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Original research

PROJECT *SMILE*: IMPROVING PEDIATRIC RESIDENTS' USE OF TOOL TO MINIMIZE PROCEDURAL PAIN

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Abstract: **Background**. In medical settings, children are subject to many painful procedures. Pain management during procedures not only reduces psychological and physical trauma but also impacts children's future responses to pain and procedures. This project aimed to create sustained change in the residents' culture surrounding procedural pain management in pediatric patients. We hypothesized that an initiative involving education, reminders, and multidisciplinary integration would increase the amount of pain reduction methods used during painful procedures.

Methods. The initiative included all pediatric residents at a single healthcare institution in the northeastern United States, where the pediatric population is only a fraction of the patient load. Project S.M.I.L.E. utilized a novel acronym that incorporates different pain-minimizing techniques to encourage the use of these techniques through educational initiatives, multidisciplinary participation, and increased access to resources. Surveys were conducted pre- and post-intervention to determine the level of change in procedural pain levels.

Results. A total of 24 pediatric residents participated in the survey. The baseline evaluation included 20 procedures, including intravenous line placements, venipunctures/heel sticks, and arterial punctures. Two years after the onset of this initiative, surveyed pediatric residents showed a sustained increase in their use of these methods.

Conclusion. This project demonstrates that the low-cost and simple methods employed in this initiative are efficacious and can be adapted for use in other programs.

Keywords: Pain management, procedural pain, pediatric pain.

INTRODUCTION In the medical setting, children are regularly subjected to a vast number of painful procedures, including vaccinations, blood draws, and intravenous catheter placements. For patients admitted to pediatric units, up to 78% are documented to have had at least one painful procedure within 24 hours, with only 28% of these children receiving any form of pain management [1]. Pain management during procedures is not only beneficial during the procedure itself by minimizing psychological and physical trauma but has also been shown to impact future responses to painful procedures. Inadequate pain control can lead to decreased future response to analgesia [2], increased pain response [3], and out-of-proportion levels of distress during future procedures [4], all of which can lead to health care avoidance and anxiety that can continue into adulthood [5].

Many pharmacological and non-pharmacological interventions are proven to be effective in minimizing procedural pain. Topical lidocaine/prilocaine preparations, such as EMLA™, have been proven efficacious in the setting of venipunctures [6] and vaccinations [7]. Feeding can be beneficial for infants undergoing painful

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procedures. Breastfeeding during procedures reduces the amount of pain felt by the infant [8,9], and the odor of breast milk has been shown to have analgesic effects [10]. Non-nutritive sucking and sucrose drops have both been used to reduce procedural pain with success [11]. Distraction is another key method utilized in minimizing pain in children. Neonates' pain scores and heart rates have been shown to decrease with the use of maternal voice during procedures [12]. Virtual reality devices, music, bubbles, books [13,14], or physical distraction techniques such as the Buzzy® device [15] can provide adequate distraction for older children.

We aimed to change pediatric resident behavior regarding procedural pain management at our institution by implementing a multi-disciplinary quality improvement initiative focused on education, resources, and reminders and to determine the sustainability of these changes over a 2-year period. While large-scale programs have been implemented in children's hospitals to achieve procedural pain reductions, we document our success in a pediatric residency program within a single institution utilizing a unique acronym and approach with minimal cost and resources.

METHODS

As a baseline measure, pediatric residents documented details of twenty painful procedures performed on the pediatric inpatient unit of Staten Island University Hospital Northwell Health. The information included the type of procedure, methods used to minimize pain, and the residents' perceived level of patient distress. Our pediatric program has eight pediatric residents per year, with a total of 24 pediatric residents. Following the baseline assessment, an educational initiative was initiated to increase residents' use of tools and methods to minimize procedural pain in the pediatric inpatient unit.

Pediatric residents were provided with education regarding procedural pain and well-documented methods to minimize pain during procedures through a 1-hour lecture given annually. The initiative was named "Project S.M.I.L.E.," which utilized a novel acronym created as an educational tool and reminder of methods to minimize procedural pain. "S.M.I.L.E" included the following methods: S= Sucrose drops/breastfeeding for infants; M= maximize distractions; I= Incorporate comfort positioning; L= lidocaine numbing cream; E= Encourage patient/family participation.

