PAEDIATRIC ACUTE PAIN MANAGEMENT

Naveen Poonai MSc MD

Associate Professor

Departments of Paediatrics, Epidemiology & Biostatistics

I acknowledge that Western University is located on the traditional lands of the Anishinaabek (Ah-nish-in-a-bek), Haudenosaunee (Ho-den-no-show-nee), Lūnaapéewak (Len-ahpay- wuk) and Attawandaron (Add-a-won-da-run) peoples, on lands connected with the London Township and Sombra Treaties of 1796 and the Dish with One Spoon Covenant Wampum. This land continues to be home to diverse Indigenous peoples (e.g. First Nations, Métis and Inuit) whom we recognize as contemporary stewards of the land and vital contributors of our society.

Presenter Disclosure

Faculty: Naveen Poonai

Relationships with commercial interests: None

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- Children's Health Research Institute
- Academic Medical Organization of Southwestern Ontario
- Canadian Institutes of Health Research
- Ontario Ministry of Economic Development, Job Creation, and Trade

Learning Objectives

Understand the barriers to recognition and management of acute pain in children

Apply both pharmacologic and non-pharmacologic strategies in managing acute pain in children

Evaluate the impact of pain management strategies with validated instruments

Overview

History and scope of the problem

Pain assessment

Non-pharmacologic strategies

Pharmacologic strategies

Procedural pain

Why is pain such a big problem in children?

Pain is the most **common reason** why children visit the hospital

1 **75** **1/4**

More than **75%** of children experience pain in hospital

Pain research accounts for only **0.25%** of all health-related research in Canada

Source: www.sickkids.ca

Why is pain such a big problem in children?

I'm not sure how best to assess pain in kids

I'm not sure what the best remedies are

Why is pain such a big problem in children?

88 hours

18 hours

Source: www.sickkids.ca

How did we get here?

1930s

Often no anesthesia is required…a sponge dipped in sugar will often suffice to calm a baby [for surgery]

- Philip Thorek

"Infants don't feel pain"

1950s

1990s

Large disparity in pain management between children and adults first described

Opioid Crisis

2012

2013

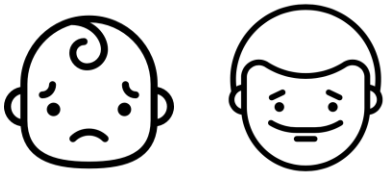
Federal regulations on use of several opioids in children: **codeine, tramadol, oxycodone**

How big of a problem is undertreated pain?

55-60% of children admitted with a painful condition receive **no** analgesia in the ED

Of those that receive analgesia,
~70% wait more than an hour…

…and **~40%** wait more than 2 hours

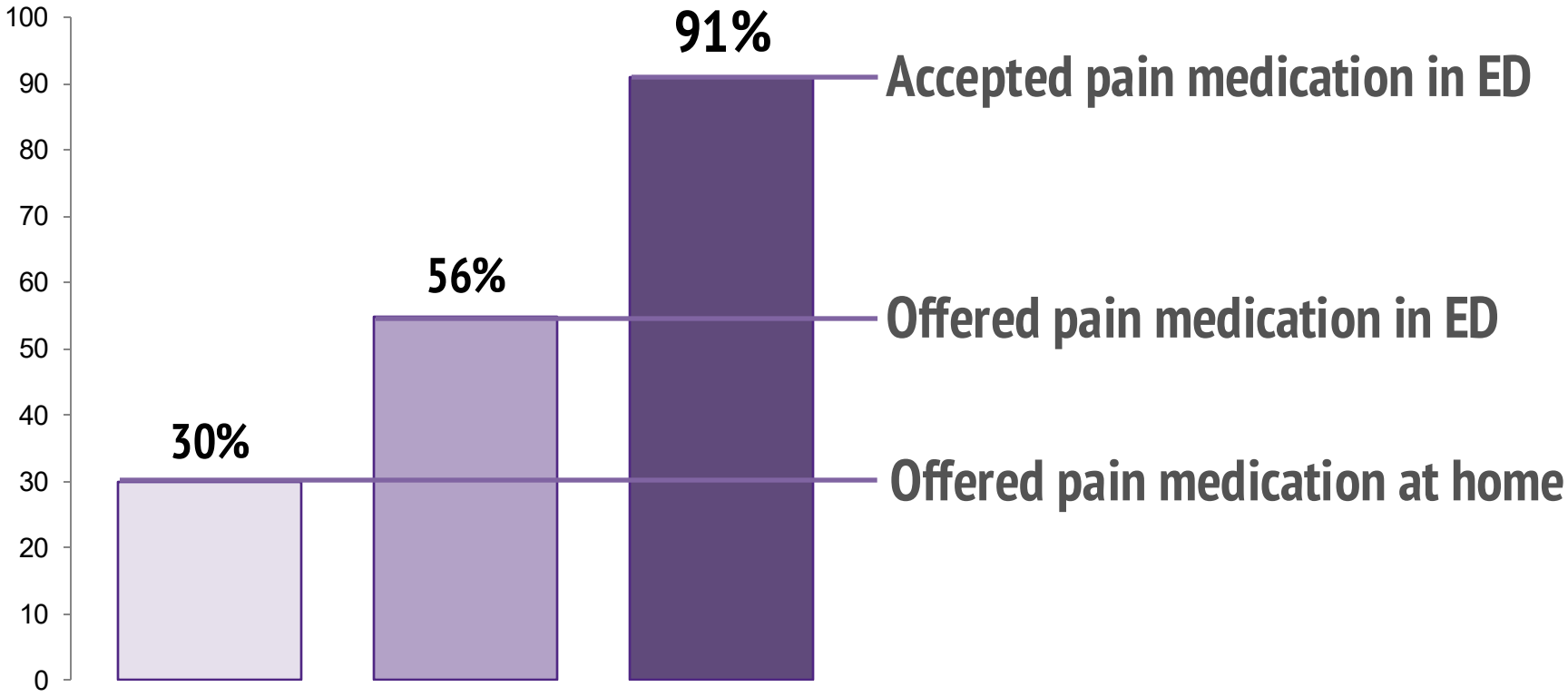


Compared to adults, children receive fewer doses of analgesia and/or incorrectly dosed analgesics

