

ABSTRACT

Background: Individual states, regions, and local emergency medical service (EMS) agencies are responsible for the development and implementation of prehospital patient care protocols. Many states lack model prehospital guidelines for managing common conditions. Recently developed national evidence-based guidelines (EBGs) may address this gap. Barriers to statewide dissemination and implementation of model guidelines have not been studied. The objective of this study was to examine barriers and enablers to dissemination and implementation of an evidence-based guideline for traumatic pain management across five states.

Methods: This study used mixed-methods to evaluate the statewide dissemination and implementation of a prehospital evidence-based guideline. The guideline provided pain assessment tools, recommended opiate medication dosing, and indications and contraindications for analgesia. Participating states were provided an implementation toolkit, standardized training materials, and a state-specific implementation plan. Outcomes were assessed via an electronic self-assessment tool in which states reported barriers and enablers to dissemination and implementation and information about changes in pain management practices in their states after implementation of the EBG.

Results: Of the five participating states, three reported dissemination of the guideline, one through a state model guideline process, and two through regional EMS systems. Two states did not disseminate or implement the guideline. Of these, one state chose to utilize a locally developed guideline, and the other state did not perform guideline dissemination at the state level. Barriers to state implementation were: the lack of authority at the state level to mandate protocols, technical challenges with learning management systems, and inability to track and monitor training and implementation at the agency level. Enablers included having a

state/regional EMS office champion and the availability of an implementation toolkit. No participating states demonstrated an increase in opioid delivery to patients during the study period.

Conclusion: Statewide dissemination and implementation of an evidence-based guideline is complex with many challenges. Future efforts should consider the advantages of having statewide model or mandatory guidelines, the value of local champions, and be aware of the challenges of a statewide learning management system and of tracking the success of implementation efforts.

INTRODUCTION

Emergency medical services (EMS) is a complex system that provides care to over 17 million patients annually.¹ Approximately 25% of EMS encounters are for trauma or traumatic pain-related conditions.¹⁻³ Historically, the management of acute traumatic pain in the prehospital setting has been variable and suboptimal, relying on local expertise and opinions, rather than evidence-based protocols.^{4,5} As a result, improving prehospital pain management has been identified as a high priority.⁶⁻⁸

Both the 2001 National EMS Research Agenda^{5,9} and the 2006 Institute of Medicine (IOM) report on the Future of Emergency Care in the United States¹⁰ called for the development and implementation of evidence-based treatment protocols to reduce variability in prehospital care and improve outcomes across the nation.⁵ In response to the challenges in managing traumatic pain in the prehospital setting,^{4,11-13} the NHTSA Office of EMS and the HRSA EMS for Children (EMSC) Program jointly funded the development of an EBG, utilizing the Model Process for the prehospital management of acute traumatic pain.⁴

States have widely variable structures for EMS protocols with only about 50% of states with statewide protocols actually requiring their use.¹⁴ To add to the variability across the nation, among those states with mandatory protocols, approximately half have provisions by which agencies can petition to allow further modification at the local level.¹⁴ Given this wide variability in state EMS structure, the goals of this project were to identify and evaluate barriers and enablers to the effective dissemination and implementation of an at EBG at the statewide level, in order to facilitate future efforts to widely adopt best-practice protocols.

METHODS

Study design

This was a mixed-methods observational study with qualitative and quantitative elements.

Study population (State selection process)

The investigators solicited interest from all U.S. states and territories through the National State EMS Officials (NASEMSO) communication networks, including listservs and presentations at annual meetings. The goal was to select a group of states that had an existing infrastructure to support the project, but with varied EMS system characteristics. Study investigators established criteria *a priori* for state selection and participation in the project. To be eligible, states could not have mandatory state protocols or have an established statewide traumatic pain protocol. States had to have $\geq 75\%$ of their agencies patient care reports collected in a statewide, National EMS Information System (NEMSIS) Version 2.0 (v2)-compliant registry and be willing to share their data with study investigators. Study investigators also considered additional characteristics such as availability of a statewide learning management system (LMS), authority for voluntary statewide protocol guidelines, and demographics of the EMS system.

