JACEP OPEN
JOURNAL OF THE AMERICAN COLLEGE OF EMERGENCY MEDICINE Open Access
A GLOBAL JOURNAL OF EMERGENCY MEDICINE

WILEY

ORIGINAL RESEARCH

Emergency Medical Services

Defining priorities for emergency medical services education research: A modified Delphi study

Scott Lancaster PhD, NRP[1] | William J. Leggio EdD, NRP[2] | Stephanie Ashford EdS, NRP[3] | Elliot Carhart EdD, NRP[4] | Kim D. McKenna PhD, NRP[5] | Remle P. Crowe PhD, NREMT[6] 🔗 🐦

[1]Cataldo Ambulance Service, Somerville, Massachusetts, USA

[2]Office of the Chief Medical Officer, Austin, Texas, USA

[3]St. Charles County Ambulance District, St. Peter's, Missouri, USA

[4]Department of Clinical Health Professions, Radford University, Roanoke, Virginia, USA

[5]Unaffiliated, Independent Researcher, St. Louis, Missouri, USA

[6]ESO, Inc., Austin, Texas, USA

Correspondence
Remle P. Crowe, PhD, NREMT, ESO, 11500 Alterra Parkway, Austin, TX 78758, USA.
Email: Remle.Crowe@eso.com

Abstract

Objective: As out-of-hospital medicine evolves, emergency medical services (EMS) education practices must also be updated to ensure that EMS professionals acquire and maintain the skills needed to best serve patients. We aimed to identify and rank the top 10 research priorities related to EMS education in the United States.

Methods: We conducted a convenience survey of EMS educators to identify challenges facing EMS education before leveraging a purposefully selected panel of EMS educators to prioritize research gaps through a modified Delphi approach. Data were collected electronically (March 2021–June 2021) over 4 survey rounds consisting of idea generation (Rounds 1 and 2), importance scoring (Round 3), and consensus ranking (Round 4). At the end of Round 4, composite scores were used to generate a list of 10 prioritized research gaps related to EMS education.

Results: In the pre-Delphi survey, 463 EMS educators identified 2055 challenges facing EMS education. We recruited 32 EMS education experts as Delphi panelists and 28 completed all 4 rounds. Panelists submitted 77 knowledge gaps. The top 10 knowledge gaps included defining competency of EMS learners and educators, association of curricula and accreditation requirements with real-world practice, the effects of diversity and cultural humility among educators and learners on equitable patient care, evidence-based teaching methods, and public perception of the EMS profession and education system.

Conclusions: Although 10 gaps were prioritized, panelists deemed all 77 gaps as having considerable importance for EMS education. This suite of knowledge gaps is intended to guide researchers and research-funding bodies for future resource allocation.

- -

1 | INTRODUCTION

1.1 | Background

As out-of-hospital medicine is constantly evolving, there is a need to continually evaluate and update emergency medical services (EMS) education practices to ensure that the EMS clinician workforce acquires and maintains the knowledge, skills, and abilities to deliver consistent, high-quality patient care. Initial EMS education has experienced an important period of reflection and change from the first Emergency Medical Technician (EMT)-Ambulance National Standard Curricula in 1971, to the National EMS Education and Practice Blueprint of 1993, to the National EMS Education Standards first published in 2009 and revised in 2021.[1,2] On a national level, continuing EMS education has also evolved from a prescriptive core refresher course to the more flexible National Continued Competency Program model allowing for customization to local operational needs.[3] Additionally, the COVID-19 pandemic brought many changes to the initial and ongoing education of EMS professionals, particularly around how education is delivered.[4] Despite these key changes and the critical role of education in the formation of EMS clinicians, there remains a paucity of research focused specifically on the field of EMS education and educators.

1.2 | Importance

An evidence-based approach to EMS education depends on a solid foundation of high-quality research. High-quality research requires funding sources, research expertise, and defined feasible research questions.[5] As funding and experienced researcher resources are often limited in the field of EMS education, having a common list of clearly articulated priorities is helpful to target and pool scarce resources.[6] Although efforts to focus research resources and activities for clinical research topics related to out-of-hospital care[7–10], a national consensus on priorities for research related to EMS education has not yet been established.

1.3 | Goals of this investigation

The objective of this study was to define and rank research priorities related to EMS education in the United States. These priorities are intended to guide and unify future research initiatives for effective use of existing resources to further the evidence base related to EMS education and the workforce of EMS educators.

