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Paramedic attitudinal profiles regarding pediatric pain management: A latent class analysis in a standardized emergency medical services system

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Abstract:

OBJECTIVES: Pediatric pain is frequently under-recognized and undertreated in prehospital emergency care despite guideline-based recommendations, and practice variation may persist even within standardized emergency medical services (EMS) systems.

METHODS: We conducted a prospective, cross-sectional survey of paramedics working in a nationally standardized EMS system in Türkiye to identify latent attitudinal (self-reported) profiles related to pediatric prehospital analgesia and to examine whether profile membership differed by demographic or professional characteristics. Attitudinal items underwent exploratory dimensionality assessment and were then modeled using latent class analysis.

RESULTS: Among 129 paramedics, two profiles were identified: proactive/system-oriented (57.4%) and conservative/low-engagement (42.6%). The proactive/system-oriented profile reported higher endorsement of decision-support tools (mobile drug-dosing applications and in-ambulance analgesia algorithms), more consistent self-reported post-analgesia vital sign monitoring, and greater self-reported use of non-pharmacologic adjuncts. The conservative/low-engagement profile reported lower intended engagement with these self-reported practices and greater reliance on perceived barriers. Profile membership was not associated with age, sex, years of EMS experience, or prior training.

CONCLUSION: Distinct attitudinal (self-reported) profiles regarding pediatric prehospital analgesia were identified; whether these profiles translate into objectively observed analgesia delivery requires validation using routine documentation and, where feasible, linked ED outcomes.

Keywords:

Analgesia, latent class analysis, paramedics, pediatric pain, prehospital care

Introduction

Pediatric pain remains a neglected priority in prehospital emergency care,

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Box-ED section**What is already known about the study topic?**

- Pediatric pain is frequently under-recognized and undertreated in prehospital care
- Even within standardized emergency medical services (EMS) systems, meaningful practice variation persists.

What is the conflict on the issue? Has it importance for readers?

- It is unclear whether variability is driven mainly by demographic/training differences or by underlying attitudinal patterns/self-reported practice orientations
- Identifying “who needs what kind of support” is important for improving prehospital–emergency department continuity in pediatric pain management.

How is this study structured?

- Prospective, cross-sectional survey of paramedics in a standardized EMS system
- Latent class analysis was used to identify distinct attitudinal profiles (self-reported practice orientations).

What does this study tell us?

- Two profiles emerged: A proactive/system-oriented group and a conservative/low-engagement group
- Profile membership was not explained by age, sex, years of experience, or prior training, supporting profile-informed training and system supports.

with evaluations consistently documenting suboptimal assessment and treatment in emergency medical services (EMS) systems.^[1,2] Inadequately treated pain in childhood is linked to long-term physiological and psychological consequences, including dysregulated stress responses, trauma-related symptoms, and epigenetic changes.^[3-5] Although evidence-based prehospital guidelines recommend early analgesia for acute pain in children,^[6,7] observational data and reviews show substantial oligoanalgesia across diverse EMS systems.^[8,9] Adequate prehospital opioid analgesia reduces pain scores on pediatric emergency department (PED) arrival and supports consistent dosing, whereas undertreated children often arrive in severe pain, require catch-up dosing, and experience prolonged distress during the early emergency-care encounter.^[10-12]

Against this background, paramedics must make rapid decisions about pharmacologic pain relief in children in time-pressured environments.^[1,8,12] Their willingness to treat pain is shaped by concerns about dosing accuracy, masking time-critical diagnoses, medicolegal risk, physician authorization, and caregiver expectations in child and family encounters.^[1,13-15] Conversely, clear

protocols, access to intranasal opioids, structured pediatric education, and decision-support tools have been linked to greater confidence and higher rates of appropriate analgesia.^[1,2,8,16-18] Most studies, however, catalogue these influences as isolated “barriers” or “enablers” and do not explain why paramedics exposed to similar systems diverge so markedly in practice. Contemporary models of fear-avoidance, cognitive load, and the Theory of planned behavior instead suggest relatively stable decision-making/attitudinal orientations, yet pediatric prehospital analgesia research has rarely identified latent subgroups of paramedics with distinct decision-making profiles that could inform tailored practice support.^[19-22]