Study procedures:

The study was conducted over a four-year period during which, the evidence-based guideline for acute traumatic pain was published.⁴ Essential elements of the guideline were identified and include the following:

- that all patients be considered candidates for analgesia, regardless of transport interval;
- that opioid medications should be considered for patients in moderate to severe pain;
- that all patients should be reassessed at frequent intervals using a standardized pain scale, and
- that patients should be re-dosed if pain persists (Figure 1)

The EBG contains dosing recommendations for parenteral opiate administration in addition to recommendations for specific age-appropriate pain scales.⁴ These essential elements were to be included in any statewide protocol, guideline, or training.

EBG Toolkit and Training Development

In accordance with the recommendation of the EBG Model Process¹¹, the study team developed a guideline implementation, dissemination, and evaluation “toolkit” to be used as a reference for the states.¹⁵ The toolkit materials were chosen based upon prior efforts described in the literature with additions aimed at addressing known barriers to prehospital pain management.¹⁶⁻²¹ The toolkit included information for dissemination and implementation along with background information and a description of this project’s role in the EBG Model Process. In consultation with each state’s assigned project leader, the study team also developed individual implementation plans and evaluation roadmaps specific to each state’s unique needs and perspectives.

To support dissemination, the toolkit included information about the pain management EBG, recommended age-specific pain scales, and an example of how the EBG was modified into a statewide protocol in Maryland.⁵ For implementation, the toolkit included the published pain management EBG, a list of the essential elements of the EBG, the source literature surrounding the EBG, training materials, literature describing barriers and “solutions to barriers” in prehospital pain management, and a fact sheet for states to use when communicating with individual agencies. The toolkit also included an implementation assessment tool with NEMSIS v2 data elements for tracking EBG implementation and gauging the level of agency adoption of the EBG.

Study investigators worked with a prehospital educational consultant through the Health and Safety Institute to develop a training module.²² The training consisted of a didactic slide presentation with audio, instructor talking points, and pre- and post-tests. The training module was made available to each state for uploading to their respective LMS for the purpose of providing statewide provider education. These training materials were provided as a resource but were not mandated. If they chose, states were allowed to use their own training adapted to their needs. Table 1 contains a list of the elements contained in the toolkit.

Each state EMS office was tasked with identifying a local project leader, or “champion,” who would lead the efforts to disseminate the toolkit and training materials, track agency participation, complete state self-assessments, and obtain outcome data regarding pain management at the state level. Study investigators held monthly meetings with the designated state project leaders. The calls consisted of state updates on dissemination and implementation progress and detailed discussions about successes and challenges encountered during the project.

These meetings provided opportunities for project leaders to share their experiences with each other and with the study team.

Methods of Evaluation

Qualitative evaluation

Each state provided a summary of their implementation process via an electronic self-assessment tool. The summary included the following: 1) a summary of the experience with the EBG implementation process and current progress, 2) a description of barriers and challenges encountered during the process, 3) a description of successful implementation strategies, 4) an assessment of the usefulness of the tools provided by the study team. Finally, at the end of the project, state representatives and project leaders met with the study team and provided an in-person summary of their experience.

Study investigators compiled and reviewed the responses to this self-assessment and identified several thematic domains. These domains were collated and reviewed by the study team and with the project leaders. Within each domain, barriers and enablers were identified and categorized as either “macro-” or “micro-barriers.” For the purposes of this study, “macro-barriers” were defined as system-wide obstacles such as the lack of existing statewide guidelines or difficulty with statewide communication and education. “Micro-barriers” are specific to the individual protocol in question. For example, multiple micro-barriers have been identified in relation to prehospital pain management, including the inability to assess pain, difficult vascular access, the perceived need for vascular access, concern for drug seeking, and the resistance of receiving hospital personnel to the protocol.²³

Quantitative evaluation

The five participating states queried their statewide EMS registries to evaluate prehospital pain management practices in patients with traumatic conditions. Data evaluated included documentation of pain scores, amount of opiate analgesics administered, and re-assessment of pain. In order to evaluate pain management practices before and after the implementation of the pain protocol, the registries were queried for two periods: April-June 2014 and April-June 2016. The overall project timeline and events are shown in Figure 2.

RESULTS

Among 18 states and two territories that expressed interest in participation, five were selected: Arizona, Idaho, Kansas, Tennessee, and Wyoming. Participating states represented diverse geographical areas and diverse models of state EMS organizational structure. Characteristics of the selected states are presented in Table 2. Three states (Arizona, Idaho, and Tennessee) had statewide model (but not mandatory) protocol guidelines, and two states (Kansas and Wyoming) did not. All participating states collected NEMSIS v2 data from provider agencies.

