PCRF 2020 RESEARCH ABSTRACTS

EMS World presents the latest investigations curated by the Prehospital Care Research Forum

Established in 1992, the Prehospital Care Research Forum (PCRF) is dedicated to the promotion, creation, and dissemination of prehospital research. In this, our fourth year of partnership with EMS World, we are proud to feature selected abstracts from the International Scientific Symposium, to be held during EMS World Expo Virtual, Sept. 14–18, 2020 (www.emsworldexpo.com). Join us to find out which of these abstracts will be named Best Research in EMS!

The PCRF is proud to highlight the work of EMS providers who advance the profession with science. We believe it is the responsibility of emergency medical professionals worldwide to practice evidence-based medicine and develop a body of evidence that examines prehospital emergency care.

Each year we make research more accessible and understandable through the publication of these abstracts. We hope you will join us in creating a culture of science in EMS by participating in our symposia, workshops, and monthly journal clubs.

On the second Monday of every month at 1 p.m. Eastern, Dr. Remle Crowe facilitates a clinical podcast focused on the content of Dr. Tony Fernandez’s “PCRF Journal Club” (Journal Watch) column in EMS World Magazine. On the fourth Friday of every month, we host a joint podcast with the National Association of EMS Educators during which Dr. Megan Corry focuses on the “PCRF Research Alert” articles she authors for EMSWorld.com. Register for all podcasts at www.prehospitalcare.org.

We would like to thank our volunteer board of advisors and 42 associates. Without the dedication of these volunteers, none of this would be possible. In addition to the hard work of many people, much of our success can be attributed to the commitment of organizations dedicated to research in prehospital care. I would like to acknowledge our strategic partner, EMS World; education partner, the National Association of EMS Educators; founder, iSimulate; benefactor, ESO Solutions; partners, FirstWatch, Limmer Creative, and Jones & Bartlett Learning; and friends, Fisdap and Weber State University. The generous support of these fine organizations and our affiliation with the National Association of EMTs and the International Academies of Emergency Dispatch are what enable the PCRF to fulfill our mission.

The future of EMS depends on the quality and quantity of research we produce. We invite you to take a stand, conduct research in your community, and submit it in 2021 for the greater benefit of EMS. Our PCRF mentors are standing by to assist you.

Sincerely,

David Page, MS, NRP
Director, Prehospital Care Research Forum at UCLA
Assessing the Impact of the COVID-19 Pandemic on EMS Transport Patterns for Patients with Suspected Acute Coronary Syndrome

Author: Remle Crowe, PhD, NREMT
Associate Authors: Antonio Fernandez, PhD, NRP; Scott Bourn, PhD, RN; J. Brent Myers, MD, MPH

Introduction: During the first months of the COVID-19 pandemic, ED visits for time-sensitive conditions including acute coronary syndrome (ACS) declined. It is unknown whether EMS encounters resulting in nontransport for time-sensitive conditions have changed during the pandemic and whether patterns differ by patient characteristics.

Objective: Describe changes in EMS use and transport patterns for patients with suspected ACS during the COVID-19 pandemic compared to a control period one year prior.

Methods: This retrospective analysis used prehospital records from the ESO Data Collaborative. The authors compared responses for patients with suspected ACS from the first three months of the pandemic (study period: March 1–May 31, 2020) to the previous year (control period: March 1–May 31, 2019). Only agencies contributing records in both time periods were included. The proportion of EMS responses resulting in nontransport were compared using chi-square tests. Multivariable logistic regression models were used to assess odds of transport for patients with suspected ACS during each period controlling for age, sex, and race/ethnicity. Adjusted odds ratios (aOR) and 95% confidence intervals (95% CI) are reported.

Results: Records from 1,241 agencies were included. Total 9-1-1 call volume decreased 5% between the control period (1,131,399) and study period (1,071,868). Nontransports increased from 17% to 19% (p < 0.001). The percentages of patients recorded as African-American/Black (30%, 326 vs. 36%, 410) and Asian/Pacific Islander (2%, 22 vs. 4%, 47) were higher after reopening, while those recorded as Hispanic/Latino (16%, 244 vs. 22%, 339) or other (16%, 244 vs. 22%, 339) were higher after reopening. Median age before reopening (69; interquartile range [IQR] 55–81) was significantly (p < 0.01) higher than after reopening (64.5; IQR 50–78). More patients were less than 40 years old after reopening (18%, 326 vs. 24%, 421, p < 0.001). The percentages of patients recorded as African-American/Black (29%, 439 vs. 28%, 426) or white (53%, 806 vs. 46%, 706) were lower after reopening, while those recorded as Hispanic/Latino (16%, 244 vs. 22%, 339) or other (3%, 43 vs. 4%, 60) were higher after reopening (p < 0.001). There was no significant difference noted in patient sex (p = 0.73). Slightly more patients were transported from healthcare facilities (5%, 78 vs. 7%, 100) and homes/residences (53%, 814 vs. 55%, 839) after reopening, while slightly fewer were transported from nursing homes/assisted living facilities (33%, 515 vs. 32%, 479), police/jail (2%, 24 vs. 1%, 15), or other (2%, 20 vs. 1%, 15). Patient transports were similar from public places (5%, 81 vs. 5%, 74; p = 0.04).