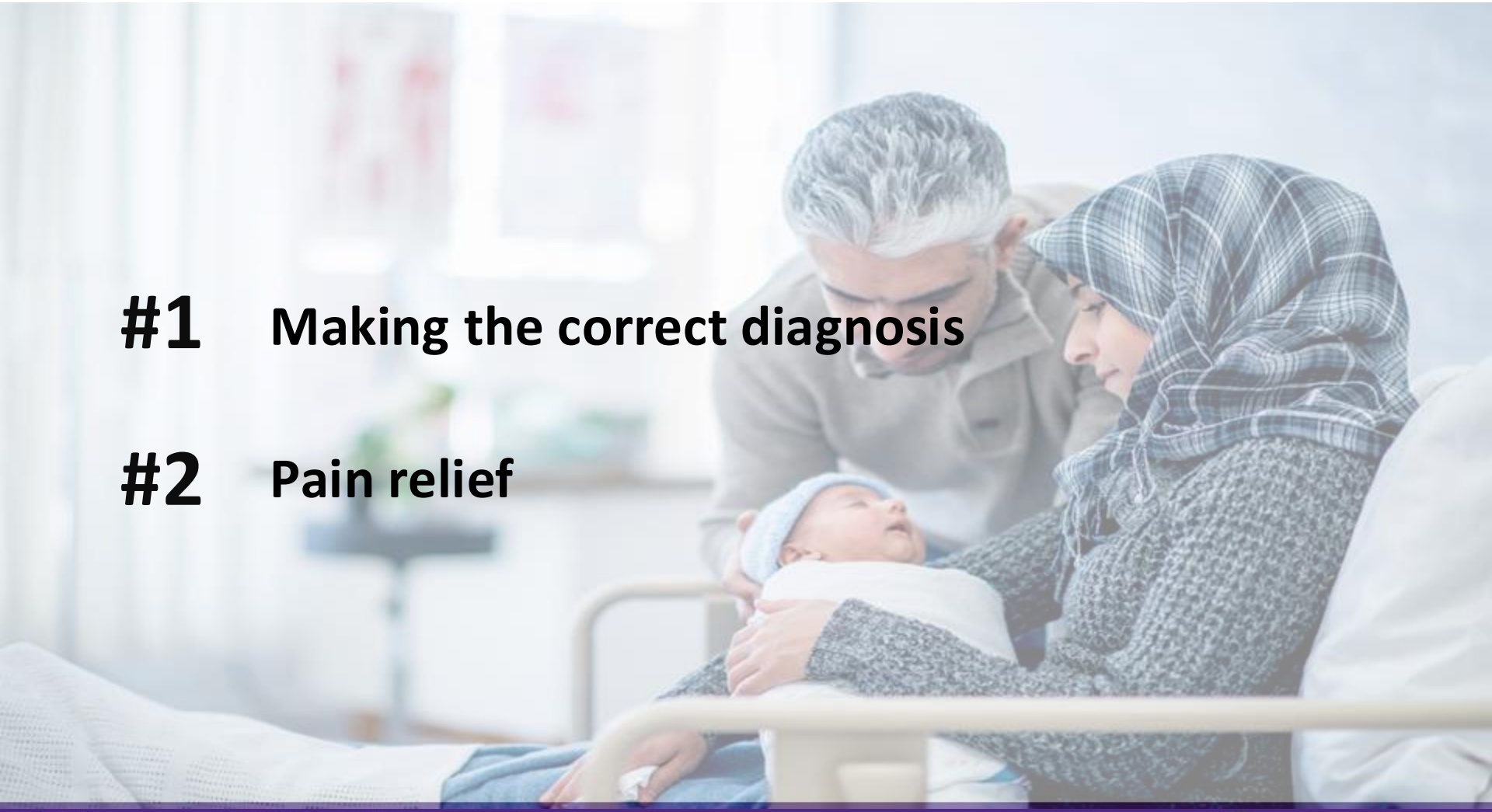
Sources: www.sickkids.ca; IASP Press

2018 Canadian Tertiary Care Survey

Poonai et al. 2018



What do parents expect?



#1 **Making the correct diagnosis**

#2 **Pain relief**

Challenges of Managing Pain in the Opioid Era

Why Should We Care?

1 in 5 Canadians is affected by chronic pain.

ASSESSSING PAIN

Assessing Pain in Children

Prior experiences

Outcome assessor

Environment

Temperament

Cognitive ability

A Multifactorial Approach is Needed

What do we know about assessing pain?

Development level - appropriate instrument should be used

Faces scales are preferred by children

Self report is the consensus standard

Pain should be assessed **early** and reassessed **often**

How many pain scales are there?

