Education About Crying in Normal Infants Is Associated with a Reduction in Pediatric Emergency Room Visits for Crying Complaints

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ABSTRACT: ***Objective:*** **The primary aim of this study was to determine whether there was any change in visits of 0- to 5-month old infants to the medical emergency room (MER) of a metropolitan pediatric hospital after province-wide implementation of a public health prevention program that teaches new parents about the properties of early crying in normal infants.** ***Methods:*** **Free-text descriptions of Presenting Complaint and Final Diagnosis on electronic MER clinic visit files were used to classify infants as cases of infant crying not due to disease. Annual crying case visits as a percent of MER visits were analyzed pre- and post-introduction of the prevention program.** ***Results:*** **Before the program, crying case visits represented 724 of 20,394 MER visits (3.5%). The age-specific pattern of MER visits for crying peaked at 6 weeks and was similar to the previously reported age-specific pattern of amounts of crying in the community. After program implementation, crying cases were reduced by 29.5% ($p < .001$). The most significant reductions were for crying visits in the first to third months of life.** ***Conclusion:*** **The findings imply that improved parental knowledge of the characteristics of normal crying secondary to a public health program may reduce MER use for crying complaints in the early months of life.**

*(J Dev Behav Pediatr 36:*252–257, 2015) **Index terms:** crying, colic, public health, education, emergency room visits.

Crying in the early months of infancy has been a perennial challenge for parents and clinicians alike. Crying concerns brought to the clinician are commonly considered to be complaints of "colic" or excessive crying. Despite decades of research, the majority of cases of colic are not diagnosed as being due to organic disease either in specialized emergency room settings[1] or in referral clinics.[2,3] When investigations outside of clinical settings are considered, there is robust evidence that in the absence of additional symptoms and signs of organic disease, all of the characteristics of crying typical of colic in the first 4 months of life are explicable as a function of normal physiological and interactive processes.[4–6] These characteristics—typical of infants with or without colic—include increasing amounts of fussing, crying, and inconsolable crying usually peaking in the second month of life and decreasing thereafter, unpredictability as to when bouts of crying will begin and end, resistance to soothing, and inconsolability in 5% to 10% of crying bouts, a pain-like face, prolonged bouts of crying, and clustering in the late afternoon and evening.[5,6] Of particular concern is the typical increasing amounts of daily crying peaking in the second month—often referred to as the "normal crying curve"[6]—because parents do not expect crying to get worse despite their best efforts to comfort and care for their infants. However, there is robust evidence that these early increases and decreases in crying are best understood as a behavioral universal of infancy, and this pattern helps to define otherwise normal crying in the first 3 months of life.[4–7]

Although this crying is typical of normal infants, it nevertheless represents a considerable strain on parents and caregivers. This is reflected in literature from all cultures (e.g., Chekhov's story "Sleepy"[8]) and in myriad entries on parent blogging sites. In particular, there is increasing interest in prolonged, unpredictable, and inconsolable crying bouts. These bouts are almost unique

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to the first few months of life[9,10] but have the ability to make caregivers feel helpless and guilty because of the alarming and uncontrollable nature of the crying.[11] Maximum bout lengths of inconsolable crying contribute disproportionately to the amount of frustration caregivers experience compared with overall frequency or duration of fussing and crying per day.[12] Furthermore, mothers who report more than 20 minutes of inconsolable crying per day are twice as likely to report symptoms of postpartum depression as are those who report "colic," where colic is defined as greater than 3 hours a day of infant distress behavior (i.e., of fussing, crying, and inconsolable crying duration combined).[13] Although less frequent clinically, the most chilling manifestation of the frustration and anger generated by early infant crying is its role as a stimulus for shaken baby syndrome or abusive head trauma.[14–17]

Because of this evidence, the National Center on Shaken Baby Syndrome (Farmington, UT) developed a prevention program (the *Period of PURPLE Crying*) designed to support caregivers in their understanding of early infant crying and to prevent shaken baby syndrome. The program was based on educating caregivers about the characteristics of crying in normally developing infants and describing the dangers of shaking and abuse. It was designed to be implemented community-wide in a 3-dose intervention. In Dose 1, parents of newborn infants receive program materials (10-min DVD and 10-page booklet) during their maternity ward admissions by a nurse. The materials are reviewed, and parents take the materials home with them to use when needed and to share with other caregivers. In Dose 2, program messages are reinforced pre- and/or postbirth through health care providers (in this case, public health nurses). Because it is a universal program, all families of newborn infants receive both doses. Dose 3 is a public education campaign that attempts to inform caregivers and other members of society about early infant crying and the dangers of shaking (e.g., http://clickforbabies.org/). Because it is directed at the public generally, exposure to this campaign by families of newborns is not tied to the birth of the baby and may be more variable. The program was implemented province-wide in all maternity hospitals and public health units in British Columbia beginning in March 2008 with complete implementation by the end of January 2009. This program and others directed at preventing shaken baby syndrome/abusive head trauma[18,19] incorporate anticipatory advice about crying as recommended by the American Academy of Pediatrics[20] and the Canadian Joint Statement on Shaken Baby Syndrome.[21]

