XyloFUNS: Xylocaine to freeze during unpleasant nasopharyngeal swabs in children—a randomized controlled trial

François Gagnon MD, Jocelyn Gravel MD, MSc, Camille Duranceau MD, Emilie Vallieres MD, PhD, Maala Bhatt MD, MSc, Stuart Harman MD, Evelyne D. Trottier MD

1Division of Pediatric Emergency Medicine, Children’s Hospital of Eastern Ontario, Ottawa, Ontario, Canada; 2Division of Pediatric Emergency Medicine, CHU Ste-Justine, Université de Montréal, Montreal, Quebec, Canada; 3Division of Microbiology, Clinical Laboratory Medicine Department, Centre Hospitalier Universitaire Sainte-Justine, Université de Montréal, Montreal, Quebec, Canada; 4Division of Infectious Diseases, Pediatrics Department, Centre Hospitalier Universitaire Sainte-Justine, Université de Montréal, Montreal, Quebec, Canada

Correspondence: Francois Gagnon, Children’s Hospital of Eastern Ontario (CHEO), 401 Smyth Rd, Ottawa, Ontario, K1H 8L1, Canada. Telephone: 514-412-4400, fax: 514-412-4217, e-mail: fgagnon@cheo.on.ca

ABSTRACT

Objectives: To evaluate the efficacy of intranasal vaporized lidocaine in reducing pain for children undergoing a nasopharyngeal (NP) swab in the Emergency Department (ED).

Study Design: A randomized blinded clinical trial was conducted in a paediatric ED. Both participants and the researcher evaluating the primary outcome were blinded. Children aged 6 to 17 years old requiring a NP swab were eligible. Participants were randomly allocated to receive intranasal lidocaine or a sham treatment prior to their NP swab. The primary outcome measure was pain during the swab as assessed by the visual analog scale. Secondary outcome measures were pain using the verbal numeric rating scale, fear using the children fear scale, and adverse effects of the intervention.

Results: Eighty-eight participants were enrolled—45 in the lidocaine group and 43 controls. The mean visual analog scale scores for pain were 46 mm in the lidocaine group and 53 mm in the control group (mean difference 7 mm; 95% CI: −5 to 19 mm). No serious adverse events were observed.

Conclusions: Intranasal lidocaine administered prior to NP swabs in the ED failed to show an improvement in pain scores for school-aged children and youth.

Keywords: Paediatric; Pain; Lidocaine; Nasopharyngeal; COVID-19.

During the COVID-19 pandemic, nasopharyngeal (NP) swabs have been recommended for viral detection (1–3). A recent adult study showed that 85% of patients described moderate, considerable or unbearable discomfort during NP swab collection (4). In children, NP swabs have been shown to cause more discomfort than does vaccination (5).

Intranasal lidocaine has been shown to be safe and successful at decreasing nasal procedural pain in children and adults (6–9). A recent position statement of the Canadian Paediatric Society suggests that intranasal lidocaine should be considered prior to nasogastric tube insertion in children, based on adult data (10). Since intranasal lidocaine was effective at decreasing nasal pain during other procedures, we wondered if it could decrease the pain caused by NP swab collection. The objective of this study was to evaluate if intranasal vaporized lidocaine administered prior to NP swabs would lower pain scores when compared to a sham treatment.
METHODOLOGY

Study design and setting
We conducted a two-arm, randomized, blinded clinical trial from May 17 to June 12, 2021. The study was approved by the CHU Sainte-Justine institutional Ethics and Review Board and registered with ClinicalTrials.gov (NCT04901065). The study was conducted in the emergency department (ED) of an urban paediatric tertiary care centre in Montreal, Quebec.