In Türkiye, the centrally organized 112 EMS system, which operates under nationally defined treatment protocols with a shared training framework and core formularies across regions, offers a “natural laboratory” in which residual variation is likely to reflect human factors rather than major structural differences in system design.^[23,24] Within this setting, this study aimed to use latent class analysis (LCA) to identify paramedics’ attitudinal profiles (self-reported practice orientations) in pediatric prehospital analgesia, assess their independence from key demographic/professional characteristics, and inform targeted implementation across the prehospital–PED continuum through practice-, education-, and system-level supports to promote more consistent pediatric pain care.

Methods**Study design and setting**

This prospective, cross-sectional survey was conducted between March 1 and 15, 2025, in Muğla, Türkiye. The study was approved by the Ethics Committee of Muğla Sıtkı Koçman University (Approval No. 220034-27). The region was purposively selected because its EMS system spans rural and urban areas with marked seasonal demand, providing diverse operational contexts within a centrally standardized national framework to examine real-world variation in pediatric analgesia attitudes and self-reported practices/orientations. The study protocol and reporting framework were developed in accordance with the STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) guideline.

Participants and Sampling

The target population comprised all active-duty paramedics employed by the local EMS system (details blinded for review). Eligibility criteria were: (i) at least 1 year of field experience, (ii) direct involvement in patient care, and (iii) provision of digital informed consent. Paramedics who were on administrative leave

or who had not cared for pediatric patients within the previous 12 months were excluded. Participants were invited via a secure, officially administered internal communication channel used for EMS operations. Participation was voluntary, anonymous, and not incentivized.

The sample size estimation was conducted using G*Power 3.1 (Heinrich Heine University Düsseldorf, Düsseldorf, Germany), assuming a medium effect size (Cohen's $w = 0.3$), $\alpha = 0.05$, and 80% power. The minimum required sample size was 108, which was inflated by 10% to 119 to account for potential nonresponse. Ultimately, 129 complete surveys were obtained, yielding a 60% response rate and exceeding the *a priori* target for latent class model stability. Participant flow is summarized in the results (215 eligible; 129 analyzed).

Survey development and content

The survey was developed through an iterative, literature-informed process covering three domains: (i) demographic and professional characteristics, (ii) pediatric training and clinical experience, and (iii) attitudinal items on beliefs and self-reported practices related to pediatric analgesia. Item content was reviewed by a multidisciplinary panel with expertise in emergency and pediatric emergency care and paramedic education for relevance and clarity, and pilot-tested with 30 paramedics to assess wording, completion time, and usability; no major structural revisions were required. Items on analgesic agents and routes captured self-reported preferences and stated practices rather than patient-episode-level administration details.

Attitudinal items were initially rated on a 10-point Likert-type scale (1 = strongly disagree, 10 = strongly agree) to capture nuanced perceptions. For LCA, responses were recoded into five ordered categories (1–2 = strongly disagree, 3–4 = disagree, 5–6 = neutral, 7–8 = agree, 9–10 = strongly agree) to reduce sparse cells in extreme categories, improve model convergence, preserve the ordinal structure, and enhance the stability and interpretability of latent classes. The survey platform was configured to require responses for all analytic items; therefore, the final dataset contained no missing item-level data.

Psychometric evaluation and item selection

An exploratory dimensionality assessment was conducted using principal components extraction with varimax rotation to identify a conceptually coherent and parsimonious attitudinal item set. Items with primary component loadings ≥ 0.70 were retained to support a concise set of strongly performing indicators, resulting in a 13-item pool representing domains such as clinical autonomy, safety practices, engagement with

decision-support tools, and contextual influences on pediatric analgesia. This exploratory dimensionality step was used pragmatically for item reduction/selection before LCA; therefore, we report the component loadings used for retention rather than emphasizing additional diagnostic indices.

