Maternal Ratings of Infant Intensity and Distractibility

Relationship With Crying Duration in the Second Month of Life

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Objective: To investigate the relationship between infant temperament characteristics assessed at 4 weeks of age and the duration of infant crying and fussing during the second month of life.

Design: Families were enrolled in this prospective study during prenatal classes, and 60 infants completed the study. Temperament was assessed when the infant was 4 weeks of age using the Early Infancy Temperament Questionnaire, and crying and fussing was assessed on 16 days during the second month of life using a parent-completed infant behavior diary.

Results: Ratings of the total duration of infant crying and fussing correlated significantly with the sum score on the temperament questionnaire ($r = 0.36; P = .005$). A longer duration of crying and fussing was associated with infants with high intensity ($r = 0.43; P = .001$) and low distractibility ($r = 0.37; P = .003$).

Conclusions: The finding that mothers rating their infants as having high intensity and low distractibility is associated with increased crying duration supports a growing body of literature suggesting that infants with high levels of crying are more reactive to sensory stimuli and harder to soothe than those who cry less. Physicians counseling parents of infants with persistent crying should recognize the infant characteristics associated with increased crying.

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Crying during the first few months of life has elicited extensive clinical and research interest. A progressive increase in crying, which peaks at a mean of approximately 2½ hours per day during the second month of life and decreases progressively thereafter, has been documented in several studies. Current research suggests that increased crying during this period is associated with difficulties in parent-infant interactions. However, the caretaking behaviors of mothers whose infants have prolonged periods of crying do not differ greatly from those of mothers whose infants cry less. In contrast, an increasing number of studies suggest that there are differences in the temperament or responsivity of infants with persistent crying compared with those who cry less.

When infants with persistent crying are assessed around the time of peak crying or later in the first year of life, they are often found to have more difficult temperaments than controls. The specific temperament characteristics that distinguish infants with persistent crying from controls vary somewhat with the time of the assessment and the measures used. Jacobson and Melvin found that at 4 to 8 months of age infants with persistent crying had a more negative mood and higher activity level than infants without persistent crying. Carey found that these infants had lower sensory thresholds and more of the difficult characteristics, and Canivet et al found that at 4 years of age children with a history of colic had a more negative mood than controls. However, some studies have found no difference between infants with a history of colic and controls on temperament measures administered after the period of peak crying. Thus, Barr and Gunnar have proposed that infants with persistent crying may have a transient difference in responsivity to stimuli as opposed to an enduring difference in temperament.

Studies done at the time of peak crying or after the period of peak crying are potentially confounded by the influence of the infant’s crying on the parents’ rating of the child’s temperament. Thus, some studies have been done investigating the relationship between temperament factors assessed earlier in life and later cry-
PARTICIPANTS AND METHODS

Parents participating in prenatal classes associated with 2 inner-city hospitals were recruited to participate in a study of an educational intervention on infant behavior. The study was approved by the institutional review board of Pennsylvania Hospital, Philadelphia. The educational intervention did not affect the duration of infant crying, so data from both the intervention and control groups were combined for this study. Of 113 mothers who gave consent to participate in the study, 8 dropped out of the study or classes prior to the birth of their child, and 3 gave birth to premature infants. Of the remaining 102 subjects, 60 returned both the temperament questionnaire completed at 4 weeks of age and a usable diary (defined below) and are the subject of this report. Those who returned the diary were similar to those who did not in terms of parental ages and infants’ gestational age, birth weight, and sex (Table 1). However, those who completed the diary were somewhat more likely to be married and to be white. In addition, although the mean Hollingshead score fell within social stratum IV of the index for both groups, the mean score was higher (indicating higher socioeconomic status) among those who returned the diary. Nineteen participants returned temperament questionnaires but not usable diaries. There was no difference in the sum score of the temperament subscales (defined below) between this group and those who completed the study.

