An Evidenced-Based Approach to Reducing the Pain of Childhood Immunization

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Capital Health

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Learning Objectives

- To review evidence-based interventions for reducing immunization pain in infants, children, and adolescents.
- To identify both evidence-based pharmacological and psychological interventions for pediatric immunization pain.
- To review evidence-based guidelines, systematic reviews, and directions for future research and clinical practice.

No conflicts of interest to disclose

Pediatric Procedural Pain

- Historically under-recognized & under-treated
- Neurophysiological & physiological effects
  - Ex: Infants undergoing unanaesthetised circumcision→ more accentuated behavioral response to immunization injections at 4 to 6 months (Taddio et al., 1997)
- Psychological consequences
  - Eg., Anxiety, fear

Pediatric Procedural Pain

- Immunizations
- Venipunctures
- Heel Sticks
- Circumcisions
- Burn Debridements
- Dental Procedures
- Bone Marrow Aspirations
- Lumbar Punctures
- Etc…

*** NEEDLE PAIN ***

Top Fears of Hospitalized School-Aged Children

1. **Getting a shot**
2. Having my finger stuck
3. Being away from my family
4. Having to stay a long time
5. The nurse/doctor telling me something is wrong with me

(Hart & Bossert, 1994)

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Canada

Table 1. Routine Immunization Schedule for Infants and Children

Age at vaccination	DTaP-IPV	Hib	MMR	Var	HB	Pneu-C-7	Men-C	Tdap	Inf
Birth					Infancy 3 doses				
2 months	⊖	✦			★	⊠	⊙		
4 months	⊖	✦				⊠	(⊙)		
6 months	⊖	✦				⊠	⊙ or		6-23 months
12 months			■	●		⊠ 12-15 months	⊙ if not yet given		⊗ 1-2 doses
18 months	⊖	✦	■		or				
4-6 years	⊖		or ■						
14-16 years					Pre-teen/ teen 2-3 doses		⊙ if not yet given	▲	

Procedural Pain Assessment…Where to start??

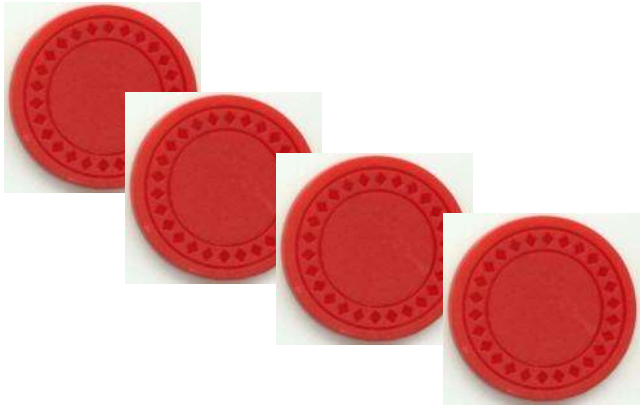
Pain Assessment

- Accurate pain assessment → effective pain management
  - (1) Self-Report
  - (2) Observational / Behavioural Measures
  - (3) Physiological Correlates
- Pediatric Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials (Ped-IMMPACT)
  - Commissioned 2 systematic reviews of pain measures for children 3 to 18 years of age

Self-Report

Pieces of Hurt tool

(Hester, 1979)



Recommended:

Children 3 – 4 years of age

Visual Analogue Scale

(VAS; Scott et al., 1977)

Recommended:

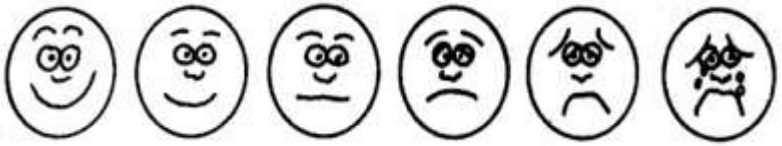
100mm VAS for children > 8 yrs & adolescents

Stinson et al. (2006). *Pain, 125,* 143-157.

Self-Report (cont)

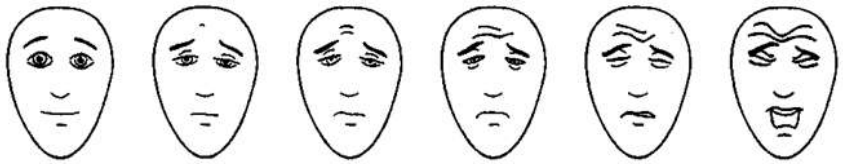
Wong-Baker FACES

(FACES; Wong & Baker, 1988)



Faces Pain Scale-Revised

(FPS-R; Hicks et al, 2001)



- Faces scales beginning with smiling 'no pain' faces appear to provide overestimates of pain
  (Chambers & Craig, 1998; Chambers et al., 1999; 2003)

Recommended:

FPS-R for children 4 – 12 yrs (and with VAS for 8 -12 yrs)

Stinson et al. (2006). *Pain, 125,* 143-157.