The pain management EBG training was made available to the states in May 2014 and was uploaded to a learning management system in three states. The study team published the implementation toolkit on the NASEMSO website (www.nasemso.org) in August 2014; it was accessed 7,265 times and downloaded 1,575 times. During the study period, implementation of the EBG was carried out in three of the five states (Arizona, Wyoming, and Tennessee). Idaho chose not to disseminate or implement the project EBG but instead disseminated its own newly-developed statewide pain guideline. For internal administrative reasons, Kansas did not engage in the dissemination or implementation process. All five states were asked to participate in the

self-assessment process whether they implemented the guideline or not in order to provide the investigators a complete view of all barriers and enablers.

Summary of Reported Barriers and Enablers

Table 3 provides detailed information from each state's self-assessment regarding their identified barriers and enablers to the guideline dissemination and implementation. A review and compilation of these responses revealed four main barriers:

- 1) delay in publication and dissemination of the guideline,
- 2) lack of mandated protocols at the state level,
- 3) lack of consensus among state, regional, and local EMS leadership, and
- 4) technical challenges utilizing the learning management system.

There were three commonly reported enablers to statewide implementation of the evidence-based guideline:

- 1) having a local champion for the guideline,
- 2) having dedicated resources for pain management EBG dissemination, and
- 3) the availability of an implementation toolkit.

State-specific results can be found in Supplement 1.

Pain Management Practices:

No state was able to measure a significant change in amount of opiate analgesia provided. Some states did identify an increase in pain score documentation and use of age appropriate pain scales (Table 4).

DISCUSSION

The appropriate management of acute traumatic pain in the prehospital setting is an important priority for EMS systems as many studies demonstrate low rates of analgesia administration and

delays in treatment.^{6-8, 23-28} The recent national publication of an evidence-based guideline for traumatic pain management provided a unique opportunity for dissemination and implementation at the state level and identification of the enablers and barriers to this process. This study found numerous barriers and some significant enablers to the dissemination and implementation of this EBG among five states.

The primary barrier to dissemination and implementation reported by the participating states was an inability to mandate the guideline. None of the states in our study have mandatory statewide protocols and state EMS administrators reported that they were frequently queried as to whether the protocol was mandatory and why there was emphasis on this protocol as opposed to others. Of note, the majority of states in the U.S. do not have mandatory statewide protocols.¹⁴ States with mandated protocols generally have an established infrastructure for dissemination and training of agencies. In addition, one prior study identified mandating protocols as a necessary step to effective protocol implementation at the statewide level.²⁹ Given this is often under the purview of state legislative authority, this remains a significant barrier for many states.

Another potential option is the development of voluntary, but well-respected, state model guidelines. In one state, where model pediatric prehospital guidelines were developed and disseminated, 68% of agencies reported adopting the state-approved pain management guideline to their existing protocols and subsequent pain treatment rates increased by 43%.³⁰ One of our participating states which had statewide model guideline in place reported that the inclusion of the new pain management EBG into their existing model protocols was straightforward, utilizing their existing infrastructure.

Mandatory statewide protocols may not necessarily result in improved treatment, however. In Maryland, for example, investigators found an increase in the average dose of morphine

administered after implementation of the traumatic pain EBG but not necessarily an increase in the proportion of patients that received analgesia.⁵ This suggests that micro-barriers at the agency level may still exist. State EMS offices can often facilitate the resolution of certain macro- and micro-barriers when identified, given that the responsibility for the state EMS system operations ultimately lie within their purview.¹⁰ We found one example in this study where state authority was necessary to overcome certain barriers. In this case, the participating state noted that the need to restock opioid medications at the hospital was a barrier to analgesia administration in the field. Ultimately, the state EMS office easily addressed this barrier via clarification of the associated regulations.

The study also found that efforts to engender change in an EMS system should enlist the support of local opinion leaders, or “champions,” who have sufficient influence to effect change within the EMS system.³¹ This is particularly important because, while our participating states identified EBG implementation as important, the dissemination and implementation of this EBG was only one of many priorities that taxed the state offices’ finite resources.¹⁰ Each of the participating states addressed these resource challenges in different ways. In two instances, the project was adopted as an academic project by students affiliated with the state EMS offices, a model that was generally successful until upon the completion of the student’s academic requirement. At that time, however, as the “champion” moved on, the project responsibilities transitioned back to full-time state officials, with less day-to-day priority. Without the ongoing focus by this “champion” in the state office, the implementation effort faltered.

