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Impact of the Cry of the Infant at Risk on Psychosocial Development

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Introduction

Infant crying is exceptional among early behaviours for its central role in the survival, health and development of the child. The sound of crying is comprised of a myriad of temporal and acoustic characteristics that serve as a biological siren, a signal that alerts and motivates the caregiver to attend to the infant's needs. The perceived meaning of, and response to, this biological siren varies as a function of the specific combination of acoustic properties that comprise the cry. For example, cries with a faster repetition rate, shorter individual cry expirations and pauses and a higher fundamental frequency (basic pitch) may elicit more urgent caregiver responses to an infant than other cries with other acoustic characteristics. For this reason, the sound of infant crying plays an important role in the development of infants who are at risk for poor psychosocial outcomes due to prenatal and other conditions that adversely affect neurobehavioral organization. These infants often have distinctive, unusually high-pitched cry sounds that are particularly salient to caregivers and may contribute to the infant's future developmental course by eliciting responses that either ameliorate or exacerbate the infant's risk condition. The nature

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of responses to hyperphonated (high-pitched) cries depends on individual differences among caregivers and the perceptual set they bring to caregiver-infant interactions.

Subject

High-pitched (hyperphonated) cry sounds are characteristic of infants who suffer from a wide range of neurobehavioural insults,[1,2] including brain damage,[3,4] malnutrition,[5] asphyxia[6,7] and maternal use during pregnancy of drugs ranging from heroin,[8] methadone[9] and cocaine[10] to marijuana, cigarettes and alcohol.[11,12] Preterm and low birth weight infants,[13] as well as seemingly healthy full-term, full birth weight infants[14] who suffer a subtle but common form of prenatal malnutrition,[15,16] also frequently emit hyperphonated cry sounds. Whereas typical cries may range in fundamental frequency (basic pitch) from 400 to 650 Hz, hyperphonated cries are defined by a qualitative break in the cry sound to a fundamental frequency above 1,000 Hz that may range to 2,000 Hz and more.

Problem

Within a developmental model that focuses on the bidirectional effects of infants and caregivers on each other's behaviour and development, the demand characteristics of the infant's cry sound, and the way it is responded to, may play an important role in infant development. As the exceptionally high-pitched quality of the cry sound of the infant at risk is the most distressing and obvious acoustic characteristic to caregivers of both genders and across cultures, we must ask what the functional significance of this particular cry sound is for both infant and caregiver.

Research Context

In analogue laboratory settings, experimental[17,18] and correlational[19,20] methods have been used to examine how specific temporal and acoustic characteristics of infant crying affect adults' perceptual responses. Naturalistic observations[21] and longitudinal designs[22,23,24] have also been used to explore how higher-pitched cry sounds affect caregiver responses and longer-term infant psychosocial development.

Key Research Questions

The key research questions focus on how and in what way this particularly salient, high-pitched cry sound affects caregivers' perceptual and behavioural responses. These questions have required not only an examination of differences in infant cry sounds, but also an examination of

the basis for individual differences in caregivers' interpretations of, and responses to, these different cry sounds.

Recent Research Results

Whereas research originally sought to find whether cries elicited by discrete eliciting conditions could be perceptually differentiated,[4,25] more recent research has centered on cries as representing a continuum of sounds.[26,17] A model emphasizing a "synchrony of arousal" between infants and caregivers describes how increases or decreases in infant arousal produce corresponding changes in the temporal and acoustic characteristics of infant crying that then typically produce corresponding increases or decreases in the perceived arousal and motivation of the caregiver.[27] For example, as the infant becomes increasingly hungry and aroused, cries become more rapid and increasingly higher-pitched, resulting in increasingly higher-perceived arousal in the caregiver. In this way, the cry sound mediates a symbiosis between the conditions that result in infant crying and the caregiver's responses to the infant.

Reflecting a special condition of infant arousal, the high-pitched hyperphonated cry of the infant at risk elicits significantly stronger perceptual and physiological reactions than typical infant cries. Across cultures,[14,28] hyperphonated cries are perceived to be more irritating, aversive, arousing and "sick" sounding than typical cries and to elicit more immediate responses that include holding and cuddling.[29] Several studies indicate that there are at least two distinct dimensions underlying the perceptions of hyperphonated cries — one in which the infant sounds "sick" and requires ameliorative care and one in which the cry is perceived as unusually aversive.[14,30] A higher cry pitch has been directly related to these particular perceptions.[30]

The presence of at least two dimensions underlying the perceptions of infant cry sounds underscores the importance of considering how the same cry sound may have different meanings to caregivers, depending on the listener's emotional set. Whereas some caregivers show heart rate decelerations to hyperphonated cries, indicative of attentive responses to an infant who sounds "sick," other caregivers show unusually high heart rate accelerations characteristic of inattentive, defensive responses to aversive sounds.[28] These different response patterns may provide the basis for important differences in caregiver-infant interactions. For example, the heightened heart rate response has been found in women at high risk for physical child abuse, even before they have children of their own.[31] In fact, parents who abuse their infants have heightened heart rates to infant cries[32] and indicate that hyperphonated cries are similar to the

sounds of the cries of their own abused infants.[33] Other research has begun to explore other caregiver characteristics that may provide the basis for differential responsivity to higher-pitched cries. In contrast to the typical response of increased arousal to higher-pitched cry sounds, adolescent mothers,[34] women suffering from depression[35] and women who use cocaine during pregnancy[36] perceive cries of increasing pitch as being less arousing and less worthy of immediate care.