At least **20** **observational** pain scales

At least **34 self-report** measures

7 scales have been widely **validated**

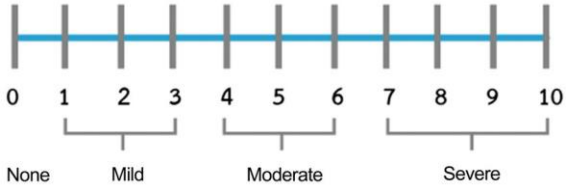
Recommended Pain Scales

FLACC - Revised Scale: 0-3 years or non-verbal

Faces Pain Scale - Revised: 4-12 years

Verbal Numerical Rating Score: Over 6 years

FLACC Scale	0	1	2
1 Face	No particular expression or smile.	Occasional grimace or frown, withdrawn, disinterested.	Frequent to constant frown, clenched jaw, quivering chin.
2 Legs	Normal position or relaxed.	Uneasy, restless, tense.	Kicking, or legs drawn up.
3 Activity	Lying quietly, normal position, moves easily.	Squirming, shifting back and forth, tense.	Arched, rigid or jerking.
4 Cry	No crying (awake or asleep).	Moans or whimpers; occasional complaint.	Crying steadily, screams or sobs, frequent complaints.
5 Consolability	Content, relaxed.	Reassured by occasional touching, hugging or being talked to, distractible.	Difficult to console or comfort.