2 | METHODS

2.1 | Study design and setting

This study consisted of 2 main steps. First, a qualitative approach was used to compile a list of challenges and opportunities in EMS education

The Bottom Line

Using a modified Delphi methodology, the authors had an expert panel identify priorities for research in emergency medical services (EMS) education. The top 5 in order of decreasing priority included the following: characteristics defining entry-level competency of the EMS professional, characteristics defining EMS educator competency, association of EMS initial education curriculum content with the current EMS evidence base/accepted standards of care, effects of diversity and cultural humility among EMS students/educators/professionals on equitable patient care, and presence and effects of implicit bias in EMS education delivery.

stemming from a broad convenience sample of EMS educators (pre-Delphi survey). Second, we recruited a panel of national subject matter experts to identify and rank the highest priorities for EMS education research using a modified Delphi approach. This study was approved by the Institutional Review Board (IRB2020-03) at Northern Essex Community College in Haverhill, MA. Participant consent was obtained through the electronic software used to collect data for this study before initiating the questionnaires.

2.2 | Pre-Delphi survey

Before initiating the modified Delphi process, we conducted an open convenience survey to EMS educators (providing initial education, continuing education, or both) to generate a list of opportunities and challenges in EMS education. The pre-Delphi survey specifically asked:

> "What are the top opportunities or challenges in EMS education? (Consider both initial education and continuing education of all levels.)"

The survey was promoted via social media and the National Association of EMS Educators membership. The survey was also sent to national EMS-related organizations and federal/state EMS partners with a request to participate and/or distribute. Additional pushes and reminder emails were left at the discretion of the organizations that helped distribute the message during the data collection period. Data were collected from September to October -2020.

The convenience survey contained programmed skip logic in the SurveyMonkey survey software (Momentive, Inc, San Mateo, CA) to determine eligibility and isolate responses to those of current or former EMS educators. Eligible participants were provided with open-end text boxes to enter up to 10 responses regarding top opportunities and challenges facing EMS education. Demographic characteristics were also collected via the survey instrument.

Four investigators (R.P.C., S.L., S.A., K.M.) conducted qualitative thematic analysis using an inductive approach to group themes and subthemes and remove duplicate concepts. Disagreements were resolved by a fifth author (W.L.). The final thematically grouped list resulting from the pre-Delphi survey then informed a framework for the first round of the electronic Delphi process.

2.3 | Modified Delphi panel selection and approach

We used a modified Delphi consensus approach to identify and prioritize gaps in research related to EMS education. We selected this approach based on its ability to effectively establish research agendas in other health care settings as well as EMS.[3,9–12] The modified Delphi involved a systematic 5-round process for idea generation, tabulation, evaluation, and ranking of proposed education research priorities.

We used purposeful selection to recruit national experts in EMS education through their involvement with national EMS and fire organizations. We sought to include a diverse range of background experiences, demographic characteristics, and practice settings. As such, the study investigators created a list of national EMS and fire organizations and sent emails requesting that these organizations nominate potential representing members to participate in the study. In an effort to improve representation in terms of practice setting and demographic characteristics, this selection was supplemented with respondents from the pre-Delphi survey who indicated a willingness to participate in further rounds of this research via an item in the initial survey. Delphi panels often involve between 10 and 50 participants and the literature supports that having more than 30 participants does not have a strong influence on the overall themes proposed.[11,12] As such we sought to recruit approximately 30 participants for Round 1 of the Delphi. Participation in the panel was voluntary, and personal information was not linked directly to survey responses to maintain confidentiality throughout each round.

2.4 | Modified Delphi data collection and analysis

All data were collected using the SurveyMonkey electronic platform (Momentive Inc, San Mateo, CA). Data collection for this 4-round process was conducted from March 2021 through June 2021. Data analyses were performed using Stata/IC version 15.1 (StataCorp LLC, College Station, TX).

Delphi Round 1:

In the initial round of idea generation, panelists were asked:

> "What are the top 3 knowledge gaps involving EMS education that should be priorities for future research? As you respond, consider both initial and continuing education."

When answering this question, participants were asked to consider the thematically grouped list of opportunities and challenges in EMS education identified through the pre-Delphi survey. All responses from Round 1 were collated and members of the study team performed thematic analysis. Unique themes were identified using a grounded theory approach, and thematically equivalent responses were collapsed under the same theme. Two investigators (R.P.C., S.A.) independently performed initial thematic analysis. The themes were further refined by 2 additional investigators (K.M., S.L.) and approved through consensus of all 4 reviewers.

Delphi Round 2:

Panelists were presented with the complete list of knowledge gaps related to EMS education research derived from the thematic analysis in Round 1. In Round 2, panelists were then asked:

> "What knowledge gaps involving EMS education that should be priorities for future research are missing from the list?"

All additional responses were reviewed by the 4 investigators who conducted the first round of thematic analysis. Thematically equivalent responses were again grouped, and all new themes were added to the list of themes from Round 1.

Delphi Round 3:

Panelists were presented with the complete list of themes derived from responses in Rounds 1 and 2. In this third round, participants were asked to rate the importance of each knowledge gap. A 5-point Likert-type scale was used: 1 – "not at all important," 2 – "minimal importance/negligible," 3 – "moderate importance but still a factor," 4 – "considerable importance," 5 – "very important/critical." Next, mean scores for each knowledge gap were calculated. We then identified the 30 gaps with the highest mean importance scores.

