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Comparison of Emergency Medicine Resident and Attending Physician Approval Rates in Online Medical Control: A 10-year Retrospective Analysis

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Abstract

Objectives: We assessed whether emergency medicine residents, after completing a structured 4-hour training program and supervised proctoring, demonstrate decision making in online medical control comparable with that of board–certified attending physicians.

Methods: This was a retrospective cross-sectional study of online medical direction calls to the University Medical Centre of El Paso, the emergency medical services (EMS) base station for the El Paso Fire Department. First-year residents completed a 4-hour curriculum covering EMS systems, protocols, ethics, communication, and simulation, followed by 5 supervised calls. We analyzed all online medical control encounters between August 2016 and August 2025. Calls lacking a binary approval outcome were excluded. Approval/disapproval rates were compared between residents and attendings using Fisher's exact test for small samples, chi-square tests for overall comparisons, and 2-proportion z-tests for large categories. Odds ratios (ORs) with 95% CIs were calculated. Equivalence testing applied a prespecified margin of ± 3%.

Results: Of 10,492 calls, 8405 were eligible. Residents (n = 6589) approved 93.4% of requests versus 93.1% for attendings (n = 1816) (χ^2 = 0.11, P = .74; OR, 1.04; 95% CI, 0.84-1.29). Category-level comparisons revealed no statistically significant differences, with Fisher's exact $P > 0.05$ for all subgroups. Patient refusals (99.5% vs 100%) and termination of resuscitation (98.0% vs 99.4%) were uniformly high across both groups. The 2 one-sided test procedure confirmed equivalence, with a 90% CI for the difference (−0.85% to 1.35%) falling entirely within the ±3% margin.

Conclusion: Emergency medicine residents trained with a focused 4-hour curriculum and limited supervised experience performed online medical control duties at a level statistically and clinically equivalent to attending

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Abstract (continued)

physicians across a decade of real-world EMS consultations. This model provided a practical and efficient way to include residents in EMS medical direction roles, supporting both system capacity and residency education.

Keywords: *resident education, prehospital care, medical direction, OLMC, training*

1 INTRODUCTION

1.1 Background

Online medical control serves as a critical link between prehospital care providers and physician oversight, ensuring that decisions requiring deviation from standing orders, high-risk procedures, patient refusals, or ethically complex interventions adhere to established clinical and ethical standards.[1–3] The role requires rapid decision making under time pressure, sound clinical judgment, and familiarity with emergency medical services (EMS) system protocols, which are essential skills for an emergency physician.[4]

1.2 Importance

Although emergency physicians traditionally fulfill this role, expanding it to include trained emergency medicine residents helps distribute the workload, preserves attending physician capacity for other clinical responsibilities, and provides valuable resident education in EMS systems-based practice.[5] The Accreditation Council for Graduate Medical Education (ACGME) has deemed online medical control a core component of emergency medicine resident training.[6,7] Although trainees often handle online medical control calls and must demonstrate proficiency in EMS systems and medical oversight through residency milestones, no training curriculum, number of hours, or call requirements are specified.[8–11] Thus, the optimal training method and duration needed to prepare residents for independent online medical control remain unclear.[12,13]

At the University Medical Center (UMC) of El Paso, the only level I trauma center within a 260-mile radius and the EMS base station for the El Paso Fire Department, Texas Tech University Health Sciences Center emergency medicine residents complete a concise, structured EMS online medical control curriculum. This curriculum includes a 4-hour didactic and simulation-based course followed by 5 live, proctored calls under the supervision of an attending physician. After completing the program, residents are authorized to handle EMS consultation calls independently, approving or denying requests from field providers.

1.3 Goals of This Investigation

This study examined documented online medical control calls from a single tertiary care and level I trauma center over a 10-year period and sought to determine whether residents trained under this model demonstrate approval and disapproval rates similar to those of board-certified attending physicians within a prespecified equivalence margin. We hypothesized that resident approval rates would fall within a prespecified equivalence margin relative to attending physicians.

2 METHODS

2.1 Study design

This investigation was a retrospective, cross-sectional study of EMS online medical control calls at a single tertiary care center over 10 years.

2.2 Setting

This study was conducted at the Texas Tech University Health Sciences Center Department of Emergency Medicine in El Paso, Texas, in partnership with UMC El Paso. UMC El Paso is the primary tertiary care center in West Texas and the only level I trauma center. It serves as the EMS base station for the El Paso Fire Department, which is the sole responder to 911 calls in the city.

2.3 Selection of Participants

All residents who completed the training curriculum described responded to online medical control calls. All calls for online medical control documented between August 15, 2016, and August 15, 2025, were eligible for inclusion. Calls with missing physician type, unclear outcomes, or not applicable to approval or denial decision making were excluded.