Conclusions: EMS encounters for suspected ACS decreased for March, April, and May during the COVID-19 pandemic compared to a year earlier. More encounters resulted in nontransport, even for patients with suspected ACS. Future work could explore root causes of observed disparities in nontransport by race/ethnicity and gender.

A Comparison of EMS Patients Diagnosed With COVID-19 Before and After Reopening in the United States of America

Author: Antonio Fernandez, PhD, NRP
Associate Authors: Remle Crowe, PhD, NREMT; Scott Bourn, PhD, RN; J. Brent Myers, MD, MPH, FACEP

Introduction: Demographic shifts in COVID-19-diagnosed patients following the easing of stay-at-home orders and the opening of economies in late spring of 2020 have been reported. Characteristics of patients with COVID-19 encountered by EMS have not been thoroughly explored.

Objective: Compare EMS encounter and demographic characteristics of patients diagnosed with COVID-19 before and after the first reopening.

Methods: This retrospective analysis evaluated prehospital records for all 9-1-1 patients from the national ESO data collaborative who had a hospital ICD-10 diagnosis of COVID-19. Patient demographics were compared during two time periods. For the analysis, March 15–April 30, 2020, represented “before reopening”; May 1–June 15, 2020, represented “after reopening.” Patient demographics including age, race, and sex were examined. Age was examined as both a continuous variable and dichotomized (less than 40/40 or older). Incident location type was also examined. Chi-square and Wilcoxon rank-sum tests were performed.

Results: There were 1,844 COVID-19-diagnosed 9-1-1 patients before reopening and 1,765 after reopening. The median age before reopening (69; interquartile range [IQR] 55–81) was significantly (p < 0.01) higher than after reopening (64.5; IQR 50–78). More patients were less than 40 years old after reopening (18%, 326 vs. 24%, 421, p < 0.001). The percentages of patients recorded as African-American/Black (29%, 439 vs. 28%, 426) or white (53%, 806 vs. 46%, 706) were lower after reopening, while those recorded as Hispanic/Latino (16%, 244 vs. 22%, 339) or other (3%, 43 vs. 4%, 60) were higher after reopening (p < 0.001). There was no significant difference noted in patient sex (p = 0.73). Slightly more patients were transported from healthcare facilities (5%, 78 vs. 7%, 100) and homes/residences (53%, 814 vs. 55%, 839) after reopening, while slightly fewer were transported from nursing homes/assisted living facilities (33%, 515 vs. 32%, 479), police/jail (2%, 24 vs. 1%, 15), or other (2%, 20 vs. 1%, 15). Patient transports were similar from public places (5%, 81 vs. 5%, 74; p = 0.04).

Conclusions: EMS patients diagnosed with COVID-19 were younger after the easing of stay-at-home orders. Also after reopening, more patients were reported to be Hispanic/Latino or other race, and slightly more patients were transported from homes/residences and healthcare facilities.
Evaluating Prehospital Use of Personal Protective Equipment During the COVID-19 Pandemic

Author: Antonio Fernandez, PhD, NRP
Associate Authors: Remle Crowe, PhD, NREMT; Scott Bourn, PhD, RN; J. Brent Myers, MD, MPH, FACEP

Introduction: Challenges with personal protective equipment (PPE) availability during the COVID-19 pandemic have been well documented. However, the use and reuse of PPE has not been fully described in the prehospital environment.

Objective: Describe the use and reuse of PPE among EMS providers during the COVID-19 pandemic.

Methods: This retrospective analysis used prehospital records from the national ESO data collaborative from March 5–June 15, 2020. Three impressions related to COVID-19 were incorporated into the primary and secondary impressions lists on March 5: COVID-19 confirmed by testing; COVID-19 exposure to confirmed patient; and COVID-19 suspected/no known exposure. All 9-1-1 records with a documented EMS provider primary or secondary impression indicating COVID-19 were included. The authors examined EMS provider-documented use of N95 respirators, surgical masks, powered air purifying respirators (PAPRs), face shields, and eye protection. Additionally, the authors evaluated reuse of N95s, surgical masks, and face shields. Reuse information was not available for PAPRs and eye protection. PPE was considered to have been used during the encounter if any of the above-mentioned PPE articles were documented for at least one EMS provider listed on the prehospital care record. Descriptive statistics are reported.

