't have medications? Well.

Nichole Bosson: That's a challenge. Right? Fluids definitely help right fluids and early fluids. And I love. We got a lot of questions about blood in the chat, and I'm sorry I didn't mention that before. But there's a separate

Nichole Bosson: compendium manuscripts about blood, and really addressing that we simply acknowledge that blood is, if available, is important for any patient with hemorrhagic shock. But when we're treating crush fluids are helpful and early, so that may be something you can administer. There have been a lot of questions about Albuterol, so maybe you can't place an Iv and administer IV medications. But your BLS service. Albuterol

Nichole Bosson: can mitigate hyperkalemia through shifting that potassium into the cells at least temporarily help. It is higher dose than you're typically using for your wheezing patients, and would be fairly continuous. And, of course, in a confined space, you have to think about how you deliver that albuterol, whether you want to oxygenate the environment which could be combustible or use, say, an MDI and spacer, which is how we approach it frequently

Nichole Bosson: in the USAR space. Given the confined space environment other than that. Really great questions about what else people can do. Mitigating hypothermia does not take anything. Fancy so blankets and windshields.

Nichole Bosson: You know, performing that assessment and identifying that patient who's at higher risk can be done without those medications controlling, bleeding and supporting, and the patient's airway and preventing airway compromise. Certainly in some environments it's less

Nichole Bosson: of a concern. But we definitely worry about that when there's dust and debris in the environment and actually protecting the airway with masking can prevent, say, a future need to intervene on those patients so broadening the question a bit. But thinking about, what can you do if you don't have those ALS abilities to administer the medications. And, as I mentioned before, you know, tourniquets highly controversial.

Nichole Bosson: It's something to consider if you have severe crushed limb, and you are very concerned that that patient is going to have a large bolus of toxins as they are extricated, and you reperfuse that limb. Consideration for tourniquet placement to sequester the injured tissue until you can do a controlled release

Nichole Bosson: is is something that could be considered, and I'll leave it there, and if that triggers other questions, I'm happy to take them.

Joni Harvey: Thank you, Dr. Bosson, switching over to Dr. Nutbeam. We actually have a question for you, multiple questions for both of you, for Dr. Nutbeam from Joshua Mastenbrook. Any data on the difference in vehicle type, for example, pickup truck versus car, and their association with entrapment.

Tim Nutbeam: So hi, folks sorry for sorry for the terrible audio of my recording we recorded it in advance, expecting terrible audio. But I think it's probably better over over this form.

Tim Nutbeam: thank you very much for inviting me this evening. I've got to point out that I'm not an engineer. So I'm primarily a clinician and a researcher. I think your question is primarily about physics and materials, and we do see big difference. When you see differences between the strength of materials and momentum associated with the crash. So kinematics, velocity, and weight between the vehicles, you will see the rate of entrapment go up significantly.

Tim Nutbeam: So modern vehicles with vehicles manufacturing that last 10 years tend to be structurally very strong. But if you put them up against a heavy vehicle, for example, a heavy goods vehicle, or a large pickup with a full load. Then you'll see those you'll see significant exchange of forces. So in summary, it's all about engineering and physics rather than clinical care. But when you have differences between the vehicle is where you'll see the highest rate of entrapment.

Joni Harvey: Great. Thank you. I'm staying with you, Dr. Nutbeam. Did you feel that age, gender and other demographic factors influence injury patterns and outcomes.

Tim Nutbeam: So yes, definitely So

Tim Nutbeam: so there's a big difference between patterns and outcomes. So generally, the differences that we see in injury. Patterns are statistically significant differences rather than clinically important differences. So there are small differences in the rates between females and males. Females are slightly more likely to get spinal injuries. But it's not good. The difference isn't so much that it's going to make a difference to your extrication strategy.

Tim Nutbeam: When it comes to outcomes. There's huge differences depending on both sex and also particularly on age. And some of that is interaction between treatment, car design approach.

Tim Nutbeam: historic health inequalities, many, many things interacting with that. The biggest predictor of a poor outcome following a motor vehicle collision is patient age.

Joni Harvey: Well staying with the spinal cords for Dr. Nutbeam. What is the evidence that spine boards prevent or treat injury.

Tim Nutbeam: So they definitely don't treat injury. They're not a mechanism of treatment, and from my perspective there is very little evidence that they reduce or prevent injury. There is a very recent systematic scoping review which has been published which looks at pre-hospital immobilization in general, and the benefit of pre-hospital immobilization cannot be defined.

Tim Nutbeam: If you look at international extrication practices. So spinal boards are pretty much gone in the UK. And most of Scandinavia, we're using scoops far far more commonly collars have completely gone. In the Scandinavian countries and from Western Australia high collars have been replaced with soft collars. Most of Europe have moved away quite strongly from using collars routinely, only using them on selected cases.