2.4 Interventions

Each spring, first-year Texas Tech University Health Sciences Center emergency medicine residents complete a structured 4-hour curriculum designed to prepare them for online medical control duties. The course includes 1 hour on the US EMS system; 45 minutes on national and Texas EMS education; 45 minutes on local EMS protocols and guidelines; 15 minutes on online medical control communication; and 30 minutes on ethical and legal considerations. Resident physicians then participate in 8 to 10 case-based simulation scenarios lasting approximately 45 minutes. After completing the didactic and simulation components, residents conduct 5 supervised, live online EMS consultations under direct attending supervision before being cleared for independent online medical control duties (Supplementary Appendix 1).[12]

The Bottom Line

Training requirements for emergency medicine residents performing online medical control (OLMC) are not well-defined, and prior studies have not compared resident and attending approval patterns in real-world settings. In this 10-year analysis of 8,405 OLMC calls, residents who completed a focused 4-hour curriculum approved EMS requests at rates similar to attending physicians, with difference within a prespecified ±3% equivalence margin. The clinical appropriateness of individual requests and approval decisions was not evaluated.

The El Paso Fire Department operates a single-tier, all-advanced life support (ALS) EMS system, providing paramedic-level care on every response. During the study period, El Paso Fire Department handled an average of 62,000 EMS-related 911 calls annually, which equates to 245 EMS calls per 100,000 city residents. El Paso Fire Department protocols required online medical control consultation whenever advice, support, or guidance on appropriate patient management was needed, when a nonprotocol request was required, or when patient refusals occurred after an ALS intervention. Interventions included 12-lead electrocardiogram (ECG), intravenous (IV) dextrose for hypoglycemia, adenosine for rhythm termination, IV medication administrations, and medication requests beyond baseline protocols. Online medical control was also required to obtain permission to discontinue cardiopulmonary resuscitation that had already been initiated in the field.

2.5 Outcomes

The primary outcome of the study was agreement in the request approval rates between residents and attending physicians. Secondary outcomes included equivalence between request approval rates for medications, termination of resuscitation, nonprotocol requests, procedure requests, and transport destination.

2.6 Data Analysis

Consultation records were documented in real-time by the resident or attending physician providing online medical control during 2-way radio communication using Research Electronic Data Capture (REDCap). Fields included date and time, physician type, demographics, call reason, and whether the request was approved or denied, if applicable. The "call category" was an optional field, and some calls contained multiple categories due to perceived call complexity. REDCap is a secure, web-based platform that supports validated data entry, audit trails, automated export functions, and interoperability with external data sources.[14,15]

2.7 Ethics Approval

This study was reviewed by the institutional review board (IRB) and was determined not to involve human subjects research under the title 45 of the Code of Federal Regulations, Part 46, Section 102 (45 CFR 46.102), meeting the criteria for exemption (IRB #E26040).

2.8 Statistical Analysis

Approval percentages were calculated for residents and attendings, both overall and by request category. The primary measure of effect was the absolute difference in approval proportions (resident minus attending). Differences in proportions were compared using a 2-sample z test for proportions when all expected cell counts were ≥ 30 and Fisher's exact test when any expected cell count was < 30. Approval percentages were calculated for residents and attendings, both overall (using pooled proportions across all eligible encounters) and by request category.

Equivalence was assessed using the 2 1-sided test (TOST) procedure at a 5% significance level applied to the absolute difference in approval proportions, with a prespecified equivalence margin of ± 3%. Equivalence was established if the 90% CI for the approval difference was entirely within this margin. The equivalence threshold was selected as a conservative clinical standard, consistent with previous emergency medicine and teleconsultation studies in which differences of <5% were considered acceptable.[16]

Power calculations indicated that with more than 8000 calls included, the study had at least 80% power to detect absolute differences in approval rates as small as 1.1% between residents and attendings.

The data set included calls answered by 240 residents (24 per year) and 20 attending physicians over a 10-year period. Because multiple consultations were answered by individual physicians, resulting in clustering at the physician level, sensitivity analyses were performed using generalized estimating equations with robust standard errors. These analyses yielded results consistent with the primary proportion-based analyses, indicating that within-physician clustering did not materially affect inference.

3 RESULTS

A total of 10,492 emergency physician calls for medical control were reviewed. Of these, 2087 were excluded because they did not involve a binary approval decision; such calls included physician notifications, ECG interpretations, or consultative requests. The remaining 8405 calls with an approve-or-deny outcome were included in the analysis.

Among these, 6589 (78.4%) were answered by residents, whereas 1816 (21.6%) were answered by attendings. Some calls involved multiple categoric requests as reasons for online medical control contact.