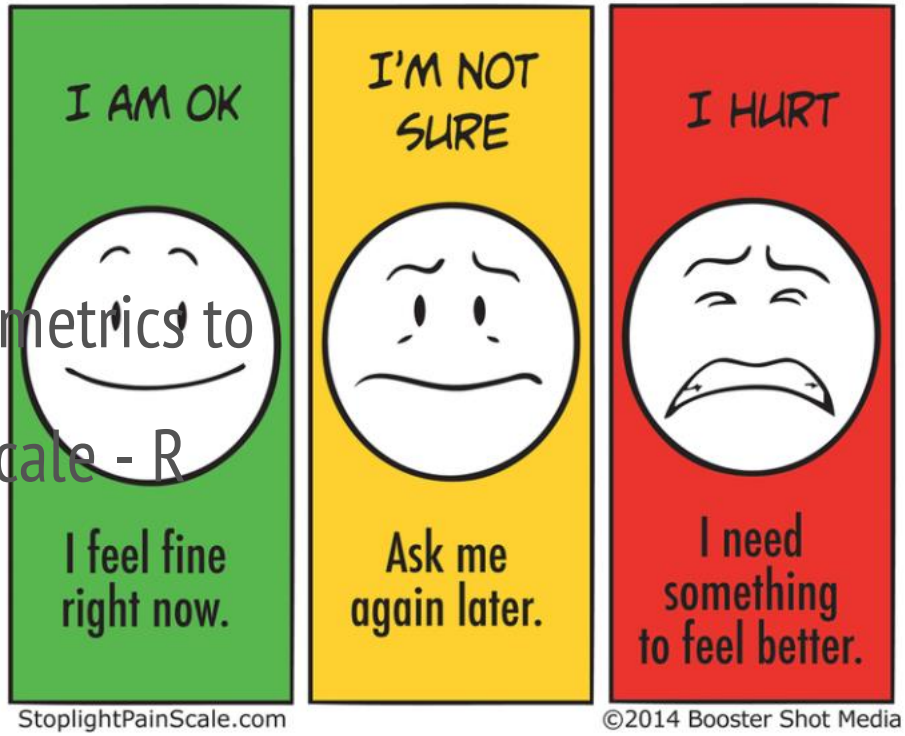


The Most Useful Tool…in My Opinion

Age 3+ years

Comparable metrics to

Faces Pain Scale - R



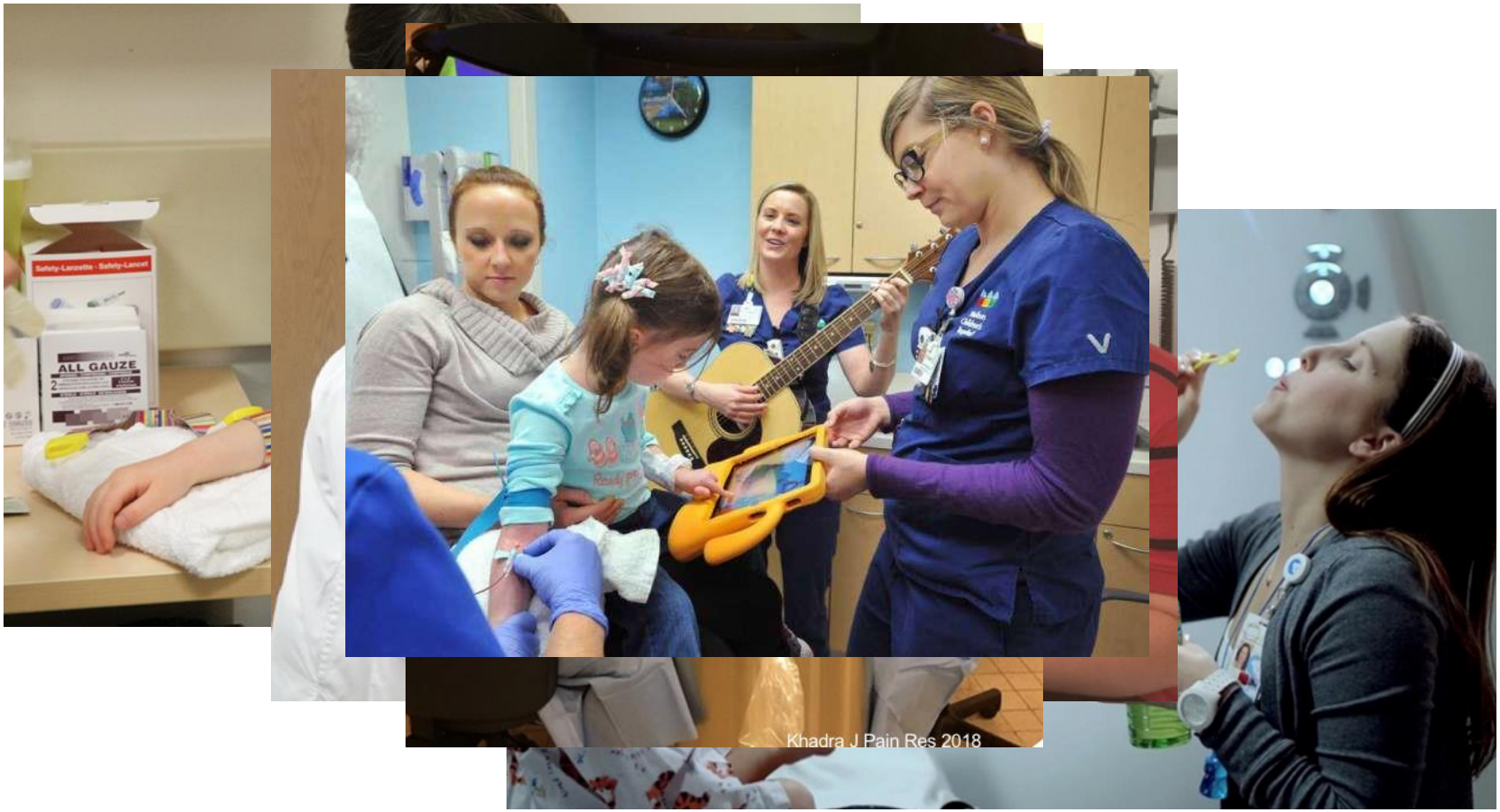
Caregiver Presence

Does not reduce pain but **decreases distress** of child

Empowers caregiver by allowing them to participate in pain management

Recommended by AAP

Distraction and Positioning



Child Life Specialist

Health care professionals who work with **children and families** in health care settings

Help cope with challenges of hospitalization, illness, disability and **pain**

Recommended by AAP

Musculoskeletal Pain

MSK injuries comprise **10-20%** of ED visits

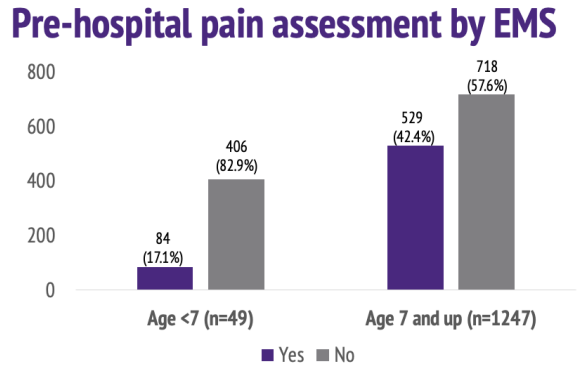
Pain often rated as **moderate to severe**

More than **40%** of children do not receive adequate analgesia

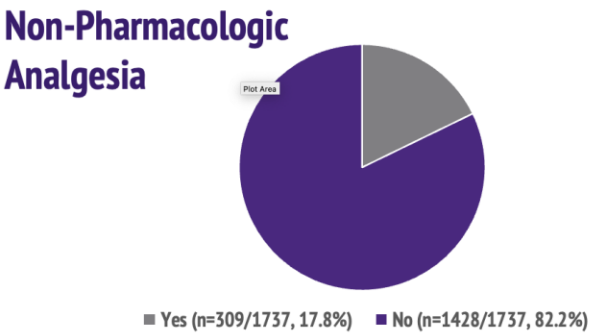
Most children continue to experience pain **post-discharge**

Prehospital Analgesia for Limb Trauma

Pre-hospital providers assess pain more often in **older** children



Non-pharmacologic analgesia is provided to **less than 20%** of children



Poonai et al. 2022 Can J Emerg Med

Gaps in our Understanding

How do we shorten time to analgesia?

Are opioids better than non-opioids?

Is there a role for combination therapy?

Can we teach parents to manage pain at home?

Psychological and Physical Therapies

Immobilization

Ice

Child life specialists

Distraction

Caregiver Presence

TENS

Transcutaneous electrical nerve stimulation

Reduces pain by descending inhibitory signals in the CNS

Evidence is contradictory

Superior to placebo for **chronic pain**
but insufficient evidence for acute pain

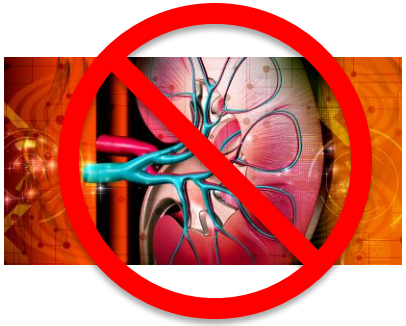
Ibuprofen in MSK Pain

Following immobilization, **ibuprofen** best choice for **mild to moderate** pain

Superior to acetaminophen or codeine

As good or better than oxycodone or morphine and fewer adverse effects than **oral opioids**