These differences in caregiver responsivity to infants with higher-pitched and hyperphonated cry sounds have been shown to be related to the infant's subsequent psychosocial development. In a longitudinal study, infants who typically have hyperphonated cries were randomly assigned to caregiving environments varying in how responsive they were to infant behaviour. In less responsive homes, infants had increasingly lower IQ scores over time, more withdrawn temperaments and less quality interactions with their mothers (including physical neglect) through at least three years of age than similar infants who had a more responsive caregiving environment.[22,23] Other work has similarly shown that mothers who better understood the meaning of their preterm infants' cries had infants who later showed higher Bayley mental scores and language development scores at 18 months.[24]

Conclusion

The psychosocial development pathway of the infant at risk will reflect the combined effects of the infant's altered neurobehavioural organization, the resulting behavioural repertoire of the infant, and how individual caregivers respond to the infant. As part of this behavioural repertoire, the hyperphonated cry of the infant at risk is a two-edged sword. So aversive are the physical properties of high-pitched infant crying that caregivers will often try to do whatever is necessary to try to stop the noxious sound. In most cases, these attempts will provide the kinds of auditory, visual, vestibular and tactile-kinesthetic forms of stimulation that promote infant development. This process may be accentuated when caregivers respond with attentive, more immediate ameliorative care to an infant they think sounds "sick." In some cases, however, caregivers may respond to the aversive quality of the cry with unusually heightened arousal that provides that basis for "defensive" reactions, actions that are physically detrimental to the infant's well-being and/or emotional and physical withdrawal of the mother from the infant over time. When a mother suffers from depression, for example, her emotional condition may make her even less able to respond to the crying infant as the needs of that infant increase. In extreme cases, her response patterns may include an increased risk for physical child abuse and/or

neglect. These divergent response patterns and effects on several aspects of the infant's psychosocial development have been supported in longitudinal studies.

Implications

An important implication of the above research is that infant crying should not be viewed as a singularly defined behaviour that affects caregivers in a uniform manner. Cries vary widely in their perceptual salience and meaning to caregivers. Another implication is that the same cry sound may have very different perceptual salience and meaning based on the characteristics of the caregiver. It is this combination of cry sounds and adults' characteristics that determines the effects of infant crying on responses of the caregiver and thus on the infant's psychosocial development. These issues also have implications for understanding the impact of other conditions, such as infant colic[37] or difficult temperament,[38] in which the cry of the infant has been shown to have higher-pitched components. When helping parents of infants with excessive crying cope with the stresses of the infant's behaviour, we should be cognizant of possible differences in the cry sound and how these cry sounds may have different salience for different caregivers, especially those suffering from depression or other conditions that alter the caregiver's perceptual set.

References

1. Corwin MJ, Lester BM, Golub HL. The infant cry: what can it tell us? *Current Problems in Pediatrics* 1996;26(9):325-334.
2. Zeskind PS, Lester BM. Analysis of infant crying. In: Singer LT, Zeskind PS, eds. *Biobehavioral assessment of the infant.* New York, NY: The Guilford Press; 2001:149-166.
3. Prechtl HF, Theorell K, Gramsbergen A, Lind J. A statistical analysis of cry patterns in normal and abnormal newborn infants. *Developmental Medicine and Child Neurology* 1969;11(2):142-152.
4. Wasz-Hockert O, Lind J, Vuorenkoski V, Partanen T, Valanne E. The infant cry: A spectrographic and auditory analysis. *Clinics in Developmental Medicine* 1968;29:1-42.
5. Lester BM. Spectrum analysis of the cry sounds of well-nourished and malnourished infants. *Child Development* 1976;47(1):237-241.
6. Michelsson K, Sirvio P, Wasz-Hockert O. Pain cry in full-term asphyxiated newborn infants correlated with late findings. *Acta Paediatrica Scandinavica* 1977;66(5):611-616.
7. Michelsson K. Cry analyses of symptomless low birth weight neonates and of asphyxiated newborn infants. *Acta Paediatrica Scandinavica - Supplement* 1971;216:1-45.
8. Blinick G, Tavolga W, Antopol W. Variations in birth cries of newborn infants from narcotic-addicted and normal mothers. *American Journal of Obstetrics and Gynecology* 1971;110(7):948-958.
9. Huntington L, Hans SL, Zeskind PS. The relations among cry characteristics, demographic variables, and developmental test scores in infants prenatally exposed to methadone. *Infant Behavior & Development* 1990;13(4):533-538.

10. Lester BM, Corwin MJ, Sepkoski C, Seifer R, Peucker M, McLaughlin S, Golub HL. Neurobehavioral syndromes in cocaine-exposed newborn infants. *Child Development* 1991;62(4):694-705.