Participants
Patients 6 to 17 years of age attending the paediatric ED and requiring a NP swab for SARS-CoV-2 testing were eligible. We did not include patients less than 6 years of age because self-evaluation of pain is less reliable in this age group (11). Patients were excluded if they required immediate medical attention, had nasopharyngeal trauma or anomaly, received an opioid, had hypersensitivity to lidocaine, significant intellectual disability or risk of aspiration, contraindication to lidocaine administration (cardiac arrhythmia, seizures, hepatic impairment, familial malignant hyperthermia, pseudocholinesterase deficiency, methemoglobinemia, and G6PD deficiency), severe pain (defined as requiring opiates or intranasal medication immediately) or were unable to provide informed consent (e.g., language barrier).

Study arms
Participants were randomized to receive 1) 0.1 mL of a 10% lidocaine solution (Odan, Lidodan Endotraceh, Lidocaine hydrochloride non-aerosolized vaporization) delivered in one nostril using a single non-aerosolized vaporization or 2) a sham procedure (control) consisting of the activation of an identical bottle of the 10% lidocaine solution, preemptively emptied, mimicking the delivery of the real intervention, although no fluid was administered (only air). Distraction, relaxation techniques and comfort positioning were permitted as they are the standard of care for procedure preparation in our setting.

Randomization and allocation concealment
Randomization used a 1:1 ratio with blocks of variable size, stratified according to participant age (<12 or ≥12 years of age). Stratification on participant age was chosen based on the authors’ clinical experience that younger children experience more distress during NP swab collection compared to adolescents. The randomization sequence was generated using a computerized random number generator. Allocation was known by the individual who completed the sequence (J.G.) and the research nurses. A single research assistant (F.G.) was involved in participant recruitment and outcome assessment was blinded to group assignment throughout the study procedures.

Study outcomes and measures
The primary outcome was self-reported pain intensity experienced during the NP swab collection, using the standardized Visual Analog Scale (VAS) (11–15). Secondary outcomes were pain scores assessed by the verbal numeric rating scale (NRS), median fear scores prior to NP swab collection assessed by the children fear scale (CFS) ranging from 0 to 4 (16), need for movement restriction of the child during the collection and family desire to receive the intervention again (yes/no) in the event of another collection. The safety outcomes were adverse effects post-intervention (nasal pain or numbness, bad taste, palpitation, dizziness, or other) and serious adverse events (arrhythmia, seizure, methemoglobinemia, malignant hyperthermia or need for medical intervention or assessment related to the administration).

From a laboratory perspective, results of the PCR internal controls were assessed to evaluate if the administration of lidocaine prior to NP sample collection had an impact on PCR efficacy. PCR internal controls are positive controls that must be detected within each sample to confirm adequacy of the PCR reaction and the absence of PCR inhibition.

Procedure and blinding
Participants were recruited by a single research assistant who obtained informed written consent from the parents/guardians and assent from the children. Following enrollment, baseline data were recorded including pain intensity using the NRS score at triage and fear using the CFS prior to the spray administration. NRS and CFS scores were obtained by verbal report. Immediately prior to the study intervention, the research assistant exited the room to maintain blinding. A research nurse, who was not involved in the recruitment or outcome assessment, assigned the participant to the appropriate group based on the randomization list. They then selected either the spray bottle labelled “A” or “B” based on group assignment. The bottles were identical except for the letter identifier. The nasal vaporization was then administered by the nurse in a standard fashion to optimize delivery of medication (Supplementary Appendix A). The research assistant returned to the room following completion of the study intervention to assess the presence of self-reported discomfort during the vaporization. Immediately prior to NP swab collection, the CFS score was recorded a second time. Five minutes after the intervention, the research nurse then performed the NP swab collection in a standardized manner in the same nostril (Supplementary Appendix A). Immediately after the swab was collected, participants were asked to report the pain intensity they experienced during the swab using the VAS and NRS scores. The VAS scores were measured by the research assistant in a standardized fashion using a VAS slider and recorded in mm, from 0 to 100 mm.