Technical challenges involving the use of an LMS were found to be another barrier to dissemination of the EBG. We encouraged states to utilize a well-known LMS to provide standardized education to providers. On-line didactics delivered via an LMS can be a productive

educational strategy that overcoming many of the geographic, temporal, and financial barriers common to EMS education.³² Ideally, for this study, the participating state would use the LMS to track use of the training and collect learners' pre- and post-test scores. In execution, however, this study revealed certain problems with relying on an LMS for training. For example, older software required updates and extensive information technology (IT) support was required for the LMS to function effectively, limiting its use in nearly every state. Such challenges are well-described limitations of using an LMS.³²

Finally, each state was provided a toolkit designed to provide information regarding the EBG for the state-level personnel as well as field providers and receiving hospital personnel. States participating in this project indicated that the toolkit was detailed and informative. However, there was mixed feedback on which elements of the toolkit were most useful. For example, some states indicated that the supplemental resource literature was not helpful. Most states agreed that specification of the key elements was useful. Of note, many states did not get far enough in the implementation phase to use all elements of the toolkit. As such, the perception that some elements were not helpful may stem from their lack of use given the time frame of the project. As this is the first study examining the usefulness of a prehospital EBG dissemination and implementation toolkit, future research should be directed at studying what specific toolkit contents are most useful.

Published recommendations for implementation strategies to improve patient outcomes recommend rigorous ongoing monitoring to ensure successful implementation.³⁰ The study investigators encouraged states to monitor change in pain management practice at the state level by utilizing their state EMS registries. However, only three states provided data on the change in pain management practices. With the limited data obtained, none demonstrated an increase in the

provision of field analgesia. However, one state was able to demonstrate a significant increase in pain score documentation. This increase in pain score documentation is similar to other studies.³³ Although each state's attempt to measure a change in pain management practice provided valuable information to the study, we discovered that using statewide registries to track implementation of the pain management EBG at the local level was challenging. They are generally not designed to collect granular, case-level events. Similarly, in a separate study utilizing NEMESIS data, investigators could not rely on pain score documentation as a means to identifying encounters.²³ The submission of EMS data from local EMS agencies to state registries to NEMESIS is regulated at the state level. Each state has differing requirements for data requirements and submission, thus making the gathering of consistent data across states challenging. As Table 4 demonstrates, each state used different criteria to choose their target population for analysis.

Table 5 provides a list of important steps in the pre-planning, implementation, and maintenance phases of a statewide guideline implementation program based on the findings from this study. An overall assessment of the five states' experience and outcomes leads to the following recommendations:

Recommendation #1 – Develop statewide model guidelines or mandatory protocols. States interested in disseminating and implementing evidence-based guidelines should consider developing statewide model guidelines or mandatory protocols. States with well accepted model guidelines that are widely endorsed by local decision makers appear to be able to disseminate and implement protocols easier than states without such model guidelines. Generally, as the state guidelines are developed, a process for updating them, including the incorporation of newly-published EBGs, is established concomitantly. This process, pre-established, greatly facilitates

the incorporation of new EBGs into the state guidelines, with subsequent dissemination and implementation following “naturally”. This was the experience of one of our states which has voluntary statewide guidelines. Experience in other projects with states that have voluntary or mandatory guidelines suggests an equivalent ease of both dissemination and implementation.^{5,19,40}

Recommendation #2 – Establish protocol dissemination and implementation “champions.”

Multiple authors note the benefit of champions in the dissemination and implementation of guidelines.³⁴⁻³⁶ Champions must be “change agents,” capable of establishing consensus and encouraging evolution of practice amongst a wide variety of EMS providers. Additionally, organizations should consider a “champion team” such that more than one individual is tasked with dissemination and implementation preventing stagnation of the project in the event that one member of the team leaves their position.

The following are potential roles of an EBG champion:

- Discuss the expected impact of EBG implementation within the EMS community, including the potential benefit in patient outcomes,
- Facilitate consensus amongst state, regional, and local EMS leadership in addition to invested stakeholders and subject matter experts,
- Develop state, regional, and local infrastructure to support dissemination and implementation of guidelines across the state, and
- Organize pilot programs to test dissemination and implementation of the guideline with representative EMS agencies and identify “micro-” and “macro-barriers” as well as enablers to implementation.