Latent class modeling

LCA was conducted to identify unobserved subgroups of paramedics based on their attitudinal response patterns. Models specifying one to five latent classes were fitted using maximum likelihood estimation. Model selection was guided by multiple fit indices, including the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), sample-size adjusted BIC (SS-BIC), the Lo–Mendell–Rubin Likelihood Ratio Test (LMR-LRT), and the Bootstrap Likelihood Ratio Test (BLRT), in combination with clinical interpretability. Posterior class membership probabilities were used for modal (most likely) class assignment. To promote parsimony and avoid overfitting, candidate models in which any class comprised $<10\%$ of the sample were rejected *a priori*, and classification precision was evaluated using entropy, with higher values indicating clearer separation between classes.

Model selection prioritized the BIC, which is commonly recommended for latent class modeling because it balances model fit with parsimony. Although models with additional classes were explored, solutions with more than two classes produced either small subclasses approaching the predefined minimum class size threshold or classes that did not represent clearly interpretable clinical patterns. Therefore, the two-class solution was retained as the most parsimonious and clinically interpretable representation of the attitudinal response patterns.

Statistical Analysis

Descriptive statistics were used to summarize participant characteristics. Continuous variables were assessed for normality using the Shapiro–Wilk test and visual inspection of histograms. Normally distributed variables were reported as mean $\pm$ standard deviation, and non-normally distributed variables as median (interquartile range).

To identify unobserved attitudinal (self-reported) profiles among paramedics, LCA was performed using participants' attitudinal response patterns. Models specifying one to five latent classes were compared. The optimal number of classes was selected based on criteria reflecting both model fit (AIC and BIC) and classification quality, indicating how clearly individuals could be separated into distinct profiles (entropy). Based on these criteria and clinical interpretability, a two-class model was selected as the most parsimonious representation of the data.

Participants were assigned to the most likely latent class according to posterior probabilities. Differences between latent classes were examined using an independent-samples *t*-test or Mann–Whitney *U*-test for continuous variables and Chi-square or Fisher's exact test for categorical variables, as appropriate. All statistical tests were two-tailed, with a significance level of $P < 0.05$. Analyses were performed using IBM SPSS Statistics version 27.0 (IBM Corp., Armonk, NY, USA) and R software (R Foundation for Statistical Computing, Vienna, Austria), including the poLCA package, were used for the analyses.

Results

Of the 215 active-duty paramedics in the region, 129 completed the survey, yielding a response rate of 60%. All respondents met the inclusion criteria, and no missing data were observed. The mean age of participants was 31.4 ± 5.2 years (range: 22–46), and 52.7% identified as female. Approximately half were married (51.9%), and 55.0% reported having at least one child. The mean duration of professional EMS experience was 10.5 ± 6.1 years (range: 1–25).

Nearly all respondents had completed basic life support (99.2%), pediatric basic life support (96.1%), and advanced cardiac life support (92.2%) training. Although 89.1% reported having administered analgesics in pediatric prehospital settings, only 3.9% had received

formal education specifically focused on pediatric pain management. Paracetamol was the most commonly self-reported preferred analgesic (82.9%), followed by opioid analgesics (29.5%). Intravenous administration was the most frequently self-reported route (67.4%), whereas intramuscular (35.7%) and intranasal (13.2%) routes were used less often. These descriptive findings reflect self-reported preferences and stated practices and are not intended to represent case-level pediatric analgesic administration or dosing appropriateness.

Exploratory dimensionality assessment (principal components extraction with varimax rotation) supported a strong, unidimensional structure for the attitudinal item pool. All 13 items demonstrated component loadings ≥ 0.70 and were retained for LCA [Table 1].