Avoid NSAIDs if concerned about renal insufficiency but no good evidence for increased risk of bleeding



Le May et al. 2017 Pediatrics
Drendel et al. 2009 Ann Emerg Med

Ibuprofen in Painful Conditions

JAMA Pediatrics | Original Investigation

Pharmacologic Management of Acute Pain in Children
A Systematic Review and Network Meta-Analysis

Laura Olejnik, MD; João Pedro Lima, MD; Behnam Sadeghirad, PharmD, MPH, PhD; Jason W. Busse, DC, PhD; Ivan D. Florez, MD, MSc, PhD; Samina Ali, MD; James Bunker, BScN; Danny Jomaa, MD, MBI, MSc; Adam Bleik, PharmD; Mohamed Eltorki, MBChB, MSc

NSAIDS offer the best benefit to harm ratio in for acute pain in children

Oral Opioids in MSK Pain

No benefit of oral morphine over **ibuprofen**

Oxycodone and **oral morphine** have greatest risks of adverse CNS effects

Tramadol not well studied in children and has an FDA warning to avoid use in age < 14 years

Opioids should be **added to** rather than replace non-opioids (reduced adverse effects)

Moderate to Severe MSK Pain

IN fentanyl = IV morphine

Minor adverse effects

30-40 mm pain reduction at **10-20 minutes**

Duration **60 minutes**

IN ketamine versus IN fentanyl

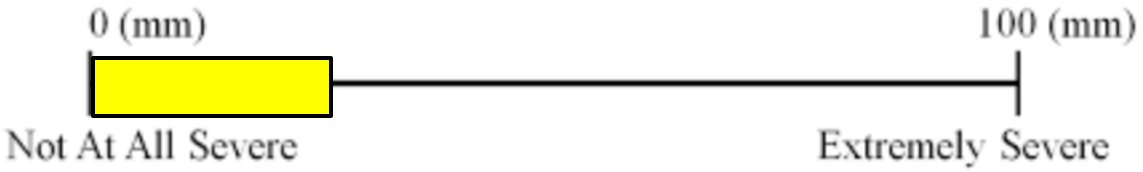
Sub-dissociative dose **IN ketamine 1-2 mg/kg**

Non-inferior to IN fentanyl at **20-30 min**

Similar duration **60 minutes**

Sedation **more common**

Neither decrease pain to < 30 mm

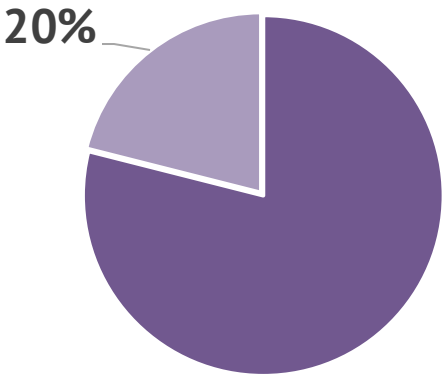


TRAUMA PAIN

Implications of Poorly Managed Trauma Pain

Most children recover after injury, but many have significant psychologic sequelae

Prevalence of PSSS in Paediatric Trauma Patients



Post-traumatic stress symptoms in 20%

More severe **pain** is associated with more PSSS acutely and 6 months later

Increased risk of **chronic pain**

Hildebrand et al. 2020 Pediatr Emerg Care

Consequence of Well Managed Trauma Pain

- Reduced risk of post-traumatic stress symptoms and chronic pain
- Earlier **healing**
- Shorter hospital **length of stay**
- Reduced **costs**
- Reduced morbidity and mortality

What do we know about pain management?

Trauma is the **leading** cause of mortality in children

Only **half** of children achieve pain resolution

Older males have higher injury severity scores (ISS) but receive **worse** pain management

Parental presence is associated with better analgesia

Obvious MSK or facial trauma is associated with faster IV analgesia versus closed head injuries or neck pain

What drugs are the most effective for PSSS?

PSSS can persist for months → PTSD in up to 40%

Both **NSAIDs** and **opioids** effectively reduce pain in the early post-trauma period in adults

Opioids are better at reducing post-traumatic stress symptoms compared to NSAIDs

Opioids may have specific effects on fear memory and anxiety

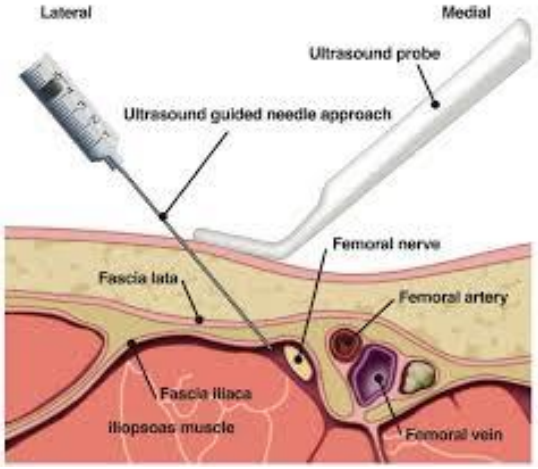
Grau et al. 2022 Int Clin Psychopharmacol

