The Phenomena of Early Infant Crying and Colic

Ronald G. Barr, MDCM, FRCPC
Ross Trust Seminar
Infant crying: causes, challenges and long-term outcomes
Centre for Community Child Health
Royal Children’s Hospital
Melbourne, Australia
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Infants crying: “photographs made by the instantaneous process”
Darwin, The Expression of Emotion in Animals and Man, 1872

The “Argument”
Clinical crying problems are:

a. Costly
b. Not explained by “pathology” in the infant or the caregiver
c. Should be reconceptualized as a manifestation of normal behavioral development

The Argument (cont’d)
The phenomena of early infant crying may be adaptive (from the point of view of evolutionary behavioral ecology).

This understanding of early increased infant crying (and colic) as “normal” has some implications for clinical approaches to early infant crying problems.

The “Cost” of Early Infant Crying
Crying concerns in the health care system

Early increased crying is used as an advertisement for the Quebec telephone call-in service. It accounts for about 30% of all calls.

Maternal Emotional Distress and “Colic”


Mothers who had infants with colic (modified Wessel’s criteria) had elevated levels of emotional distress, despite equivalent distress levels in 3rd trimester.

The “cost” of crying

Sleep and St. James-Roberts, 1998

- Cost of health professional time for cry and sleep complaints in the first 3 months (salary only): $CDN 46.08/baby
- Annual cost for NHS: $CDN 35,304,652
- Equivalents:
  a. 775 full time nurses
  b. 4238 hip fractures
  c. 270 patients with HIV treated for life

What is colic?

Defining features

(Gormally & Barr, 1997)

1. Age-dependent crying patterns (peak during 2nd month). These are due to changes in the amounts of crying that cluster during the evening.
2. Associated behaviors (prolonged cry bouts, unsoothability, “pain facies”)
3. “Paroxysmal” (unpredictable)

Wessel’s “Rule of 3’s”

An infant has colic when s/he cries:

> 3 hours/day
> 3 days/week
> 3 weeks

Assumption:

Colic is an abnormality, or “something wrong” with the infant
The Argument Against Pathology

- Non-pathological mechanisms can account for all primary features of colic
- Good outcome

“Colic” is not explained by pathology in the infant or in the caregiver

The Lamp Post

Anthropology
Psychobiology
Clinical
Nonlinear dynamic systems (catastrophe)

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The “crying curve” (Brazelton, 1962)

Large differences from infant to infant

“Peak Pattern” of Early Crying Behavior

Hunziker & Barr, Pediatrics 1986
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!Kung San Gathering
(Photos by Marjorie Shostak)

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!Kung San Mother & Infant
(Photo by Marjorie Shostak)

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Western Caregiving Styles

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Caregiving Contexts

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<tr>
<th>Contact</th>
<th>!Kung San</th>
<th>Western</th>
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<tr>
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<td>Responsivity</td>
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Hourly Cry/Fret Duration in !Kung San Infants in Early Months
Barr, Konner et al DMCN 1991

Large infant to infant differences
Hourly Cry/Fret Frequency in !Kung San, Dutch, and USA Infants

Hourly Cry/Fret Duration in !Kung San vs. Dutch Infants

Age-related Crying Patterns in Preterm Infants
(Barr, Chen, Hopkins et al, DMCN)

N-shaped curves in other biological functions

N-shaped curve in caloric intake

“Distress Curves” have been found in all non-human mammalian (i.e. breast feeding) species investigated.

- Guinea pig pups (Pettyjohn, 1979)
- Infant rat pups (Hofer et al, 1999)
- Chimpanzees (Bard, 2000)
- Free-living Rhesus macaques (Barr et al, 2005)
Parental Responses to Infant Chimp Distress
(Bard K, in Barr et al (eds) 2000)

Evidence that the “Crying Curve” is a Behavioral Universal of Infancy
There is a similar pattern and timing in:
1. All samples of Western infants
2. Cultures with radically different caregiving styles
3. Prematures
4. A wide variety of human infant biological & behavioral functions
5. Non-human species

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Unsoothable Crying Bouts in London, Copenhagen, and with a “proximal” form of care

Uniqueness of Unsoothable Crying Bouts to Early Crying

By 5 months, the mean amount of unsoothable crying is 1-3 minutes/day in all infants.

The early cry is a *graded* signal, not a typological sign or signal

Gustafson: Can we hear the causes of infant crying?
“He sounds just like a porpoise”
In Barr, Hopkins, Green: Crying as a Sign, a Symptom and a Signal, London: MacKeith Press, 2000
“If you were a good mother, you would…”

- Listen carefully to the cry and learn to read what the cause of the crying is so that you address the needs of your baby...
- Learn the right way to soothe your infant so that s/he can be calmed and not cry...

