**Prehospital Pain Management**
Evidence-Based Guidelines for the Pharmacologic Management of Acute Pain by Emergency Medical Services

By the National Association of State EMS Officials (NASEMSO), The American College of Emergency Physicians (ACEP®), and the National Association of EMS Physicians (NAEMSP®)

For the National Highway Transportation Safety Administration (NHTSA), Office of EMS

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**Collaborating Organizations**

**PRINCIPAL INVESTIGATOR:**
National Association of State EMS Officials (NASEMSO)

**CO-INVESTIGATORS:**
American College of Emergency Physicians (ACEP®)
National Association of EMS Physicians (NAEMSP®)

For more information: [https://nasemso.org/projects/prehospital-pain-management-ebg](https://nasemso.org/projects/prehospital-pain-management-ebg)

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**Disclaimer & Disclosure**

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EMS is charged with providing person-centered evidence-based, and cost effective quality care that improves practice and patient outcomes.

It can take years to integrate evidence into practice – and when it comes to pain mgt in our current environment, we don’t have years to figure it out!

[https://specialty.mims.com/](https://specialty.mims.com/)
“It is easier to find men who will volunteer to die, than to find those who are willing to endure pain with patience.”

Julius Caesar

How can EMS best assess and manage pain to reduce physical, psychological and emotional suffering?

Follow the evidence

Analyze its merits
Adapt practice as needed

Introductory remarks

George Lindbeck, MD
State EMS and Trauma Medical Director
Virginia Department of Health
Principal Investigator
NASEMSO

Overall project flow diagram

*EBG Technical Expert Panel consisted of pain management experts, EMS physicians, EMS clinicians, researchers, and educators, pediatric emergency medicine physicians, a pharmacologist, a patient advocate, and an evidence-based guideline methodologist

Prehospital guidelines: Revised recommendations
PROJECT GOALS

1. Develop a set of EBGs for EMS pain mgmt building on the AHRQ findings
2. Develop performance measures for pain management and patient care guidelines
3. Develop educational materials for EMS clinicians to roll out the EBG and patient care guidelines

Agency for Healthcare Research and Quality (AHRQ) did a systematic review of comparative effectiveness of analgesics used by EMS

What is evidence-based practice?

Elements of a systematic review

- Identify Critical Needs
- Define what is to be examined and how
- Plan for implementation
- Examine, reflect, adjust
- Implement and sustain

The TEP developed 9 PICO* questions based on AHRQ review + 1 re: peds analgesia via fentanyl IN

*Patient/population-intervention-comparison-outcome

Frame questions
- Involve stakeholders
- Define what is to be examined and how

Explicit questions
- Systematic evaluation of evidence
- To stakeholders and decision-makers using appropriate formats for different end users
- Active dissemination of results
- Commitment to update

Rigorous review methods
- Transparent
- Repeatable


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Frame questions
- Involve stakeholders
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Rigorous review methods
- Transparent
- Repeatable
GRADE methodology

- Grading of Recommendations, Assessment, Development, and Evaluation
- Detailed methodology, summary findings, evidence-to-decision tables presented in companion paper

Strength of recommendation on a continuum
Strong against  Conditional  Strong for

Education offering objectives
Upon completion, each participant will do the following with a level of proficiency that meets the standards for their scope of practice:

- Identify the major recommendations of the EMS Pain Mgt Guidelines and explain their rationales.
- Safely implement EBG for pain management within their local protocols.
- Defend the need for person-centered EMS pain management based on quality evidence.

PICO Questions & Recommendations
Each question will be presented individually with the strength of the evidence, guideline recommendation, rationales, and caveats

Ashish R. Panchal, MD, PhD
NREMT
The Ohio State University
Wexner Medical Center
**PICO #1 - Strong Recommendation**
*(Low certainty of evidence)*

We recommend in favor of IN fentanyl over IM or IV opioids in the treatment of moderate to severe pain in pediatric patients prior to vascular access or without (or no indications for) IV access.