The day following the intervention, an attempt was made by the research assistant to contact caregivers by phone for a follow-up questionnaire. They were asked about adverse effects and their desire to receive the same intervention in the future if another NP swab collection was required. A question was added part-way through the study to assess participant blinding; caregivers and participants were asked to guess whether they were randomized to the lidocaine or control group. If participants were unable to be contacted more than 7 days post-intervention (3 attempts minimum), follow-up data were considered invalid.

Analysis
Baseline demographics of the participants in both groups were calculated and descriptive statistics were used to compare ordinal data. The primary analysis was a Student’s T test to compare the mean pain score after the procedure between the intervention and the control groups. Secondary analyses were
performed using a Student’s T test for continuous variables and a Fisher exact test for categorical variables. An intention-to-treat approach was used for all analyses. A pre-planned sub-analysis was conducted based on age (<12 and ≥12 years old).

Linear regressions were performed to identify associations between the VAS score and other clinical information. This permitted evaluation of association between intervention and pain after adjusting for identified risk factors. Univariate associations with $P < 0.05$ were included in a multiple variable linear regression. The 95% confidence intervals were measured for each result. Blinding of participants and caregivers was assessed by comparing the proportion of appropriate guesses of both groups.

**Sample size**

Previous studies reported a standard deviation on the VAS of 14 mm for migraine (13), 16 mm for acute orthopedic pain (15), or 20 mm for venipuncture (12). We used a conservative approach and used a standard deviation of 20 mm for calculating our sample size. A previous experimental study reported that the repeatability coefficient of the VAS for children was 12 mm when the pain did not change (14). This was deemed the minimal clinically significant difference. Based on these conservative assumptions, it was calculated that a sample size of 44 children per group were needed to detect a minimal difference of 12 mm on the VAS with an alpha of 0.05 and a power of 0.8, whilst taking into account a standard deviation of 20 mm.

**RESULTS**

A total of 97 children were eligible for inclusion, of which 88 (91%) agreed to participate and were randomized to intranasal lidocaine ($n = 45$) or a sham treatment ($n = 43$). All enrolled participants completed the study in their assigned group (Figure 1). Baseline demographics of study participants were similar between groups (Table 1). Most participants (68%) were less than 12 years old and 55% were female. There was no difference in pre-spray CFS scores in the two groups (median 1/4; IQR: 0 to 2). The proportion of participants complaining of pain at triage were similar between both groups (64% for lidocaine versus 61% for control), but the median NRS-11 score at triage was higher in the lidocaine group (4, IQR: 0 to 6) compared to the control group (2, IQR: 0 to 7).

Mean pain scores during the NP swab measured with the VAS were similar for both groups ($46 ± 32$ mm for lidocaine versus $53 ± 26$ mm for control); (difference: 7; 95% CI: −5 to 19). The mean pain score using the NRS was also similar for both groups ($5.0 ± 3.1$ for lidocaine versus $5.7 ± 2.9$ for control); (difference: 0.7; 95% CI: −0.5 to 2). There was no difference in those <12 years old for the VAS score between groups ($57 ± 29$ mm for lidocaine versus $58 ± 25$ mm for control); (difference: 1; 95% CI: −13 to 15). No significant difference was found in the ≥12 year old sub-group between groups ($25 ± 28$ mm versus $43 ± 26$ mm); (difference: 17; 95% CI: −4 to 38). The median CFS scores measured post-spray and prior to the NP swab were 1/4 (IQR: 0 to 2) in both groups. The need for movement restriction and comfort positioning was similar between groups (Table 2).

More children reported discomfort during lidocaine vaporization (16%) compared to the control (2%) (difference: 14, 95% CI: 0–28). There were more adverse effects described during the follow-up call in the lidocaine group (36%) in comparison to the control group (15%) (difference: 21; 95% CI: 2 to 37), including more nasal numbness (13% versus 0%, difference: 13; 95% CI: 2 to 26). No serious adverse events were noted.