What is colic?
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“Classic” colic: Paroxysmal
- Unpredictable
- Begins and ends apparently unrelated to anything in the environment
- May begin or end “suddenly”

Basic Phenomenon in “Well behaved” Chaotic Systems: the Lorenz Attractor

Non-linear phase transitions
Non-linear Phase Transitions in Behavioral Systems

Concept of Infant Behavioral States (Wolff, 1987)

The “Shape” of Non-linear Transitions

“Explaining” Prolonged Crying Bouts, Resistance to Soothing and Paroxysmal Crying Bouts

Summary re: “Paroxysmal” Crying Bouts

No pathologic or abnormal mechanism need be postulated to explain unpredictable, paroxysmal, “unexplained” nature of crying bouts. They are most likely to be classical state transitions in infants functioning as “well-behaved” non-linearly organized behavioral systems.
“Colic:” a reconceptualization

Rather than thinking of colic as distinct, qualitatively different, and due to underlying pathophysiology or pathopsychology...
Perhaps we should think of it as continuous with normal behavior, qualitatively similar, and due to infants acting as they should, or were designed to, act.

Outcome of “colic” in Infants
(Lehtonen, Gormally, and Barr, 2000)

- Wt. Gain delay Transient
- Allergy None
- Crying Much reduced
- Behavior disturbance None
- Temperament difficult None
- Sleep problems None
- Negative reactivity None

There are 3 curves, not 1

Wessel’s criteria

#1 Persistent mother-infant distress syndrome (Papousek et al.)

#2 Difficult infant

#3 Wessel’s criteria

“Colic” has a good outcome
Clifford et al: Sequelae of Infant Colic

• Diaries at 6 weeks and 3 months of age
• Modified Wessel’s criteria
• Of those with colic at 6 weeks:
  a. 86.3% did not have colic at 3 months: 13.7% still did ("persistent" colic)
• At 3 months, 6.4% had colic:
  a. Of these, 50% did not have colic at 6 weeks (in other words, 50% with colic at 3 months “developed” it)

Although early increased crying (‘colic’) has no long term negative outcomes, persistent or repeated elevated crying after 3-4 months does have long-term predictability to later poorer outcomes

There are 3 curves, not 1

Longterm Effects of “Post” Curve Crying


The Argument Against Pathology

Non-pathological mechanisms for primary features:
  a. Crying curve
  b. Unsoothable crying bouts
  c. Paroxysmal crying

Good outcome
  a. For infants with classical colic (first 3-4 months)
  b. Less good for infants with “post-curve” persistent elevated crying

Typical Assumption: Colic is an abnormality, or “something wrong” with the infant
Current Evidence-based Assumption: Colic and early increased crying are normal, and there is nothing wrong with the infant.

The Phenomena of Early Increased Crying May Be Adaptive:
1. They contribute to survival
2. They have the properties of an "honest signal"

How Crying Signals May Have Functioned in our Evolutionary Past (after Bowlby):
- PROXIMITY-PROMOTING to assure
  1. Adequate Nutrition
  2. Protection from Predators
  3. Close Mother-Infant Interaction and Attachment

Cry as a Stimulus for Milk Letdown (after Lind et al):

In Summary:
"Colic" is a manifestation of normal behavioral development.
"Colic" is the upper end of a continuum of crying behavior in normal infants (like height: some infants are taller and some are shorter).
"Colic" is not an indication of disease in the infant.
Cry-Feed Relationship Among !Kung San (Konner)

Probability of nursing following cry/fret in !Kung San infants, from direct observations

Crying promotes mother-infant attachment and “bonding”

Thanks to Pilyoung Kim and colleagues (James Swain, Gary Evans)

The limbic-hypothalamic-midbrain circuits called ‘Maternal Circuits’ overlap with the mesocorticolimbic dopaminergic reward pathways.

Rodent mothers have greater activations in the reward circuits while nursing.

Mothers were exposed to cries and pictures of their own and others’ babies.

Breastfeeding mothers had greater activations in the mesocorticolimbic reward circuit in response to own baby cry at 2-4 weeks postpartum.

Also, hypothalamus, VTA, OFC, Putamen

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Swain et al. (2007)

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Swain et al. (2007)

Fesio, Numan, Ferris, 2005

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Breastfeeding mothers had greater activations in the mesocorticolimbic reward circuit in response to own baby cry at 3-4 months postpartum.

Breastfeeding mothers had greater activations in the mesocorticolimbic reward circuit in response to own baby pictures at 2-4 weeks postpartum.

Differences in brain responses to own baby picture among two groups decrease at 3-4 months postpartum became smaller.

