Educational Outreach to Reduce Immunization Pain in Office Settings

WHAT'S KNOWN ON THIS SUBJECT: Many strategies have been developed to address the pain and anxiety associated with immunizations, but these often are underutilized by pediatric providers. An educational outreach strategy known as "academic detailing" has been effective in changing health provider practices.

WHAT THIS STUDY ADDS: In this study, an academic detailing strategy featuring a single teaching visit to the offices of pediatric practitioners in our community, focusing on reduction of injection pain, had demonstrable effects on practice behaviors up to 6 month after application.

abstract

OBJECTIVE: The goal was to examine the impact of a teaching module on immunization pain reduction practices in pediatric offices 1 and 6 months after the intervention.

METHODS: Fourteen practices were selected randomly to receive a 1-hour teaching session on immunization pain reduction techniques, and 13 completed the study. Before the intervention, telephone interviews were conducted with parents concerning their children's recent immunization experiences. At 1 and 6 months after the intervention, parents of children who had recent immunizations were interviewed by using the same questionnaires. Clinicians also were surveyed at baseline and at 6 months.

RESULTS: A total of 839 telephone interviews and 92 clinician surveys were included. Significant changes from baseline were identified at 1 and 6 months after the intervention. At 1 month, parents were more likely to report receiving information ($P = .04$), using strategies to reduce pain ($P < .01$), learning something new ($P < .01$), using a ShotBlocker ($P < .01$), using sucrose ($P < .01$), and having higher levels of satisfaction ($P = .015$). At 6 months, all rates remained significantly higher than baseline findings (all $P < .01$) except for satisfaction. Clinician surveys revealed significant increases in the use of longer needles, sucrose, pinwheels, focused breathing, and ShotBlockers at 6 months.

CONCLUSIONS: A 1-hour teaching session had measurable effects on the use of pain-reducing strategies at 1 and 6 months after the intervention. This research supports the hypothesis that small-group teaching sessions at the site of care can be associated with changes in practice behaviors. *Pediatrics* 2010;126:e1514–e1521

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KEY WORDS

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Although immunizations against childhood diseases represent an enormous advance in the medical care of children, the pain and distress associated with these procedures are disconcerting not only to the children[1–3] but also to their parents[4] and health care providers.[5,6] For a subgroup of children, these noxious procedures dominate the entire medical encounter and cast a shadow over the relationships of the children with their health care providers.[7]

Over the years, many strategies have been developed to address the pain and anxiety associated with immunizations; unfortunately, however, results are published in the disparate literature areas that are involved with this clinical problem (eg, pediatrics, nursing, and psychology). In an attempt to gather this information into a centralized usable format for clinicians, a multidisciplinary consensus conference was held, with the goal of evaluating the evidence regarding immunization techniques. The recommendations made at that meeting and at another consensus meeting were published subsequently.[8,9] Unfortunately, these strategies are often underutiltized by pediatric providers.[10,11]

Changing practice patterns to incorporate new information generally is quite challenging.[12–14] The most commonly used technique for continuing medical education, namely, lectures, rarely changes practice behavior, as indicated in study after study.[15,16] Other techniques, such as audit and feedback, guideline development, financial incentives and penalties, and other administrative interventions, are helpful but often are geared for use in hospitals rather than pediatric offices, where immunizations typically occur.[17–19] Therefore, to address immunization pain, the strategy that seemed most applicable was educational outreach, also known as "academic detailing."

The term educational outreach describes personal visits by trained individuals to health care providers in their own settings.[20] Educational outreach is successful because it uses a number of key principles of adult learning, such as active involvement of learners, chances for feedback, and occurrence in an informal, comfortable setting for physicians (ie, their offices). Similar to pharmaceutical representatives, academic detailers bring food, present a cogent discussion on a particular topic, and leave attractive materials for physicians to review.[21–25] Initial meta-analyses of the data obtained from 18 educational outreach studies involving almost 1900 physicians suggested that educational outreach, especially when combined with other strategies, was a promising approach to changing provider behavior.[26] Despite the limitations of this technique, it has been endorsed by many experts as a primary modality to change physician behavior.[11–13]

The objective of this study was to evaluate the impact of a 1-hour, office-based, teaching session on immunization administration practice. We hypothesized that there would be increases in parent and provider reports of the use of pain-relieving techniques discussed in educational sessions, that parent and provider satisfaction with the immunization experience would increase, and that these changes would persist for up to 6 months.