Behavioural Measures: Pain

Face, Legs, Arms, Cry, Consolability Scale

(**FLACC**; Merkel et al., 1997)

- Intended: 4 - 18 yrs Studied: 0 -18 yrs
- 5 items scored 0 - 2 (Scale range: 0 - 10)

Children's Hospital of Eastern Ontario Pain Scale

(**CHEOPS**; McGrath et al., 1985)

- Intended: 1 - 17 yrs Studied: 4 mo -17 yrs
- 6 items scored 0 - 3 (Scale range: 4 - 13)

von Baeyer & Spagrud. (2007). *Pain, 127,* 140-150.

Behavioural Measures: Distress

Procedure Behavior Check List

(PBCL; LeBaron & Zeltzer, 1984)

- Intended: 6 - 17 yrs
- 8 items scored 1 to 5

Studied: 0.1 - 19 yrs
(Scale range: 8 - 40)

Procedure Behavioral Rating Scale-Revised

(PBRS-R; Katz et al, 1980)

- Intended: 8 mo - 17 yrs
- 11 items scored 0 or 1

Studied: 3 - 10 yrs
(Scale range: 0 - 11)

von Baeyer & Spagrud. (2007). *Pain, 127,* 140-150.

We know it hurts…so what do we do about it?

Psychological Interventions

Deep Breathing

Muscle Relaxation

Hypnosis

Preparation

Imagery

Positive Self-Talk

Distraction

Parent Coaching

Psychological Interventions for Procedural (Needle) Pain

THE COCHRANE COLLABORATION®

- Systematic Review and Meta-Analysis
- Search Criteria
  - Children & adolescents 2-19 years
  - Undergoing needle-related procedures
  - Healthy & chronic/transitory illness
  - RCTs with a control/comparison group
- 7 electronic databases, list-serves, contact with experts, reference lists

Uman, Chambers, McGrath, & Kisely. (2006). *Cochrane Database of Systematic Reviews, Issue 4.*

Uman, Chambers, McGrath, & Kisely. (2008). *Journal of Pediatric Psychology, 33,* 842-854.

Systematic Review (cont)

- 28 RCTs (N= 1951) from 7 countries
- Needle procedures:
  - Immunization (n = 9), Venepuncture (n = 8), Lumbar Puncture (n = 5), IV insertions (n = 4), Bone marrow aspiration, (n = 3), Intramuscular injection (n = 1)
- Strong Support
  - Distraction
  - Hypnosis
  - Cognitive-Behavioural Interventions/Therapy

Uman, Chambers, McGrath, & Kisely. (2006). *Cochrane Database of Systematic Reviews, Issue 4.*

Uman, Chambers, McGrath, & Kisely. (2008). *Journal of Pediatric Psychology, 33,* 842-854.

Child Immunizations: A systematic review

- 20 RCTs involving 1380 infants and children (1 month- 11 years of age) receiving immunizations

- Strongest efficacy in reducing pain and distress:
  - Breathing exercises
  - Child-directed distraction
  - Nurse-led distraction
  - Combined cognitive-behavioural interventions

Chambers, C.T., Taddio, A., Uman, L.S., & McMurtry, C.M., for the HELPinKIDS Team. (2009). *Clinical Therapeutics, 31, S77-S103*.

New Evidence and Future Directions

Virtual Reality

- IV Placement (Gold et al., 2006)
  - Head-Mounted Display (HMD) of skateboarding experience using multiple senses (e.g., tactile, auditory)
- Pediatric oncology patient (Nilsson et al., 2009)
  - Immersive vs. Non-Immersive
  - Non-Immersive 3D game ‘diamond-hunting game displayed on computer screen

Active vs. Passive Distraction

- Active distraction superior to passive distraction in pediatric cold-pressor study (Dalhquist et al., 2007)
  - Active distraction uses more senses & includes active cognitive component (internal distraction)

- Music
  - Use of headphones (Kristansdottir & Kristansdottir, 2010)
  - Interactive live music (Caprilli et al., 2007)
  - Focus of attention music task activity (Noguchi, 2006)

Parental Behaviour: What doesn't work

- Criticism
- Apologizing
- Giving Control
- Empathy
- Reassurance

Distress Promoting

"If an adult tells you not to worry and you weren't worried before, you better hurry up and start because you're already running late"

(Curtis, 1999, p.42)

Summary

- Presentation highlighted evidence-based psychological interventions for pediatric pain
- Identified key systematic reviews and guidelines
- Presented new evidence and future directions

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Pharmacologic & Physical Interventions

Canadian Guidelines

- CIHR funded
- Published literature
  - RCTs & quasi-experimental design
  - Critical appraisal
- Recommendations
  - Based on strength of evidence
- External review

Canadian Guidelines

Level or grade	Criteria
Evidence	
I	Evidence from randomized controlled trial(s)
II-1	Evidence from controlled trial(s) without randomization
II-2	Evidence from cohort or case–control analytic studies, preferably from more than one centre or research group
II-3	Evidence from comparisons between times or places with or without the intervention; dramatic results in uncontrolled experiments could be included here
III	Opinions of respected authorities, based on clinical experience; descriptive studies or reports of expert committees
Recommendation	
A	There is good evidence to recommend the action.
B	There is fair evidence to recommend the action.
C	The existing evidence is conflicting and does not allow making a recommendation for or against the use of the action; however, other factors may influence decision-making.
D	There is fair evidence to recommend against the action.
E	There is good evidence to recommend against the action.
I	There is insufficient evidence (in quantity or quality or both) to make a recommendation; however, other factors may influence decision-making.