Posters describing "Project S.M.I.L.E." were created and displayed around the pediatric inpatient unit to remind all staff of the initiative and introduce it to families. Fliers describing the program were provided inside the families' hospital welcome packets. In addition, pins with the logo "Project S.M.I.L.E." were created, distributed, and worn by residents to increase awareness and serve as reminders.

Several pain reduction tools were provided in the form of a "toolbox," which was available in the pediatric inpatient unit. The "toolbox" was filled with items for distraction, including bubbles, pinwheels, a "Viewmaster" toy, and reminders to use numbing cream and sucrose drops/breastfeeding. Group texts were also sent to remind residents of the availability of the numbing cream and reminders to utilize the pain reduction techniques. Reminder posters were also placed in the procedure supply room. In addition to residents, faculty were also educated on the initiative through a grand round lecture. Nurses were educated on techniques to minimize procedural pain and were incorporated into the initiative.

Residents were given a follow-up survey three months after the initiation of "Project S.M.I.L.E." to determine the initial effect of the program on residents' actions. After the follow-up survey, additional measures were utilized to maximize the program and continue the positive change in practice. These methods included additional didactic opportunities, coordination with the phlebotomists' schedules, and additional reminders. Throughout the initiative, it was noted that it was difficult to schedule the placement of numbing cream for patients whose labs were drawn by the phlebotomy team due to the unpredictability of the phlebotomy lab draws despite the timed lab schedule. The phlebotomy team was subsequently incorporated into the initiative, and the phlebotomist was scheduled to call the pediatric unit 30 min prior to arrival on the pediatric unit to allow for the numbing cream to be applied to the patients by nurses or residents. Residents were then re-surveyed 1.5 years and 2 years after project initiation to determine the long-term sustained effects of the program.

Statistical analysis was conducted using an independent measure two-tailed t-test. T-tests compare the change

over time in the percentage of residents reporting increased usage of each technique at the project's 3-month, 1.5-year, and 2-year points. The same test was performed comparing the change over time in the percentage of residents reporting sometimes or always using each technique proposed by the initiative. Significant values for all t-tests were set at a p-value of 0.05.

RESULTS The baseline evaluation included 20 procedures, including intravenous line placements, venipunctures/heel sticks, and arterial punctures. Distraction was utilized in 61% of encounters and perceived by residents to be successful 64% of the time. Numbing cream and breastfeeding were not utilized for any of these procedures. According to the resident's observation, 90% of patients were mildly distressed, and 30% were moderately distressed.

Three months after Project S.M.I.L.E. was initiated, the pediatric residents completed the survey and reported an increase in the use of methods to minimize procedural pain (Figure 1): 81% of residents reported increased use of numbing cream, 93% reported increased use of distraction measures, 40% reported increased use of breastfeeding and/or sucrose drops, 73% of residents reported increased use of positioning for comfort and 80% reported increased incorporation of patient wishes while performing painful procedures. The residents were also surveyed at the 1.5-year and 2-year time points to determine the continued effects of the measures taken during that time. From the 1.5-year to the 2-year time points, the percentage of residents reporting increased use of numbing cream, distraction measures, breastfeeding and/or sucrose drops, and incorporation of patient/family wishes increased (p-values <0.001 for numbing cream and p<0.01 for the other modalities).

In addition, residents were also asked to report how often they utilized these techniques. At the 1.5-year time, most residents reported "sometimes or always" using numbing cream and comfort positioning for painful procedures, and approximately 45% of residents reported sometimes/always using distraction measures and breastfeeding and/or sucrose drops during painful procedures. At the 2-year timepoint, we saw a further increase in the percentage of residents sometimes or always using all the measures as compared with the 1.5-year time point: 71% reported using numbing cream, 61% were using distraction measures, 63% were using sucrose drops and/or breastfeeding, and 91% were using positioning for comfort. These increases were significant by a two-tailed independent t-test for a p-value of <0.05.