Delphi Round 4:

Panelists were presented with the preliminary consensus list of the top 30 prioritized gaps compiled using the mean importance scores from Round 3. In this fourth round, panelists were asked to rank order the top 10 most important gaps. The ranks entered by panelists were translated to scores by assigning points for each rank. For example, a rank of 1 (most important) was assigned 10 points and a rank of 10 (least important) was assigned 1 point. For each knowledge gap, the total composite score was calculated by summing the scores of all panelists. The 10 gaps with the highest composite scores were compiled into the final list.

3 | RESULTS

3.1 | Pre-Delphi survey

A total of 463 EMS educators responded to the pre-Delphi convenience survey. Demographic characteristics of respondents are summarized in Appendix SA1. In total, respondents provided 2055 submissions for the top opportunities and challenges in EMS education. Qualitative analysis identified 8 themes in the pre-Delphi survey: (1) Assessment/Feedback/Verifying Competency, (2) Curriculum

TABLE 1 Modified Delphi expert panel demographic characteristics (N = 32)

	n	%
Age, years		
25–34	1	3.1%
35–44	8	25.0%
45–54	9	28.1%
55–64	12	37.5%
65+	2	6.3%
Gender		
Female	10	31.3%
Male	20	62.5%
Prefer not to answer/missing	2	6.3%
Ethnicity		
Hispanic or Latino	1	3.1%
Not Hispanic or Latino	31	96.9%
Race		
White/Caucasian	26	81.3%
Black/African-American	1	3.1%
Asian	1	3.1%
Multiracial or other race	4	12.5%
Highest education completed		
High school/high school equivalent	0	0.0%
Associate's degree (AAS, AS, AA, etc.)	2	6.3%
Bachelor's degree (BS, BA, BPH, etc.)	6	18.8%
Master's degree (MS, MA, M.Ed, MBA, MPH, etc.)	14	43.8%
Doctoral degree (MD, DO, JD, PhD, Ed.D, DBA, etc.)	10	31.3%
Currently working as EMS educator		
Yes	28	87.5%
No	4	12.5%
Type of EMS education instructed (N = 28)		
Initial EMS education	5	17.9%
Continuing EMS education	3	10.7%
Both initial and continuing EMS education	18	64.3%
Other	2	7.1%
Clinician levels instructed[a] (N = 28)		
EMR	10	35.7%
EMT	21	75.0%
Advanced EMT	13	46.4%
Paramedic	26	92.9%
Nurse	5	17.9%
Other	10	35.7%
Education setting (N = 28)		
2-year college	12	42.9%
4-year college	6	21.4%
EMS agency	2	7.1%

(Continues)

TABLE 1 (Continued)

	n	%
Fire service	2	7.1%
Hospital	1	3.6%
Other	5	17.9%
Geographic region (N = 28)		
West	8	28.6%
Midwest	8	28.6%
South	7	25.0%
East	5	17.9%
Community size (N = 28)		
Rural (<25,000 people)	2	7.1%
Suburban/Urban (25,000+ people)	26	92.9%

[a]Participants were able to select more than 1 option (percentages will not total 100%).
Abbreviations: EMR, emergency medical responder; EMT, emergency medical technician.

Content, (3) Curriculum Delivery, (4) Educators, (5) Funding/Resources, (6) Profession, (7) Regulatory, and (8) Students. Subthemes were also identified under each of the main themes. For example, under curriculum delivery, the change in modality from in-person to online education was cited along with a need for greater standardization and methods to maintain student engagement. Meanwhile, subthemes for concerns related to burnout appeared for both students and educators. A need to increase diversity and inclusion was also noted for the EMS educator workforce as well as among EMS students. Regulatory challenges included available resources to meet accreditation and other requirements along with the effects of degree requirements for initial education programs. The complete list of themes and subthemes from the pre-Delphi survey was presented to the expert Delphi panel to stimulate idea generation during Round 1 (Appendix SA2).

3.2 | Delphi participant characteristics

Thirty-two EMS educators were recruited for the Delphi panel (Appendix SA3). Most panelists reported currently working or volunteering as an EMS educator (82.4%) and the others all formerly served as EMS educators. Approximately two thirds of panelists were male (64.7%) and most self-reported their race as White/Caucasian (85.3%). Nearly half reported master's degree (44.1%) as the highest level of education completed and 29.4% reported completing a doctoral degree. Nearly two thirds of those currently serving as EMS educators reported instructing both initial and continuing EMS education (64.3%). The most common practice setting was a 2-year college program (42.9%) and most (92.9%) reported working in suburban/urban settings (Table 1).