Femoral Nerve Blocks

Easy to perform

Provides fast and effective analgesia for **femur fractures**

Can be performed using POCUS with an in-plane approach from lateral to medial



Baker et al. 2015 Pediatr Emerg Care

Thoracic Trauma

Analgesia prevents atelectasis, impaired gas exchange, and pneumonia

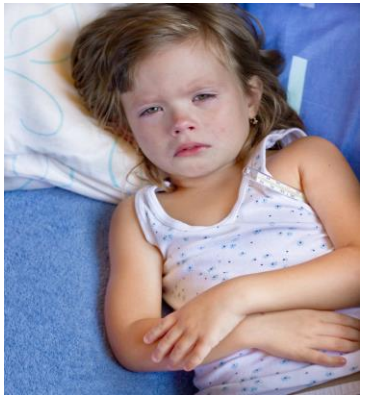
Rib fractures are very painful but uncommon in children

NSAIDs are first line with opioids as **add-on** therapy

Fentanyl theoretically has a lower risk of cardiovascular instability versus morphine

ABDOMINAL PAIN

Abdominal Pain



One of **top 10 presentations** to EDs

Most cases are “functional” in nature

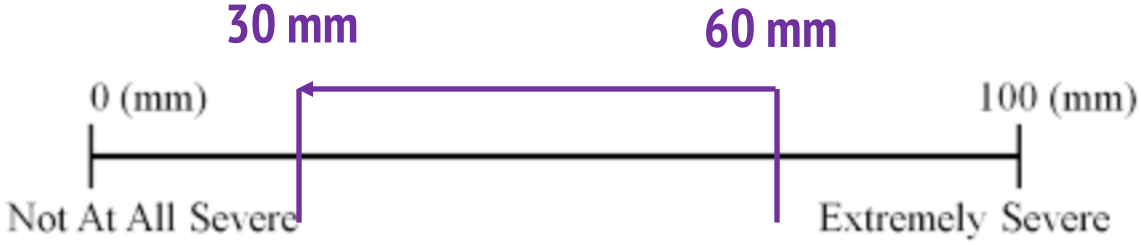
Less than 2/3 of children receive analgesia in the ED

Roughly half experience ongoing pain following discharge

Non-Opioids for Functional Abdominal Pain

2020 randomized trial of over 200 children

Both hyoscine butylbromide (Buscopan™) and acetaminophen achieved **50% reduction** in abdominal pain at 80 minutes



Appendicitis

Most **common** paediatric surgical condition

Pain consistently rated as **progressive** and **severe**

Up to a **1/3** of children receive no analgesia prior to diagnostic imaging

Appendicitis

2014 systematic review of 6 trials (342 children)

IV opioids (morphine) provides up to **40 mm** pain reduction

No increased risk of delayed management or complications such as abscess, perforation, etc.

New trial of **IV ketorolac** on the horizon

PROCEDURAL PAIN

Procedural Pain in Infants

Most painful procedures performed on neonates

IV insertion, venipuncture, lumbar puncture

Young children are significantly **less likely** to receive analgesia

Procedural Pain in Infants

Strongest evidence for:

- Sucrose
- Swaddling
- Rocking
- Breastfeeding
- Topical anaesthetic

Venipuncture

Moderate to severe pain

Cochrane review supports **breastfeeding** during procedure

Sucrose or **human milk** on a pacifier both equally effective

Neuromodulation device

Topical Anesthetics for Venipuncture

Inadequate evidence to support any recommendations

EMLA

- 2019 systematic review
- No benefit over sucrose or breastfeeding
- Increased skin blanching
- Theoretical risk of elevated **methemoglobin** levels

Vapocoolant sprays: benefit may be offset by pain of application

Sucrose for Procedural Pain

Heel lance, venipuncture, IM injection pain

Robust evidence of effectiveness (~60 studies of > 5000 infants) in children < 1 month

0.5 mL of 24% solution 2 min prior (min 0.1 mL)

Effect enhanced with **non-nutritive sucking** and **swaddling**

Lasts 4 minutes

Lumbar Puncture

Moderate to severe pain

AAP recommends **oral sucrose** and either **topical (LMX** or **Maxilene™)** or **SC lidocaine**

Topical + SC anesthetic likely have greater benefit than alone

Use of SC anesthetic leads to **improved LP success rates**

Urethral Catheterization

Limited evidence for **lidocaine jelly**

Modest benefit for sucrose < 1 month

Non-pharmacologic strategies are key

Quick Wee method:

- 31% effective versus 12% (clean catch)
- 27% contamination versus 45% (clean catch)

Nasogastric Tube Insertion

Evidence limited for **lidocaine spray** but can offer in age > 6 months

Lubricating the NG tube with 1-2 mL of **1-2% lidocaine** jelly to minimize post-insertion pain in age > 6 months

Laceration Repair

Good evidence for **LET gel** 0.2 mL/kg in > 3 months

Apply with occlusive dressing for **30–45 minutes**

Pain of **infiltrated lidocaine** reduced with:

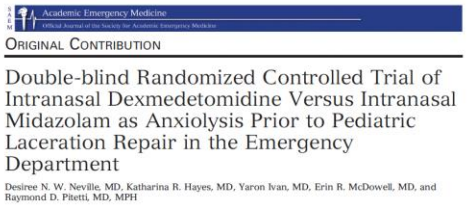
- Buffer by adding 1 mL 8.4% $NaHCO_3$ to 9 mL lidocaine
- Warm vial
- Small needle
- Slow injection

Reducing Distress During Laceration Repair

Topical anesthetics help reduce pain but do little to alleviate **procedural distress,** so distraction is important

Inconsistent evidence for oral or **IN midazolam**

2016 trial found **IN dexmedetomidine** better than IN midazolam for initial positioning


