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## The Relation of Daily Stressors to Somatic and Emotional Symptoms in Children With and Without Recurrent Abdominal Pain

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### Abstract

Prior investigations of the relation between stressors and symptoms in children with recurrent abdominal pain (RAP) have focused on major negative life events. This study used consecutive daily telephone interviews to assess daily stressors and symptoms in 154 pediatric patients with RAP and 109 well children. Results showed that patients with RAP reported more frequent daily stressors than well children reported both at home and at school. Idiographic (within-subject) analyses indicated that the association between daily stressors and somatic symptoms was significantly stronger for patients with RAP than for well children. In contrast, the relation between daily stressors and negative affect did not differ between the groups. The relation between daily stressors and somatic symptoms was stronger for patients with RAP who had higher levels of trait negative affectivity.

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Pediatric patients with recurrent abdominal pain (RAP), the most common recurrent pain complaint in childhood, exhibit high levels of somatic symptoms, functional impairment, and health service use (Apley, 1975; Walker, Garber, & Greene, 1994). For some children, this condition and its sequelae continue into adolescence and adulthood (Stickler & Murphy, 1979; Walker, Garber, Van Slyke, & Greene, 1995; Walker, Guite, Duke, Barnard, & Greene, 1998). Medical evaluations typically reveal no significant organic disease that would explain the children's pain (Stickler & Murphy, 1979; Walker et al., 1995). Although clinical literature has suggested that RAP may be a reaction to stress (e.g., Apley, 1975), empirical evidence linking RAP to stress is mixed. With one exception (Hodges, Kline, Barbero, & Flanery, 1984), cross-sectional investigations have found no difference in levels of negative life events among patients with RAP compared with other patient groups (e.g., McGrath, Goodman, Firestone, Shipman, & Peters, 1983; Walker, Garber, & Greene, 1993; Walker & Greene, 1991). In two prospective studies, however, maternal reports of family

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negative life events predicted children's symptom maintenance following medical evaluation for RAP (Walker et al., 1994; Walker & Greene, 1991).

In the research on RAP to date, stress typically has been operationalized as the occurrence of negative life events (NLEs) in the year prior to evaluation. This approach imposes several limitations for the study of RAP. First, major life events occur at time intervals that may be widely spaced throughout the year, whereas episodes of RAP may be spaced across a day and could potentially be precipitated by minor daily stressors that are not captured in measures of NLEs. Second, during the course of a year, children and their circumstances may change significantly, affecting the stress-illness relation in unknown ways. Third, with children as informants, reports of events occurring during the previous year are likely to be unreliable or invalid. In contrast, reports based on informants who may not be aware of events important to the child may be equally problematic. Finally, assessment of the frequency of NLEs in children with RAP in comparison with other groups may obscure the individual (within-subject) differences among children with RAP that are suggested by variability observed in their symptoms and outcomes (e.g., Walker et al., 1998).

Daily assessment of minor stressors provides a different perspective on stress and allows examination of several important questions. Do children with RAP experience more daily stressors than other children? Do children with RAP perceive the stressors they experience as more severe than do well children? Finally, is the intraindividual association between daily stressors and somatic symptoms stronger in patients with RAP than in well children? The latter possibility is suggested by the recent finding that the correlation between life stressors and abdominal symptoms was stronger among adolescents with a history of RAP than among their peers without such a history (Walker et al., 1998).

Theoretical and empirical literatures suggest that psychobiological reactivity might contribute to a stronger association between daily stressors and somatic symptoms in children with RAP than in well children (cf. Barr, Boyce, & Zeltzer, 1994; Boyce et al., 1995). However, what about the relation between daily stressors and emotional distress? It has been suggested that RAP may reflect somatization, that is, a tendency to express emotional distress in the form of somatic complaints (Routh, Ernst, & Harper, 1988; Walker, Garber, & Greene, 1991). Moreover, some have suggested that children with RAP might react to stress with somatic rather than emotional symptoms (e.g., Shapiro & Rosenfeld, 1987), which would potentially lead to a weaker relation between stress and emotional symptoms in children with RAP than in well children. Therefore, we examined whether the strength of the relation between stressors and emotional symptoms differed for children with RAP and well children.