Results: There were 34,984 records with a COVID-19 impression documented. Of those, 15% (5,263) did not have PPE documented. Among the 29,721 records with documented PPE, a mask (N95, surgical mask, or PAPR) was documented on 89% (26,529) of records. Of those, 82% (24,469) had documented N95 use, of which 42% (10,290) indicated reuse. Another 17% (5,261) recorded use of surgical masks, of which 42% (2,220) indicated reuse. PAPR use was documented on 3% (967) of records. Face shield use was documented on 19% of records (5,537), of which 37% (2,027) indicated reuse. Finally, eye protection was documented on 88% (26,175) of records with documented PPE.

Conclusion: On 15% of 9-1-1 records where the EMS provider believed they were caring for a COVID-19 patient, no PPE use was documented. Reuse of PPE was documented often. Future research is needed to determine if the lack of documented PPE use was due to limits in availability, incomplete documentation, or simply failure to take adequate precautions.

EMS Demand: An Analysis of County-Level Social Determinants

Author: Jackson Deziel, PhD, MPA, NRP

Introduction: EMS demand is ever-present, but significant variations exist at the local level. In this paper’s data set, annual county-level consumption of EMS varied greatly, from 153 to 11,248 calls per 10,000 persons. Therefore, it can be assumed that the market for ambulance services is far from homogeneous. This unclear, and largely unspecified, heterogeneity leads us to investigate potential social factors contributing to EMS demand. Although individual community needs are of great import for designers and managers of EMS systems, there might exist factors that transcend geopolitical boundaries and can be bookmarked as universal predictors of demand.

Methods: Data for this study were collected from publicly available reports from Florida and Oklahoma. Each state reported total annual requests for service per county from 2009–2015. County-level health and social data were gathered by the Robert Wood Johnson Foundation. For analysis, call volume (per 10,000 persons) was log-transformed to derive a semi-elasticity function. Pooled ordinary least squares model with time-fixed effects were utilized for tests of inference.

Results: A total of 874 county-year observations were analyzed. A one percentage-point increase in those in poor or fair health increased EMS call volume by 3% (B = 0.03, p < 0.000). For each additional day of poor mental health, EMS call volume increased by 6.5% (B = 0.065, p = 0.001). A one percentage-point increase in binge drinking increased EMS call volume by 1.6% (B = 0.016, p < 0.000). A one percentage-point increase in uninsured adults decreased EMS call volume by 1.1% (B = 0.011, p = 0.004). A one percentage-point increase in the unemployment rate increased EMS call volume by 3.6% (B = 0.036, p < 0.000). A one percentage-point increase in child poverty increased EMS call volume by 0.6% (B = 0.0059, p = 0.036). An additional 100 violent crimes (per 100,000 population) increased EMS call volume by 2.8% (B = 0.00028, p < 0.000).

Conclusion: After examination, these data support the idea that some community measures and behaviors have a significant effect on local EMS demand. These factors might have been treated as spurious or completely overlooked by policy makers and EMS leadership.
**Objective:** Describe patients who received prehospital ketamine in West Virginia.

**Methods:** This retrospective observational study included all West Virginia 9-1-1 patients who received prehospital ketamine from Jan. 1–Dec. 31, 2019. Data were obtained from the West Virginia EMS data repository. West Virginia protocols allow ketamine administration for pain and excited delirium. EMS provider impressions were categorized as pain/injury, altered mental status (AMS)/behavioral, and other. Patient primary symptom, demographics, and community size were evaluated. Descriptive statistics were reported.

**Results:** In 2019 there were 154,906 West Virginia 9-1-1 patients, and 173 (0.1%) received prehospital ketamine. Among all prehospital patients given ketamine, most were male (63%, 106), white (93%, 135), and in urban areas (50%, 76). Median age was 41 (IQR: 29–59). In all, 62% (74) of patients with pain/injury impressions, 33% (40) with AMS/behavioral, and 6% (7) with other received ketamine. Among patients with pain/injury impressions, 71% (48) had a primary symptom of unspecified pain, 21% (14) had hemorrhage/bleeding, 3% (2) had slowness/poor responsiveness, and one each had the following: abdominal tenderness, abnormal involuntary movements, dyspnea, and nausea. Most of these were male (65%, 46), white (95%, 60), and in rural areas (64%, 44). Median age was 43.5 (IQR: 29–60). Among patients with AMS/behavioral impressions, 46% (12) had a primary symptom of strange/inexplicable behavior, 31% (8) slowness/poor responsiveness, 8% (2) AMS, 8% (2) combative/violent behavior, 4% (1) restlessness/agitation, and 4% (1) suicidal ideations. Most of these were male (54%, 21), white (90%, 26), and in urban areas (75%, 24). Median age was 35 (IQR: 28–62). Among patients with other impressions, the only primary symptom reported was unspecified pain: 71% (5) were male, 83% (5) white, and 86% (6) in urban areas. Median age was 72 (IQR: 41–76).