LCA of these 13 items identified a two-class solution as the most parsimonious representation of underlying attitudinal profiles (self-reported practice orientations): among models specifying two to five classes, the two-class model showed the lowest BIC (4444.65), with acceptable classification precision (entropy = 0.881) and no class comprising fewer than 10% of the sample [Table 2]. Although models with three or four classes demonstrated slightly higher entropy values, these solutions yielded additional classes that were small or did not correspond to clearly distinguishable clinical patterns. In keeping with established model-selection

Table 1: Exploratory dimensionality assessment (principal components extraction with varimax rotation) of attitudinal items on pediatric analgesia

Item code	Item description	Component loading*
Item 1	Receiving physician's experience influences my treatment decision	0.767
Item 2	Parental anxiety to reach hospital quickly affects my analgesia decision	0.753
Item 3	I avoid intravenous access in children unless necessary	0.734
Item 4	Paramedic authority limitations restrict pain management	0.755
Item 5	Consulting physicians may be uncertain about pediatric dosing	0.841
Item 6	Young children cannot reliably express pain; rely on parents	0.819
Item 7	A mobile app with drug information would facilitate analgesia	0.823
Item 8	In-ambulance algorithms help analgesia administration	0.707
Item 9	I monitor vitals postanalgesia and assess normalization	0.733
Item 10	Intranasal methods reduce anxiety and improve safety	0.749
Item 11	I use nonpharmacologic methods in pediatric trauma	0.849
Item 12	We almost always consult a physician for pediatric analgesia	0.878
Item 13	Child-friendly ambulance design facilitates analgesia	0.717

*Exploratory dimensionality assessment was conducted using principal components extraction with varimax rotation. All items with primary component loadings ≥ 0.70 were retained for subsequent latent class analysis

Table 2: Model fit statistics and classification accuracy for competing latent class solutions

Model	AIC	BIC	SS-BIC	Entropy	LMR-LRT <i>P</i>	BLRT <i>P</i>	Smallest class, <i>n</i> (%)
2-class	4144.37	4444.65	4112.57	0.881	<0.001	<0.001	55 (42.6)
3-class	4144.74	4596.59	4096.89	0.952	<0.001	<0.001	25 (19.4)
4-class	4154.83	4758.25	4090.93	0.956	<0.001	<0.001	27 (20.9)
5-class	4202.12	4957.11	4122.16	0.952	0.274	<0.001	11 (8.5)

Model fit was evaluated using AIC, BIC, SS-BIC, entropy, and likelihood ratio tests (LMR-LRT and BLRT). The selected solution prioritized the lowest BIC, interpretability, and avoidance of very small classes (<10% of the sample). AIC: Akaike information criterion, BIC: Bayesian information criterion, SS-BIC: Sample-size adjusted Bayesian information criterion, LMR-LRT: Lo–Mendell–Rubin likelihood ratio test, BLRT: Bootstrap likelihood ratio test

guidance for LCA, the final model was therefore chosen based on the combination of lowest BIC, adequate classification precision, and substantive interpretability of the resulting classes.

Key attitudinal items differentiating the two latent profiles are presented in Table 3, noting that some probability estimates were imprecise (wide confidence intervals), consistent with classification uncertainty in finite samples. Class-specific endorsement probabilities revealed clear attitudinal contrasts between the proactive/system-oriented and conservative/low-engagement groups. Paramedics in the proactive/system-oriented class reported higher endorsement of, and intended use of decision-support tools, including the use of mobile drug-dosing applications (Item 7) and in-ambulance analgesia algorithms (Item 8), as well as more consistent self-reported post-analgesia vital sign monitoring (Item 9). This group also reported greater endorsement of non-pharmacologic adjuncts in pediatric trauma care (Item 11) [Table 3 and Figure 1].