11. Zeskind PS, Platzman K, Coles CD, Schuetze PA. Cry analysis detects subclinical effects of prenatal alcohol exposure in newborn infants. *Infant Behavior & Development* 1996;19(4):497-500.

12. Lester BM, Dreher M. Effects of marijuana use during pregnancy on newborn cry. *Child Development* 1989;60(4):765-771.

13. Lester BM. Developmental outcome prediction from acoustic cry analysis in term and preterm infants. *Pediatrics* 1987;80(4):529-534.

14. Zeskind PS, Lester BM. Acoustic features and auditory perceptions of the cries of newborns with prenatal and perinatal complications. *Child Development* 1978;49(3):580-589.

15. Zeskind PS, Lester BM. Analysis of cry features in newborns with differential fetal growth. *Child Development* 1981;52(1):207-212.

16. Zeskind PS. Behavioral dimensions and cry sounds of infants of differential fetal growth. *Infant Behavior & Development* 1981;4(3):297-306.

17. Zeskind PS, Klein L, Marshall TR. Adults' perceptions of experimental modifications of durations of pauses and expiratory sounds in infant crying. *Developmental Psychology* 1992;28(6):1153-1162.

18. Bisping R, Steingrueber HJ, Oltmann M, Wenk C. Adults' tolerance of cries: An experimental investigation of acoustic features. *Child Development* 1990;61(4):1218-1229.

19. Gustafson GE, Green JA. On the importance of fundamental frequency and other acoustic features in cry perception and infant development. *Child Development* 1989;60(4):772-780.

20. Dessureau BK, Kurowski CO, Thompson NS. A reassessment of the role of pitch and duration in adults' responses to infant crying. *Infant Behavior & Development* 1998;21(2):367-371.

21. Zeskind PS, Collins V. Pitch of infant crying and caregiver responses in a natural setting. *Infant Behavior & Development* 1987;10(4):501-504.

22. Zeskind PS, Ramey CT. Fetal malnutrition: An experimental study of its consequences on infant development in two caregiving environments. *Child Development* 1978;49(4):1155-1162.

23. Zeskind PS, Ramey CT. Preventing intellectual and interactional sequelae of fetal malnutrition: A longitudinal, transactional, and synergistic approach to development. *Child Development* 1981;52(1):213-218.

24. Lester BM, Boukydis CF, Garcia-Coll CT, Peucker M, McGrath MM, Vohr BR, Brem F, Oh W. Developmental outcome as a function of the goodness of fit between the infant's cry characteristics and the mother's perception of her infant's cry. *Pediatrics* 1995;95(4):516-521.

25. Muller E, Hollien H, Murry T. Perceptual responses to infant crying: Identification of cry types. *Journal of Child Language* 1974;1(1):89-95.

26. Murray AD. Infant crying as an elicitor of parental behavior: An examination of two models. *Psychological Bulletin* 1979;86(1):191-215.

27. Zeskind PS, Sale J, Maio ML, Huntington L, Weiseman JR. Adult perceptions of pain and hunger cries: A synchrony of arousal. *Child Development* 1985;56(3):549-554.

28. Zeskind PS. Cross-cultural differences in maternal perceptions of cries of low- and high-risk infants. *Child Development* 1983;54(5):1119-1128.

29. Zeskind PS. Adult responses to cries of low and high risk infants. *Infant Behavior & Development* 1980;3(2):167-177.

30. Zeskind PS, Marshall TR. The relation between variations in pitch and maternal perceptions of infant crying. *Child Development* 1988;59(1):193-196.

31. Crowe HP, Zeskind PS. Psychophysiological and perceptual responses to infant cries varying in pitch: Comparison of adults with low and high scores on the Child Abuse Potential Inventory. *Child Abuse & Neglect* 1992;16(1):19-29.

32. Frodi A. When empathy fails: Aversive infant crying and child abuse. In: Lester BM, Boukydis CFZ, eds. *Infant crying: theoretical and research perspectives*. New York, NY: Plenum Press; 1985:263-277.

33. Zeskind PS, Shingler EA. Child abusers' perceptual responses to newborn infant cries varying in pitch. *Infant Behavior & Development* 1991;14(3):335-347.

34. Lester BM, Anderson LT, Boukydis CF, Garcia-Coll CT, Vohr B, Peucker M. Early detection of infants at risk for later handicap through acoustic cry analysis. *Birth Defects: Original Article Series* 1989;25(6):99-118.

35. Schuetze P, Zeskind PS. Relations between women's depressive symptoms and perceptions of infant distress signals varying in pitch. *Infancy* 2001;2(4):483-499.

36. Schuetze P, Zeskind PS, Eiden RD. The perceptions of infant distress signals varying in pitch by cocaine-using mothers. *Infancy* 2003;4(1):65-83.

37. Zeskind PS, Barr RG. Acoustic characteristics of naturally occurring cries of infants with "colic". *Child Development* 1997;68(3):394-403.

38. Lounsbury ML, Bates JE. The cries of infants of differing levels of perceived temperamental difficultness: Acoustic properties and effects on listeners. *Child Development* 1982;53(3):677-686.