EMS operational data demonstrated that the El Paso Fire Department averaged 62,000 911 ambulance responses per year over the past 5 years. Online medical control contact for physician guidance or direction occurred in 2.7% (95% CI, 2.6%-2.7%) of all EMS calls, corresponding to an average of 1651 online medical control interactions annually (approximately 4.5 online medical control contacts per day).

A total of 9881 online medical control call category designations were recorded across 8405 unique online medical control encounters, with some calls involving multiple request categories. The most common category was for nonprotocol requests (5803; 58.7%), followed by patient refusal (2073; 21.0%), termination of resuscitation (748; 7.6%), and medication requests (597; 6%). Less frequent categories included patient forced transport (49; 0.5%), transport destination decisions (25; 0.3%), and procedure requests (12; 0.1%). An additional 574 calls (5.8%) were categorized as other.

Overall approval rates for individual online medical control requests were 93.4% for residents (6154/6589) and 93.2% for attendings (1692/1816), corresponding to an absolute difference of 0.23% (resident minus attending). The absolute difference in approval rates was 0.23% (95% CI, −1.1% to 1.5%). Equivalence within the prespecified ± 3% margin was confirmed using the 2 1-sided test procedure. Calls involving multiple request categories were analyzed as single encounters.

A total of 260 physicians (240 residents and 20 attendings) provided online medical control direction during the study period. Each year, 24 residents (12 postgraduate years [PGYs-2] and 12 PGYs-3) participated in online medical control activities. Resident physicians managed a median of 27 calls per physician-year (interquartile range [IQR], 20-35), whereas attending physicians managed a median of 91 calls per physician (IQR, 75-110). These distributions suggest moderate clustering by physician, which was addressed in sensitivity analyses using generalized estimating equations with robust standard errors.

When approval rates were stratified using request category, no statistically significant differences in any category (all $P > .05$) were observed. Residents demonstrated slightly higher approval for medication requests (81.9% vs 77.7%), whereas attendings had marginally higher approval for termination of resuscitation (99.4% vs 98.0%). In high-volume categories such as patient refusals (99.5% vs 100%) and nonprotocol requests (91.8% vs 91.0%), absolute differences were < 1% with overlapping confidence intervals. Low-volume categories (eg, procedure requests, transport destination) exhibited greater variability but no consistent directional trends. Approval percentages, sample sizes, and confidence intervals by category are included in the table.

A sensitivity analysis accounting for physician-level clustering using generalized estimating equations with robust standard errors yielded results consistent with the primary proportion-based analyses. These analyses confirmed that within-physician clustering did not materially affect estimates of approval differences or equivalence conclusions.

4 LIMITATIONS

Several limitations should also be acknowledged. First, this was a single-center study within an academic emergency medicine system, which may limit generalizability to other regions with different EMS protocols or medical oversight structures. Second, the retrospective design relied on physician-entered records in REDCap. Although these data were recorded prospectively and mandatorily, it was not possible to verify that all online medical control calls were documented. Inaccuracies or incomplete optional fields (such as call category) may have affected data granularity. Third, online medical control calls were not mutually exclusive across categories; a single encounter could be coded under multiple types (eg, both medication request and termination of resuscitation). This overlap resulted in 9881 categoric entries compared with 8405 unique approval or disapproval calls, which might have inflated the apparent number of category-level observations. Fourth, the analysis evaluated binary approval versus disapproval outcomes, which reflect decision patterns but not the quality, appropriateness, or downstream impact of those decisions. It remains unclear whether more complex or nuanced calls, such as those involving do-not-resuscitate orders or patient capacity assessments, would demonstrate similar agreement between residents and attendings. Fifth, several categories (eg, procedure requests, transport destination decisions) had small sample sizes, yielding limited statistical power and wide confidence intervals. Sixth, although this study demonstrated similar approval rates within a prespecified equivalence margin, it did not evaluate clinical accuracy, participant satisfaction, EMS providers' perspectives, or patient outcomes, all of which are important complementary measures of online medical control performance. Finally, the evaluated training model consisted of a focused, 4-hour course with limited proctoring. Although effective within this system, its applicability might vary in EMS systems with more complex calls, different training requirements, or alternative online medical control structures. Despite these limitations, the study's large sample size, 10-year observation period, and rigorous analysis enhance confidence in the validity and applicability of its findings.

5 Discussion

This study demonstrated that emergency medicine residents can perform online medical control functions involving binary approval or disapproval decisions at a level comparable with that of attending physicians after completing a focused 4-hour training course and supervised proctoring. Overall approval rates were nearly identical between residents and attendings, differing by only 0.23%. High-acuity categories, such as

patient refusals and termination of resuscitation, also showed no meaningful differences, indicating similar approval patterns under established EMS protocols.