**Conditional recommendation:** Either IN fentanyl or IV opioids once IV access established

Pain management in pediatrics challenging, priority of care

**Advantages:** Effectiveness; ease of use

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**PICO #2 - Conditional Recommendation**
*(Low certainty of evidence)*

We suggest in favor of IV acetaminophen over IV opioids alone if APAP is available, affordable, & easy to give.

**Rationale:** Equivalent pain control, better tolerability

**Possible disadvantages:** Cost; given by infusion; EMS often prefers IVP or rapid delivery routes

Is this available where you work now?
Considerations re: nausea

APAP may produce less dizziness, nausea and/or vomiting than opioids
May avoid concurrent use of antiemetic

Etiologies of nausea:
- Pain; anxiety; GI disorders, infection, medications & toxins, CNS, endocrine & metabolic
- Opioids: direct stimulation medulla chemoreceptors
- Motion sickness in EMS vehicle (Weichenthal)

PICO #3: Should IV NSAIDs vs. IV OPIOIDs be used for treatment of moderate to severe pain in the prehospital setting?

We suggest either IV NSAIDs or IV Opioids for the mgt of moderate to severe pain

Insufficient evidence to make a recommendation re: pain severity at 15 minutes, partial or full relief of pain, or time to analgesic effect

Concerns:
- Sub-therapeutic dose of ketorolac in limited data

Cost differential: ketorolac more expensive
- Adverse events may be more common with opioid (morphine) (Rainer)
- IV NSAIDs attractive if patient is opioid tolerant or dependent, claims opioid allergy or intolerance, or prefers drug with lower risk profile

Which do you use now?
PICO #4: Should **IV Acetaminophen (APAP)** vs. **IV NSAIDs** be used to treat moderate to severe pain in the prehospital setting?

PICO #4 - Conditional Recommendation
(Low certainty of evidence)

We suggest in favor of **IV NSAIDs** over IV APAP for the initial mgmt of moderate to severe pain in the prehospital setting.

We also recommend in favor of either PO NSAIDs or PO ACETAMINOPHEN for the Initial mgmt of pain in the prehospital setting.

PICO #4 - Rationale

- **IV route:** Little difference in pain severity at 30 or 60 min or in partial or complete pain relief
- **Adverse events:** Comparable
- **Cost & feasibility:** Favors IV NSAIDs
- **Consider oral, non-opioid analgesics**

All evidence: Non-graded; ED based

PICO #4 – Caveats

- All are candidates for pain mgmt & comfort measures regardless of transport interval
- Do not assume fast analgesic Rx at ED - may have significant delays (Woolner, Patrick)
- Any EMS analgesics (including PO) may markedly improve pain relief well into ED stay
PICO #5: Should IV KETAMINE vs. IV NSAIDs be used to treat moderate to severe pain in the prehospital setting?

We suggest either IV ketamine or IV NSAIDs for the initial mgt of moderate to severe pain in the prehospital setting.

Single study found significant pain relief at 30 min after ketorolac compared to ketamine, but no significant differences at 15 or 60 min, time to analgesic effect, pain relief, or pain memory.

SE higher with ketamine – not clinically significant.

PICO #6: Should IV KETAMINE vs. IV OPIOIDS be used to treat moderate to severe pain in the prehospital setting?

We suggest either IV ketamine or IV opioids for the initial mgt of moderate to severe pain.

No clinically significant difference in pain at 15, 30, or 60 min, in partial or complete pain relief, or time to analgesic effect.

Small sample size; difficult for pts to quantify.
PICO #6 - Rationale

Ketamine provides inconsistent but potentially rapid onset of pain relief and currently has a wide range of dosing strategies (IVP, IVPB, IM, IN).

Number of pts experienced mild-to-moderate side effects (dizziness, dysphoria, confusion) (Ghate)

Do you use ketamine?

PICO #6 - Conclusions

- IV opioids used more commonly now, but both drugs likely acceptable to stakeholders
- **Ketamine**: Viable alternative for pain if patient is opioid tolerant or dependent, claims opioid allergy or intolerance, or has experienced adverse events with opioids
- Non-opioid option may increase health equity, but not addressed in this evidence base

PICO Questions & Recommendations

Continuing the discussion…

Jonathan Powell, MPA, NRP
NREMT Research Fellow
PICO #7: Should IV morphine vs. IV fentanyl be used to treat moderate to severe pain in the EMS setting?