**Conclusion:** More West Virginia 9-1-1 patients received prehospital ketamine for pain/injury than for AMS/behavioral impressions. Ketamine for pain/injury was administered more often in rural areas, while ketamine for AMS/behavioral impressions was more frequent in urban areas. Those with pain/injury were older than those with AMS/behavioral impressions. Future research should evaluate the effectiveness of ketamine for pain/injury and AMS/behavioral impressions.

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**Assessing the Readiness of Stakeholders to Adopt Community Paramedicine Programs in Tennessee**

**Author:** Roger Ritchie, PhD, MPhil, MPA, BS, EMT-P

**Introduction:** Community paramedicine is an emerging model of care that promotes EMS in a more community-based and integrated role within the broader healthcare system. A hallmark characteristic of community paramedicine is that programs are designed to meet the specific needs of a given community, rendering programs unique but perplexing. A need for research aimed at exploring possible barriers that might impede the adoption of community paramedicine programs has been identified by the National EMS Advisory Board, the North Central EMS Institute, and the Joint Committee on Rural Emergency Care.

**Objective:** The purpose of this study was to explore opinions, attitudes, and beliefs among key policy makers regarding the adoption of community paramedicine programs in Tennessee.

**Methods:** Rogers’ diffusion of innovations was the theoretical framework for this qualitative case study, and a single overarching research question was used to solicit opinions among participants. Qualitative data were collected through semistructured interviews from 21 participants, including 13 EMS directors or other EMS officials, physicians, county mayors, and home health representatives. The data corpus was coded to identify emerging themes, and both inductive and deductive processes were used in analysis.

**Results:** Findings emphasized various perceived attributes but also indicated a lack in understanding of community paramedicine program definitions and parameters.

**Conclusion:** Recommendations include further research on how these programs might affect other healthcare providers, especially in rural settings. Implications for social change include providing a better understanding of community paramedicine and how future programs might best benefit patients in both rural and urban areas.

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**The Role of Spirituality in EMS Worker Experiences: Results from a National Survey**

**Author:** Brian Raming, PhD, MBA, NRP

**Associate Authors:** Jackson Deziel, PhD, MPA, NRP; Emily Kennedy

**Introduction:** The cumulative experiences of the prehospital provider can weigh heavily and ultimately influence job satisfaction and external events. This study shines a light on the religious beliefs of EMS workers and potential downstream effects.

**Methods:** An electronic survey was distributed via e-mail and social media to workers who held a prehospital provider credential. All responses were anonymous, and no personally identifying data were collected. Respondents did not receive compensation for their participation. For analysis, Likert-type questions were used with a five-point scale. For tests of inference, the authors employed chi-square tests, logistic regression, and ordered logistic regression. Content analysis of respondent comments is still ongoing.

**Results:** The survey distribution yielded 703 responses. A majority of participants indicated connection with a spiritual belief system (84%), and half (49.8%) were members of an organized religious community. When asked, 48% of participants stated their work in EMS had directly affected their religious views. Those who were a member of a religious community were 76% more likely to be happy with their job (OR 1.76, p = 0.030). Respondents who were active within their religious community (OR 1.71, p = 0.030) and those who...
had attended religious primary and/or secondary school (OR 2.53, p = 0.003) were more likely to report being religiously affected by their job. Participants who had indicated a religious effect from their job were 33% less likely to believe their mental health needs were adequately met by their employer (OR 0.666, p = 0.048).

Conclusions: The majority of respondents held some type of religious belief system, although only half were members of a religious community and even fewer were active within that community. The effects of the “caregiver” role can be heavy for prehospital providers. As with all aspects of life, one’s religious viewpoint and belief system shape mentality and action.

EMS Worker Satisfaction: Results From a National Survey

Author: Emily Kennedy

Associate Authors: Jackson Deziel, PhD, MPA, NRP; Brian Raming, PhD, MBA, NRP

Introduction: Management theory indicates a happy employee is a productive employee and employee satisfaction is a leading cause of both retention and resignation. As the price tag of replacing an employee surges into five figures, EMS organizations must explore what truly makes workers “happy.” Even small changes can exponentially affect a positive work environment at a fraction of the cost of turnover.

Methods: An electronic survey was distributed via e-mail and social media to workers who held a prehospital provider credential. All responses were anonymous, and no personally identifying data were collected. Respondents did not receive compensation for their participation. For analysis, Likert-type questions were used with a five-point scale. For tests of inference, the authors employed chi-square tests, logistic regression, and ordered logistic regression.