TABLE 2 Gaps in research related to EMS education submitted during idea generation (Delphi Rounds 1 and 2)

Theme: Competency – Assessment/Feedback/Verification

- Characteristics defining entry-level competency of the EMS professional
- Characteristics defining EMS psychomotor skill competency
- Characteristics defining continued competency of the EMS professional
- Effective methods for assessing competency in the affective domain
- Association between EMS student performance on psychomotor assessments and entry-level competency
- Association between EMS student performance and performance on national assessments/exams
- Association between EMS student performance on national assessments/exams and performance in the field

Theme: Curriculum content

- Effective methods for teaching cultural humility in EMS
- Association of cultural humility education with equitable patient care
- Effective methods for teaching the affective domain in EMS
- Effective methods for teaching therapeutic communication in EMS
- Association between education related to therapeutic communication and incidence of secondary stress syndromes (eg, burnout, compassion fatigue, PTSD)
- Effective methods for teaching ethics in EMS
- Association of EMS curriculum content with real-world practice and scope of care (including non-ambulance work settings)
- Association of EMS initial education curriculum content with the current EMS evidence base/accepted standards of care
- Association of EMS continuing education content with real-world practice and scope of care
- Depth and breadth of EMS education related to documentation
- Depth and breadth of EMS education related to research
- Depth and breadth of EMS education related to patients with behavioral health concerns
- Depth and breadth of EMS education related to pathophysiology
- Depth and breadth of EMS education related to non-life-threatening illnesses or injuries and triage to appropriate destination or on scene care
- Depth and breadth of EMS education related to specific populations (eg, geriatric, pediatric, special needs)
- Depth and breadth of EMS education related to quality improvement

Theme: Curriculum delivery

- Ideal length for didactic, clinical, and field internship associated with entry-level competency
- Association between EMS educational course time constraints and student success
- Association between EMS student skill performance during education program and clinical performance after graduation
- Association of EMS skill lab activities with performance during encounters with live patients
- Use of evidence-based EMS teaching methods
- Association of inquiry-based teaching with student performance
- Effective methods for EMS course instructional design
- Effective methods for creating assessments/exams for EMS students
- Effects of online versus in-person education on EMS student performance
- Effective instructional methods for delivering continuing education
- Effective teaching methods for clinical experiences
- Characteristics and frequency of live patient encounters during EMS education programs
- Characteristics of high-quality effective simulations in EMS education
- Effects of classroom simulations on EMS student performance in the field
- Presence and effects of diversity and cultural humility in EMS classroom materials and lab environment (e.g., textbooks, presentations, patient simulations)
- Presence and effects of implicit bias in EMS education delivery
- Effects of incorporating EMS medical directors in didactic instruction
- Factors associated with engagement in continuing education

Theme: Funding/resources

- Cost and accessibility of EMS education
- Access to computers and internet
- Association of course availability and costs with recruitment and retention of EMS professionals
- Knowledge and practices in EMS education programs regarding applying for grants

(Continues)

3.3 | Delphi results

Of the 32 invited subject matter experts who participated in Rounds 1 and 2 of the modified Delphi survey, 30 (94%) participated in Round 3, and 29 (91%) participated in Round 4. All panelists participated in Rounds 1–2; however, panelists who did not respond in Round 3 were not eligible to participate in the subsequent round.

When asked to report the top knowledge gaps that should be priorities for research related to EMS education, in the idea generation surveys (Rounds 1 and 2), panelists submitted a total of 77

TABLE 2 (Continued)

Theme: Educators

- Presence and effects of diversity and cultural humility among EMS educators
- Characteristics defining EMS educator competency
- Characteristics defining EMS preceptor competency
- Association of EMS educator knowledge, skills, and abilities with student outcomes
- Characteristics of EMS educator/program director workload
- Factors associated with EMS educator/program director turnover
- Factors associated with recruitment and retention of EMS educators
- Effects of turnover among EMS educators on patient care
- Association of compensation with recruitment and retention of EMS educators
- Presence and effects of or primary and secondary stress syndromes (eg, compassion fatigue, burnout, PTSD) among EMS preceptors and educators
- Symptoms and mitigation strategies for primary and secondary stress syndromes (eg, compassion fatigue, burnout, PTSD) among EMS educators

Theme: Students

- Effective strategies for increasing diversity and cultural humility among EMS students
- Effects of diversity and cultural humility among EMS students on equitable patient care
- Presence and effects of primary and secondary stress syndromes (eg, compassion fatigue, burnout, PTSD) among EMS students
- Factors associated with recruitment and retention of EMS students
- Association of EMS clinician compensation with recruitment and retention of EMS students
- Symptoms and mitigation strategies for primary and secondary stress syndromes (eg, compassion fatigue, burnout, PTSD) among EMS students

Theme: EMS profession

- Presence and effects of interagency communication in EMS
- Presence and effects of interagency training in EMS
- Presence and effects of diversity and cultural humility in EMS
- Characteristics defining the identity of the EMS professional
- Characteristics defining professionalism in EMS
- Characteristics and effects of on-the-job training in EMS
- Effects of volunteerism in EMS on patient care
- Factors related to failure to maintain EMS certification/licensure
- Public perception of EMS profession and EMS education system