METHODS

Study Design

The study assessed changes in the use of immunization pain reduction strategies and satisfaction with the immunization experience (for parents and staff members) by using an uncontrolled, before/after survey method. The Connecticut Children's Medical Center institutional review board approved the research.

Fourteen practices, selected randomly from those affiliated with Connecticut Children's Medical Center, were invited to participate. The 1-hour teaching session that served as the primary intervention consisted primarily of presentation of an algorithm of immunization pain reduction approaches, each with independent support of efficacy in the literature. Elements included (1) preparation of the child and family,[27] (2) selection of an appropriate needle length,[28] (3) instillation of sucrose on the tongue of infants, (4) use of distraction techniques for older children, including breathing, counting, telling stories, or blowing into a pinwheel,[29–31] (5) use of good technique and pressure at the site during the injection,[32–35] and (6) selected use of topical anesthetics.[36–41]

Educational materials, including a DVD, a poster for staff members, and a brochure for parents, were provided with the session. Offices also were supplied with Sweet-ease (Phillips Children's Medical Ventures, Monroeville, PA), a prepared sugar-water solution, pinwheels, and ShotBlockers (Bionix Medical Technologies, Toledo, OH), plastic devices that apply pressure at the injection site. During the subsequent few weeks, the study nurse contacted the practices to address any concerns and to help customize interventions to fit practice needs. The study was conducted in 3 phases.

Study Phases

Preintervention Phase (Baseline)

A questionnaire was administered to office staff members to survey current immunization practices (Appendix 1). Subsequently, consent forms were presented by the receptionist to all families of children scheduled for injections, to allow the study nurse to

contact them regarding their experience. If consent was provided, then the study nurse contacted the parent by telephone within the week and conducted a 5-minute interview about the immunization experience. Different survey questions were used for infants versus toddlers, preschool-aged children, and school-aged children (Appendix 2). Four weeks were allotted per practice for this phase. This process of obtaining consent was used for each survey phase.

Intervention and Short-term Follow-up Monitoring

After this preintervention phase, the study nurse conducted the formal teaching session. Staff members viewed the video and reviewed the poster. Brochures and appropriate supplies were left for use by the practice.

One month after the education session, consent forms were provided to the front desk for distribution to patients who were receiving immunizations. Consenting parents were contacted and the same interview as used at baseline was conducted. Data were collected over 2 to 3 weeks.

Long-term Follow-up Monitoring

Six months after the teaching session, the study nurse returned with additional consent forms and consenting parents were interviewed over the next 2 to 3 weeks. At that time, the clinical staff survey regarding immunization practices was readministered.

Data Analyses

Assessment of the project's impact involved comparison of baseline reports with 1- and 6-month postintervention reports of comforting/soothing strategy use, information sharing, and satisfaction. Statistical significance of differences in comfort measures was assessed with multivariate logistic regression models, with practice included as a covariate. Wilcoxon rank sum tests and 2-way analyses of variance, with practice modeled as a random effect, were used to explore baseline-postintervention differences in parent and provider satisfaction.

RESULTS

Sample Characteristics

Parents

Parent survey data were collected from 829 telephone interviews. Table 1 indicates distributions according to study phase (baseline, 1 month, and 6 months) and child's age category (infant, toddler, and school-aged). The number of surveys in each phase and category varied according to practice, ranging from 0 to 23. However, 92% of the phase/category/practice cells (108 of 117 cells) included ≥2 surveys. Six-month surveys were not collected for 1 practice.