Results: The survey distribution yielded 703 responses. A majority of participants reported they were happy with their current job (79.4%) and secure in their employment (72%). As to equipment and staffing, 72% felt as though they had the necessary equipment to perform their duties, but only 44% deemed their organization adequately staffed. A plurality (47.6%) believed they were not paid a fair salary, but a majority (59.7%) indicated they received adequate vacation time/leave. When rating their work environment, a quarter of participants (25.2%) stated they had been bullied at work, and 37.9% were uncomfortable requesting sick time/leave. Participants were 2.3 times more likely to report being happy with their job if they agreed their organization was adequately staffed, and two times more likely to be happy if they agreed they had adequate equipment. Additionally, respondents were 89% more likely to report happiness if they felt their employer was meeting their mental health needs. Respondent salary was not associated with job satisfaction.

Conclusion: Most respondents were happy in their current job. Adequate equipment, staffing, and mental health resources were the largest drivers of satisfaction. Although nearly half of participants believed they were not paid a fair salary, it did not affect their overall satisfaction. The results of this survey indicate managers should focus on a suite of well-rounded employee resources.

EDUCATIONAL ABSTRACTS

How Do the M5-50 Domains of Agreeableness, Conscientiousness, and Neuroticism Impact Oligoanalgesia in Paramedic Students on Field Placement?

Author: Scott Lancaster, PhD, MHA, NRP

Associate Authors: Remle Crowe, PhD, NREMT; Sam Fuge, BM, NRP; Megan O’Leary, BA; Glenn Keating, BS, NRP; M. Andrew Steeby, MA, Paramedic; Lena Wolter, BS, EMT; Dale Edwards, EdD, FPA

Introduction: Out-of-hospital analgesia administration for patients with pain from traumatic injuries is low and differs by variables such as patient age, gender, and ethnicity. The relationship between affective characteristics of the provider and the rate of out-of-hospital analgesia administration has not been thoroughly explored. The aim of this study was to assess the association between the M5-50 domains of agreeableness, conscientiousness, and neuroticism, as utilized by Fisdap (an online EMS database) and the administration of analgesic medications to trauma patients by paramedic students during field placements.

Hypothesis: Students who score high in the domains of agreeableness and conscientiousness on the Paramedic Entrance Exam administer analgesia more often than those with lower scores, while those with high scores in neuroticism administer analgesia less often than those with low scores.

Methods: A retrospective review of Fisdap paramedic student records from 2017–2019 was conducted. Records with complete entrance exam data and at least one field contact with a trauma impression were included. Records with airway interventions were excluded, as these procedures are more likely in patients who are not alert. Independent variables included scores for agreeableness, conscientiousness, and neuroticism. The outcome variable was the analgesia administration rate by paramedic students. Spearman’s correlation coefficients were used to assess the relationship between each affective characteristic and analgesic administration rate.
Results: Records for 9,923 trauma encounters documented by 562 students representing 66 paramedic education programs were included. Encounters per student ranged from 1 to 66 with a median of 16 (IQR: 11–23). Overall, 32% (n = 3,209) of patients were administered one or more analgesic agents. The median rate of analgesic administration per student was 29% (IQR: 14%–46%). No statistically significant relationship between agreeableness (rho = 0.014, p = 0.740), conscientiousness (rho = 0.0602, p = 0.154), or neuroticism (rho = -0.0215, p = 0.611) and the rate of analgesia administration was observed.

Conclusion: While oligoanalgesia represents an area of concern in out-of-hospital care, no statistically significant relationship between agreeableness, conscientiousness, or neuroticism and analgesia administration rate was observed. Limitations include the retrospective data and potential for limited influence on decision to administer analgesia by paramedic students during field placements.

Does Watching Skill Videos Affect EMT Psychomotor Pass Rates?
Author: Michael Kaduce, MPS, NRP

Introduction: EMS education requires laboratory time to ensure students are competent before field rotations. The use of skill videos in the initial healthcare education classroom has been demonstrated to assist clinical skill development, provide visual demonstration, and link classroom learning to skills performance. However, is there a trade-off in competency due to time watching videos and not practicing skills?

Hypothesis: Time spent watching demonstrational videos in EMT skill labs does not reduce first-time pass rate on the NREMT psychomotor exam.

Methods: The UCLA hybrid EMT program is 182 hours, with 68 hours spent in laboratory. A retrospective review of oxygen administration and supine spinal immobilization first-time psychomotor pass rates was conducted. Three cohorts of students who did not use the skill videos were compared with two cohorts who watched the skill videos before the start of each of their respective laboratory rotations. The demonstrational videos are between 3 and 8 minutes long and provided online. A t-test (two-sample assuming unequal variances with statistical threshold of 0.05) was performed comparing first-time pass rates of the respective skill with and without videos. This study received IRB approval from the UCLA David Geffen School of Medicine.