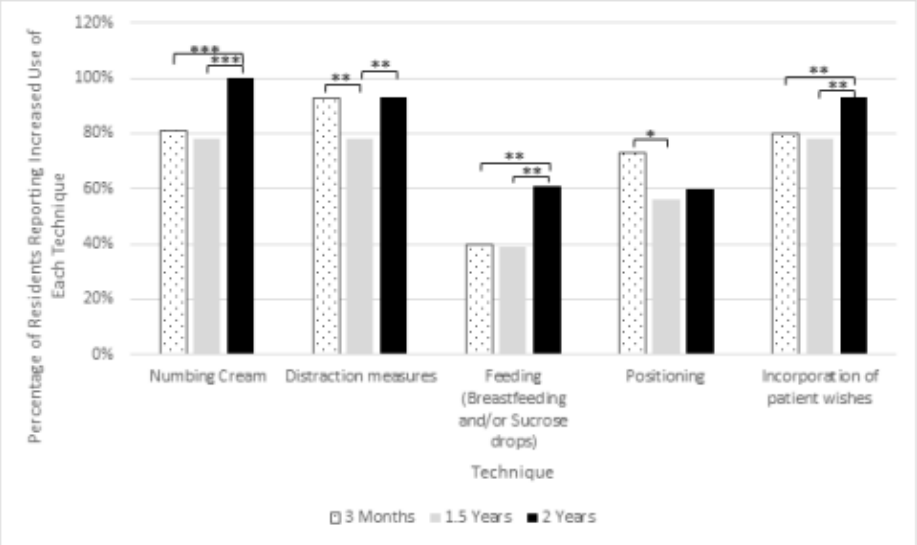

Figure 1. The percentage of residents reporting increased usage of each pain-minimizing technique at the 3-month, 1.5-year, and 2-year timepoints. * Denotes p<0.05, ** denotes p<0.01, and *** denotes p<0.001.

Residents also reported which features of the initiative were most effective. Overall, education and the involvement of the phlebotomy team were most frequently chosen by residents as the initiative's top features**.**

DISCUSSION Pain during hospitalization is a ubiquitous feature of inpatient medical care. Even in children's hospitals, pediatric pain is undertreated despite being extremely common. A Canadian survey found that 33% of patients experienced moderate to severe pain, 88% of which was acute [16]. In an American study, 20% had moderate pain within 24 hours, and 30% experienced severe pain [17]. The source of this pain was found to mostly come from needle pokes [17]. If not managed, this procedural pain can cause the child distress, which was perceived and documented by our pediatric residents at our initial baseline survey.

Several methods were employed at our institution to initiate and maintain the use of pain-minimizing techniques to decrease the amount of patient distress initially described by the residents. These methods have been well-documented, including in large-scale children's hospital settings [18]. We present our approach to decreasing procedural pain in a pediatric unit of a single institution, which can be adapted for use in other programs.

The multi-disciplinary approach to the project allowed for multiple checkpoints before performing a painful procedure. The phlebotomy team calling ahead prior to coming to the pediatric unit was noted to be helpful, as it gave residents time to apply numbing cream despite the unpredictable phlebotomy schedule. Nursing involvement provided additional reminders to the residents and increased the availability of someone to provide distraction or comfort for the patient. Parents were also engaged during the procedure by providing distraction, comfort positioning, and, if applicable, breastfeeding. Their participation helped minimize the distress not only in the child but also in them by helping to alleviate feelings of helplessness they may have otherwise felt.

Education about pediatric pain was routinely provided and seen as beneficial by the residents. Lectures for the residents were repeated annually, a single grand round session for the faculty to introduce the topic and initiative, written reminders in the procedure supply room, and monthly texted reminders contributed to the initiative. The lectures also provided insight into the reasoning behind the program and diminished the potential hurdles when trying to change the culture around procedural pain.

The availability of the resources was initially a limitation. The resource toolbox was initially not easily accessible. When this was discovered, the toolbox was moved to a more central location on the pediatric floor. Lidocaine and sucrose drops were also not initially readily available, but they are now stocked in the pediatric unit.

The initiative was assessed and modified during the 2-year time course to address the limitations. 2 years after the start of the program, we were able to document a sustained and increased use of procedural pain management techniques by pediatric residents. The evaluation at the 2-year time point includes residents who were not involved at the launch of the program. With continued education and availability of resources, we have changed the behavior of pediatric residents in our program, which continues to carry over to the new residents as the program's culture continues to evolve.

CONCLUSION Using a unique acronym, along with providing education and resources in a multi-disciplinary approach, we were able to document an increase in the use of methods to decrease procedural pain by pediatric residents. We were able to demonstrate this effect in a pediatric unit within a larger hospital, with changes that were sustained for 2 years after the initiation of the program. The methods are efficacious and can be adapted by other programs seeking to improve procedural pain management in small pediatric programs, while utilizing minimal resources.

Conflicts of interest: The authors declare no conflicts of interest.

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