We used a diary methodology to assess the relation of daily stressors with both somatic and emotional symptoms in children with RAP and well children. One advantage of a diary methodology is that it lends itself to idiographic, intraindividual (within-subjects) analyses that may identify particular individuals for whom the stress-illness association is quite strong. Personal and social characteristics of these individuals can then be identified. For instance, prior investigators have found that in adults, the relation between stressors and health outcomes was stronger for individuals low in self-esteem (DeLongis, Folkman, & Lazarus, 1988), lacking social support (Caspi, Bolger, & Eckenrode, 1987), or with high levels of neuroticism (Bolger & Schilling, 1991; Larsen & Kasimatis, 1991)—a construct closely related to trait negative affectivity (NA; Watson & Clark, 1984). The impact of these individual difference variables has rarely been examined in studies of the stress-illness relation in children. Therefore, extrapolating from the adult literature, we hypothesized that the relation between daily stressors and somatic symptoms would generally be stronger for

patients with RAP than for well children but that this relation would be strongest for patients with RAP who had low self-esteem, low social support, or high trait NA.

Finally, women and girls tend to report more emotional and somatic symptoms than men and boys (Nathanson, 1977) and may differ in the experience of pain (Unruh, 1996). In some cases, the relation between stress and symptoms has been found to differ for boys and girls (Walker et al., 1994; Walker & Greene, 1987). Therefore, we examined the role of child gender in all analyses.

## Method

### Sample

**RAP patients (n = 154)**—The sample of patients with RAP consisted of 154 consecutive new patients aged 8 to 15 who were referred to the Pediatric Gastroenterology Clinic of Vanderbilt University Medical Center for evaluation of abdominal pain. Patients were eligible if they met Apley's criteria for RAP, that is, at least three episodes of abdominal pain severe enough to interrupt activities and occurring over a period of at least 3 months (Apley, 1975). Exclusionary criteria included a known chronic health condition, physical handicap, or mental retardation. Of the 229 patient families contacted, 57 (26%) failed to meet eligibility criteria and 18 (8%) declined, leaving a total sample of 154. The sample was primarily Caucasian (95%) and female (57%). The mean age was 10.80 years ( $SD = 2.10$ ).

**Well children (n = 109)**—Well children were recruited from public schools in metropolitan Nashville and an adjacent rural county. A two-step sampling procedure was used. In the first step, children participated in a school-based study of children's health status. Parental consent forms were sent home from school with the children and included consent for subsequent telephone contact regarding participation in the present "Daily Diary Study." Data from the school-based study were used to identify well children who met eligibility criteria for the Daily Diary Study. To minimize the possibility that the well sample would include children with RAP or other significant health problems, we recruited the well sample from school children who, in the school-based study, had reported abdominal pain on no more than 2 days in the past 2 weeks and who had scored below the sample median for well children on the Children's Somatization Inventory (CSI; Garber, Walker, & Zeman, 1991; Walker et al., 1991; the median was 11 for boys and 14 for girls). Parents of these children were contacted by telephone and screened for further exclusionary criteria in their children including (a) chronic medical conditions (e.g., diabetes), (b) organic disease involving abdominal pain (e.g., peptic ulcer, Crohn's disease), and (c) criteria for RAP. Recruitment was monitored to obtain the same proportion of well children as RAP patients with respect to gender, ethnicity, and age. Of the 124 families invited to participate, 11 (9%) declined to participate and 4 (3%) were excluded because they did not meet eligibility criteria, leaving a total of 109 participating families. The well sample was similar to the RAP sample in that it was primarily Caucasian (95%) and female (57%) and had a mean age of 10.84 years ( $SD = 1.92$ ).