As an indirect measure of whether the program messages were being received and affecting parent behavior around normal infant crying, medical emergency room (MER) visits to the BC Children's Hospital (BCCH) for complaints of crying and colic unrelated to physical disease were monitored from January 2002 through February 2012. BCCH is a free-standing pediatric hospital in Vancouver, BC, Canada, and it is the only pediatric hospital in the province. Although families may go to local or regional hospitals or their family physician for concerns about crying and colic, the use of the BCCH MER was assumed to provide an indicator of whether health providers were sought by parents of newborn infants for crying concerns. To assess the possible effect of the program, we had 3 aims as follows: (1) to document the use of the BCCH MER for complaints of crying or colic not due to organic disease, (2) to determine whether MER visits for crying or colic reflected the typical age-related crying in normal infants, and (3) to determine whether the MER visits for crying or colic would change following implementation of the *Period of PURPLE Crying* program. Two conflicting hypotheses were entertained. The first was that MER visits for crying concerns would increase because the program encourages parents who have concerns about their infant's crying to see a health care professional to see if "something is wrong" that is causing the baby's crying. The second was that MER visits for crying concerns would decrease because of parents' improved understanding of the typical characteristics of crying in normal infants in the first 5 months of life. There have been no previous reports of whether such prevention programs decrease visits to emergency rooms for crying complaints not related to physical disease.

METHODS

The study used electronic free-text records of Presenting Complaint, Final Diagnosis, and Disposition for each medical emergency room (MER) visit. Presenting Complaint is entered by the triage nurse on first contact in the MER; the Final Diagnosis is entered by the attending physician after discharge or admission; the Disposition is limited to Routine Discharge, Left Without Being Seen, Left Against Advice, Transfer to Another Facility, Admitted (to the hospital) or Deceased. The data set was obtained from Decision Support Services of the Provincial Health Services Authority under whose authority the BC Children's Hospital (BCCH) operates. The final data set consisted of 30,790 MER visits by infants 0–59 months of age from January 2002 to February 2012. In addition to the Presenting Complaint, Final Diagnosis, and Disposition, it also included the date of the visit, infant age in days, total time in MER, and a level of acuity code.

Each MER visit e-record was reviewed to determine whether the visit counted as a case of infant crying unrelated to physical disease based on the free-text descriptors used. The conceptual operationalization of a "case" aimed to provide a probabilistic determination of the visit as a case as being those visits that, on review of the Presenting Complaint and Final Diagnosis, any MER physician would agree was a crying case without physical disease.

Criteria were developed in a pilot study review of 1546 cases. In the first step, free-text descriptors were reviewed. Presenting Complaint descriptors were judged to help define a case if they included words such as "crying," "colic," "crying and decreased feeding," "inconsolable crying," etc. Similarly, Final Diagnosis descriptors that helped to define a case could be "crying," "colic," "colic pain," "colic overfeeding," etc. In the second step, algorithms were

developed to combine Presenting Complaint and Final Diagnosis descriptors to decide on whether the visit was a "case" of crying or colic not due to physical disease. In general, if both the Presenting Complaint and Final Diagnosis included the designated descriptors (e.g., Presenting Complaint of "crying a lot" and Final Diagnosis of "crying/colic"), then the case was classified as a crying case not due to physical disease. If one descriptor was a designated word or phrase but the other was not (e.g., Presenting Complaint of "crying" but Final Diagnosis of "feeding problems"), it could be judged to be a case or not depending on the descriptors, but these cases were subject to review by 3 of the authors (R.G.B., M.C., F.R.) and possible full chart review. In addition, algorithms for specific recurrent descriptor combinations were defined as to whether they were cases (e.g., Presenting Complaint of "? crying" and Final Diagnosis of "normal newborn or well baby") or were not cases (e.g., Presenting Complaint of "crying" and Final Diagnosis of "constipation"). If the presenting complaint was blank (missing data), then the classification was decided solely on the Final Diagnosis descriptors.