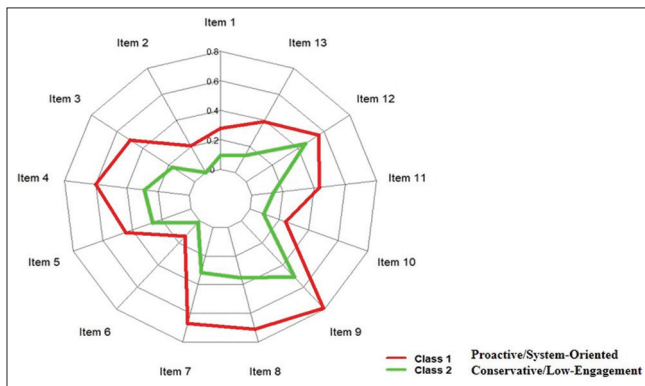


Figure 1: Class-specific endorsement probabilities for key attitudinal items differentiating latent profiles. The radar plot shows class-specific probabilities of endorsing the highest response category ("strongly agree," defined as responses 9–10 on the original 10-point scale) for selected attitudinal items from the final two-class latent class model. Class 1 represents the Proactive/System-Oriented profile and Class 2 represents the Conservative/Low-Engagement profile. Items shown: (3) Avoid IV access unless necessary; (4) Paramedic authority limitations; (5) Physician uncertainty in pediatric dosing; (7) Mobile drug-dosing application; (8) In-ambulance analgesia algorithms; (9) Post-analgesia vital sign monitoring; (11) Non-pharmacologic adjuncts; (12) Physician consultation for analgesia

In contrast, the conservative/low-engagement class demonstrated lower endorsement across these self-reported practices, reflecting reduced lower intended engagement with decision-support tools and lower endorsement of related safety-oriented practices. Differences were also observed in perceived structural and procedural constraints, including limitations related to paramedic authority (Item 4) and reliance on physician consultation for pediatric analgesia (Item 12) [Table 3].

Comparative analysis of demographic and professional characteristics showed no statistically significant differences between the two latent classes (all $P > 0.05$). Detailed between-class comparisons are presented in Table 4. The separation between the two profiles across key attitudinal domains is visually illustrated in the radar plot [Figure 1].

Discussion

Two distinct attitudinal profiles emerged among paramedics working within a nationally standardized EMS system: A proactive/system-oriented class and a conservative/low-engagement class. Despite uniform exposure to national protocols, and a largely homogeneous training environment, these profiles differed in their self-reported engagement with and intended use of decision-support tools, post-analgesia monitoring, and the breadth of analgesic strategies. Importantly, profile membership was not associated with age, sex, years of experience, or work context, suggesting that variability in pediatric prehospital analgesia may be influenced less by measured structural or demographic factors and more by underlying cognitive/attitudinal orientations. Because these classes were derived from self-reported responses, they should be interpreted as attitudinal profiles; correspondence with objectively observed analgesia delivery or ED-process outcomes requires validation with linked routine data.

The proactive/system-oriented profile represented a higher-endorsing subgroup that reported intended

Table 3: Class-specific probabilities of strong endorsement for selected attitudinal items

Item code	Item description	Class 1 probability (95% CI)	Class 2 probability (95% CI)
Item 3	I avoid intravenous access in children unless necessary	0.623 (0.086–0.746)	0.217 (0.106–0.740)
Item 4	Paramedic authority limitations restrict pain management	0.748 (0.212–0.875)	0.358 (0.156–0.878)
Item 5	Consulting physicians may be uncertain about pediatric dosing	0.554 (0.164–0.664)	0.327 (0.176–0.741)
Item 7	A mobile app with drug information would facilitate analgesia	0.841 (0.240–0.923)	0.395 (0.231–0.925)
Item 8	In-ambulance algorithms help analgesia administration	0.890 (0.270–0.933)	0.438 (0.232–0.972)
Item 9	I monitor vitals postanalgesia and assess normalization	0.986 (0.477–1.000)	0.634 (0.464–1.000)
Item 11	I use nonpharmacologic methods in pediatric trauma	0.545 (0.099–0.669)	0.176 (0.090–0.643)
Item 12	We almost always consult a physician for pediatric analgesia	0.699 (0.443–0.814)	0.569 (0.461–0.814)