Seventy-three percent (in both groups) of participants/primary caregivers said that they would want the vaporization again if they had to repeat a NP swab. In the 30 participants asked, 18 (60%) participants and their caregivers thought they

---

**Figure 1.** Flow-diagram of the recruitment and follow-ups.
had received the lidocaine during their participation. That proportion did not differ between groups (65% for the lidocaine group and 54% for the control group, difference: 11; 95% CI: −22 to 41). The proportion of appropriate guess was similar in both age groups (<12 years old: 50% versus >12 years old: 66%).

Table 3 shows the association between potential predictors and pain measured using the VAS in univariate regression modelling. Fear prior to the intervention was the most important predictor of pain during NP swab. For each increase of 1 point in the pre-spray CFS, the VAS score increased by 12 mm. Age was also statistically associated with pain: for each increase of 1 year of age, the mean VAS score decreased by 3 mm. Multiple variable linear regression performed among the factors statistically associated in the univariate analysis showed that younger age group (+14 mm) and higher fear score (+9 mm) remained predictors of more reported pain.

From a microbiology laboratory perspective, all samples were adequate. SARS-CoV-2 was not detected in any and there was no evidence of PCR inhibition from lidocaine.

DISCUSSION

This randomized blinded controlled study failed to show an improvement in pain scores for children aged 6 to 17 years old who received vaporized intranasal lidocaine prior to NP swab collection.

Two previous trials of topical anesthetic prior to intranasal midazolam administration (6) and oropharyngeal swabs (17) showed reductions in pain scores. However, studies using intranasal lidocaine prior to nasogastric tube insertion (18,19), naso-endoscopy evaluation (20), and intranasal midazolam administration (21) failed to show a positive effect.

NP swab collection is a moderately painful procedure endured by children frequently during the COVID-19 pandemic. There are no generally accepted methods to reduce discomfort associated with the procedure. Seventy-three percent of the participants expressed interest in having the same pre-procedural intervention prior to future NP swab. This suggests that children and their families desire an effective intervention to reduce pain associated with NP swab collection.

As demonstrated in previous studies, younger children felt more procedural pain than older children (22–24). Age cannot be changed but fear should be considered a potential target for future interventions since, not surprisingly, it was correlated with pain during NP swabs as with other procedures (10,25). The importance of non-pharmacological techniques, such as preparation, comfort positioning, relaxation, and distraction methods adapted to the developmental age cannot be overstated (10,26–28).

There are multiple potential explanations for the negative result. It is possible the vaporized lidocaine did not reach far enough in the nostril to decrease pain caused by the NP swab. It is also possible that the use of a sham intervention comforted participants in the control group. This could have resulted in lower reported pain scores in the control group, biasing the results toward a smaller difference in pain scores between the groups. If this were true, it underscores the importance of non-pharmacological interventions to reduce procedural fear and distress. Additionally, the wide confidence interval of the primary analysis suggests that our study was underpowered. The standard deviation in the VAS we reported was significantly greater than what was previously reported in the literature. We hypothesize that this may be due to the wide age range included in the study.

Limitations

As placebos have been shown to be effective for painful situations, the use of a control was essential for this study (29). We acknowledge that the strategy of using a sham intervention is imperfect. Unfortunately, it was not possible to use a placebo nasal vaporization without deleterious effect, since both water and saline vaporization are irritating to the nostril (30). Therefore, either substance could have biased our results toward a more beneficial effect of the research intervention.

The sample was only powered for the primary analysis so it is difficult to know how to interpret the trend towards lower pain scores in children older than 12 years in the lidocaine group.