Theme: Regulatory

- Association of EMS degree requirements with compensation and recruitment/retention
- Association of EMS degree requirements with patient outcomes
- Association of EMS program accreditation with student performance on national assessments
- Association of EMS program accreditation with EMS clinician clinical performance after graduation.
- Association of EMS program accreditation standards with real-world EMS practice

Abbreviations: EMS, emergency medical services; PTSD, posttraumatic stress disorder.

knowledge gaps after qualitative analysis to condense themes and remove duplicate topics (Table 2). After Round 3, the 30 gaps with the highest importance scores were identified (Table 3). The top scoring gap in Round 3 pertained to the effects of diversity and cultural humility among EMS students, educators, and professionals on equitable patient care. Characteristics related to defining competency among EMS professionals and educators followed closely in mean importance scores. Meanwhile the 2 lowest scoring gaps in the top 30 pertained to factors associated with recruitment and retention of EMS educators and students. Of note, all gaps in this round had a mean importance score of 3.9 or higher indicating considerable or critical importance of these themes.

Finally, at the end of Round 4, the prioritized list of the top 10 knowledge gaps for future research related to EMS education was identified (Table 4). The highest number of total points was assigned to characteristics defining entry-level competency of the EMS professional, closely followed by characteristics defining competency of EMS educators. The effects of diversity and cultural humility ranked fourth on the

final list of top 10 priorities. Rounding up the top 10 priorities was the association of EMS initial education program accreditation standards with real-world EMS practice and clinical performance.

3.4 | Limitations

Although we leveraged a modified-Delphi process that has been frequently used with success to define research priorities while seeking to reduce within-group bias through rounds of asynchronous responses, the process we used has several limitations. First, it remains possible that key themes were missed as this process is panel dependent. Although the expert panel was purposefully recruited to represent a diverse range of educator experiences, including initial and continuing education, the panelists remained a convenience sampling of EMS education experts from the United States. Although the characteristics of the expert panel were similar to those of the convenience sample participating in the pre-Delphi survey, participants in this study mainly

TABLE 3 Mean importance scores for top 30 research gaps (Delphi Round 3)

Gap	Mean Importance Score
Effects of diversity and cultural humility among EMS students, educators, and professionals on equitable patient care	4.48
Characteristics defining entry-level competency of the EMS professional	4.41
Characteristics defining EMS educator competency	4.38
Presence and effects of implicit bias in EMS education delivery	4.34
Association of EMS initial education curriculum content with the current EMS evidence base/accepted standards of care	4.31
Depth and breadth of EMS education related to patients with behavioral health concerns	4.28
Use of evidence-based EMS teaching methods and student outcomes	4.28
Characteristics defining EMS field preceptor competency	4.28
Effective methods for teaching and assess competency in the affective domain in EMS	4.24
Association of EMS curriculum content with real-world practice and scope of care (including non-ambulance work settings)	4.24
Effective strategies for increasing diversity and cultural humility among EMS students	4.24
Student and patient outcomes related to the affective domain in EMS education	4.21
Association of EMS educator knowledge, skills, and abilities with student outcomes	4.21
Effective methods for teaching cultural humility in EMS	4.17
Association of EMS continuing education content with real-world practice and scope of care	4.17
Presence and effects of diversity and cultural humility in EMS classroom materials and lab environment (e.g., textbooks, presentations, patient simulations)	4.14
Characteristics defining professionalism in EMS	4.14
Public perception of the EMS profession and EMS education system	4.14
Association of EMS program accreditation standards with real-world EMS practice and clinical performance	4.14
Characteristics defining continued competency of the EMS professional	4.1
Factors associated with EMS educator/program director turnover	4.1
Association of EMS skill lab activities with performance during encounters with live patients	4.07
Characteristics defining EMS psychomotor skill competency	4.03
Effective methods for creating assessments/exams for EMS students	4.03
Characteristics and frequency of live patient encounters during EMS education programs	4.03
Presence and effects of primary and secondary stress syndromes (eg, compassion fatigue, burnout, PTSD) among EMS students	4.00
Effects of classroom simulations on EMS student performance	3.97
Characteristics of EMS educator/program director workload	3.97
Factors associated with recruitment and retention of EMS educators	3.97
Factors associated with recruitment and retention of EMS students	3.93

Abbreviations: EMS, emergency medical services; PTSD, posttraumatic stress disorder.

represented urban settings and had experience teaching at the EMT and paramedic levels. We did not further distinguish additional granularity in educational practice settings among those teaching in urban settings (eg, large inner-city programs). Further, the survey only collected data regarding the current practice setting of participants and may not have captured relevant prior experience in different practice settings. Thus, potential remains for underrepresentation of important EMS education research topics based on education setting or other characteristics. Additionally, although all participants contributed gaps in the idea generation rounds of this study, not all participants completed the final rounds of the modified Delphi process resulting in potential response bias.