Values are model-based probabilities (95% CI) of endorsing the highest response category ("strongly agree," defined as responses 9–10 on the original 10-point Scale) for selected attitudinal items in the final two-class latent class model. Class membership was assigned using modal posterior probabilities. CI: Confidence interval

Table 4: Demographic and professional characteristics of paramedics across latent classes

Variable	Class 1	Class 2	$\chi^2/Z/t$	P
Age (years)	31 (22–43)	29 (25–46)	–0.936	0.349
Sex				
Male	31 (41.9)	30 (54.5)	2.027	0.155
Female	43 (58.1)	25 (45.5)		
Marital status				
Single	35 (47.3)	27 (49.1)	0.041	0.840
Married	39 (52.7)	28 (50.9)		
Highest academic degree achieved				
Associate degree	24 (32.4)	21 (38.2)	0.693	0.707
Bachelor's degree	39 (52.7)	28 (50.9)		
Graduate degree	11 (14.9)	6 (10.9)		
Professional experience (years)	10.74±5.98	10.18±6.35	0.513	0.609
Parental status				
No children	35 (47.3)	23 (41.8)	0.193	0.660
Has children	39 (52.7)	32 (58.2)		
Station type				
Urban	44 (59.5)	35 (63.6)	0.089	0.765
Rural	30 (40.5)	20 (36.4)		
Formal training in pain management				
No	70 (94.6)	54 (98.2)	0.393	0.393
Yes	4 (5.4)	1 (1.8)		
Previous administration of analgesics in ambulance				
Yes	66 (89.2)	49 (89.1)	0.000	0.999
No	8 (10.8)	6 (10.9)		

Values are presented as median (minimum–maximum), mean±SD, or *n* (%), as appropriate. Group comparisons used Pearson's Chi-square test for categorical variables, Mann–Whitney *U*-test for nonnormally distributed continuous variables, and Independent-samples *t*-test for normally distributed variables. Class 1 denotes proactive/system-oriented profiles; Class 2 denotes conservative/low-engagement profiles. SD: Standard deviation

use of mobile applications and algorithm cards for pediatric dosing, monitored vital signs after analgesia, and more often employed non-invasive and non-pharmacologic strategies. This pattern is consistent with prior work linking higher self-efficacy, familiarity with pediatric protocols, and perceived system support to more consistent intentions and self-reported practice orientations regarding analgesia in prehospital and emergency care settings.^[1–3] Cognitively, these paramedics may manage task complexity by “offloading” cognitive demands onto external aids such as dosing applications and checklists rather than avoiding treatment, in line with cognitive load theory applied to emergency medicine decision-making.^[20] Their practices align with guideline-recommended multimodal pediatric pain management and may be consistent with a more structured, guideline-concordant approach; however, ED transition outcomes were not measured in this survey-based study, and whether these attitudinal differences translate into objectively observed analgesia delivery or ED-level outcomes requires validation using run-sheet/medication documentation and, where feasible, linked ED data.^[6,8]

By contrast, the conservative/low-engagement profile reflected a more restrictive, risk-averse orientation, with lower use of decision-support tools, less consistent post-analgesia monitoring, and a narrower analgesic

repertoire. This pattern aligns with prior descriptions of pediatric prehospital oligoanalgesia, in which hesitancy is driven by fear of dosing errors, concern about masking evolving pathology, and medicolegal anxiety.^[1–3,7] Conceptually, it is consistent with a fear-avoidance pattern: under time pressure and faced with complex pediatric dosing, these paramedics may be more likely to report a preference for minimal intervention and greater hesitancy than to seek cognitive support.^[19] Limited engagement with mobile apps and algorithms may reflect not only knowledge gaps but also reduced perceived self-efficacy and a preference for procedural minimalism, paralleling work that links pain-management behavior to attitudes, perceived behavior control, and intention within the theory of planned behavior framework.^[21] These theoretical frameworks are offered as interpretive lenses; we did not directly measure cognitive load, fear-avoidance, or theory of planned behavior constructs in this survey. In a setting of standardized protocols and high baseline training, such attitudinal conservatism underscores the need to address emotional and cognitive barriers – alongside informational content – when strengthening pediatric pain care for children and families in the prehospital setting.