### Measures

**Daily Diary Interview (DDI)**—Development of the DDI was based on a review of related literature on diary studies of stress and illness (e.g., Bolger, DeLongis, Kessler, & Schilling, 1989; DeLongis et al., 1988; Larsen & Kasimatis, 1991; Quittner & Opipari, 1994; Stone & Neale, 1982). Eckenrode and Bolger (1995) have argued that the unit of analysis in daily event studies should be smaller than a single day because an event is likely to have its greatest effect soon after it occurs. Accordingly, the DDI divided the day into three time periods: the morning period before school, the school day, and the afternoon-evening period

after school. These three time periods were particularly appropriate for this sample because episodes of RAP tend to be brief and, for some children, are associated with particular settings and times of day.

The major domains of stressors assessed by the DDI included those related to family, peers, and school. Stressor items were selected to be relevant to children in general and to those with RAP in particular. The initial item pool was derived from similar inventories of children's daily stressors (Compas, Davis, Forsythe, & Wagner, 1987; Robinson, Garber, & Hilsman, 1995) and included items such as taking a test at school, having an argument with a friend, and not being allowed to participate in an activity. In addition, because of evidence that patients with RAP experience more health-related life event stressors than other children (Hodges et al., 1984; Wasserman, Whittington, & Rivara, 1988) and evidence that mothers of patients with RAP report more family member illness than do mothers of other children (Walker et al., 1993), we included daily stressors in the health domain (e.g., a family member being sick) in our checklist of potential stressors. Using this list, we conducted a pilot study in which 150 well children and 25 patients with RAP were asked to endorse stressors they had experienced that day and to list any additional stressors. On the basis of results of the pilot work, several rarely endorsed items were deleted from the list and several stressors nominated by the children were added.

A common problem with inventories of daily stressors is that some stressors may be confounded with health outcomes (Dohrenwend, Dohrenwend, Dodson, & Shrout, 1984). This is the case for children with RAP for whom episodes of pain and "feeling sick" may be regarded as stressors. We included items such as these in the DDI to assess the frequency of illness-related stressors. However, these items were excluded from all other analyses.

The DDI used a cued-recall procedure, similar to that used by Quittner and Oipari (1994). Interviews prompted children's recall of activities earlier in the day by referring to daily routines (e.g., eating breakfast, arriving home from school). On each day, children were asked about three time periods (morning, school, after school).<sup>1</sup> Questions for each time period began with an open-ended format, prompting children to describe events that occurred during that time period. The purpose of these open-ended questions was to build rapport and to identify any spontaneously generated descriptions of stressors unique to a particular child. Next, children were read a structured list of stressors that might have occurred during that time period. Children were asked to rate the severity of each stressor endorsed by responding, on a 4-point scale, to the question, "How bad was it for you?"

**Daily Symptom Report (DSR)**—The DSR was embedded within the DDI. The DSR lists 15 symptoms that are rated on a 5-point scale ranging from 0 (*not at all*) to 4 (*a whole lot*). Children reported their symptoms on the DSR for each of three time periods during the day, following their report of stressors for that time period. Thus, the DSR was completed for three time periods (before school, during school, after school) on each of 5 days. The DSR is scored to obtain three symptom indices. The Index of Somatic Symptoms was an abbreviated state version of the Children's Somatization Inventory (CSI; Garber et al., 1991; Walker et al., 1991), composed of the six most frequently endorsed items from the CSI (i.e., headache, stomachache, nausea, tired, sore muscles, feeling weak). In this study, alpha reliability for the 6-item index ranged from .74 to .83 across the 15 administrations during the week of interviews. The index had a significant correlation with the full-scale CSI (average  $r = .47$ ).

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<sup>1</sup>On days when a child was out of school for illness or other reasons, a modified protocol was administered that asked the child about the morning (until noon) and the afternoon-evening.

Items for the Indices of Positive and Negative Affect were drawn from the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988). During the week of daily interviews, alpha reliability ranged from .75 to .86 for the 6-item Index of Negative Affect and from .78 to .87 for the 3-item Index of Positive Affect. The Index of Negative Affect had a significant correlation with the Negative Affect scale from the PANAS (average  $r = .40$ ), and the Index of Positive Affect had a significant correlation with the Positive Affect scale from the PANAS (average  $r = .47$ ).