**PICO #7 - Conditional recommendation**
(low certainty of evidence)

*If opioids are selected for pain mgmt., we suggest either IV morphine or IV fentanyl for the treatment of moderate to severe pain in the prehospital setting*

- **Morphine**: Associated with higher rates of nausea
- **Fentanyl**: More route options (IN)

Conflicting results in EMS vs. hospital-based trials

PICO #7 – Rationale

Opiates have been the cornerstone of pain management for centuries

**Natural + Synthetic Agents**

Bind to opioid receptors in and outside of CNS

- “Mu-1” produce clinical analgesia
- “Mu-2” produce respiratory depression, euphoria, physical dependence, and constipation

PICO #7 – Rationale cont.

Other receptors: delta, sigma, kappa, and epsilon

Kappa produces analgesia, sedation and miosis

Select an opioid based on pain severity, route options, previous responses to opioids, SEs, how drug may interact with a patient’s disease state(s) & local protocols

Which do you prefer?
**PICO #8: Should a combination of weight-based IV OPIOID + KETAMINE vs. weight-based IV OPIOID alone be used to Rx moderate-severe pain in the prehospital setting?**

**PICO #8 - CONDITIONAL RECOMMENDATION**
(VERY LOW CERTAINTY OF EVIDENCE)

*We suggest AGAINST the combination of weight-based IV opioid + wt-based IV ketamine vs. weight-based IV opioid alone*

**Rationale:** Lack of clinical improvement in pain control, slight increase in undesirable SE, and desire to avoid complexity in administration

**PICO #9: Should a combination of IV OPIOID + IV KETAMINE vs. IV KETAMINE alone be used to treat moderate to severe pain in the prehospital setting?**

**PICO #9 - NO RECOMMENDATION**
(VERY LOW CERTAINTY OF EVIDENCE)

*NO recommendation made at this time on the combination of IV KETAMINE + IV OPIOID vs. IV KETAMINE alone due to significant uncertainty of the evidence and incomplete information concerning the comparison*

Need more

https://www.youtube.com/watch?v=56rDexucUDU

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**PICO #10:** Should **NITROUS OXIDE** vs. **IV OPIOIDS** be used to treat moderate to severe pain in the prehospital setting?

**DISCUSSION**

Pain management is a core competency for EMS practitioners

**Why is this important?**

- Pain is a frequent complaint of EMS patients
- Historical reliance on IV opioids

Growing opioid epidemic and expanding medical options opened door to exploring evidence-based guidelines (EBGs) with choices identified

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Current EMS Data

- Challenges persist in providing adequate analgesia in the field
- Pain frequently undertreated
- Disparities accentuated based on patient demographics

What are the barriers to effective pain management by EMS?

We don’t always follow the EVIDENCE!

What meds were used for EMS pain mgt by Eagle Systems? (2/15)

- Fentanyl (60%)
- Morphine (43%)
- Ketamine (16%)
- Ketorolac (16%)
- Nitrous Oxide (6%)
- Dilaudid (6%)
- IV Acetaminophen (1 system)
2019 NEMSIS public use research database

N total: 26,501,968 records for 911 responses
N Pain subset (initial pain score documented at ≥6): 3,206,755 pts
Received prehospital analgesics: 428,562 (13%)

<table>
<thead>
<tr>
<th>Drugs used</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Opioid</td>
<td>392,148 (91.5%)</td>
</tr>
<tr>
<td>NSAID</td>
<td>20,529 (4.8%)</td>
</tr>
<tr>
<td>Ketamine</td>
<td>16,338 (3.8%)</td>
</tr>
<tr>
<td>Acetaminophen</td>
<td>9,425 (2.2%)</td>
</tr>
</tbody>
</table>

Sum >100% as one person could receive ≥2 classes of meds

Model EMS Protocol for Prehospital Pain Management

Not part of study - included for completeness

Individualized
Multimodal
Multidisciplinary

GOAL
Multimodal options are used by EMS to treat pain from various etiologies in a safe and effective way based on pain severity, patient history, hemodynamic status, & choice unless interventions are contraindicated or patient refuses


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What's in your toolbox now?