Recommendation #3 – Consider state-based learning management systems as one element of the dissemination and implementation strategy. Although we encountered difficulties with the utilization of these systems, state-based learning management systems still hold significant potential in the dissemination and implementation of protocols.^{25,32} Learning management systems must be user-friendly; function in areas with poor internet connectivity or on computers with out-of-date hardware and software; and should be able to track participation, collecting pre- and post-test scores, and other information useful to EMS educators.

Recommendation #4 – Consider using a toolkit for the dissemination and implementation process. States participating in this project indicated that the project team’s detailed toolkit provided a significant amount of important and helpful information. To be effective, a toolkit must contain content that is targeted to the specific population (state, local, etc.) using it. This project toolkit may act as a starting point in determining which future toolkit contents are most useful.

Recommendation #5 – Develop systems that are able to track implementation progress. Key to process improvement is the ability to track program progress.³⁰ Without the ability to review implementation progress, EBG champions are left with anecdote and speculation to guide their impression of implementation progress. States must develop mechanisms for soliciting feedback from regions, services, and providers regarding barriers or enablers to project success and ensure that the medical intentions and the operational implications of the developed protocol remain aligned. In addition, data registries should be utilized to allow tracking of specific implementation goals.

LIMITATIONS

This was an observational study engaging state EMS offices in an effort to disseminate and implement a pain management EBG, and as such, it has certain limitations. First, our primary outcome measures were collected through a self-reported assessment tool. The reliability of the data is therefore dependent on the completeness of responses and respondents' understanding of the questions.^{37,38} However, given that an in-person debriefing was attended with representation from all 5 participating states, there was an opportunity to clarify any missing information from the self-assessment tool, and the effects of any bias were likely mitigated. Second, there was no prescribed standardized method for dissemination, training, or implementation of the EBG, leaving states to work within their current organizational framework. This inherently limited the efficacy and scope of the project. The authors note that it was a precept of the project to allow states to utilize their internal processes in order to identify the associated barriers and enablers, and to ultimately identify best practices. Third, despite the study team providing training materials to the states, only a small fraction of providers, in two states, actually underwent pain management EBG training. Therefore, a large majority of providers in the participating states were untrained. Given a longer study period, more providers could have completed the EBG training, which may have improved implementation. Among the three states that disseminated and implemented the guideline, implementation actually began to substantially occur toward the end of the study period. Subsequent yearly measurements of field analgesia may demonstrate a gradual increase in use. Finally, due to the study design and inclusion of only five states, it is not clear that the results can be generalized to other states or populations although there were several unifying themes found across all the participating states. In addition, given that this project has

focused on the state level of dissemination and implementation, there may be limited applicability of the results at the individual agency level.

CONCLUSION

Statewide dissemination and implementation of an evidence-based guideline is a complex process with several challenges. In this study, several thematic barriers and enablers emerged which may guide state, regional, and local EMS systems in similar endeavors. Future efforts should consider the advantages of having statewide model or mandatory guidelines, the value of local champions, the potential of a statewide learning management system, and the necessity of tracking the success of implementation efforts.

REFERENCES

1. Wang HE, Mann NC, Jacobson KE, Ms MD, Mears G, Smyrski K, Yealy DM. National characteristics of emergency medical services responses in the United States. *Prehosp Emerg Care*. 2013;17(1):8-14.
2. Lerner EB, Dayan PS, Brown K, Fuchs S, Leonard J, Borgialli D, Babcock L, Hoyle JD, Jr., Kwok M, Lillis K, Nigrovic LE, Mahajan P, Rogers A, Schwartz H, Soprano J, Tsarouhas N, Turnipseed S, Funai T, Foltin G, for the Pediatric Emergency Care Applied Research N. Characteristics of the Pediatric Patients Treated by the Pediatric Emergency Care Applied Research Network's Affiliated EMS Agencies. *Prehosp Emerg Care*. 2014 Jan-Mar;18(1):52-9
3. Tsai A, Kallsen G. Epidemiology of pediatric prehospital care. *Ann Emerg Med*. 1987;16(3):284-292.
4. Gausche-Hill M, Brown KM, Oliver ZJ, Sasson C, Dayan PS, Eschmann NM, Weik TS, Lawner BJ, Sahni R, Falck-Ytter Y, Wright JL, Todd K, Lang ES. An Evidence-based Guideline for Prehospital Analgesia in Trauma. *Prehosp Emerg Care*. 2014;18 Suppl 1:25-34.
5. Brown KM, Hirshon JM, Alcorta R, Weik TS, Lawner B, Ho S, Wright JL. The Implementation and Evaluation of an Evidence-Based Statewide Prehospital Pain Management Protocol Developed Using the National Prehospital Evidence-Based Guideline Model Process for Emergency Medical Services. *Prehosp Emerg Care*. 2014;18 Suppl 1:45-51.
6. Maio RF, Garrison HG, Spaite DW, Desmond JS, Gregor MA, Cayten CG, Chew JL, Jr., Hill EM, Joyce SM, MacKenzie EJ, Miller DR, O'Malley PJ, Stiell IG. Emergency medical services outcomes project I (EMSOP I): prioritizing conditions for outcomes research. *Ann Emerg Med*. 1999;33(4):423-432.