### Table 1. Participants’ characteristics

|                     | Lidocaine | Control |
|---------------------|-----------|---------|
|                     | N = 45    | N = 43  |
| Median age (IQR)    | 10 (7,13) | 10 (7,12) |
| <12 yo (%)          | 30 (67)   | 30 (70)  |
| ≥12 yo (%)          | 15 (33)   | 13 (30)  |
| Sex, female (%)     | 16 (36)   | 24 (56)  |
| NP swab in the past (%) | 27 (60) | 31 (72) |
| Median # NP swab (IQR) | 1 (0,1,5) | 1 (0,2) |
| Presented with ANY pain at triage (%) | 29 (64) | 26 (61) |
| Median NRS score (IQR) | 4 (0,6)  | 2 (0,7)  |
| Analgesia within 6 hours prior (%) | 22 (49) | 18 (42) |
| Acetaminophen       | 18 (40)   | 13 (30)  |
| Ibuprofen           | 12 (27)   | 9 (21)   |
| Indication for NP swab (%) | 35 (78) | 35 (81) |
| Symptoms of COVID   | 10 (22)   | 8 (19)   |
| COVID screening for hospitalization, surgery or sedation | 1 (0,2) | 1 (0,2) |
| Median pre-intervention CFS score (IQR) | 37 (82) | 34 (79) |
| Position during NP swab (%) | 8 (18) | 9 (21) |
| Sitting              | 11 (24)   | 5 (12)   |
| Laying               | 17 (38)   | 14 (33)  |
| Neurological complaint | 6 (13)    | 6 (14)  |
| Oral/Dental complaint | 5 (11)    | 8 (19)  |
| Respiratory complaint | 3 (7)     | 7 (16)  |
| Other complaints*   | 3 (7)     | 3 (7)    |

*Genitourinary (3), Hematologic (1), Endocrinologic (1), Skin and Soft tissue (1). Abbreviations: YO = years old; IQR = interquartile range; NP = nasopharyngeal; CFS = Children Fear Scale.
CONCLUSION

For children aged 6 to 17 years old undergoing NP swab collection in the ED, there was no impact of intranasal lidocaine prior to the swab collection on pain scores as measured by the VAS and the NRS. There was a strong association between age, fear, and pain; future studies should investigate developmentally adapted nonpharmacologic strategies such as distraction to reduce pain in this population.

Table 2. Summary of primary, secondary, and safety outcomes

|                      | Lidocaine | Control | Mean or proportion difference (95% CI) |
|----------------------|-----------|---------|---------------------------------------|
|                      | N = 45    | N = 43  |                                       |
| Mean VAS score (+/−SD) |           |         |                                       |
| All ages             | 46 (+/−32) | 53 (+/−26) | 7 (−5, 20)                           |
| <12 years old        | 57 (+/−29) | 58 (+/−25) | 1 (−13, 15)                           |
| ≥12 years old        | 25 (+/−28) | 43 (+/−26) | 17 (−4, 38)                           |
| Mean NRS score (+/−SD) | 5.0 (+/−3.1) | 5.7 (+/−2.9) | 0.7 (−0.5, 2)                         |
| Median post-spray CFS score (IQR) | 1 (0,2) | 1 (0,2) | P-value: 0.185*                        |
| Physical restraint and comfort position (%) |   |         |                                       |
| None                 | 31 (69)   | 26 (42) |                                       |
| Redirection of movements | 4 (9) | 9 (21) | 12 (−3, 27)                           |
| Comfort position/ minimal restriction | 1 (2) | 3 (7) | 5 (−6, 17)                           |
| Active physical restriction | 9 (20) | 5 (12) | 8 (−7, 24)                           |
| Discomfort upon administration of the intervention | 7 (16) | 1 (2) | 13 (−1, 28)                           |
| Follow-up phone call achieved | N = 45 | N = 41 |                                       |
| Adverse effects (%) |                  |         |                                       |
| Any                  | 16 (36)   | 6 (15)  | 21 (2, 37)                            |
| Nasal pain           | 2 (4)     | 4 (10)  | 5 (−6, 19)                            |
| Nasal numbness       | 6 (13)    | 0 (0)   | 13 (2, 26)                            |
| Unpleasant taste     | 8 (18)    | 2 (5)   | 13 (−1, 27)                           |
| Palpitations         | 0 (0)     | 0 (0)   | 0                                     |
| Dizziness            | 0 (0)     | 0 (0)   | 0                                     |
| Other symptoms**     | 4 (9)     | 1 (2)   | 6 (−5, 18)                            |
| Serious adverse events*** | 0 (0) | 0 (0) | 0                                     |
| Would want intervention again prior to a future NP swab (%) | 33 (73) | 30 (73) | 0 (−18, 19)                           |
| Guess re which intervention was received (%) | N = 17 | N = 13 |                                       |
| Lidocaine            | 11 (65)   | 7 (54)  | 11 (−22, 41)                          |
| Control              | 6 (35)    | 6 (46)  |                                       |