The Early Infancy Temperament Questionnaire was completed at 4 weeks of age. This 76-item parent questionnaire has 9 subscales representing the 9 temperament characteristics identified by Thomas et al. Internal consistencies for the subscales ranged from 0.43 to 0.76, and test-retest reliability over 2 to 3 weeks for 1- to 2-month-old infants ranged from 0.48 to 0.80. All subscales are designed so that higher scores represent characteristics that tend to make infants more difficult to manage. For example, higher scores on the intensity subscale indicate greater intensity, and higher scores on the adaptability subscale indicate less adaptability. Thus, the sum of all the temperament subscales, which we will refer to as the sum score, has been used as one measure of how challenging an infant may be to parent. Because the means and SDs for the subscales of the Early Infancy Temperament Questionnaire vary considerably, we calculated an SD score for each subscale as follows: (child’s subscale score – mean subscale score in standardization sample) / subscale SD. We then summed the SD score for each subscale to calculate the sum score.

Parents were asked to complete an infant behavior diary for 4 specified days per week, for each week of life from 5 through 8. If they missed one of the specified days they were allowed to complete the diary for the next closest day that week. The diary has been previously described. Parent-recorded crying has been shown to correlate with audio recordings (r = 0.67). Parents are asked to fill in continuous time bars with symbols representing infant behaviors: sleeping, crying, fussing, feeding, and awake/content. The smallest subdivision is 5 minutes. For data from any week to be considered complete at least 3 of the 4 days needed to be completed. If there was not complete data from at least 3 of the 4 weeks the study was conducted, the diary was deemed incomplete and not included in the study. Thus, diaries that were missing data from one week could be included. All 60 diaries included in the study had complete data from the fifth week of life; 59 had complete data from weeks 6 and 7; and 58 had complete data from week 8.

Statistical analysis was performed using Statistical Product and Service Solutions software (SPSS 9.0; SPSS Inc, Chicago, Ill.). For continuous data, the t test for independent samples was used to compare group means. Categorical data were compared using the χ2 test. Pearson product moment correlations between the temperament measure and the duration of crying and fussing were calculated. To assess the relative importance of different temperament subscales a stepwise regression was performed with temperament subscales as the independent variable and duration of crying and fussing as the dependent variable.

The study done earliest in life found that morning fetal movements at 37 weeks’ gestation correlated highly with crying at 1 and 6 weeks of age (r > 0.50). Increased fetal movements have also been found to correlate with later ratings of difficult temperament. These studies support the theory that temperament characteristics detectable in fetal life relate to later crying. Barr et al investigated the relationship between ratings of temperament at 2 weeks and crying at 6 weeks of age. They found that the sum score of all temperament subscales (higher scores on each subscale are associated with more difficult behaviors) correlated with the duration of crying per day at 6 weeks of age (r = 0.21). This study used an abbreviated temperament scale that did not assess all 9 dimensions of temperament identified by Thomas et al. In discussing the relatively low correlation found in their study, Barr et al state, “one can only speculate whether a different or more complete assessment of infant temperament, had it been available, might have accounted for more of the individual differences in crying and fussing.” Since this study was completed, the Early Infancy Temperament Questionnaire, a rating scale designed to assess all 9 aspects of temperament in infants 1 to 4 months of age, has been published. In this study, we report the relationship between temperament assessed using this scale at 4 weeks of age and crying over the next month.

RESULTS

On average, infants cried and fussed nearly 2 hours per day (Table 2). The longest duration of crying occurred between 6 PM and midnight, and the amount of crying that occurred during each 6-hour time interval increased throughout the day (Table 2). The sum score on the temperament measure correlated significantly with total crying and fussing. We also investigated the correlation between the sum score and crying and fussing during each of the 4 time periods during the day. After adjusting for multiple comparisons (Bonferroni adjustment; P < 0.01 significant), only the duration of crying and fussing between noon and 6 PM and between 6 PM and mid-
The correlation between each specific temperament characteristic and total crying and fussing was investigated (Table 3). After adjusting for multiple comparisons (Bonferroni adjustment; $P<.006$ significant), intensity and distractibility correlated significantly with total crying and fussing. Intensity and distractibility (higher scores represent less distractibility or more difficulty soothing) correlated significantly with crying and fussing at every time period during the day except midnight to 6 AM (data not shown).

Many items on the intensity and distractibility subscales of the temperament questionnaire ask parents to consider these traits in relation to crying or fussing. However, 2 items on the distractibility scale do not ask specifically about crying or fussing. The mean score for these 2 items correlated with total duration of crying and fussing almost as well as the full scale ($r=0.34$; $P=.01$).

The relative contribution of each temperament characteristic to total crying duration was investigated with stepwise linear regression analysis. Only intensity and distractibility contributed to the model (Table 4).