**Network of Relationships Inventory (NRI)**—The NRI (Furman & Buhrmester, 1992) assesses children's perceptions of their relationships with significant others with respect to seven types of support provision: (a) reliable alliance—a lasting dependable bond, (b) enhancement of worth, (c) affection, (d) companionship, (e) instrumental help, (f) intimacy, and (g) nurturance of the other. In this study, children rated support in their relationships with their mothers and with their closest friends. Children were asked to rate how much each type of support occurred in each relationship (e.g., "How much free time do you spend with each of these persons?"). Response ratings were on a 5-point Likert scale. The present study used the version of the NRI that has three items on each subscale (Furman & Buhrmester, 1992). Responses to these items were summed to obtain a total support score. Alpha reliability for this scale was .92.

**Perceived competence**—Perceived competence at the time of the initial evaluation was assessed with the Global Self-Worth subscale of the Self-Perception Profile for Children (SPPC; Harter, 1982, 1985), a measure of children's global and domain-specific perceptions of self-worth. The SPPC has a 4-point response format. Harter (1982) reported adequate internal consistency and convergent validity for the measure. In this study, coefficient alpha was .81 for the 6-item Global Self-Worth subscale. Total scores on this subscale were computed by summing the responses to each item.

**PANAS (Watson & Clark, 1984; Watson et al., 1988)**—The PANAS is a brief scale that reliably measures positive affect and negative affect. Some items were modified for administration to children in this study. Participants were asked to use the previous 2 weeks as the time frame for their responses. Alpha reliability was .91 for positive affect and .88 for negative affect.

## Procedure

The DDI was administered by telephone in the evenings on 6 consecutive days. Most children were interviewed by the same person throughout the week. On the first day, mothers and children provided demographic data and responded to several measures including the NRI, the SPPC, and the PANAS. On each of the subsequent 5 school days, children responded to the DDI regarding their experiences of stressors and symptoms for each of the three time periods of the day. The lists of stressors and symptoms were read to the children, and they responded using a printed response sheet. In some cases, not all interview days were consecutive because scheduled family activities were given precedence over the interview. Nonetheless, nearly all children (95% in each group) completed the interviews within a 2-week period.

## Results

### Preliminary Analyses

Because patients with RAP were interviewed 2 weeks after their clinic evaluations, it was possible that they had recovered from RAP. Therefore, we examined the frequency of abdominal distress (pain, upset stomach) reported during the week the DDI was

administered. We found that 93% of patients with RAP reported abdominal distress at least once during the week of the diary interviews, 58% reported abdominal distress on 3 or more days, and 22% reported abdominal distress on all 5 days. (Percentages for the well group were 45%, 8%, and 2%, respectively.) A chi-square analysis comparing the groups with respect to the occurrence versus nonoccurrence of abdominal distress during the week was significant,  $\chi^2(1, N = 251) = 81.26, p < .0001$ .

A Group  $\times$  Sex analysis of variance (ANOVA) with repeated measures (morning, school, after school) on the Index of Somatic Symptoms yielded a significant effect for group,  $F(1, 254) = 63.46, p < .0001$ . Patients with RAP reported significantly higher scores than well children on the Index of Somatic Symptoms at all times of day—before, during, and after school: before school (RAP group,  $M = 0.66, SD = 0.54$ ; well group,  $M = 0.22, SD = 0.23$ ),  $t(261) = 9.04, p < .05$ ; during school (RAP group,  $M = 0.66, SD = 0.60$ ; well group,  $M = 0.19, SD = 0.23$ ),  $t(256) = 256, p < .05$ ; after school (RAP group,  $M = 0.68, SD = 0.57$ ; well group,  $M = 0.22, SD = 0.24$ ),  $t(261) = 8.95, p < .05$ . The level of somatic symptoms did not vary significantly by time of day for either group.