Results: In this study 241 and 237 students’ first-time psychomotor pass rates were evaluated without the oxygen administration or supine spinal immobilization skill videos respectively. An additional 145 students’ first-time psychomotor pass rates were evaluated with the skill videos for the two skills. The first-time pass rates for oxygen administration without and with the skill video were 95.2% and 91.8% respectively. The first-time pass rates for supine spinal immobilization without and with the skill video were 82.7% and 82.1% respectively. The p-value for oxygen administration was 0.24 and for supine spinal immobilization was 0.42.

Conclusion: In these data there was no significant difference in first-time pass rates on the psychomotor exams with or without the skill videos. Showing a short, specific skill video that highlights important ideas can increase learning acquisition and limit time spent lecturing in the laboratory.

Predicting the End: Entrance Exam to Summative Exam Predictive Value
Author: Alycia Brantz-Miller, MS, NRP
Associate Authors: Jeffrey Rollman, MPH, NRP; Sahaj Khalsa, BS, NRP; Eric A. Martens, BS, EMPA, NRP; Mason Dvorak, BA, EMT-B; Whitney Morgan, MS, NRP; Jennifer Berry, BA; Thomas L. Fentress, MBA, NRP, PI, CF; James Dinsch, MS, NRP, CCEMTP

Introduction: Accreditation standards pressure paramedic programs to admit students most likely to succeed. Programs failing to meet retention levels risk being cited among other consequences. Therefore, it is critical for programs to understand how best to predict student success. The Fisdap Paramedic Entrance Exam (PEE) and Paramedic Readiness Exam (PRE) version 3 measure knowledge at program start and end. The PEE assesses baseline knowledge in four cognitive areas—anatomy and physiology (A&P), EMT, mathematics, and reading comprehension—and several affective domains. PRE evaluates summative knowledge.

Objective: To investigate relationships between PEE and subsequent PRE performance relative to predictive improvement and summative success.

Methods: An IRB-approved retrospective study linked deidentified PEE and first-attempt PRE records from Fisdap (an online EMS database). Cognitive PEE sections and overall PRE scores were individually split into quartiles. A cut score of 73 was used to calculate odds of PRE success with quartile-based PEE overall and section performance using ordered logistic regression analysis.

Results: In all 1,185 students met inclusion criteria for analysis. The ordered logistic regression determined each successive higher quartile had significantly increased odds of passing the PRE:3 PEE overall (OR = 1.083, 95% CI 1.068–1.098); A&P (OR = 1.076, 95% CI 1.061–1.091); Math (OR = 1.045, 95% CI 1.032–1.058), EMT (OR = 1.043, 95% CI 1.029–1.056), Reading (OR = 1.037, 95% CI 1.024–1.050).

Discussion: The A&P section of the PEE had the strongest association with student success on the PRE. Poor performance on the PEE is not a definitive predictor of students’ likelihood of passing the PRE. Grouping students into quartiles based on PEE scores and tracking PRE completion demonstrated substantial mobility of students between quartiles. A&P was most predictive of PRE success.
Conversely, reading was least predictive of PRE success.

**Conclusion:** The PEE offers predictive value to summative PRE performance. The PEE should be included as part of a multifaceted selection process rather than a singular selection criterion.

**Modifiable Programmatic Factors as Predictors of Success on the NREMT Paramedic Cognitive Examination**

**Author:** Scott Lancaster, PhD, MHA, NRP  
**Associate Authors:** Walt Stoy, PhD, EMT-P; Susan Duty, ScD, RN; Shelly Strowman, PhD

**Introduction:** It is unknown why the National Registry of Emergency Medical Technicians (NREMT) Paramedic cognitive examination pass rates fall below other allied health programs or what aspects of paramedic programs might predict success on the NREMT examination. One reason might be the lack of standardization of program design. Paramedic educational models vary greatly not only across the country but within states. The aim of this study is to access the association between modifiable programmatic variables in Commission on Accreditation of Allied Health Education Programs (CAAHEP) accredited paramedic programs and first-attempt pass rates on the NREMT paramedic cognitive examination.

**Hypothesis:** Modifiable programmatic factors, such as program delivery method; total classroom, clinical, and field hours; program staffing patterns; use of prerequisite courses; and other factors impact the education received by paramedic students and therefore have an effect on program outcomes on the NREMT paramedic examination.

**Methods:** Using a cross-sectional census survey methodology, CAAHEP-accredited paramedic programs in the United States were recruited to participate in an online survey that included 22 modifiable programmatic variables (independent variables), two nonmodifiable factors (for demographic purposes), and the program’s first-attempt pass rate on the NREMT paramedic cognitive exam in 2017 (outcome variable).