It is also important to note this study occurred during the COVID-19 pandemic, and related events may have affected the availability of EMS educators to participate in the study and influenced perceptions related to the identified gaps. First, many educators likely experienced shifts in workload as materials originally planned for in-person classroom instruction needed to be modified for online delivery. This increased workload and potential fatigue related to online platforms may have resulted in a lower response than would have been received before the pandemic. Additionally, social distancing measures and local policies may have led to greater emphasis and perceived importance of virtual curriculum delivery methods and challenges related to lack of in-person communication or access to live patients. Nevertheless,

8 of 10 | WILEY JACEP OPEN
JOURNAL OF THE AMERICAN COLLEGE OF EMERGENCY PHYSICIANS Open Access
A GLOBAL JOURNAL OF EMERGENCY MEDICINE

LANCASTER ET AL.

TABLE 4 Top 10 prioritized research gaps related to EMS education (Delphi Round 4)

Rank	Research priority	Total points
1	Characteristics defining entry-level competency of the EMS professional	138
2	Characteristics defining EMS educator competency	131
3	Association of EMS initial education curriculum content with the current EMS evidence base/accepted standards of care	119
4	Effects of diversity and cultural humility among EMS students, educators, and professionals on equitable patient care	103
5	Presence and effects of implicit bias in EMS education delivery	89
6	Use of evidence-based EMS teaching methods	82
7	Depth and breadth of EMS education related to patients with behavioral health concerns	62
8	Public perception of the EMS profession and EMS education system	59
9	Effective methods for teaching the affective domain in EMS	52
10	Association of EMS program accreditation standards with real-world EMS practice and clinical performance	47

Abbreviation: EMS, emergency medical services.

the changes introduced during the early phases of the pandemic have likely resulted in long-lasting changes to curriculum delivery and support further research related to the gaps identified by this panel related to virtual education methods.

4 | DISCUSSION

Looking forward, *EMS Agenda 2050* cited EMS education as the foundation of empowerment and enrichment for EMS professionals to provide people-centered care, which will undoubtedly require evidence-based approaches to evaluating challenges and updating education practices.[13] By leveraging a panel of EMS education subject matter experts, we used a modified Delphi process to distill the top 10 research priorities related to EMS education, intended to guide future work. These top 10 priorities included defining competency for EMS professionals and educators, the association of education curricula with real-world practice, effects of diversity and cultural humility on equitable patient care, concerns related to implicit bias in education delivery, use of evidence-based teaching methods, education related specifically to patients with behavioral health concerns, public perception of EMS and the EMS education system, methods for teaching the affective domain, and the association of EMS program accreditation with real-world practice and clinical performance. Effectively addressing these challenges necessitates understanding gaps in related knowledge and purposefully targeting research resources to help build the evidence base to fill these gaps.

Consistent with previously identified themes in seminal national documents more than 2 decades ago, 5 of the top 10 knowledge gaps (priorities 1, 3, 6, 9, and 10) related to the association between EMS educational program curricula, education methods, and real-world practice.[1,5,14] Defining entry-level competency of the EMS professional was the highest ranked gap and remains the cornerstone needed to evaluate how effectively EMS education programs prepare EMS professionals for real-world practice. Unfortunately, the knowledge and skillset expected of EMS professionals at each level continue to vary across the country as a lack of consensus regarding entry-level competency persists.[15] The *EMS Education Agenda* identified national EMS program accreditation as a means of ensuring minimum program requirements at all EMS levels.[1] At the time of writing, accreditation has been implemented on a national level only for initial education programs at the paramedic level. Moreover, access to accredited paramedic education programs remains unequal, particularly for those living in rural areas, though other education deserts remain even within urban settings.[16] Areas with noted health care professional shortages and those without access to a trauma center or teaching hospital were also less likely to have an accredited paramedic education program.[16] Research quantifying the effects of accreditation and its link to real-world performance is key for understanding the value of full implementation of national EMS program accreditation at all levels.

Additionally, priorities within the top 10 included specific instruction methods and content. For example, priority 6 related to the use of evidence based-teaching methods, whereas priority 9 specifically related to how to effectively teach the affective domain. The emphasis related to the affective domain is consistent with the vision laid forth for people-centered care in *EMS Agenda 2050* and a 2021 position statement from the National Association of EMS Physicians encouraging EMS curricula to extend beyond technical skills.[13,17] Meanwhile, priority 7 highlighted a need for greater focus on EMS education related to patients with behavioral health concerns. This finding is supported by the most recent advanced life support practice analysis by the National Registry, which found that behavioral/psychiatric disorders represented the second most frequent primary or secondary impression in children and the fourth for adults.[18] Further, in a statewide analysis, Fishe et al. identified a need for increased EMS training related to behavioral emergencies among children.[19] Although there is general consensus regarding a need for greater education related to patients with behavioral emergencies, the balance of content and implementation would benefit from additional research.