We also examined the data for group differences on child self-report questionnaires, that is, perceived global self-worth, perceived social support, and trait NA. Results of Group  $\times$  Sex ANOVAs yielded significant group effects for global self-worth,  $F(1, 257) = 9.56, p < .01$ , and for social support,  $F(1, 234) = 13.06, p < .001$ . Patients with RAP had lower scores than well children on global self-worth (for RAP,  $M = 19.52, SD = 3.97$ ; for well,  $M = 20.97, SD = 3.27$ ) and on perceived social support (for RAP,  $M = 10.17, SD = 1.70$ ; for well,  $M = 11.06, SD = 1.88$ ). In addition, there was a significant Group  $\times$  Sex interaction effect for trait NA,  $F(1, 232) = 6.44, p < .01$ . Girls with RAP reported higher NA than did well girls,  $t(130) = 5.65, p < .001$  (for girls with RAP,  $M = 1.34, SD = 0.72$ ; for well girls,  $M = 0.73, SD = 0.49$ ). Boys with RAP and well boys did not differ significantly on NA. Within the RAP group, the level of NA was significantly higher for girls ( $M = 1.34, SD = 0.72$ ) than for boys ( $M = 0.89, SD = 0.61$ ),  $t(125) = 3.72, p < .001$ .

### Do Patients With RAP Report More Daily Stressors Than Well Children?

The dependent variables for this question were the average number of daily stressors reported by each child for each time period. (For this and subsequent analyses, daily stressors associated with illness, such as “feeling sick,” were excluded.) A Group  $\times$  Sex ANOVA was conducted with stressors at each time period as a repeated measure. Results indicated a significant effect for time of day,  $F(2, 305) = 164.58, p < .0001$ . Post hoc tests showed that children reported significantly more stressors during school than before school,  $t(258) = 7.83, p < .0001$ , or after school,  $t(258) = 15.85, p < .0001$ . The ANOVA also yielded a significant Group effect,  $F(1, 259) = 9.20, p < .01$ . Patients with RAP reported significantly more daily stressors ( $M = 1.13, SD = 0.86$ ) than did well children ( $M = 0.81, SD = 0.65$ ). This effect held at all three times of day: before school (RAP group,  $M = 1.91, SD = 1.43$ ; well group,  $M = 1.44, SD = 1.16$ ),  $t(261) = 2.83, p < .01$ ; during school (RAP group,  $M = 2.66, SD = 2.15$ ; well group,  $M = 2.06, SD = 1.84$ ),  $t(257) = 2.33, p < .02$ ; after school (RAP group,  $M = 0.92, SD = 0.85$ ; well group,  $M = 0.64, SD = 0.62$ ),  $t(261) = 2.93, p < .01$ . The Group  $\times$  Time of Day interaction was not significant.

In addition, a Group  $\times$  Sex interaction effect approached significance,  $F(1, 259) = 3.74, p = .054$ . Post hoc analyses showed that girls with RAP reported more stressors ( $M = 1.32, SD = 0.95$ ) than did well girls ( $M = 0.84, SD = 0.63$ ),  $t(148) = 3.71, p < .001$ . In contrast, among boys, the number of daily stressors did not differ significantly by group (for the RAP group,  $M = 0.88, SD = 0.64$ ; for the Well group,  $M = 0.77, SD = 0.69$ ),  $t(111) = 0.84, ns$ .

### Do Patients With RAP Perceive the Stressors They Experience as More Severe Than Do Well Children?

This question was addressed by averaging the severity ratings for all stressors reported by each child over the course of the week. These severity ratings were then analyzed with a Group  $\times$  Sex ANOVA. Results yielded a main effect for group that was marginally significant,  $F(1, 259) = 3.64, p < .06$ , indicating a trend for patients with RAP to rate daily stressors as more severe than did well children (for RAP,  $M = 1.44, SD = 0.70$ ; for well,  $M = 1.25, SD = 0.68$ ). There was a significant main effect for gender,  $F(1, 259) = 7.98, p < .01$ , with girls perceiving stressors as more severe ( $M = 1.47, SD = 0.68$ ) than did boys ( $M = 1.21, SD = 0.70$ ),  $t(261) = 3.09, p < .01$ .