*p-value as per Fisher’s exact test.
**Nasal congestion (2), Nasal humidity (1), Epistaxis (1), Facial pruritis (1).
***Defined as arrhythmia, seizure, malignant hyperthermia, methemoglobinemia, or need for medical assessment or treatment related to the study intervention.

Abbreviations: VAS = Visual Analog Scale; SD = standard deviation; NRS = Numerical Rating Scale; CFS = Children Fear Scale; IQR = interquartile range; NP = nasopharyngeal.

Table 3. Linear regression of the association between potential predictors and pain measured using the visual analog scale (0–100 mm)

|                      | Univariate | Multivariate |
|----------------------|------------|--------------|
|                      | OR (95%CI) | P-value      | OR (95%CI) | P-value      |
| Sex female           | 1 (−11 to 14) | 0.853 | | |
| Age per year         | −3 (−4 to −1) | 0.006 | | |
| Age group (< 12 yo)  | 24 (12 to 36) | <0.001 | 14 (2 to 27) | 0.021 |
| Previous NP swab     | −5 (−9 to −0.4) | 0.031 | −2 (−6 to 2) | 0.420 |
| Presented with ANY pain at triage | −14 (−27 to −2) | 0.027 | −4 (−16 to 7) | 0.458 |
| NRS at triage        | −2 (−4 to 0.2) | 0.052 | | |
| Analgesia in previous 6h | −3 (−16 to 10) | 0.642 | | |
| Fear according to CFS pre-vaporization | 12 (7 to 16) | <0.001 | 9 (5 to 14) | <0.001 |
| Received lidocaine   | −7 (−20 to 5) | 0.262 | −6 (−17 to 4) | 0.245 |

Abbreviations: OR = odds ratio; yo = years old; NP = nasopharyngeal; NRS = Numeric Rating Scale; CFS = Children Fear Scale.
reduce distress. Further study of intranasal lidocaine appears to be warranted in older children.

**Clinical Trial registration**: Clinicaltrials.gov, NCT04901065, clinicaltrials.gov/ct2/show/NCT04901065, registered May 25, 2021.

**SUPPLEMENTARY DATA**

Supplementary data are available at Paediatrics & Child Health Online by searching for pxac077.

**ACKNOWLEDGEMENTS**

The research team would like to thank the children and families who accepted to participate in the study. Also, they would like to thank Mrs Stéphanie Pellerin, Ramona Cook, and Erika-Pier Caron-Brulotte for their help in participant’s recruitment.

**DATA SHARING STATEMENT**

Deidentified individual participant data and the study protocol will be made available to researchers who provide a methodologically sound proposal immediately following publication. No end date. Proposals should be directed to fgagnon@cheo.on.ca.

**FUNDING AND ROLE OF FUNDER**

This study was financially supported by the “Fondation du CHU Sainte-Justine.” The funder had no role in the study design, collection, analysis or interpretation of data, the writing of the report or the submission of the paper for publication.

**POTENTIAL CONFLICTS OF INTEREST**

All authors: No reported conflicts of interest. All authors have the paper for publication.

**REFERENCES**

1. G. C. Testing for COVID-19: Diagnosing and how we test 2020 [cited February 08, 2021]. https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/symptoms/testing/diagnosing.html.