### Table 1. Characteristics of Participants Completing and Not Completing the Study*

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Completed Study</th>
<th>Study Not Completed</th>
<th>$P$ Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parents</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maternal age, y</td>
<td>31.3 (4.5)</td>
<td>30.6 (5.6)</td>
<td>$.48†</td>
</tr>
<tr>
<td>Paternal age, y</td>
<td>33.3 (5.5)</td>
<td>34.0 (7.7)</td>
<td>$.83†</td>
</tr>
<tr>
<td>White, %</td>
<td>85</td>
<td>62</td>
<td>$.008‡</td>
</tr>
<tr>
<td>Married, %</td>
<td>92</td>
<td>76</td>
<td>$.04‡</td>
</tr>
<tr>
<td>Hollingshead score</td>
<td>52.6 (12.2)</td>
<td>46.5 (18.7)</td>
<td>$.03†</td>
</tr>
</tbody>
</table>

*Data given as mean (SD) unless otherwise noted.  †Significant with Bonferroni adjustment ($P<.006$).

### Table 2. Duration of Crying and Fussing and Correlation With the Sum Score

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Crying/Fussing, Mean (SD), min</th>
<th>Correlation With Sum Score</th>
<th>$r$ Value</th>
<th>$P$ Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000-0600h</td>
<td>15.3 (13.7)*</td>
<td>0.23</td>
<td>.08‡</td>
<td></td>
</tr>
<tr>
<td>0600-1200h</td>
<td>27.2 (17.9)*</td>
<td>0.26</td>
<td>.05‡</td>
<td></td>
</tr>
<tr>
<td>1200-1800h</td>
<td>32.2 (20.2)*</td>
<td>0.30</td>
<td>.02‡</td>
<td></td>
</tr>
<tr>
<td>1800-2400h</td>
<td>42.2 (24.8)*</td>
<td>0.31</td>
<td>.02‡</td>
<td></td>
</tr>
<tr>
<td>Total Day</td>
<td>118.0 (59.9)</td>
<td>0.36</td>
<td>.005</td>
<td></td>
</tr>
</tbody>
</table>

*All pairwise comparisons are significant ($P=.003$; paired $t$ test). †Pearson product moment correlation. ‡Significant with Bonferroni adjustment ($P<.01$).

### Table 3. Correlation Between Temperament Characteristics and Total Crying/Fussing

<table>
<thead>
<tr>
<th>Temperament Characteristic</th>
<th>Total Duration of Crying/Fussing</th>
<th>$r^2$</th>
<th>$P$ Value</th>
<th>Overall $r^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sum score</td>
<td>0.36</td>
<td>.005</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activity</td>
<td>0.09</td>
<td>.49</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rhythmity</td>
<td>0.18</td>
<td>.18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adaptability</td>
<td>0.13</td>
<td>.32</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intensity</td>
<td>0.43</td>
<td>.001†</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mood</td>
<td>0.18</td>
<td>.16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approach</td>
<td>-0.01</td>
<td>.92</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Persistence</td>
<td>0.18</td>
<td>.16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distractionibility</td>
<td>0.37</td>
<td>.003†</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensory threshold</td>
<td>0.12</td>
<td>.38</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Pearson product moment correlation. †Significant with Bonferroni adjustment ($P<.006$).

### Table 4. Predicting Crying and Fussing Using Temperament Characteristics*

<table>
<thead>
<tr>
<th>Temperament Characteristic</th>
<th>Standardized $r^2$</th>
<th>$P$ Value</th>
<th>Overall $r^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intensity</td>
<td>0.34</td>
<td>.008</td>
<td>0.24</td>
</tr>
<tr>
<td>Distractionibility</td>
<td>0.26</td>
<td>.04</td>
<td></td>
</tr>
</tbody>
</table>

*Significant factors entering into stepwise linear regression.

An increasing number of studies have reported an association between temperament characteristics and persistent crying in early infancy. This is the first study to assess all 9 temperament characteristics prior to the period of peak crying. When all 9 temperament characteristics are considered together by calculating a sum score on the Early Infancy Temperament Scale, there is a moderate correlation with total crying and fussing during the second month of life. Barr et al also found a significant correlation between total score on a 17-item modification of the Infant Temperament Questionnaire completed at 2 weeks of age and total crying and fussing at 6 weeks of age ($r=0.21$). The higher correlation between the sum score and crying found in this study compared with the study by Barr et al may reflect the use of a more complete temperament questionnaire in this study or improved correlation with crying when temperament questionnaires are completed at 4 weeks compared with 2 weeks of age.