In the piloting phase, classifications were reviewed in 1193 cases, and against full chart reviews for 4 cases. In the actual study, all charts were classified by the same coder. Intraobserver reliability for reliably classifying a visit as a case was achieved at acceptable levels (85% agreement) with a kappa of 0.69 ("substantial agreement"). Figure 1 provides an extract from a coding worksheet to illustrate application of the algorithms for specific cases.

For the first 2 aims, preimplementation MER visits were pulled for January 1, 2002, to February 29, 2008. Visits for March 1, 2008, through February 28, 2009, were not used because these were the months when the prevention program was being implemented. For the third aim, postimplementation visits were pulled for March 1, 2009, through February 29, 2012. From March 1, 2012, a new predefined more general coding scheme was adopted for MER administrative charts that could not be used to provide equivalent classifications, and so the surveillance was discontinued.

To meet the first aim (use of BCCH MER visits for complaints of crying and colic unrelated to physical disease), crying cases were expressed as a percentage of total MER visits for the preimplementation period. This helped to control for extrinsic factors that may have affected MER use generally during the study period. To meet the second aim (age-specific visits to MER), the number of crying case visits per week of age during the preimplementation period were plotted. To meet the third aim (change in visits to MER pre- and postimplementation), percentages of crying case MER visits per month were used as the dependant variable and entered into a mixed effects hierarchical logistic

Year of Admission	MER Admindate	Age in Months	Presenting Complaint	MER Final Diagnosis	Case	Not a Case	Chart Review
2008	5-May-08	0.33	CHOKING NOISES, IRRITABLE, VOMIT	NASAL BREATHING - N BABY		✓	
2005	31-Jul-05	1.94	FUSSY? FEVER	VIRAL ILLNESS		✓	
2004	21-Dec-04	2.14	INCREASED CRYING - VOMITED COUGH	VIRAL ILLNESS		✓	
2003	26-Jun-03	1.02	DECREASE FEEDING			✓	
2004	7-Jan-04	1.02	DECREASE FEEDING			✓	
2004	23-Jun-04	1.94	FUSSY	RESOLVED FUSSINESS	✓		
2007	29-Sep-07	1.94	FUSSY	WELL BABY	✓		
2007	20-Jul-07	1.94	FUSSY	WELL BABY	✓		
2004	8-Oct-04	1.94	FUSSY	WELL BABY	✓		
2004	2-Dec-04	1.94	FUSSY	WELL BABY	✓		
2005	19-Feb-05	1.94	FUSSY SINCE TUESDAY	WELL LOOKING	✓		
2002	28-Feb-02	2.76	NON-SPECIFIC	LWBS		✓	✓
2002	10-Feb-02	1.91	FOR RECHECK CRYING	NEONATAL JAUNDICE, NEWBORN		✓	✓
2005	7-Aug-05	1.94	FUSSY TODAY	NEONATAL R/O SEPSIS		✓	✓
2004	24-Jun-04	2.79	NOT VOIDING	NO DIAGNOSIS		✓	✓
2006	1-Apr-06	1.02	DECREASE INTAKE	NO DX LISTED		✓	✓
2002	25-Nov-02	1.02	DECREASED BMS	NO DX LISTED		✓	✓

Figure 1. Extract from coding worksheet. BMS, bowel movements; LWBS, left without being seen.

regression, allowing for unmeasured confounders between years and adjusted for age.

RESULTS

During the preimplementation period, there were 20,394 visits for infants 0–5 months of age to the medical emergency room (MER) of the BC Children's Hospital. Of these, a total of 724 (3.5%) were classified as crying or colic without physical disease cases based on the probabilistic classification algorithm derived from Presenting Complaint and Final Diagnosis descriptors.

To determine whether visits to the MER for complaints of crying or colic had similar age-specific characteristics as does crying in normal infants,[4–6,22] a plot of the number of crying case visits by week of age is represented in Figure 2. As in previous studies of the "normal crying curve," the figure shows a clear increase in cases in the first month of life, a peak at 6 weeks during the second month, and a decrease during the third to fifth months of life.

The difference in visits for crying cases as a percent of overall MER visits per month pre- to post-implementation of the prevention program is depicted in Figure 3. Although the *pattern* of age-related visits to the MER remained the same pre- and post-implementation (i.e., increasing, peaking in the second month of life and then decreasing), the overall percent of visits for crying complaints unrelated to physical disease decreased. The relative risk (RR) of a visit for crying or colic in the postimplementation period compared with the preimplementation period was 0.705 (95% confidence intervals [CI], 0.59–0.85; $p < .001$) representing an overall 29.5% reduction in visits. As might be expected from Figure 3, the overall decline postimplementation was due primarily to statistically significant reductions in the first, second, and third months of age (<1 mo: RR = 0.61 [95% CI, 0.45–0.81]; 1 to <2 mo: RR = 0.66 [95% CI, 0.50–0.88]; 2 to <3 mo: RR = 0.73 [95% CI, 0.50–1.05] representing reductions of 39%, 34%, and 27%, respectively).