**Results:** Of the 585 eligible programs recruited, 278 programs (49.1%) completed the survey and were included in the data analysis. Descriptive statistics were produced for each variable, inferential statistics were produced for variables by high/low-pass-rate groups, and univariate logistic regressions were completed to identify possible factors for inclusion in the final model. Eight variables remained for inclusion. A multivariate logistic regression model (R2 = 0.087) retained three variables, including number of field hours (OR = 1.001, p = 0.041), use of flipped classroom (OR = 1.872, p = 0.026), and computer-based testing (CBT) use (OR = 0.293, p = 0.026).

**Conclusion:** This study was the first to examine the numerous modifiable programmatic predictors of success on the NREMT among accredited paramedic programs. Three significant predictors remained in the model, indicating a possible association between pass rates and increased field hours and use of flipped classroom. Interestingly, use of CBT was negatively associated with success, which needs further study.

**The Association Between EMT Entrance Exam Scores and EMT Student Success**

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**Associate Authors:** Joe May, BA, EMT-P; Kathleen O’Connor, MPP, NRP; Aaron Klassen, MD, MA; Alana Lemke, BA; Megan Corry, EdD, EMT-P; Antonio Fernandez, PhD, NRP

**Background:** EMT program graduates have a wide range of success. Many EMT students do not complete the course or are unable to pass the cognitive exam. In this study we explored if EMT program
success can be predicted by scores on the EMT Entrance Exam (EEE) from Fisdap (an online EMS database).

**Hypothesis:** There is an association between scores on the Fisdap EEE and student success.

**Methods:** EMT data from a retrospective cohort was collected from Fisdap, an online EMS database, between 2017 and 2019. Participants were included if they completed an EEE, EMT Readiness Exam-4 (ERE4), and had a graduation status assigned. The outcome variable was class success as determined by the student graduation and ERE4 score, dichotomized as pass/fail. The data were analyzed using a Wilcoxon rank-sum test and a univariate logistic regression.

**Results:** A total of 196 students from 11 programs met the inclusion criteria. The median scores on the EEE were overall 86, Anatomy & Physiology (A&P) 16, Biology 4, Math 7, Medical Terminology 8, and Self-Efficacy 47. The overall EEE, A&P, Biology, and Medical Terminology scores were significantly associated with a higher likelihood of success, while no significant difference was associated with Math scores (see Figure 1).

**Conclusion:** The A&P, Biology, and Medical Terminology scores were statistically and practically significant predictors of success. The overall EEE and Self-Efficacy scores were statistically significant; however, they might not be practically significant predictors. Math scores were not predictive of success.

### Predicting the End: Entrance to Summative Exam Predictive Value

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**Introduction:** Accreditation standards pressure paramedic programs to admit students most likely to succeed. Therefore, it is critical for programs to understand how to best predict student success. The Fisdap Paramedic Entrance Exam (PEE) assesses several affective domains based on the M5-50 personality trait index, a specific subject-based ordering of International Personality Item Pool (Goldberg, 1999), which is considered fairly reliable for personality analysis (Socha, 2010). The Paramedic Readiness Exam (PRE) evaluates summative knowledge.

**Objective:** To investigate the correlation between affective domain scores on PEE and success on PRE.

**Method:** An IRB-approved retrospective study linked deidentified PEE and first-attempt PRE records from Fisdap (an online EMS database). Three domains—agreeableness, conscientiousness, and neuroticism—were provided. R Studio was used for statistical analysis and graphical interpretation.

**Results:** A total of 1,097 students met the requirements for inclusion. Scatter plots were used to identify possible relationships. The Pearson correlation coefficients provided are means, and a score of greater than +/- 0.2 demonstrates a significant correlation between the two variables. For the PRE with cut score 73, agreeableness ([-0.089], n = 2); conscientiousness([-0.032], n = 4); and neuroticism (0.030, n = 5). For PRE with cut score of 65, agreeableness (0.078, n = 2); conscientiousness (0.038, n = 2); and neuroticism (0.029, n = 2). Subject-specific scores on the PRE were correlated with affective domains. Agreeableness: airway ([-0.035], n = 2); medical ([-0.021], n = 1); cardiology ([0.140], n = 1); operations ([0.126], n = 2); trauma ([-0.11], n = 1). Conscientiousness: medical (0.034, n = 2); ob/peds ([-0.025], n = 2); airway ([-0.036], n = 2); cardiology ([0.050], n = 1); operations (0.037, n = 1); trauma ([-0.013], n = 1). Neuroticism: cardiology (0.088, n = 1); ob/peds (0.082, n = 1); operations ([0.037], n=1); and trauma ([0.092], n=1).