Barr et al also found that total score on the temperament questionnaire they used correlated best with crying during the morning and afternoon, poorly with crying between 6 PM and midnight, and not significantly with crying between midnight and 6 AM. We also found the lowest correlation between total difficulty score and crying and fussing from midnight to 6 AM (Table 2). This is the period of the day with the largest amount of crying, and other variables, such as regularity or length of sleep/wake cycles, type of sleep associations, or other factors, may relate to crying at this time. In contrast to the study...
by Barr et al, we found the highest correlation between the sum score and crying during the evening. The differences between the correlation coefficients for the 3 time intervals from 6 AM to midnight are small in both our study and the one by Barr et al, suggesting that the relationship between temperament and duration of infant crying is likely to be similar throughout these time periods.

The use of a sum score deserves comment. It is not the traditional measure of difficulty that is based on evaluation of only 5 or the 9 subscales: rhythmicity, adaptability, intensity, mood, and approach. In addition, using the sum score may obscure the fact that it is often the interaction between specific temperament characteristics and parent expectation that leads to the infant being perceived as difficult. However, the factors that make older infants and toddlers difficult may not be the same as those that make 0- to 2-month-old infants difficult, and a sum score has been used in previous temperament research with infants. In addition, it should be noted that with the exception of the approach subscale, there were small positive (although not statistically significant) correlations between all temperament subscales and duration of infant crying and fussing (Table 3).

We found temperament ratings of higher intensity and less distractibility at 4 weeks of age correlated best with duration of crying over the next month. This is consistent with other studies that have examined the relationship between temperament rating scales and parents’ crying diaries. For example, Barr et al found that ratings of infant vigor (ie, how intensely the child engages in activities) and reactivity to physical stimuli correlated with crying at 6 weeks of age. The findings are also supported by studies that demonstrate that infants with more persistent crying have a higher crying to fussing ratio (suggesting greater intensity) than infants with less crying and no difference in the frequency of crying episodes, but a longer duration of each episode (suggesting less soothability).

One potential limitation of this study is the assessment of temperament using only maternal ratings. Some have suggested that maternal ratings are influenced as much by maternal characteristics as child characteristics. In addition, although we assessed temperament prior to the most commonly reported period of peak crying, there is significant individual variability in crying duration over time during the first 8 weeks of life. Because the temperament scale includes many items related to crying and fussing, it is possible that the ratings were influenced by increased crying already manifested by some infants at 4 weeks of age. However, when we investigated this possibility for the distractibility subscale using the 2 items that did not ask about crying or fussing, the correlation was similar to that found for the full scale. Moreover, 2 recent studies of infants with colic that used independent assessments of intensity and distractibility (or soothability) support our findings. White et al videotaped infants with colic and controls during a standardized physical examination, and independent raters scored the infants with colic as crying more intensely and being more difficult to console than the controls. In another study, when infants with colic or controls were crying around the time of a scheduled feeding, infants with colic were much less likely to be soothed by an orally administered sucrose solution than were infants without colic.

This study should be interpreted in the context of the following additional limitations. Those who enrolled in the study were likely to be married parents from the middle and upper social strata, and those who completed the study were even more likely to have these characteristics. They were also more likely to be white. It is possible that cultural factors that influence infant/parent interactions would change the relationship between specific infant temperament characteristics and crying.

In summary, this study adds to a growing body of literature that suggests infants with higher levels of crying are more intense and harder to soothe than infants with less crying. The finding is robust across groups and has been found in studies of infants recruited because they have colic and in this study of families recruited from prenatal classes. This study does not address the question of whether the differences in these characteristics seen in the first 2 months of life are best viewed as enduring temperament traits or a transient period of increased reactivity. Resolution of this question will require prospective longitudinal studies. Physicians counseling parents of children with persistent crying may use these studies to help parents better understand their infant’s individual differences and plan interventions to decrease crying. However, it may be premature to predict the continuation of difficult temperament characteristics on the basis of persistent crying in infancy.

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REFERENCES


Books Received for Review