Capabilities of the EMS educator workforce were identified as the second highest research priority (priority 2). Educator attributes

are linked to preparedness and success of EMS students on national exams.[20–22] Nevertheless, the education and performance of EMS educators are variable as there is no agreed-upon set of standard requirements for functioning in this role. Solutions to create standardization around competency requirements and evaluation for EMS educators have been proposed, but some are dated, and research into the efficacy of these approaches is limited.[23,24]

Another key theme among the highest ranked knowledge gaps was diversity, equity, access, and inclusion (priorities 4 and 5). A growing body of literature has highlighted gender and racial inequities in prehospital care, including disparities in pain management, stroke assessment, and management of acute coronary syndrome.[25–28] Increasing diversity within the EMS workforce represents an important means for reducing inequities in EMS medical care. The diversity of newly nationally certified EMS clinicians has been relatively stagnant for more than a decade, and surveys suggest limited diversity among EMS educators and training officers.[29–32] Research is needed to identify and overcome barriers, including implicit biases within education programs and assessments, recruitment for underrepresented groups in EMS, and developing effective retention strategies.

The theme of public perception of the EMS profession and education system ranked in the top 10 knowledge gaps (priority 8). Previous work has highlighted gaps in public perception, with much of the public unaware of the differences in training and scope of care provided by EMTs versus paramedics.[33] Much public knowledge about EMS has been introduced through popular culture and media productions, which may generate unrealistic expectations and stereotypes. The education system has a role in defining the professional identity of EMS and has important implications for public perception, funding, and personnel recruitment.

Although this study identified a list of the top 10 prioritized gaps for EMS education research, the challenges associated with performing this research remain. The capacity for ongoing EMS education research is reliant in part on a small number of prepared researchers within the field to perform such work. There is a pressing need to develop EMS educators who are trained to perform and who have the support to conduct high-quality, methodologically sound research. The *EMS Agenda for the Future* further highlighted the need for incorporating research-oriented learning objectives into EMS curricula.[14] Making research a part of early and ongoing EMS education, and creating EMS research career paths, are needed to promote investigators from within the field.

In summary, using a modified Delphi approach, this study leveraged an expert panel of EMS educators to prioritize research gaps for EMS education in the United States. A total of 77 knowledge gaps were identified, and a list of the top 10 research priorities for EMS education was generated. The top 10 priorities included themes related to defining learner and educator competency, linking curricula to real-world practice, the effects of diversity, equity and inclusion among students and educators, use of evidence-based teaching methods, and public perception of the EMS profession and education. Nevertheless, it should be noted that the scoring differences used to rank priorities were small, reflecting considerable importance among all gaps identified and worthiness for resource allocation in future research endeavors. These priorities are intended to guide researchers and research-funding bodies to unify efforts for more effective use of resources and research capacity with the profession of EMS education.

ORCID

Remle P. Crowe PhD, NREMT https://orcid.org/0000-0001-9733-9294

TWITTER

Remle P. Crowe PhD, NREMT https://twitter.com/@rpcrowe

REFERENCES

1. National Highway Traffic Safety Administration. *EMS Education Agenda for the Future: A Systems Approach.* Accessed September 23, 2022. https://www.ems.gov/pdf/education/EMS-Education-for-the-Future-A-Systems-Approach/EMS_Education_Agenda.pdf
2. National Highway Traffic Safety Administration. *2021 National Emergency Medical Services Education Standards.* Accessed September 2, 2022. https://www.ems.gov/pdf/EMS_Education_Standards_2021_v22.pdf
3. The National Registry of Emergency Medical Technicians. National Continued Competency Program. Accessed June 27, 2022. https://www.nremt.org/Document/nccp
4. Cash RE, Leggio WJ, Powell JR, et al. Emergency medical services education research priorities during COVID-19: a modified Delphi study. *JACEP Open.* 2021;2(4):e12543.
5. Sayre M, White L, Brown L, McHenry S. National EMS research agenda. *Prehosp Emerg Care.* 2001;6:S1-43.
6. Ball MT, Powell JR, Collard L, York DK, Panchal AR. Administrative and educational characteristics of paramedic programs in the United States. *Prehosp Disaster Med.* 2022;37(2):152-156.
7. Sayre MR, White LJ, Brown LH, McHenry SD. The National EMS research strategic plan. *Prehosp Emerg Care.* 2005;9(3):255-266.
8. Maio RF, Garrison HG, Spaite DW, et al. Emergency medical services outcomes project I (EMSOP I): prioritizing conditions for outcomes research. *Ann Emerg Med.* Apr 1999;33(4):423-432.
9. Foltin GL, Dayan P, Tunik M, et al. Priorities for pediatric prehospital research. *Pediatr Emerg Care.* 2010;26(10):773-777.

10. Browne LR, Shah MI, Studnek JR, et al. 2015 pediatric research priorities in prehospital care. *Prehosp Emerg Care.* 2016;20(3):311-316.