A key finding of this study is the “experience trap:” years of EMS practice did not distinguish the proactive/

system-oriented from the conservative/low-engagement class. Age, tenure, parental status, educational level, station type, and prior pediatric pain training were similarly distributed, challenging the assumption that experience alone de-biases conservative practice or naturally improves pediatric pain care, consistent with prior reports of persistent pediatric oligoanalgesia despite seniority and formal training.^[1-3] Our data instead suggest that conservative habits may become reinforced over time if not actively addressed, and that even experienced paramedics may continue to avoid pediatric analgesia despite clear protocols. One plausible explanation is the limited availability of structured outcome feedback from receiving hospitals to prehospital teams: when analgesia-related outcomes (e.g. ED arrival pain severity or the need for 'catch-up' dosing) are not routinely visible to paramedics, experiential learning may preferentially reinforce 'safe' non-intervention rather than guideline-concordant analgesia. Over time, such feedback-poor environments may foster clinical inertia, whereby established habits persist despite protocols and training – particularly for pediatric dosing decisions perceived as high-risk and cognitively demanding. For PED clinicians, this may suggest that children arriving without adequate prehospital analgesia could be consistent with stable attitudinal orientations (self-reported practice patterns) rather than inexperience alone, underscoring the importance of shared expectations and continuity across the ambulance–PED interface. However, whether latent profile membership corresponds to objectively observed analgesia delivery requires validation using run-sheet/medication documentation (e.g., analgesia rates, dosing, and documentation quality) and, where feasible, linked ED outcomes.

These findings have potential implications for implementation science and precision education in EMS. In practical terms, the profiles highlight modifiable implementation targets directly relevant to guideline-concordant and safe pediatric analgesia – namely uptake of dosing aids/algorithms (to reduce dosing uncertainty), consistent post-analgesia monitoring, and support for multimodal non-pharmacologic adjuncts. Notably, despite high completion of core life-support courses, only 3.9% of respondents reported formal education focused on pediatric pain management, underscoring a specific educational gap that may be addressed through profile-informed training strategies. A one-size-fits-all training model may be insufficient to shift entrenched conservative/low-engagement patterns, and broad protocol revisions or classroom teaching may have limited impact when used alone.^[1,2] Instead, high-fidelity, scenario-based simulation with structured use of dosing applications and feedback may help this group overcome fear-avoidance and build procedural

fluency.^[6,8,19] In parallel, proactive/system-oriented paramedics can be leveraged as peer mentors and local champions, consistent with implementation approaches that emphasize peer-led reinforcement and local opinion leaders when embedding new practices.^[1,21] Embedding brief prompts that support child- and family-centered communication (e.g., reassurance and expectation-setting) alongside dosing supports may further strengthen the early care experience without adding undue cognitive burden.

Previous studies show that pediatric oligoanalgesia persists even where child-friendly analgesic options and structured pain protocols exist.^[1-3,6,8] These works frequently cite limited pediatric exposure, dosing uncertainty, and weak feedback mechanisms as key barriers, but rely on variable-centered analyses that assume a largely homogeneous provider group. Using a person-centered analytic lens, our study indicates that paramedics operating under the same structural conditions cluster into distinct attitudinal profiles/decision-making orientations that cut across traditional demographic categories. This segmentation offers a practical framework for aligning educational and implementation strategies with the distribution of self-reported decision-making orientations in a standardized EMS workforce. However, although the underlying concept of attitudinal heterogeneity is likely transferable across EMS systems, the observed prevalence of each profile may vary by local scope of practice, analgesic formularies, medical oversight models, training culture, and institutional norms. Unlike variable-centered summaries, LCA provides model-based class membership probabilities and an explicit measure of classification precision (entropy), offering a segmentation framework for profile-informed implementation hypotheses that can be evaluated with objectively measured endpoints in future studies.