Tim Nutbeam: So yeah, there's definitely big international differences in our approach to immobilization. We think from what we've understand from our biomechanical evidence that a gentle, patient handling approach is the way to go. But if a patient does have a definite spinal cord injury, then they need particularly gentle handling, but most of them will have another time dependent injury which prevents them from looking after their spinal cord.

Tim Nutbeam: So by the time you've had the transfer of energy to give you a spinal cord injury. You've normally got an associated head, injury, chest, injury, abdominal injury, which prevents spinal cord, perfusion or causes spinal cord hypoxia. So we need to balance this very carefully. So we know that slow and steady

Tim Nutbeam: doesn't do the job so slow and steady, is just slow. It's not slow and steady, so gentle, patient handling, but with a focus on timely extrication, is the way forwards for these patients.

Joni Harvey: And then a follow-up question for Dr. Bosson.

Joni Harvey: Can you please? Elaborate on the dose of sodium bicarbonate, including push and infusion.

Nichole Bosson: I wasn't quick enough. I got that one in the chat, so I will say it out loud, too. We do address this in the discussion, we recommend an initial push of sodium bicarb along with the calcium and the Albuterol prior to extrication. Again, in these situations, we're talking about someone who's been entrapped for some time right? And so administering that prior to extrication. And then.

Nichole Bosson: if patients are prolonged entrapment, authors do generally recommend that bicarbonate drip to alkalize the urine and provide some renal protection, some debate there, you know, in terms of the actual effectiveness of that. But I would say across the literature that is still recommended at a target urine, PH. of 6.5. And so we detail that in terms of how that could be administered

Nichole Bosson: for a prolonged entrapment with a bicarbonate drip, and I also posted the specific language into the Q&A. For those that want to read more about it.

Tim Nutbeam: Did I? Just the I, I think, Dr. Bosson's so guidance is.

Tim Nutbeam: It applies to a far wider group of patients than specifically vehicle extrication that we're talking about. And I think.

Tim Nutbeam: from my understanding of the patients, particularly from the UK who have vehicle extrication, the rate of them which have genuine crush injury with hyperkalemia changes in PH, and all the things that we're talking about is extremely extremely low.

Tim Nutbeam: and when we try and replicate, crush, injury, vehicle, crush injury in the lab in the animal lab. We really struggle to do it because you need to crush tissue for so long and so much tissue to get these changes in PH that we're talking about here.

Tim Nutbeam: So I think it's a very different situation from building entrapment and prolonged crush where people are trapped for hours, and they've got big big coverage. If you're just trapped by a small part of your body, even if it's for an extended period of time you won't get these potassium shifts and the cellular destruction that we're talking about here. So in the UK we've taken a completely different route, and we don't recommend any of those treatments for crush injury in the setting of vehicle entrapment.

Tim Nutbeam: because we believe the harm in waiting for them outweighs any benefit which is the focus on absolutely minimizing that entrapment time. So I'm sure there are some special circumstances in vehicle entrapment when all those medicines are necessary. But I'm a very simple emergency physician, and I like to do a few things. Well, I hope that doesn't. I hope you're in agreement with that Dr. Bosson, rather than see that, as an interruption.

Nichole Bosson: Absolutely. No. I'm glad you reemphasize that, because at the very beginning, you know, I wanted to say our recommendations are based on the totality of entrapment, and this includes disaster situations or patients who are entrapped for days in our La County system. We do have a crush management protocol. We do not exclude patients who are in motor vehicle collisions from this, but I will say in my time here, 12 years in La County.

Nichole Bosson: I know of less than a handful of cases where it was clearly demonstrated. There are those cases, but clearly demonstrated that a patient entrapped in a motor vehicle, benefited from the management of crush syndrome, they do exist, but it is not the most common, and so balancing right, getting that patient out quick if you can. This recommendation of a bicarbonate drip and testing the PH of a urine is definitely for a patient. You're managing over hours to days.

Nichole Bosson: not 30 min, which would be the typical extrication for a motor vehicle collision. Thank you for reemphasizing that.

Joni Harvey: Thank you and thank you everyone for your questions. Thank you. Dr. Boston and Dr. Nutbeam, for presenting with us today. I know there's still a lot of questions to get to Dr. Bassen. You are a rock star going through those in the chat. So thank you for that. But anyone else just again as a reminder. If we did not get to your question today, then we will compile that document with the responses, and it will be in the archived recording for today's session.

Joni Harvey: So thank you all for attending today's EMS focus, webinar. We do appreciate your engagement and hope that you did find the session valuable again. Please keep an eye out for the recording and any additional resources as they will be added to ems.gov. So thank you. Everyone have a wonderful day.