DISCUSSION

Given the well-described frustration engendered by the typical increases in infant crying of normal newborns in the early months of life,[4–6,11,12] it is not surprising that significant numbers of infants would be taken to medical emergency facilities by concerned parents to be evaluated. The fact that crying increases over weeks and that a proportion of crying bouts are inconsolable and unpredictable regardless of what parents do can only compound the frustration and feelings of helplessness that parents have. Nevertheless, it is somewhat striking that of all medical emergency room (MER) visits for infants aged 5 months or younger in a metropolitan area specialty pediatric hospital over a 6-year period, 3.5% appear to have been related to frustration or concerns about crying or colic or parental interpretations that the crying represented a significant medical concern. Of course, this is in addition to whatever visits to other regional hospital emergency rooms or physicians or public health care offices occurred.

The age-related pattern of MER visits is remarkably similar to the age-specific patterns of daily amounts of crying and fussing previously described in normal infants in the community.[4,6,10,15,22] This pattern of increasing crying peaking sometime in the second month and then decreasing into the fourth and fifth months holds for overall distress (crying and fussing combined) but also for fussing, crying, and inconsolable crying separately.[11,23] This pattern is also a defining characteristic in virtually all clinical descriptions of "colic."[2,3] Although determination of the visits was indirectly ascertained through free-text descriptors for presenting complaints and final diagnosis on MER electronic logs, the fact that the MER visits shows a similar age-specific pattern provides indirect

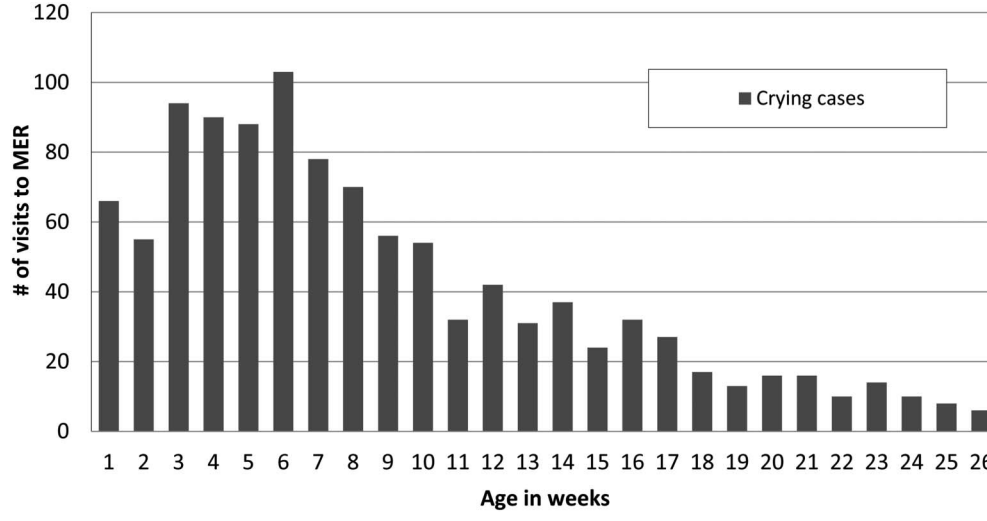

Figure 2. Number of visits to medical emergency room for crying complaints by week of age at time of presentation.