What could or should be?

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Elephant Elite E119571

Pediatric Pain Assessment

How did this happen?

Lorin R. Browne, DO, FAAP
Associate Professor of Pediatrics and Emergency Medicine
Medical College of Wisconsin
Associate Medical Director, Pediatrics
Milwaukee County Office of Emergency Management EMS

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https://www.myconfinedspace.com/

Myths about pain in children

Infants can't feel pain
Children experience less pain than adults
Children will admit to pain
Children recover more quickly from pain
Opiates always cause respiratory depression in children

https://www.apa.org/monitor/2021/07/ce-corner-developmental-trauma

Assessment: Pain by the numbers

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Photo by Matt Duncan on Unsplash
**Pain assessment in children**

Requires careful observation of key behaviors appropriate for their age & development

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**Revised FLACC Scale: Birth to 7 yrs or unable to communicate their pain**

Scores range: 0–10 (0 = no pain)

<table>
<thead>
<tr>
<th>Categories</th>
<th>Score 0</th>
<th>Score 1</th>
<th>Score 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face</td>
<td>No particular expression or smile</td>
<td>Occasional grimace or frown; withdrawn, disinterested. Sad, appears worried.</td>
<td>Frequent to constant quivering chin, clenched jaw; disinterested looking face; expression of fright or panic.</td>
</tr>
<tr>
<td>Legs</td>
<td>Normal position or relaxed; usual tone to limbs</td>
<td>Uneasy, restless, tense; occasional tremors</td>
<td>Kicking or legs drawn up; marked increase in spasticity; constant tremors/jerking</td>
</tr>
<tr>
<td>Activity</td>
<td>Lying quietly, normal position, moves easily; regular rhythmic respirations</td>
<td>Squirming, shifting back &amp; forth, tense; guarded movements; mildly agitated; shallow, splinting respirations, intermittent sighs</td>
<td>Ached, rigid, or jerking; severe agitation, head banging; shivering, breath holding, gasping, severe splinting</td>
</tr>
<tr>
<td>Cry</td>
<td>No cry (awake or asleep)</td>
<td>Moans or whispers, occasional complaint; occasional verbal outbursts, constant grunting</td>
<td>Crying steadily, screams or sobs, frequent complaints; repeated outbursts, constant grunting</td>
</tr>
<tr>
<td>Consolability</td>
<td>Content, relaxed</td>
<td>Reassured by occasional touching, hugging or being talked to, distractible</td>
<td>Difficult to console or comfort; pushing caregiver away, resisting care or comfort measures</td>
</tr>
</tbody>
</table>

*(Malviya, S. et al, 2006)*

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**Children’s Hospital of Eastern Ontario Pain Scale (CHEOPS)**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Score 0</th>
<th>Score 1</th>
<th>Score 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cry</td>
<td>No</td>
<td>Crying, moaning</td>
<td>Scream</td>
</tr>
<tr>
<td>Facial</td>
<td>Smile</td>
<td>Neutral</td>
<td>Grimace</td>
</tr>
<tr>
<td>Verbal</td>
<td>Positive statement</td>
<td>Negative statement</td>
<td>Suffering from pain</td>
</tr>
<tr>
<td>Torso</td>
<td>Neutral</td>
<td>Variable, upright</td>
<td>Stretched</td>
</tr>
<tr>
<td>Legs</td>
<td>Neutral</td>
<td>Cont. moving, kicking</td>
<td>Stretched</td>
</tr>
</tbody>
</table>

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**Children 4-12 years of age**

**Faces Scales**

![Faces Scales Image](https://www.disabledworld.com/health/pain/scale.php)
Combination tool

Rating | Impact on the patient
--- | ---
10 | Worst pain you can imagine
7-9 | Pain is so bad, normal activities are impacted, including talking or sleeping
4-6 | Pain makes it hard to concentrate. You can’t ignore the pain but you can still work through some activities
1-3 | Mild pain: Noticeable, but tolerable
0 | No pain

Not all pain scores appear accurate
What else should EMS assess?