Academic Emergency Medicine

ORIGINAL CONTRIBUTION

Double-blind Randomized Controlled Trial of Intranasal Dexmedetomidine Versus Intranasal Midazolam as Anxiolysis Prior to Pediatric Laceration Repair in the Emergency Department

Desiree N. W. Neville, MD, Katharina R. Hayes, MD, Yaron Ivan, MD, Erin R. McDowell, MD, and Raymond D. Pitetti, MD, MPH

Intranasal Dexmedetomidine

2020 **systematic review** of 19 trials (> 2000 children) undergoing distressing procedures

IN dexmedetomidine safely provides better sedation than midazolam and chloral hydrate for non-painful procedures

Optimal dose is 3 or 4 mcg/kg

PEDIATRICS
OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

Intranasal Dexmedetomidine for Procedural Distress in Children: A Systematic Review

Naveen Poonai, Joseph Spohn, Ben Vandermeer, Samina Ali, Maala Bhatt, Shawn Hendrikx, Evelyne D. Trottier, Vikram Sabhaney, Amit Shah, Gary Joubert and Lisa Hartling

Intranasal Dexmedetomidine

Recently completed dose-finding study found **3 mcg/kg** effectively sedated almost 2/3 of children for laceration repair

The **ALICE** trial, comparing IN dexmedetomidine, nitrous oxide, and IN midazolam launched in early 2024

Avoiding the Sutures

Consider tissue adhesives **(skin glue** or **steri-strips)**

No increased risk of poor cosmesis

Less pain, shorter procedure, and no removal needed

Higher risk of dehiscence mitigated with **steri-strips over glue**

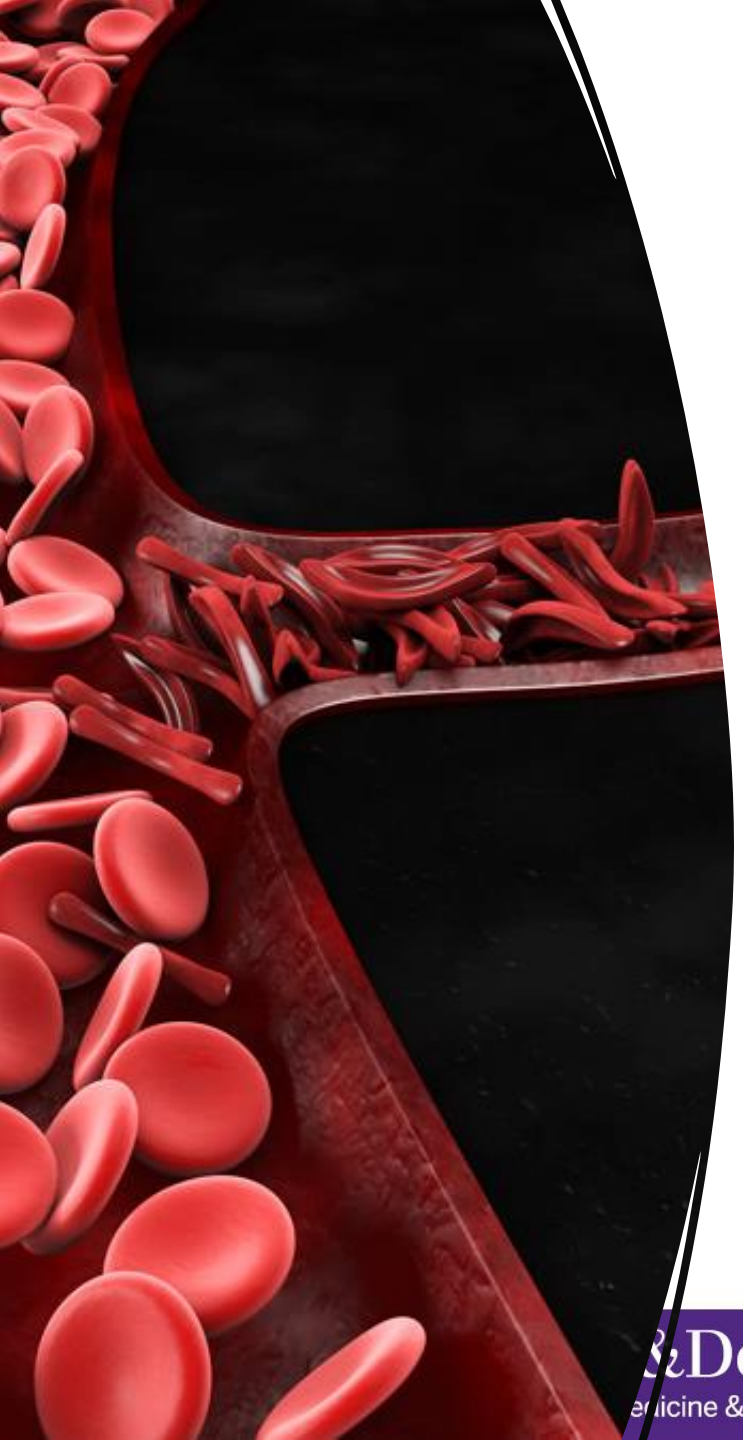
Nitrous Oxide

For **mild and moderately painful procedures** (venipuncture, laceration repair) +/- IN fentanyl

Systematic reviews demonstrate safety but highlight the importance of **patient cooperation** for analgesia and sedation

Rapid onset and offset

Insufficient evidence for fracture reduction as monotherapy



SICKLE CELL CRISIS

Sickle Cell Crisis

Vaso-occlusive episode (VOE) is most common presentation

Triggered by dehydration, illness, fatigue, cold, stress

Mild pain → NSAIDs and acetaminophen

Moderate/severe pain → IN fentanyl then PO morphine

If pain not well controlled → IV morphine

Remember!