11. Keeney S, Hasson F, McKenna H. *The Delphi Technique In Nursing and Health Research.* Wiley-Blackwell; 2011.

12. Akins RB, Tolson H, Cole BR. Stability of response characteristics of a Delphi panel: application of bootstrap data expansion. *BMC Medical Research Methodology.* 2005;5(1):37. https://doi.org/10.1186/1471-2288-5-37

13. EMS Agenda 2050: A People-Centered Vision for the Future of Emergency Medical Services. *National Highway Traffic Safety Administration;* 2019.

14. National Highway Traffic Safety Administration. Emergency Medical Services: Agenda for the Future; 1996

15. The National Registry of Emergency Medical Technicians. *2014 National EMS Practice Analysis.*

16. Cash RE, Clay CE, Leggio WJ, Camargo CA. Geographic distribution of accredited paramedic education programs in the United States. *Prehosp Emerg Care.* 2022;26(1):93-101.

17. Leggio WJ, Grawey T, Stilley J, Dorsett M. EMS curriculum should educate beyond a technical scope of practice: position statement and resource document. *Prehosp Emerg Care.* 2021;25(5):724-729.

18. Panchal AR, Rivard MK, Cash RE, et al. Methods and implementation of the 2019 EMS practice analysis. *Prehosp Emerg Care.* 2022;26(2):212-222.

19. Fishe JN, Lynch S. Pediatric behavioral health-related EMS encounters: a statewide analysis. *Prehosp Emerg Care.* 2019;23(5):654-662.

20. Russ-Eft DF, Dickison PD, Levine R. Instructor quality affecting emergency medical technician (EMT) preparedness: a LEADS project. *Int J Train Dev.* 2005;9(4):256-270.

21. Margolis GS, Studnek JR, Fernandez AR, Mistovich J. Strategies of high-performing EMT-basic educational programs. *Prehosp Emerg Care.* 2008;12(2):206-211.

22. Russ-Eft DF, Dickison P, Levine R. Taking the pulse of training transfer: instructor quality and EMT certification examination results. *Hum Resour Dev Q.* 2010;21(3):291-306. doi: 10.1002/hrdq.20052

23. National Association of EMS Educators USDoT, U.S. Department of Health and Human Services. *2002 National Guidelines for Educating EMS Instructors.* Accessed September 1, 2022. https://one.nhtsa.gov/people/injury/ems/instructor/instructor_ems/2002_national_guidelines.htm

24. National Association of State EMS Officials. *EMS instructor qualifications: a template to assist states with implementing the EMS education agenda for the future: a systems approach.* Accessed September 1, 2022. https://nasemso.org/wp-content/uploads/EMS-Instructor-Qualifications-Template.pdf

25. Hewes HA, Dai M, Mann NC, Baca T, Taillac P. Prehospital pain management: disparity by age and race. *Prehosp Emerg Care.* 2018;22(2):189-197.

26. Govindarajan P, Friedman BT, Delgadillo JQ, et al. Race and sex disparities in prehospital recognition of acute stroke. *Acad Emerg Med.* 2015;22(3):264-372.

27. Lewis JF, Zeger SL, Li X, et al. Gender differences in the quality of EMS care nationwide for chest pain and out-of-hospital cardiac arrest. *Women's Health Issues.* 2019;29(2):116-124.

28. Farcas AM, Joiner AP, Rudman JS, et al. Disparities in emergency medical services care delivery in the United States: a scoping review. *Prehosp Emerg Care.* 2022:1-14. https://doi.org/10.1080/10903127.2022.2142344

29. Crowe RP, Krebs W, Cash RE, Rivard MK, Lincoln EW, Panchal AR. Females and minority racial/ethnic groups remain underrepresented in emergency medical services: a ten-year assessment, 2008–2017. *Prehosp Emerg Care.* 2020;24(2):180-187.

30. Ruple JA, Frazer GH, Hsieh AB, Bake W, Freel J. The state of EMS education research project. *Prehosp Emerg Care.* 2005;9(2):203-212.

31. Bentley MA, Eggerichs-Purcell JJ, Brown WE, Wagoner R, Gibson GC, Sahni R. A national assessment of the roles and responsibilities of training officers. *Prehosp Emerg Care.* 2013;17(3):373-378.

32. Rudman JS, Farcas A, Salazar GA, et al. Diversity, equity, and inclusion in the United States emergency medical services workforce: a scoping review. *Prehosp Emerg Care.* 2022:1-13. https://doi.org/10.1080/10903127.2022.2130485

33. Crowe RP, Levine R, Rodriguez S, Larrimore AD, Pirrallo RG. Public perception of emergency medical services in the United States. *Prehosp Disaster Med.* 2016;31(S1):S112-s117.

AUTHOR BIOGRAPHY

Scott Lancaster, PhD, NRP, is the Director of Operations for Cataldo Ambulance Service in Sommerville, Massachusetts and an Adjunct Assistant Professor for the Online Emergency Medical Care Degree Program at Eastern Kentucky University.

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.