**Discussion:** PRE scores with either the published cut score of 73 or cut score of 65, as well as all subject scores, showed a very weak relationship with any affective domain.

**Conclusion:** PEE affective domains provide very weak indication of the student’s ability to achieve high scores on PRE in either the overall score or subject-specific scores.

### The Effects of Laboratory Skills on Performance on a Summative Paramedic Exam

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**Introduction:** Paramedic programs spend a considerable amount of time and resources ensuring successful completion and documentation of individual laboratory skills for their students. The Committee on Accreditation of Educational Programs for the Emergency Medical Services Professions (CoAEMSP) lists the minimum recommended number of individual skills evaluated in the laboratory setting. This study was designed to determine if the number of successful individual skills in a laboratory setting correlates to performance on the Fisdap Paramedic Readiness Exam 4 (PRE4).

**Methods:** A retrospective analysis was conducted using Fisdap educational data from July 2017 through December 2019. This study used student performance on the summative PRE4 as well as PRE4 topic subscores. Student records and individual skill completion were analyzed. Linear regression analyses were conducted using robust standard errors.

**Results:** Drawing from Fisdap educational data, 17,149 student records were analyzed, including 2.7 million lab skills. The total number of skills performed in the lab setting were positively correlated with PRE4 score (β: 0.024, p < 0.0001). The summative effect of lab skills were also positively correlated with PRE4 subscores (Airway β: 0.132, p < 0.0001; Cardiology β: 0.045, p < 0.0001; Medical β: 0.051, p < 0.0001; Obstetrics β: 0.408, p < 0.0001; Pediatrics β: 0.461, p < 0.0001; Trauma β: 0.132, p < 0.0001).
Conclusion: No clinically significant correlation was found between the number of successful individual laboratory skills completed and PRE4. While psychomotor skills are important to the development of a paramedic, programs should consider completing the recommended minimum number of individual laboratory skills and providing supplemental instruction in other key areas.

Quartile-Based Student Performance Trends Between Paramedic Entrance and Readiness Exams

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Objective: To investigate student mobility between PEE cognitive domain scores and PRE success.

Methods: An IRB-approved retrospective study linked deidentified PEE and first-attempt PRE records. Cognitive PEE sections and overall PRE scores were individually split into quartiles and compared to determine the proportion of students in each PEE cognitive section quartile who persisted to the corresponding PRE quartile. A chi-square test of independence was performed to determine any significant difference in persistence among the cognitive sections. It is not well understood how PEE performance correlates with PRE success. This deters further investigation into the mobility of student scores between the PEE and PRE.

Results: A total of 1,185 students met inclusion criteria for analysis. The results indicate quartile-based examination of test performance usually shifts between the PEE and PRE. Given the small sample size, the results might be hard to generalize, but paramedic educators should be encouraged to recognize that low or high PEE performance is not necessarily indicative of future PRE performance.

Conclusion: Paramedic educators should be aware that the performance of most students, as measured by PEE, then PRE, changes over time.

Obstetrical Emergencies in the Field: First Responder Training

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Introduction: In the area surrounding San Antonio, Tex., few first responders undergo refresher courses on emergency deliveries in the field. However, first responders continually ask for refresher courses due to lack of training in this area. While deliveries in the field are uncommon, they represent a vulnerable situation that demands rapid action and sound judgment.

Objective: Fourth-year medical students will teach first responders about emergency field deliveries with a lecture and hands-on session, educating and empowering participants to care for future patients in similar situations.

Methods: Students called 25 fire stations surrounding San Antonio to offer the course. Ten sessions were completed from October to December 2019. The course consisted of a 30-minute presentation covering normal vaginal and breech deliveries, umbilical cord prolapse, shoulder dystocia, and maternal hemorrhage. Afterward, a hands-on practice session was conducted wherein first responders practiced bimanual uterine massage and normal vaginal and breech deliveries using obstetric manikins. Finally, the training concluded with practice questions revolving around clinical scenarios to solidify understanding. To assess the educational success, each participant took a pre-survey and post-survey.

Results: Fifty-nine first responders participated. The mean scores were 45% on the pre-test and 99% on the post-test (p < 0.001). Before the course 55% of first responders felt confident about their ability to perform an emergency field delivery. After the course 100% felt confident (p < 0.001). The mean percentage of correct responses improved from 45% to 99% (p < 0.001).

Conclusion: The session yielded evidence of multifaceted improvement for participants. Participants showed a knowledge increase by more than doubling their success on the post-survey compared to the pre-survey. After the session every participant felt confident about performing a delivery in the field, while fewer than half felt confident before the session. The future direction of this project will be to develop a formal curriculum that can be widely distributed, free of charge, to all first responders and medical schools. This will allow educational partnerships to develop between medical schools and first responders throughout the country so this training can reach as many first responders as possible.