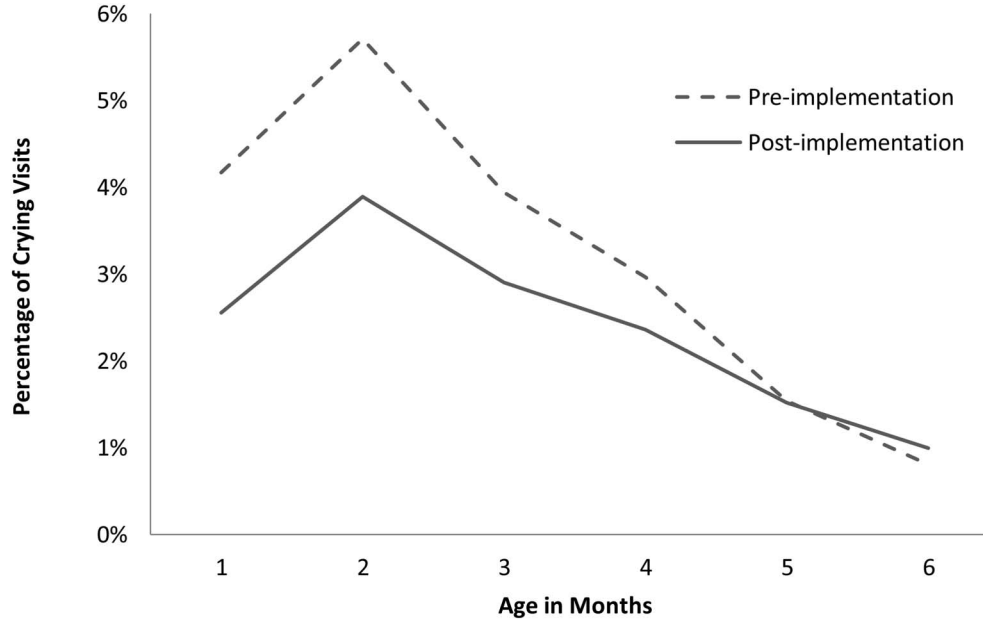

Figure 3. Crying visits as percent of medical emergency room visits by month of age pre- and post-implementation.

convergent support that the ascertainment was capturing crying or colic complaints not associated with physical disease.

An important aim of the study was to determine whether the MER visits for crying or colic would change after implementation of the *Period of PURPLE Crying* program that is designed to support parents in their understanding of early infant crying. In previous randomized controlled trials,[24–26] the program had been shown to increase parental knowledge about the characteristics of crying in normal infants. However, whether such an increase in parental knowledge would actually affect parental behavior in the face of real-life crying experiences was unknown. In this pre- to post-study, there was an associated significant reduction of almost 30% in MER visits for cases of crying and colic in the 3 years after implementation of the program in maternity wards and public health units across the province of British Columbia. Furthermore, the most significant reductions were for crying complaints during the first 3 months of life, the ages that were specifically described in the *Period of PURPLE Crying* program materials. On one hand, this decrease supports the hypothesis that the number of visits would decrease because the parents themselves felt supported by their improved understanding of the features of crying in newborns and how frustrating it can be. On the other hand, it does not support the hypothesis that the number of MER visits would increase as a result of the *PURPLE* materials' encouragement for parents to see a health care provider if they were concerned about their infant's crying. In fact, of course, the decrease most likely represents the net difference from some parents being less, and some parents being more, likely to take their infant to the MER for crying concerns.

This study has a number of limitations. First, because it is a pre- to post-implementation design, the decrease in MER visits can only be considered an association rather than necessarily a causal relationship. Second, the association could have been affected by extrinsic factors occurring over time. However, using MER visits for crying as a percent of overall MER visits should have helped to control for some secular trends in MER usage that may have occurred over the period of study. Third, although a decrease in MER visits was described, it is possible that there was a concomitant increase in visits to local or regional hospitals and/or family practices that function as primary care providers in British of Columbia. If so, then the prevention program would have been associated with a shift in visits for crying complaints from the MER to more generalist providers rather than a decrease for the medical care system as a whole. If that occurred, the shift would still be consistent with the program having supported parents in seeking more appropriate health care services. Fourth, there is no meaningful way to know whether a case of crying secondary to significant organic disease was missed because the parents who would otherwise have taken their infant to a health care facility did not do so because of information in the prevention program. To minimize this possibility, caregivers are specifically reminded that "…you can always check with your doctor to see if there is something wrong that is causing the crying" in the booklet (*Period of PURPLE Crying* booklet, page 4) and in the film. Fifth, in light of the above limitations, there is no simple way to estimate potential cost savings for the health care system generally. Although the costs of dealing with crying complaints are likely to be considerable,[27] the proportion of families that will use the MER of a free-standing pediatric hospital will vary depending on the community and

other supportive services available from the system as a whole, including accessibility and cost of primary care.

Despite these limitations, the apparent decrease in MER visits from pre- to post-implementation of a public health program to support parents and reduce shaken baby syndrome or abusive head trauma and infant abuse is encouraging that parental concern about this vexing infant behavior can be addressed to some extent through parental education to improve knowledge about normal infant crying behavior. The specificity of the age of the infants whose visits to the MER for crying concerns was reduced enhances the likelihood that the program was effectively implemented at least in the metropolitan areas where the hospital serves. Finally, the results are encouraging both for parents and clinicians that concern for the unremitting, frustrating, and crying in the early postpartum weeks may be modified with more appropriate information and understanding of this challenging normal developmental behavior.

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