### Is the Association Between Number of Stressors and Level of Symptoms Stronger in Patients With RAP Than in Well Children?

This question focused on the strength of the idiographic within-subject correlation between the number of stressors and each type of symptom (somatic symptoms, negative affect, positive affect) for each time period. For each type of symptom, within-subject correlations were computed across 15 time intervals (3 per day for 5 days) assessed in the daily diaries.<sup>2</sup>

A Group  $\times$  Sex multivariate analysis of variance (MANOVA) was conducted with the  $z$  scores for each of the three types of stressor-symptom associations (stressors with somatic symptoms, stressors with negative affect, and stressors with positive affect) as repeated measures. Results indicated a significant multivariate effect for the repeated measures factor, Wilks's lambda (2, 210) = 33.98,  $p < .0001$ . Post hoc tests indicated that, for the total sample, the within-subject association between stressors and positive affect was significantly lower (mean normalized within-subject  $r = -.04$ ) than both the within-subject association between stressors and somatic symptoms (mean normalized within-subject  $r = .34$ ) and the within-subject association between stressors and negative affect (mean normalized within-subject  $r = .31$ ).

The MANOVA also yielded a significant multivariate effect for group,  $F(1, 211) = 5.36, p < .02$ . Subsequent univariate ANOVAs indicated a significant group effect for the within-subject correlation between number of daily stressors and level of somatic symptoms,  $F(1, 253) = 6.60, p < .01$ . Specifically, patients with RAP had a significantly higher correlation between daily stressors and somatic symptoms (mean normalized within-subject  $r = .40, SD = .42$ ) than did well children (mean normalized within-subject  $r = .26, SD = .40$ ). In contrast, the within-subject correlations between stressors and negative affect and between stressors and positive affect did not differ by group (mean normalized within-subject correlation between stressors and negative affect = .34 for the RAP group and .26 for the well group; mean normalized within-subject correlation between stressors and positive affect = -.04 for the RAP group and -.05 for the well group). Thus, RAP patients were not significantly different from well children in their emotional responses to stressors, but they exhibited higher rates of somatic symptoms in response to stressors.

Examination of frequency distributions of the within-subject Pearson correlation coefficients between stressors and somatic symptoms showed considerable variability in both groups (ranging from -.40 to .91 for the RAP group and from -.79 to .85 for the well group). We were particularly interested in knowing what proportion of children had a very strong relation between stressors and somatic symptoms. Our results indicated that within-subject

<sup>2</sup>Some participants had fewer than 15 observations going into their within-subject correlation because they stayed home from school on 1 or more days and reported on only 2 time periods on those days. In addition, the  $N$ s on which the within-subject correlations are based vary slightly because a few participants did not report any variability on one of the measures entering into one or the other correlations, and thus that correlation could not be computed for that participant.

Pearson correlation coefficients of .50 or greater were obtained by more than a third of the RAP group (34%), compared with 20% of the well group,  $\chi^2(1, N = 251) = 6.13, p < .01$ . The remaining analyses aimed to identify psychosocial characteristics that might help to explain individual variability in the strength of the stress–symptom relation.

### **Do Children’s Self-Worth, Social Support, and Trait NA Moderate the Impact of Stressors on Somatic Symptoms?**

It is possible that intraindividual (within-subject) correlations between daily stressors and symptoms are moderated by across-subjects differences in traitlike variables. To evaluate this possibility, we calculated the correlation of each potential moderator variable with the within-subject coefficients between daily stressors and symptoms. The only significant moderator was NA, and its moderating effect was only significant for the RAP group. Specifically, for the RAP group, the association of NA with the within-subject coefficient between daily stressors and symptoms was .22 ( $p < .01$ ), indicating that the relation between stressors and somatic symptoms was stronger for patients with RAP who had higher levels of trait NA. Perceived self-worth and social support were not significant moderators of the daily stressor–symptom association for either group.