2. W.H.O. Laboratory testing for covonovirus disease (COVID-19) in suspected human cases: Interim guidance 2020 [updated March 2020]. https://apps.who.int/iris/bitstream/handle/10665/331329/WHO-COVID-19-laboratory-2020.4-eng.pdf?sequence=1&isAllowed=y.

3. Lagier JC, Colson P, Tissot Dupont H, et al. Testing the repatriated for SARS-Cov2: Should laboratory-based quarantine replace traditional quarantine? Travel Med Infect Dis 2020;34:101624. doi: 10.1016/j.tmaid.2020.101624.

4. Wang H, Liu Q, Hu J, et al. Nasopharyngeal swabs are more sensitive than oropharyngeal swabs for COVID-19 diagnosis and monitoring the SARS-CoV-2 load. Front Med (Lausanne) 2020;7:334. doi: 10.3389/fmed.2020.00334

5. Westra AE, van Gils EJ, Aarts F, et al. Perceived discomfort levels in healthy children participating in vaccine research. J Empir Res Hum Res Ethics 2013;8:66–72. Epub 2013/08/13. doi: 10.1525/jer.2013.8.3.66

6. Smith D, Cheek H, Denson B, Pruitt CM. Lidocaine pretreatment reduces the discomfort of intranasal midazolam administration: A randomized, double-blind, placebo-controlled trial. Acad Emerg Med 2017;24:161–7. doi: 10.1111/acem.13115.

7. Farrington M, Bruene D, Wagner M. Pain management prior to nasogastric tube placement: Atomized lidocaine. ORL Head Neck Nurs 2015;33:8–16.

8. Lor YC, Shih PC, Chen HH, et al. The application of lidocaine to alleviate the discomfort of nasogastric tube insertion: A systematic review and meta-analysis. Medicine (Baltimore) 2018;97:e9746. doi: 10.1097/MD.0000000000009746.

9. Gjonaj ST, Lowenthal DB, Doxor AJ. Nebulized lidocaine administered to infants and children undergoing flexible bronchoscopy. Chest 1997;112:1665–9. doi: 10.1378/chest.112.6.1665.

10. Elyene D. Trottier M-JD-B, Laurel C-K, Krista B, Samina Ali. Managing pain and distress in children undergoing brief diagnostic and therapeutic procedures 2019 [updated November 2019; cited February 22, 2021]. https://www.cps.ca/en/documents/position/managing-pain-and-distress.

11. Birnie KA, Hundert AS, Laloo C, Nguyen C, Stinson JN. Recommendations for selection of self-report pain intensity measures in children and adolescents: A systematic review and quality assessment of measurement properties. PAIN 2019;160:5–18. doi:10.1016/j.pain.2019.01.003.

12. Susam V, Priedel M, Basile P, Ferri P, Bonetti L. Efficacy of the Buzzy System for pain relief during venipuncture in children: A randomized controlled trial. Acta Biomed 2018;89;6–16. doi: 10.23750/abm.v89i6.7378.

13. Sheridan DC, Hansen ML, Lin AL, Fu R, Meckler GD. Low-dose propofol for pediatric migraine: A prospective, randomized controlled trial. J Emerg Med 2018;54:600–6. doi: 10.1016/j.jemermed.2018.01.003.

14. Bailey B, Gravel J, Daoust R. Reliability of the visual analog scale in children with acute pain in the emergency department. Pain 2012;153:839–42. doi: 10.1016/j.pain.2012.01.006.

15. Le May S, Ballard A, Khadra C, et al. Comparison of the psychometric properties of 3 pain scales used in the pediatric emergency department: Visual analogue scale, face pain scale-revised, and colour analogue scale. Pain 2018;159:1508–17. doi: 10.1016/j.pain.2018.02.0001.236.

16. McMurtry CM, Noel M, Chambers CT, McGrath PJ. Children's fear during procedural pain: Preliminary investigation of the Children's Fear Scale. Health Psychol 2011;30:780–8. doi: 10.1037/a0024817.