↳ Encourage oral or IV fluids and supplemental O_2

Opioids

Titrate to clinical effect

Opioids should be adjuncts to non-opioids

Health Canada and US FDA advise avoidance of codeine in children < 18 years and hydrocodone in children < 6 years

Administration within 30 minutes of procedural sedation increase risk of ventilatory complications and vomiting

trekk Translating Emergency Knowledge for Kids

https://trekk.ca/resources?tag_id=D010147

CAREGIVER EDUCATION

Caregiver Education

Verbal discharge instructions are:

- Infrequently given
- Inconsistent
- Poorly understood
- **Not followed**

Caregiver Education for Otitis Media

Otitis media affects 75% of school age kids

1/3 continue to experience pain and fever up to 7 days after initiating treatment

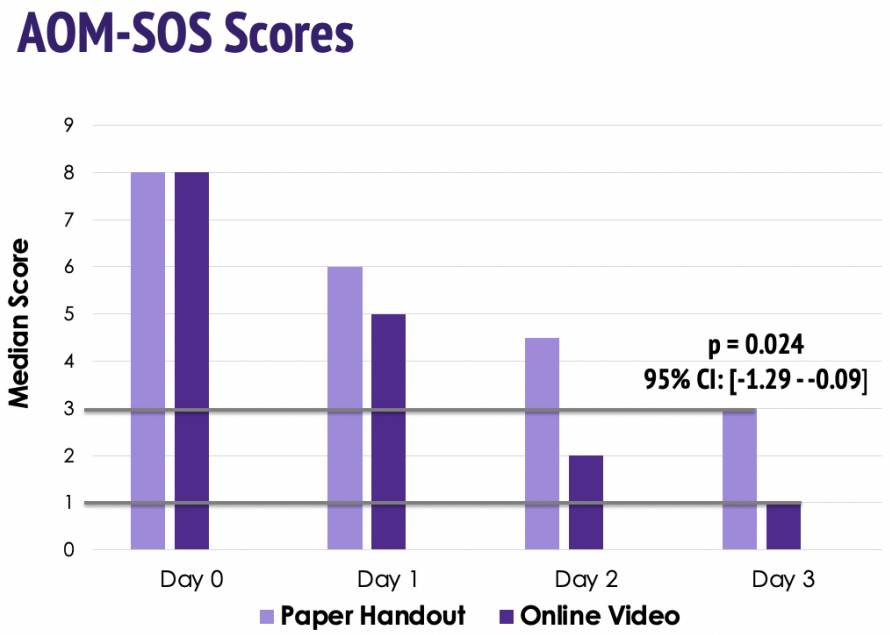
Caregiver education through digital platforms are more appealing, user-friendly, and accessible

Caregiver Education for Otitis Media

Caregiver Education for Otitis Media

2018 clinical trial of digital education for > 200 parents of children with otitis media

Significantly lower symptom scores by day 3



RESEARCH UNDERWAY

The Comfort Promise

Institution-wide **lean quality improvement strategy** launched by the Children's Hospital of Minnesota in 2013

The Comfort Promise

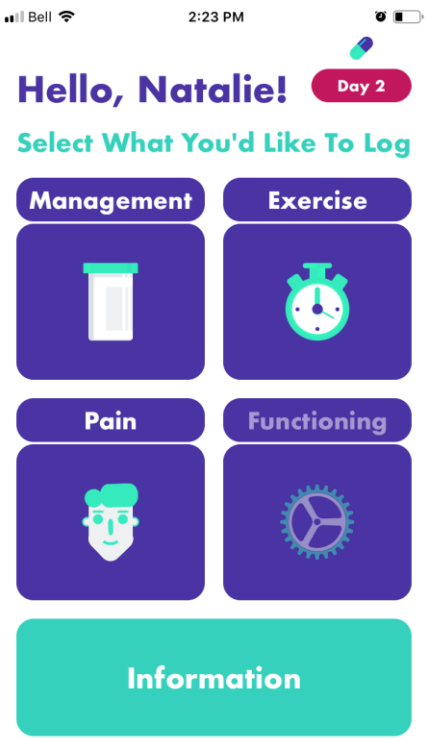
The Comfort Promise

Recovery Guidance for Ankle Sprains

Functional limitation can persist for up to 4 weeks post injury

Apps can provide recovery guidance

The **SPRAIN trial** (Smartphone app for Post-discharge Reminders for Ankle Inversion iNjuries) will launch this month



Port-A-Cath Access

Needle inserted through the skin to access device for medications or blood

Very common procedure in children with cancer

Topical anesthetic does little to reduce procedural distress

Virtual Reality for Port-A-Cath Access

Virtual reality (VR) as a method of distraction has shown benefit for IV insertion and painful dressing changes

The **VIRTUE** trial is near completion and will explore the benefits of VR to reduce distress in children undergoing port-a-cath access

Take it to Work

- Age-appropriate pain scales are fundamental
- Ibuprofen a better choice than oral morphine
- Intranasal fentanyl a less invasive option that IV morphine
- Acetaminophen or HBB effective for functional abdominal pain
- Analgesia beneficial for appendicitis without complications
- Quick-Wee may reduce need for urethral catheterization
- Topical anesthetic recommended for lumbar punctures

QUESTIONS

naveen.poonai@lhsc.on.ca

@NPoonai