Clinicians

Thirteen of the 14 initially recruited practices completed the entire academic detailing and evaluation process. One practice did not finish the intervention and short-term follow-up phase, indicating it was too busy to continue. The practices were all located in suburbs of Hartford, Connecticut. Six practices were small (1–3 primary care physicians) and 7 were large (4–9 primary care physicians). A total of 51 baseline surveys and 41 six-month surveys were collected, with means of 4.2 and 3.4 surveys completed per practice, respectively. Clinician names were not recorded; therefore, baseline and postintervention data could be matched only according to practice. Baseline clinician surveys

TABLE 1 Information and Comforting Strategies According to Parent Reports

Strategy	Proportion, %			1 mo vs Baseline		6 mo vs Baseline	
	Baseline	1 mo	6 mo	OR (95% CI)	*P*	OR (95% CI)	*P*
All ages	*N* = 345	*N* = 296	*N* = 188				
Received written information	28.1	35.1	39.4	1.4 (1.0–2.1)	.041	1.9 (1.3–2.9)	.002
Used any strategies or techniques	57.7	70.9	64.4	1.8 (1.3–2.6)	<.001	1.3 (0.9–2.0)	NS
Learned new techniques	8.1	45.6	31.9	11.1 (6.9–17.9)	<.001	4.6 (2.7–7.7)	<.001
Infants	*N* = 104	*N* = 83	*N* = 49				
Breastfeeding	7.7	4.8	8.2	0.6 (0.2–2.4)	NS	1.1 (0.3–4.5)	NS
Pacifier	15.4	7.2	18.4	0.5 (0.2–1.3)	NS	1.7 (0.6–4.7)	NS
Pacifier with sugar/Sweet-ease[a]	0	37.3	8.2				
Toddlers	*N* = 133	*N* = 121	*N* = 81				
Pinwheel (parent/provider)	9.8	56.2	28.4	25.3 (11.0–58.3)	<.001	6.0 (2.3–15.4)	<.001
Other distractions (parent/provider)	76.7	65.3	75.3	0.5 (0.4–0.9)	.03	1.1 (.54–2.1)	NS
ShotBlocker	0.8	22.3	33.3	128.0 (11.6–1413)	<.001	180 (12.9–2511)	<.001
School-aged children	*N* = 108	*N* = 92	*N* = 58				
Pinwheel (parent/provider)	9.3	23.9	20.7	5.6 (2.1–15.0)	.001	4.3 (1.2–15.2)	.021
Other distractions (parent/provider)	57.4	76.1	68.9	2.5 (1.3–5.1)	.009	4.2 (1.5–11.1)	.004
ShotBlocker	1.9	54.3	43.1	123.9 (22.7–677)	<.001	94.5 (15.2–586)	<.001

Odds ratios (ORs) were adjusted for practice. CI indicates confidence interval; NS, not significant.

[a] Baseline use was 0%; therefore, odds ratios are undefined.

were not collected at one practice and 6-month surveys were not collected at another; these were both small practices and were excluded from the before/after clinician analysis. Their parent interview samples were adequate for inclusion in the parent survey analysis.

Interview Results

Parents

Four sets of analyses were conducted to explore changes in the use of comforting measures, as reflected in parent reports at baseline and 1 month and 6 months after intervention. One set included the full sample of 829 surveys and assessed 3 items applicable to all children (provision of written materials, use of any comforting strategies, and report that the parent had learned new ways to sooth, to comfort, or to prepare the child). A second set used the 236 surveys on infant experience and 3 items specific to infants (breastfeeding, use of a pacifier, and use of a pacifier dipped in sugar/Sweet-ease). Changes in the use of distraction strategies by the parent and/or provider were examined separately for the 258 toddler surveys (set 3) and 335 school-aged child surveys (set 4). Use of pinwheels, ShotBlockers, and other distractions (storytelling, talking to the child, counting, or focused breathing) were included in this analysis. Table 1 presents the frequencies of strategies used at each study phase, as well as odds ratios (adjusted for practice) generated with multinomial regression models, comparing 1- and 6-month data with baseline data.

All Children

Rates of receipt of written information, use of some comforting strategies, and learning of new comforting techniques were significantly increased at 1 month. Rates of receipt of written information and learning something new remained significantly increased over baseline at 6 months. More than one-half of parents were already using some strategies at baseline, but the proportion increased to 71.9% at 1 month and remained higher (64%), although not statistically significantly so, at 6 months.

Infants

Among the 3 strategies surveyed for infants, only use of a sugar/Sweet-ease–dipped pacifier increased dramatically after the educational sessions. No parents reported using this at baseline, but the proportion increased to 37.3% in the 1-month survey.