7. Foltin GL, Dayan P, Tunik M, Marr M, Leonard J, Brown K, Hoyle J, Jr., Lerner EB, Prehospital Working Group of the Pediatric Emergency Care Applied Research N. Priorities for pediatric prehospital research. *Pediatric emergency care*. 2010;26(10):773-777.
8. Browne LR, Shah MI, Studnek JR, Farrell BM, Mattrisch LM, Reynolds S, Ostermayer DG, Brousseau DC, Lerner EB. 2015 Pediatric Research Priorities in Prehospital Care. *Prehospital Emergency Care*. 2016;20(3):311-316.
9. Sayre MR, White LJ, Brown LH, McHenry SD, National EMSRAWT. The National EMS Research Agenda executive summary. Emergency Medical Services. *Ann Emerg Med*. 2002;40(6):636-643.
10. Institute of Medicine (U.S.). Committee on the Future of Emergency Care in the United States Health System. *Emergency Medical Services at the Crossroads*. Washington, D.C.: National Academies Press; 2007.
11. Lang ES, Spaite DW, Oliver ZJ, Gotschall CS, Swor RA, Dawson DE, Hunt RC. A National Model for Developing, Implementing, and Evaluating Evidence-based Guidelines for Prehospital Care. *Acad emerg med*. 2012;19(2):201-209.
12. Browne LR, Shah MI, Studnek JR, Ostermayer DG, Reynolds S, Guse CE, Brousseau DC, Lerner EB. Multicenter Evaluation of Prehospital Opioid Pain Management in Injured Children. *Prehosp Emerg Care*. 2016 Nov-Dec;20(6):759-767
13. Drayna PC, Browne LR, Guse CE, Brousseau DC, Lerner EB. Prehospital Pediatric Care: Opportunities for Training, Treatment, and Research. *Prehosp Emerg Care*. 2015 Jul-Sep;19(3):441-7
14. Kupas DF, Schenk E, Sholl JM, Kamin R. Characteristics of Statewide Protocols for Emergency Medical Services in the United States. *Prehosp Emerg Care*. 2015;19(2):292-301.
15. NASEMSO. Statewide Implementation of an Evidence-Based Guideline General Toolkit V2.1. In: US Department of Transportation National Highway Traffic Safety Administration, Services Office of Emergency Medical Services. eds: NASEMSO; 2014.
16. Bachmann DJ, Jamison NK, Martin A, Delgado J, Kman NE. Emergency Preparedness and Disaster Response: There's An App for That. *Prehosp Disaster Med*. 2015;30(5):486-490.
17. Committee on the Treatment of Cardiac Arrest: Current Status and Future Directions; Board on Health Sciences Policy; Institute of Medicine; Strategies to Improve Cardiac Arrest Survival: A Time to Act. Graham R, McCoy MA, Schultz AM, editors. Washington (DC): National Academies Press (US); 2015 Sep.
18. McGinnis KK. Rural and Frontier Emergency Medical Services Agenda for the Future. In: Association NRH, ed: Health Resources and Services Administration, Office of Rural Health Policy; 2004.
19. American College of Chest Physicians. Tobacco Dependence Treatment Toolkit. 2014; <http://tobaccodependence.chestnet.org>. Accessed September 29, 2016
20. Williams I, Mears G, Raisor C, Wilson J. An Emergency Medical Services Toolkit for Improving Systems of Care for Stroke in North Carolina. *Preventing chronic disease*. 2009;6(2):A67.