Longitudinal linkage of latent class membership with real-world run-sheet data and PED records could help determine whether proactive/system-oriented paramedics are associated with more timely and adequate, objectively documented analgesia delivery and whether this is associated with measurable differences in pain trajectories and early ED care processes. Qualitative interviews with representatives of each class may clarify cognitive, emotional, and contextual drivers of self-reported orientations and decision-making, while implementation trials of profile-targeted interventions (e.g. app-based decision support, peer mentoring, simulation curricula) could test whether shifting clinicians toward more proactive orientations improves consistency of pediatric pain care across the prehospital–PED continuum using objectively measured behavioral endpoints. Future studies should

validate these survey-derived profiles against objective documentation and, where feasible, linked PED data, and then test profile-informed interventions using behavioral endpoints.

Limitations

This study has several limitations. Most importantly, the latent classes were derived from self-reported survey responses and therefore represent attitudinal (self-reported) profiles rather than observed clinical behavior. Objective behavioral validation was not available (e.g., run-sheets, medication records, dosing accuracy, pain scores, or ED outcomes); therefore, whether profile membership corresponds to objectively observed analgesia delivery requires validation in future studies. We did not collect patient-episode-level clinical details (e.g., recipient age strata, pain severity/indication, agent/dose per encounter, or dosing appropriateness), limiting the clinical granularity of the reported analgesic practices. Second, it was conducted in a single province and EMS organization in Türkiye, which may limit generalizability to systems with different scopes of practice, crew models, or pediatric formularies. Third, reliance on self-reported survey data introduces potential social desirability and recall bias, whereby participants may report responses aligned with perceived best practice rather than their actual behavior, potentially inflating endorsement of more proactive attitudes. Although the response rate was 60%, non-response bias cannot be excluded. Characteristics of non-responders were not available for comparison; therefore, responders may have differed systematically in attitudes or intended practice. In addition, individual pediatric case volume/exposure was not quantified; heterogeneity in recent pediatric encounters may have influenced self-reported attitudes and intended practices. Fourth, the cross-sectional design precludes causal inference regarding determinants of attitudes and intended practices. Finally, psychometric evaluation and LCA were performed in one sample without external validation; class solutions may therefore be sample-dependent, and modal class assignment may introduce some classification uncertainty and imprecision (wide confidence intervals), warranting cautious interpretation. Given the number of comparisons performed, some statistically significant associations may reflect chance findings (Type I error) and should therefore be interpreted cautiously as exploratory.

Conclusion

This study suggests that variation in pediatric prehospital analgesia within a nationally standardized EMS system may be influenced less by measured structural or demographic factors and more by distinct latent attitudinal profiles/practice orientations

among paramedics. Two subgroups – a proactive/system-oriented and a conservative/low-engagement profile – were identified, underscoring the potential influence of cognitive, emotional, and contextual factors on self-reported approaches to pediatric pain management before PED arrival. These findings support moving beyond generic training toward profile-informed/attitudinally targeted practice, education, and system-level supports. While the concept of attitudinal heterogeneity is likely transferable across EMS systems, the relative prevalence of each profile may vary by local scope of practice, training culture, and institutional context. Future work should test whether profile-informed interventions are associated with improvements in objectively measured analgesia delivery (e.g., run-sheet documentation of rates/doses) and related ED-process outcomes, ideally using linkage to routine prehospital and PED data.

Author contributions statement (CRediT)

Conceptualization: YG, LMG.

Methodology: YG, FCT.

Formal analysis: FCT.

Investigation: LMG, OFK, HEK, PC.

Data curation: LMG, OFK.

Visualization: LMG, FCT.

Writing – original draft: LMG, YG.

Writing – review and editing: LMG, YG, OFK, FCT, HEK, PC.

Supervision: YG.

Project administration: YG.

Conflicts of interest

None Declared.

Ethical approval

The study protocol was approved by the Ethics Committee of Muğla Sıtkı Koçman University (Approval No. 220034-27). The study was conducted in accordance with applicable ethical standards.

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