From an educational standpoint, these findings support the adequacy of a brief, structured 4-hour training model in preparing residents for online medical control responsibilities. Although the ACGME requires emergency medicine residents to receive instruction in the EMS system and online medical control oversight, it does not specify how this should be implemented.[6,7] In a survey of 109 ACGME-accredited emergency medicine residency programs, approximately 90% reported offering some form of online medical control training, yet fewer than half required classroom or online instruction (44.3% and 22.7%, respectively).[17] The optimal curriculum for developing independent competency in online medical control decision making remains undefined.[8–11]

Several EMS and online medical control curricula have been described, but none have directly compared resident and attending physician performance during live calls. Mancera et al[18] described an EMS curriculum used at the University of Wisconsin that incorporated dedicated Medical Command Shifts in which residents performed online medical control under attending physician supervision. Nineteen resident learners who completed the course indicated that their course experience met their expectations and the course learning objectives. However, independent resident performance following the rotation was not evaluated. Similarly, Tift and Nable[12] developed a 2.5-hour online medical control course combining lectures and live simulations. Although participating residents reported increased self-perceived comfort with taking online medical control calls, their decision making was not compared with that of attending physicians. In another study, Balasubramanian et al[13] provided EMS didactic instruction and simulated online medical control calls to emergency medicine residents and subinterns, resulting in improved knowledge and confidence but without direct comparison with attending responses.

The present study extended prior work by providing comparative data on residents' and attending approval patterns during live online medical control encounters. Residents approved EMS requests at rates comparable to those of attending physicians, within a prespecified equivalence margin. Over a decade of activity, internal risk management reviews identified no legal actions or adverse legal events involving residents or attending physicians provided by online medical control. Collectively, these results suggest that a structured 4-hour curriculum enables EMS systems to safely integrate residents into online medical control roles without compromising decision quality. This supports ongoing inclusion of residents into EMS online medical direction as both an educational opportunity and a safe operational practice.[18] Future research should evaluate long-term outcomes of resident-provided online medical control, including call quality metrics, paramedic satisfaction, and clinical impact, to define competency standards for online medical control training further.

This study has several notable strengths. First, the sample size was large, with more than 10,000 online medical control calls reviewed over nearly a decade. This volume provided sufficient statistical power to detect differences as small as 1% between residents and attending physicians in high-volume categories (approximately 8000 calls), although lower-volume categories were not adequately powered for such comparisons. Second, the study was conducted within a real-world EMS system serving a diverse urban and suburban patient population, enhancing both external validity and operational relevance. Third, the structured training model, combining didactics, simulation, and supervised proctoring, was applied uniformly to all residents, ensuring a consistent and reproducible educational intervention that could be implemented at other academic centers. Finally, multiple complementary statistical approaches were used to confirm the robustness and stability of findings, supporting the validity of the conclusions. Together, these factors strengthen the internal validity of the findings and their applicability to residency-based EMS online medical direction programs nationwide.

Future research should validate these findings across other EMS systems with different training structures, call volumes, and models of medical oversight. Prospective multicenter studies would enhance generalizability and enable standardized evaluation across diverse settings. Comparative research examining longer or more intensive training programs could also determine whether additional preparation leads to measurable improvements in performance.

Beyond approval rates, future research should focus on patient-centered outcomes, such as morbidity, mortality, transport appropriateness, and resource utilization, to assess clinical outcomes and operational impacts on the safety and effectiveness of resident participation in online medical control. Educational research should also investigate the role of simulation, structured feedback, and competency-based assessments in training. Determining the minimum effective training "dose" and evaluating supplemental strategies, like postcall debriefings or advanced simulations, could help develop evidence-based curricula. Lastly, qualitative studies exploring EMS provider perspectives on resident versus attending online medical control could provide insights into communication, trust, and perceived quality of medical oversight, thereby aligning educational goals with the operational realities of prehospital care.

In this retrospective analysis of >8000 online medical control encounters spanning 10 years, emergency medicine residents trained with a focused 4-hour curriculum approved EMS requests at rates similar to attending physicians, with differences consistently within a prespecified ± 3% equivalence margin. Approval patterns were comparable across major request categories, including high-risk scenarios such as patient refusals and termination of resuscitation. The clinical appropriateness of individual requests and approval decisions was not evaluated; therefore, the conclusions are limited to approval patterns rather than clinical outcomes.

AUTHOR CONTRIBUTIONS

Original research and manuscript writing by Russell Baker. Manuscript revisions were performed by Dr. Alexander Toppo.

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CONFLICT OF INTEREST

All authors have affirmed they have no conflicts of interest to declare.

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SUPPLEMENTARY MATERIALS

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