Toddlers, Preschool-Aged Children, and School-Aged Children

In the toddler/school-aged child surveys, a strategy was considered to be used if the parent indicated that the parent or the provider used the technique. When findings were operationalized in this way, pinwheels and ShotBlockers were used significantly more frequently at 1 month and 6 months, compared with baseline, for both toddlers and school-aged children. Pinwheels were especially popular for toddlers (56% at 1 month) and ShotBlockers for school-aged children (54.3% and 43.1% at 1 and 6 months, respectively). A high level of use of other distractions was reported in baseline surveys (approximately three-fourths of the surveys for toddlers and 58% for school-aged children); however, 6-month surveys of school-aged children indicated a statistically significant increase in the use of other distractions.

TABLE 2 Pain-Relieving Strategies According to Provider Reports

Strategy	Proportion, %		OR (95% CI)	*P*
	Baseline ($N = 51$)	6 mo ($N = 41$)		
Infant needle size of >⅝ in	15.2	34.1	4.5 (1.1–17.9)	.034
Toddler needle size of >⅝ in	17.0	51.2	15.0 (3.3–68.2)	<.001
Adolescent needle size of >⅝ in	31.9	63.4	43.1 (4.0–460.0)	.002
Sucrose/Sweet-ease (infants)	3.9	29.3	31.6 (3.2–314.4)	.003
Pinwheel (toddlers/school-aged children)	11.8	53.7	81.0 (7.4–882.3)	<.001
Focused breathing (toddlers/school-aged children)	35.3	56.1	3.0 (1.2–7.8)	.021
Topical anesthetics (toddlers/school-aged children)	15.7	24.4	1.8 (0.5–6.2)	NS
ShotBlocker (toddlers/school-aged children)	3.9	46.3	50.3 (7.4–339.2)	<.001

Odds ratios (ORs) were adjusted for practice. CI indicates confidence interval; NS, not significant.

Clinicians

Clinician data on preferred needle size and use of 5 pain-relieving strategies from baseline to 6 months are summarized in Table 2. The proportion of providers who reported use of needles longer than ⅝ inches, according to project recommendations, doubled for infants and adolescents and tripled for toddlers. Use of sucrose/Sweet-ease for infants and use of pinwheels, focused breathing, and ShotBlockers for older children were each reported at significantly higher rates at 6 months. An increase in topical anesthetic use also was noted for toddlers, but the change was not significant with controlling for practice.

Satisfaction

Satisfaction ratings are summarized in Table 3. Parents were primarily very satisfied with the immunization experience at all times measured (median response: 5). Satisfaction was somewhat improved after the intervention but was not significantly different from baseline at 6 months. Clinicians were less satisfied at baseline, compared with parents, with their ability to re-

TABLE 3 Preintervention and Postintervention Satisfaction

	Satisfaction Score		*P*	
	Mean ± SD	Median	Wilcoxon Rank Sum Test	Analysis of Variance
Parents				
Baseline (*N* = 342)	4.56 ± 0.75	5		
1 mo (*N* = 296)	4.71 ± 0.54	5	.026[a]	.015[b]
6 mo (*N* = 186)	4.68 ± 0.61	5	.108[a]	.143[b]
Providers				
Baseline (*N* = 49)	3.43 ± 0.94	3		
6 mo (*N* = 41)	3.83 ± 0.86	4	.027[a]	.017[c]

Satisfaction was indicated as 1 = very dissatisfied to 5 = very satisfied.

[a] Relative to baseline ratings.

[b] Probability associated with before/after survey effect, Tukey's honestly significant difference posthoc test.

[c] Probability associated with before/after survey effect in 2-way analysis of variance (with practice as a random effect).

duce pain and anxiety during the immunization process (median baseline response: 3). At the 6-month survey, clinicians who responded were significantly more satisfied than were those at baseline (median 6-month response: 4).