Crying Levels and “Affective” Caregiver Responses (Acebo & Thoman)

Higher levels of crying are associated with increased levels of positive interaction.

Even the highest levels of crying are associated with more positive interaction than the lowest levels of crying.

“Modeling” Adaptive Value of Cry Functions: Cry-Feed 1st Pathway

“Modeling” Adaptive Value of Cry Functions: Cry-Attachment
Summary: the “good”

- Early crying may be advantageous for survival


Some clinical implications of the normality of early increased crying

For the parent: Scott the High Crier—Marilyn’s Story

Clinical Implications

- If you do not take the curve into account, therapeutic interventions can be misinterpreted as effective when they are not effective, or ineffective when they are effective

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- If you do not take the curve into account, therapeutic interventions can be misinterpreted as effective when they are not effective, or ineffective when they are effective

- ALL infants experience the curve, and “organic causes” only move the infant “up” within the range of crying
Clinical Implications

Wessel's criteria

New York Times
July 8, 1944

“...who admitted that he had killed his 31/2 week old daughter because she cried too much...”

The Shaking

- Weak Neck Muscles
- Normal Large Head to Body ratio
- Violent, sustained shaking

Intracranial “Cascade” from Shaking

Mechanical Stresses During Shaking & Eye Lesions

Outcomes of Hospitalized Cases

- 20-35% die
- Of the survivors, 65-80% have significant long term neurological and developmental abnormalities
Why is crying in normal infants relevant to Shaken Baby Syndrome?

Questionnaire Study of Soothing Methods in Holland
van der Wal et al, Arch Dis Child, 1998

Techniques used to soothe infants:
1. Smother 2%
2. Slap 3%
3. Shake 5%


"The impact of these private acts must be further studied as there may be other long-lasting and serious intracranial impacts that have not been characterized."

The "crying curve" (Brazelton, 1962)

Hypothesis: IF crying was a significant stimulus for sbs, THEN the pattern of age-related incidence of sbs should be similar to the age-related properties of the crying curve.

Age-specific incidence of hospitalized cases of SBS
(Barr, Trent et al Child Abuse & Neglect 2006)

Age-specific Incidence of Publicly-reported Cases of SBS
(Lee, Barr et al JDBP 2007)
Curves of Early Crying and SBS Incidence

Sheets L et al.: Sentinel injuries precede abusive head trauma in infants
Presented Helfer Society, Sept 2008, Tucson, AZ

Pathways to Shaking

The Pathways to Prevention: Appropriateness of Advice

The Pathways to Shaking: Wrong Advice?

The Period of PURPLE Crying
Five Things We Think We Know

- The "crying curve" (and "colic") is a behavioral universal of infancy
- Unsoothable bouts are **unsoothable**!
- Post-curve, persistent or repeated elevated crying after 3-4 months is an important, but different, phenomenon, and has long-term predictability to later outcomes;
- The early cry is a *graded* signal, not a typological sign or signal
- The most important negative clinical consequence of “colic” for the infant is shaken baby syndrome or infant abuse

How Do “Increasing Carry, Comfort, Walk and Talk Responses” Work?

Cross-species Caregiving and Breastmilk Composition

Infants with Colic in London, Copenhagen, and with a “proximal” form of care

Reconceptualization of “Colic:” Colic is a manifestation of normal behavioral development

All of the features of the crying definitive of excessive crying (or “colic”) can be understood as manifestations of the upper end of a spectrum of crying behavior that is typical of normally developing infants rather than a distinct crying pattern indicative of underlying disease in the infant or psychopathology in the caregiver(s).
Moderate Retinal Hemorrhage in Shaken Baby Syndrome

Guinea Pig Distress as a Function of “Place” & Mother Presence (Pettijohn 1979)

Levels of Description of Crying

A proposed taxonomy for describing crying phenomena, in which “cycles,” “events” and “bouts” are related hierarchically in terms of the cry cycles and how they are related to each other.

Coded State Changes between Crying and Alert

N-shaped curves in habituation to visual stimuli

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Is there an "early crying peak" in free-ranging Rhesus macaques? (Barr, Warfield, Catherine SRCD Apr 9, 2005)

Methodological Caveat for Measuring Curves

Principle:
You must make enough measurements at the right times to capture the properties of the phenomenon you are measuring.

Time Spent in "Crying" or "Alert" States or "In transition"

Frequency histograms of % negative vocalizations in 10-second blocks, prior to (upper graph) and following (lower graph) taste administrations.

Negative Vocalizations:
Crying = 100%
Alert = 0%
Transition = 10-90%

“6 weeks of age” is week 7 of life

Symposium organized by M. Alvarez, Stockholm