Others have suggested that the overall level of stressors and symptoms may influence the relation between daily stressors and somatic symptoms (cf. DeLongis et al., 1988). For example, the relation between individual daily stressors and symptoms may have been stronger for children who experienced high levels of stress during the week than for children who experienced low levels of stress. Similarly, children who tended to have higher average daily levels of somatic symptoms or negative affect may have been more reactive to individual stressors. We assessed these possibilities by examining the correlations of mean daily stressors, mean daily somatic symptoms, and mean daily negative affect with the within-subject coefficients between daily stressors and daily somatic symptoms. None of these coefficients were significant for either group, suggesting that between-subjects differences in levels of daily stress, somatic symptoms, and negative affect did not account for intraindividual differences in the association between daily stressors and daily somatic symptoms.

## **Discussion**

Previous research on RAP has relied on measures that required parents and children to summarize events and outcomes over periods of time ranging from several weeks to a year. This research typically has been conducted in clinic settings at the time of the child’s medical evaluation, when both children and their parents may be experiencing higher than usual levels of distress. In contrast, the diary methodology in this study assessed events and symptoms on a daily basis in the familiar context of children’s own homes 2 weeks following their medical evaluations. Thus, these data may be more ecologically valid than those of previous investigations in that the protocol did not require recall beyond the day of the interview and the data were obtained on routine days in children’s lives.

The diary methodology opened a window onto the daily experiences of children with RAP as they went from home to school and then to after-school activities. One of the most striking findings was the extent to which these children continued to experience abdominal pain and other somatic symptoms following their medical evaluations. Nearly all of the children with RAP (93%) reported abdominal discomfort on at least 1 of the 5 days of interviews, and the majority (58%) reported abdominal discomfort on 3 or more days. Furthermore, compared to well children, children with RAP reported significantly higher levels of other somatic symptoms (e.g., headaches, fatigue) at all times of day. This finding



underscores the extent of somatic discomfort experienced by children with RAP and suggests that for the majority this discomfort continues despite medical attention.

The primary goal of this study was to assess the extent to which these somatic symptoms were associated with daily stressors. We began by comparing the frequency and perceived severity of daily stressors reported by children with RAP and by well children. During the week of interviews, children with RAP reported significantly more daily stressors than did well children, and there was a trend for children with RAP to rate their stressors as more severe compared with well children. The fact that a standard list of stressors was presented to each child suggests that children with RAP may indeed have experienced more of these stressors than their peers had. However, it also is possible that children with RAP were simply more attuned to these events and therefore more likely to endorse them, whereas their peers may have experienced similar events but quickly forgotten about them.

Both children with RAP and well children reported significantly more stressors during school than they reported before or after school. Thus, the experience of stress at school did not differentiate children with RAP from other children. Rather, as discussed below, the somatic nature of their reaction to stressors at school and elsewhere appears to be the factor that differentiates children with RAP from others.

Our prior work led us to hypothesize that the relation between stressors and somatic symptoms would be stronger for children with RAP than for well children. We tested this hypothesis by calculating correlation coefficients that represented, for each child, the relation between stressors and symptoms across the 15 time periods assessed in the daily telephone interviews. These coefficients were significantly higher for children with RAP than for well children, indicating a stronger relation between stressors and symptoms for children with RAP. We also examined the intraindividual coefficients between stressors and negative affect; these did not differ significantly for the two groups of children. Thus, our data provide evidence that children with RAP may be distinguished from other children by a response to stress that is manifest in higher levels of somatic symptoms. Indeed, for more than a third of children with RAP, the relation between stressors and symptoms was quite high, exceeding a Pearson correlation of .50.

Of course, given that stressors and symptoms were both assessed at the end of the day, the direction of causal influence remains unclear. Although stressors may have precipitated symptoms, it also is possible that physical discomfort caused children with RAP to become more aware of daily stressors or that physical discomfort precipitated other stressors. For example, a child who is not feeling well might be slow getting ready for school, arrive at school late, fall behind in classwork, and develop anxiety that, in turn, lowers the pain threshold and interferes with his or her ability to cope with both pain and stressors. In this way, daily stressors and symptoms may influence each other in an escalating cycle (cf. Walker, 1999). The important point, regardless of the direction of influence, is that the relation between stressors and symptoms was stronger for children with RAP than for well children.