Variation in Practice Behavior Changes

To estimate overall practice behaviors during immunizations, we calculated the proportions of parents who reported the use of ≥1 soothing/comforting strategies at baseline, at 1 month, and at 6 months, according to practice. A scatterplot of results from the 12 practices with surveys completed both at baseline and at 6 months is provided in Fig 1. The proportion of parents who reported strategy use at 6 months is plotted in association with the proportion of parents who reported use at baseline for each practice. A point on the reference line would indicate a practice whose reported use at 6 months was equivalent to its reported baseline use. At baseline, a range of strategy use of 42% to 76% was reported for the practices (mean: 59%). At 6 months, the range was 40% to 100% (mean: 68%). Practices with lower baseline rates tended to show greater differences at 6 months, compared with those with higher baseline rates. Eight practices increased their use over baseline rates, 3 of those by ≥28%. Reported rates of pain relief strategy use were actually lower for 4 practices.

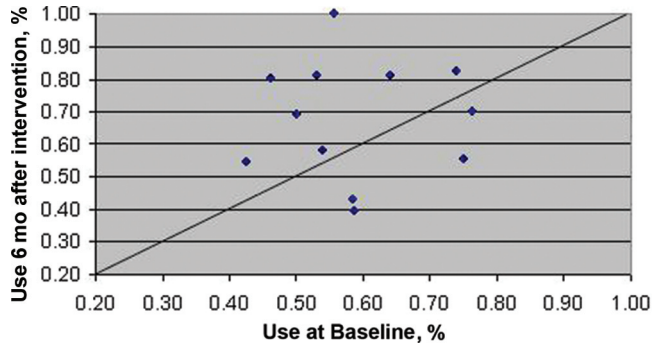

FIGURE 1
Use of pain-relieving techniques.

DISCUSSION

Although it is not known whether the repeated discomfort of multiple injections has long-term effects on children's subsequent nociception, stress reactivity, or anxiety during medical encounters,[10] it is clear that, by applying available knowledge, we can significantly reduce pain during and immediately after immunizations. An extensive list of techniques have been demonstrated in controlled trials to reduce injection pain.[8,9,27–41] Uniform use of any one of these techniques, or a combination of them, could significantly reduce the burden of pain during immunizations. There is clear evidence, however, that this is not occurring.[10]

Eliciting changes in medical practices is a complex process.[11,12] Physicians, nurses, and other health care providers must be comfortable with their knowledge base, to have the confidence to provide care for other people's children. Unfortunately, suggesting changes in practice behaviors may be interpreted as implying that present practices are inadequate, and suggestions may be rejected immediately. Changes are even harder to accomplish in office settings. Offices often are removed from educational programs that are offered in hospitals. There typically are fewer colleagues available in office settings to promote new ideas and against whom to benchmark practice. This isolation and vulnerability may explain the success of pharmaceutical representatives in providing education for practitioners and influencing prescribing practices.

Although no single strategy has been demonstrated to be highly effective in inducing changes, educational outreach visits have been shown to affect performance at least modestly in a number of studies. A relatively large body of evidence supports the efficacy of this intervention[26]; therefore, this technique seemed to provide the best opportunity to disseminate the information accrued during the consensus meeting.[8]

We decided to survey parents about what occurred during immunizations,

rather than relying on practitioner reports or observation of behavior. As reported, levels for 10 of the 12 variables measured in the survey were significantly increased over baseline at 1 month after the teaching session. Levels of 9 of these variables were still increased over baseline at 6 months. Although rates typically decreased at times further after the teaching session, children still had better immunization experiences 6 months after our intervention than they had before our intervention.

We also surveyed practitioners about their practices through a questionnaire administered before and 6 months after our intervention. Those results indicated significant increases in the use of 5 of the 6 interventions that were recommended, including increased length of needles for all children, use of sucrose for infants, and use of pinwheels, focused breathing, and pressure at the injection site.

Satisfaction with the clinical encounter also was examined, although this is a multifactorial controversial variable. Parents' satisfaction levels were significantly higher 1 month after interventions were presented, compared with baseline levels. Although parents reported higher levels of satisfaction at 6 months than did parents who were surveyed before the teaching session, the result did not achieve statistical significance. Provider satisfaction was statistically improved over baseline levels, however.

Practices varied initially in their use of immunization pain reduction strategies. In a crude approximation of practice changes, parents in 8 of 12 practices reported increased use of pain reduction techniques over baseline levels and parents in 3 practices reported values $\geq$28% over baseline levels.