21. Centers for Bioterrorism Preparedness Program Pediatric Task Force, Pediatric Disaster Advisory Group, New York City Department of Health and Mental Hygiene Healthcare Emergency Preparedness Program. Pediatric Disaster Toolkit: Hospital Guidelines for Pediatrics During Disasters. 2008; 3rd:<https://www1.nyc.gov/assets/doh/downloads/pdf/bhpp/hepp-peds-childrenindisasters-010709.pdf>, 2016. Accessed September 16, 2016.
22. Health and Safety Institute. <http://www.hsi.com>. Accessed September 16, 2016
23. Hewes HA, Dai M, Mann NC, Baca T, Taillac P. Prehospital Pain Management: Disparity By Age and Race. *Prehosp Emerg Care* 2018 Mar-Apr;22(2):189-197.
24. Swor R, McEachin CM, Seguin D, Grall KH. Prehospital pain management in children suffering traumatic injury. *Prehosp Emerg Care*. 2005;9(1):40-43.
25. Hennes H, Kim MK, Pirrallo RG. Prehospital pain management: a comparison of providers' perceptions and practices. *Prehosp Emerg Care*. 2005;9(1):32-39.
26. Siriwardena AN, Shaw D, Bouliotis G. Exploratory cross-sectional study of factors associated with pre-hospital management of pain. *J Eval Clin Pract*. 2010;16(6):1269-1275.
27. Fullerton-Gleason L, Crandall C, Sklar DP. Prehospital administration of morphine for isolated extremity injuries: a change in protocol reduces time to medication. *Prehosp Emerg Care*. 2002;6(4):411-416.
28. Abbuhl FB, Reed DB. Time to analgesia for patients with painful extremity injuries transported to the emergency department by ambulance. *Prehosp Emerg Care*. 2003;7(4):445-447.
29. Sasson C, Forman J, Krass D, Macy M, Hegg AJ, McNally BF, Kellermann AL. A Qualitative Study to Understand Barriers to Implementation of National Guidelines for Prehospital Termination of Unsuccessful Resuscitation Efforts. *Prehosp Emerg Care*. 2010;14(2):250-258.
30. Taillac P. Utah State EMS Protocol Guideline. 2015; <https://health.utah.gov/ems/stateprotocolguidelines/>. Accessed September 3, 2016.
31. Neumar RW, Barnhart JM, Berg RA, Chan PS, Geocadin RG, Luepker RV, Newby LK, Sayre MR, Nichol G, American Heart Association Emergency Cardiovascular Care C, Council on Cardiopulmonary CCP, Resuscitation, Council on Clinical C, Council on E, Prevention, Council on Quality of C, Outcomes R, Advocacy Coordinating C. Implementation Strategies For Improving Survival After Out-of-Hospital Cardiac Arrest in the United States: Consensus Recommendations from the 2009 American Heart Association Cardiac Arrest Survival Summit. *Circulation*. 2011;123(24):2898-2910.
32. White M, Shellenbarger T. Harnessing the Power of Learning Management Systems: An E-Learning Approach for Professional Development. *J Nurses Prof Dev*. 2017;33(3):138-141.
33. Jaeger A, Dudley N, Holsti M, Sheng X, Gurley KL, Adalgais K. Impact of an Offline Pain Management Protocol on Prehospital Provider Self-Efficacy: A Randomized Trial. *Prehosp Emerg Care*. 2017;33(6):388-395.

34. Shaw EK, Howard J, West DR, Crabtree BF, Nease DE, Jr., Tutt B, Nutting PA. The role of the champion in primary care change efforts: from the State Networks of Colorado Ambulatory Practices and Partners (SNOCAP). *J Am Board Fam Med.* 2012;25(5):676-685.
35. Hysong SJ, Best RG, Pugh JA. Clinical practice guideline implementation strategy patterns in Veterans Affairs primary care clinics. *Health Serv Res.* 2007;42(1 Pt 1):84-103.
36. Ploeg J, Skelly J, Rowan M, Edwards N, Davies B, Grinspun D, Bajnok I, Downey A. The role of nursing best practice champions in diffusing practice guidelines: a mixed methods study. *Worldviews Evid Based Nurs.* 2010;7(4):238-251.
37. Passmore C, Dobbie AE, Parchman M, Tysinger J. Guidelines for constructing a survey. *Family medicine.* 2002;34(4):281-286.
38. Broadwater-Hollifield C, Gren LH, Porucznik CA, Youngquist ST, Sundwall DN, Madsen TE. Emergency physician knowledge of reimbursement rates associated with emergency medical care. *Am Journal Emerg Med.* 2014;32(6):498-506.