Nonetheless, there was considerable individual variability in the strength of the relation between stressors and symptoms even within the RAP group. Drawing on the method of DeLongis et al. (1988), we asked whether between-subjects differences in self-esteem, social support, and trait NA might explain these intraindividual (within-subject) differences in the relation between stressors and somatic symptoms. Our findings indicated that for children with RAP, but not for well children, trait NA significantly moderated the relation between stressors and symptoms. Specifically, higher levels of trait NA significantly

predicted a stronger relation between daily stressors and somatic symptoms for children with RAP.

How might NA influence the relation between daily stress and symptoms? Bolger and Schilling (1991) found that neuroticism, which is related to NA, was associated with increased reactivity to daily stressors. They speculated that the impact of neuroticism on reactivity may be explained by the tendency for individuals high in neuroticism to use less effective coping mechanisms when confronted with stress (Bolger, 1990; Bolger & Schilling, 1991; Bolger & Zuckerman, 1995). Similarly, children with high NA may interpret stressors as more threatening, may doubt their coping abilities, and may use passive coping strategies that are less likely to be effective and therefore result in physiological arousal and emotional distress. In children with RAP, this arousal might be manifest in somatic symptoms if the salience of illness and the encouragement of illness behavior in their families (Walker & Zeman, 1992) causes them to focus on the somatic components of their distress. In this way, the relation between stressors and symptoms could be increased in children with RAP who have high trait NA.

Contrary to the DeLongis et al. (1988) study of daily stressors in adults, neither social support nor self-esteem moderated the relation between stress and symptoms in this study. However, we used global stable measures of social support and self-esteem that may not reflect resources available to a child at the time of a particular stressor. It is possible that measures of support and competence specific to each stressor would moderate the relation between stress and symptoms.

Another important finding was that although children in the RAP and well groups differed in the link between stress and somatic symptoms, they did not differ significantly in the relation between stress and negative affect. Thus, children with RAP do not appear to be less emotionally reactive to stress than normal children, as has been suggested by some (e.g., Shapiro & Rosenfeld, 1987). Rather, they express both somatic and emotional distress in relation to stressors. What differentiated the groups here was that although the well children responded to daily stress with negative affect, they did not show the same level of somatic distress as children with RAP.

This study's generalizability is limited in that the RAP group was composed of patients referred to a tertiary care center following the failure of treatment in the primary care setting. These patients represent a narrow band of children with RAP whose symptoms are the most chronic and difficult to manage. The well group, in contrast, excluded children who reported abdominal pain more than weekly or who had scores above the sample median on the CSI. Thus, they were a particularly healthy group. In future research, it will be important to include children with RAP who are nonpatients to assess whether the association that we observed between stress and somatic symptoms is characteristic of RAP or is confounded with health service utilization. Future research should also identify subgroups of patients with RAP (e.g., those with irritable bowel syndrome, functional dyspepsia, functional constipation, or functional abdominal pain) to assess whether the impact of stress on symptoms differs for subgroups whose symptoms may reflect different underlying physiological processes (cf. Rasquin-Weber et al., 1999; Von Baeyer & Walker, 1999).

Another limitation of this study is that the daily diary methodology relies on self-report. Laboratory studies would allow us to further explore, under controlled conditions, the processes linking stress and symptoms. For example, by monitoring physiological processes under conditions of stress, one could evaluate the extent to which stress in children with RAP is associated with greater central nervous system reactivity, alterations in gastrointestinal function, or visceral hyperalgesia (cf. Hyams & Hyman, 1998). In a

laboratory setting, it also may be possible to examine the extent to which family members may draw children's attention to somatic aspects of their reactions to stress or may influence children's coping strategies.

Two major conclusions may be drawn from this study. First, at a methodological level, the use of a daily diary methodology represents a useful strategy for observing processes related to stress and illness in pediatric populations. Second, at a substantive level, use of this methodology has documented the relevance of daily stress to understanding the somatic complaints of pediatric patients with RAP.

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