Although most interventions were used more frequently after our teaching session than before it, they were not universally adopted. The questions of why some practitioners were more likely to adopt a given intervention than were others and why some interventions that were adopted initially by many practitioners remained popular and others did not remain unanswered. The cost of the interventions was not a factor, at least initially, because all practices were given all supplies. It may well be that some providers determined that the benefits they thought would accrue were not worth the investment of time they perceived was necessary to put these interventions in place.

Addressing the educational needs of practitioners in the community is a challenging task. Educational outreach certainly is one approach to be considered and, in our study, its use resulted in changes in certain aspects of immunization administration in offices for $\geq$6 months. There are, however, clear limitations to its usefulness as a major vehicle for continuing medical education. The cost of sending a clinician to offices to teach about specific topics may be prohibitive.

Interestingly, alternative models have been developed to address these difficulties. Vater[42] described the Educating Providers in Their Communities program. Through this initiative, trained peer professionals are sent to offices to make evidence-based presentations on a number of topics. Training modules are presented by a trained "detailer," and continuing medical education credits and a meal are offered. This approach significantly reduces the expense of educational outreach because a single visitor can discuss a number of different topics.

Another innovative approach to improving care in offices is through the use of learning collaboratives. In this model, the relative isolation and lack of focused expertise of individual or group practitioners is overcome through the development of quality improvement partnerships. Vermont and North Carolina have already established such collaboratives, in which practices are linked with quality improvement experts.[43] Another strategy that has been used to increase knowledge and to promote change is the use of interactive videoconferencing, through which practitioners can participate in discussions without leaving their offices. Importantly, no single strategy by itself has been shown to change practice behaviors uniformly, but a combination of approaches that are ongoing is far more likely to do so.

CONCLUSIONS

Needle pain during intramuscular injections traditionally has been viewed as a necessary evil, the price that must be paid to reap the genuine benefits of immunizations. In this study, a single teaching visit to the offices of pediatric practitioners in our community that focused on reduction of injection pain had demonstrable impact on practice behaviors up to 6 months after its occurrence. This strategy, along with others, should be considered as part of an overall plan to improve health care quality for children during their medical encounters in office settings. Finally, regarding immunizations and other procedures, children's comfort need not be sacrificed in the provision of good medical care; in fact, it should be considered an essential component of it.

APPENDIX 1: INJECTION PROJECTION PROJECT CLINICIAN SURVEY

The clinician survey was a 17-question, self-report instrument that was administered at baseline and 6 months after the intervention and collected the following data: (1) demographic data (gender and practitioner type), (2) in-

jection experience (years giving injections and number of injections given per day), (3) customary needle length (for intramuscular and subcutaneous injections, separately for infants, toddlers, and school-aged children), (4) site of administration (anterior thigh or deltoid, according to age categories), (5) distraction techniques used for infants and for toddler/school-aged children (sucrose/Sweet-ease, pacifier, singing, blowing/focused breathing, topical anesthetics, breastfeeding, counting, ShotBlocker, pinwheel, or other), and (6) satisfaction with ability to reduce pain and anxiety during the immunization process (on a 5-point Likert scale).

APPENDIX 2: INJECTION PROTECTION PROJECT PARENT SURVEYS

Two surveys, one for infants (0–2 years of age) that contained 19 questions and one for toddlers, preschool-aged children, and school-aged children (2–12 years of age) that contained 23 questions, were developed for parents. Data collected with both included (1) demographic data on the child and parent, (2) details of the injection (how many injections, who administered them, at what point in the visit they were given, parents' knowledge about the immunizations, and, if multiple immunizations were administered during the visit, whether they were given simultaneously or sequentially), (3) whether written information on preparation or soothing of the child was provided, (4) whether the parent learned any new ways to soothe, to comfort, or to prepare the child, (5) whether any soothing/comforting strategies were used, and (6) parents' satisfaction with the manner in which the child's immunization was administered (on a 5-point Likert scale from 1 = very unsatisfied to 5 = very satisfied). Parents of infants were asked whether they used breastfeeding, a pacifier, or a pacifier dipped in sugar water. Parents of toddlers, preschool-aged children, and school-age children were questioned about their and their providers' use of distraction/relaxation/reassuring strategies, including use of a pinwheel, singing/talking to the child, storytelling, singing, counting, blowing/focused breathing, and use of a ShotBlocker.

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