17. Kanodia A, Srigyan D, Sikka K, et al. Topical lignocaine anaesthesia for oropharyngeal sampling for COVID-19. Eur Arch Otorhinolaryngol 2021;278:1669–73. doi: 10.1007/s00405-020-06402-4.

18. Babl FE, Goldfinch C, Mandrawa C, Crellin D, O'Sullivan R, Donath S. Does nebulized lidocaine reduce the pain and distress of nasogastric tube insertion in young children? A randomized, double-blind, placebo-controlled trial. Pediatrics 2009;123:1548–55. doi: 10.1542/peds.2008-1897.

19. Craig SS, Seith RW, Cheek JA, et al. Lidocaine and phenylephrine versus saline placebo nasal spray for the pain and distress of nasogastric tube insertion in young children and infants: A randomised, double-blind, controlled trial. Lancet Child Adolesc Health 2019;3:391–7. doi: 10.1016/S2352-4642(19)30058-6.

20. Chadha NK, Lam GOA, Ludemann JP, Kozak FK. Intranasal topical local anesthetic and decongestant for flexible nasendoscopy in children: A randomized, double-blind, placebo-controlled trial. JAMA Otolaryngol–Head Neck Surg 2013;139:1301–5. doi:10.1001/jamaoto.2013.5297.

21. O’Connell NC, Woodward HA, Flores-Sanchez PL, et al. Comparison of preadministered and coadministered lidocaine for treating pain and distress associated with intranasal midazolam administration in children: A randomized clinical trial. J Am Coll Emerg Physicians Open 2020;1:1562–70. doi: 10.1002/emp2.12227.

22. Chan E, Hovenden M, Ramage E, et al. Virtual reality for pediatric needle procedure pain: Two randomized clinical trials. J Pediatr 2019;209:160–7.e4. doi: 10.1016/j.jpeds.2019.02.034.

23. Hedén L, von Essen L, Ljungman G. Children's self-reports of fear and pain levels during needle procedures. Nurs Open 2020;7:376–82. doi: 10.1016/nop2.399.
24. Rømsing J, Dremstrup Skovgaard C, Friis SM, Henneberg SW. Procedure-related pain in children in a danish university hospital. A qualitative study. *Paediatr Anaesth* 2014;24:602–7. doi: 10.1111/pan.12402.

25. Fein JA, Zempsky WT, Cravero JP. Relief of pain and anxiety in pediatric patients in emergency medical systems. *Pediatrics* 2012;130:e1391–405. doi: 10.1542/peds.2012-2536.

26. Indovina P, Barone D, Gallo L, Chirico A, De Pietro G, Giordano A. Virtual reality as a distraction intervention to relieve pain and distress during medical procedures: A comprehensive literature review. *Clin J Pain* 2018;34:858–77. doi: 10.1097/AJP.0000000000000599.

27. Birnie KA, Noel M, Chambers CT, Uman LS, Parker JA. Psychological interventions for needle-related procedural pain and distress in children and adolescents. *Cochrane Database Syst Rev* 2018;10:CD005179. doi: 10.1002/14651858.CD005179.pub4.

28. Bukola IM, Paula D. The effectiveness of distraction as procedural pain management technique in pediatric oncology patients: A meta-analysis and systematic review. *J Pain Symptom Manage* 2017;54:589–600.e1. doi: 10.1016/j.jpainsymman.2017.07.006.

29. Gniß S, Kappesser J, Hermann C. Placebo effect in children: The role of expectation and learning. *Pain* 2020;161:1191–201. doi: 10.1097/j.pain.0000000000001811.

30. Head K, Snidvongs K, Glew S, et al. Saline irrigation for allergic rhinitis. *Cochrane Database Syst Rev* 2018;6:CD0125–97-CD. doi:10.1002/14651858.CD012597.pub2. PubMed PMID: 29932206.