Pain assessment tool in patient with dementia

Shared decision-making and patient preferences

What is a person-centered approach to pain mgt?
Patient choice is important!

What else should be considered?
Underlying pathology, pain intensity, scope of practice

What can help alleviate pain other than medications?
Empathy, verbal engagement
Use repositioning, breathing; heat/cold; splints; guided imagery

When you touch someone with intention, you are saying, I am here to help you heal.

Obtaining Past Medical History is Critical

Cure sometimes. Treat often. Comfort always.
Hippocrates
Non-pharmacologic Considerations in children

Use distraction (bubbles, Buzzy, music, electronics, toys)
Consider need for caregiver presence; holding, pacifier

Considerations in Pharmacologic pain treatment options

Sabina Braithwaite, MD, MPH
Associate Professor of Emergency Medicine and EMS Fellowship Director
Washington University in St Louis

Options presented are not carried by all EMS agencies and do not replace protocols approved by your EMS Medical Director

"Rights" of medication administration

Patient: Denies allergy
Drug: Independent cross-check
Dose
Route & site
Timing of administration
Reason: Indicated/not contraindicated
Documentation
If non-pharmacologic interventions are insufficient - Consider use of **pharmacologic analgesics**

**PO options** for milder pain – onset of action slower; desire to avoid parenteral meds or opioids

- **Acetaminophen** 15 mg/kg PO (max dose 1 gram)
- **Ibuprofen** 10 mg/kg PO if older than 6 months (max dose 800 mg)

**Intranasal route (IN)** using the Mucosal Atomizer Device (MAD)

Preferred for initial dosing (for pain) if no IV access

- **Fentanyl** 1 mcg/kg IN
- **Ketamine** 0.5 mg/kg IN (max initial dose 25 mg; max cumulative dose 100 mg)

**INTRAMUSCULAR (IM) OPTIONS**

- **Ketorolac** (one-time dose only)
  - Adult (non-pregnant): 30 mg IM
  - Pediatric (2-14 years old): 1 mg/kg IM (max dose 30 mg)

- **Morphine** sulfate: 0.1 mg/kg IM (max initial dose 15 mg)

- **Fentanyl** 1 mcg/kg
  - (max initial dose 100 mcg)

- **Ketamine** 0.3 mg/kg IM
  - (max initial dose 25 mg)

Needle phobia!

**Why is pain management a challenge in children?**

Strongly consider intranasal options

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**Inhaled nitrous oxide (N₂O) if available**

**IV ROUTE**

**ACETAMINOPHEN**
- Adult: 1 g IV
- Peds: 15 mg/kg IV (max dose 1 g)

**KETOROLAC** (one-time dose only)
- Adult (non-pregnant): 15 mg IV
- Peds (2-14 years old): 0.5 mg/kg IV (max dose 15 mg)

**FENTANYL**
- Adult: 25-50 mcg IV
- Peds: 1 mcg/kg; (max initial dose 50 mcg)

**MORPHINE** sulfate:
- Adult: 5 mg IV
- Peds: 0.1 mg/kg IV (max initial dose 5 mg)

**HYDROMORPHONE**
- Adult: 1-2 mg IV
- Peds: 0.015 mg/kg IV (max initial dose 2 mg)

**KETAMINE**
- Adult: 25 mg slow IVP or infusion in 100 mL NS/LR
- Peds: 0.25 mg/kg IV (max initial dose 25 mg) (max cumulative dose 100 mg)

**Anticipate Before Complications** – have anti-emetic ready to treat nausea in high-risk patients
Reassess q. 5 minutes! Repeat doses per protocol (if not contraindicated) until pain is tolerable, max dose is given, patient refuses, or SE evident.

Careful/diligent ongoing reassessment.