*Adapted, with permission, from Palda and colleagues.[14]

Recommendations for Pharmacologic Interventions

- Local anesthetics
- Sweet-tasting solutions
- Oral analgesics
- Skin-cooling techniques

Recommendations for Pharmacologic Interventions

- Local anesthetics
  - To reduce pain at the time of injection, encourage parents to use topical anesthetics during vaccination of children
  - Grade A recommendation – Level I evidence

Recommendations for Pharmacologic Interventions

- Local anesthetics – Clinical Considerations
  - 3 available OTC
    - Lidocaine-prilocaine 5% cream or patch
    - Liposomal lidocaine 4% cream
    - Amethocaine 4% gel
  - Cost $5-10/dose
  - Apply to site of injection
    - 20-60 minutes before injection
    - Cover cream or gel with dressing until injection

Recommendations for Pharmacologic Interventions

- Sweet-tasting solutions
  - To reduce pain at the time of injection among ***infants up to 12 months***, who cannot be breast-fed at the time of vaccination, administer a sweet-tasting solution during vaccination
  - Grade A recommendation – Level I evidence

Recommendations for Pharmacologic Interventions

- Sweet Tasting Solutions – Clinical Considerations
  - One teaspoon (1 packet or 1 cube) sugar in 2 mL water in medicine cup
  - Prepare immediately prior to injection & unused amount
  - Administer via oral syringe, medicine cup or pacifier 1-2 minutes prior to injection
  - Amount of sugar < most medications
  - Some coughing & gagging may occur (< 5%)

Recommendations for Pharmacologic Interventions

- Oral analgesics
  - There is currently no demonstrated benefit of administering acetaminophen or ibuprofen to reduce pain at the time of injection
  - Grade A recommendation – Level III evidence

Recommendations for Pharmacologic Interventions

- Oral analgesics – Clinical Considerations
  - delayed minor adverse events (e.g. fever) may be ⇓ by prophylactic acetaminophen
  - Effect on immunogenicity
    - Clinical relevance?

Recommendations for Pharmacologic Interventions

- Skin-cooling Techniques
  - Vapocoolants, ice, cool/cold pack
  - There is insufficient evidence for or against the use of skin-cooling techniques to reduce pain at the time of injections
  - Grade I recommendation – conflicting evidence
    - Further research needed
  - If using vapocoolant – spray directly onto site of injection
    - No more than 1 minute prior to injection
    - $60 ~ 50-60 applications

Recommendations for Injection Procedures

- Positioning
- IM injection technique
- Order of injection
- Tactile stimulation
- Multiple injections
- Route of administration

Recommendations for Injection Procedures

- Positioning
  - Do Not place children in supine position during vaccination
  - Grade E recommendation – Level I evidence

Recommendations for Injection Procedures

- Positioning – Clinical Considerations
  - Optimal position unknown
    - Comfortable for parent & child
    - Limbs exposed for injection
    - Avoid excessive restraint

Recommendations for Injection Procedures

- IM injection technique
  - Administer IM vaccines to children using rapid injection technique ***without aspiration***
  - Grade B recommendation – Level I evidence

Recommendations for Injection Procedures

- Order of Injection
  - Inject the most painful vaccine ***last*** to ⇓ pain at time of injection
  - Grade B recommendation – level I evidence
  - M-M-R-II, pneumococcal conjugate reported as most painful

Recommendations for Injection Procedures

- Tactile stimulation
  - Among children ***four years of age and older***, offer to rub/stroke the skin near the injection site with moderate intensity before & during vaccination
  - Grade B recommendation – level II-1 evidence
  - Clinical considerations – avoid rubbing injection site after injection
    - May ⇑ reactogenicity

Recommendations for Injection Procedures

- Multiple injections
  - Insufficient evidence for or against simultaneous injections versus sequential injections
  - Grade I recommendation – limited & negative level I evidence

Recommendations for Injection Procedures

- Route of administration
  - Some vaccines can be administered IM or Sub-cut
  - Insufficient evidence to recommend for or against the use of a specific route of administration
  - Grade I recommendation – conflicting level I evidence
  - Follow manufacturer guidelines

Recommendations for Breastfeeding During Immunization

- Encourage breastfeeding mothers to breastfeed their infants during immunization
- Grade A recommendation – level I evidence
- Begin prior to, continue during & for several minutes after injection is complete
  - Bottle feeding is not a substitute

Summary

- Pain related to childhood immunization can be managed by the use of:
  - Local anesthetics
  - Sweet-tasting solutions
  - Proper positioning
  - Injection technique
  - Order of injection
  - Tactile stimulation
  - Breastfeeding

Key References

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