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Featured Article

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Featured Article: Caregiver Perceptions of Stress and Sibling Conflict During Pediatric Cancer Treatment

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Abstract

Objective The current study examined the effect of stress on sibling conflict during the first year of pediatric cancer treatment. **Method** Families ($N = 103$) included a child with cancer (aged 2–17 years, $M_{age} = 6.46$, $SD = 3.52$) and at least one sibling aged <5 years of the child with cancer ($M_{age} = 8.34$, $SD = 5.61$). Primary caregivers completed monthly questionnaires throughout the first year of treatment assessing five sources of stress (i.e., general life, cancer-related, financial, perceived treatment intensity, and life threat) and level of sibling conflict. Using multilevel modeling, we explored the effects of these stressors on conflict both at the within- and between-family levels to examine if changes in stress resulted in concurrent changes in conflict within an individual family, and whether greater average stress affected the trajectory of conflict between families, respectively. **Results** At the between-family level, higher average levels of cancer-related stress, general life stress, and financial stress were associated with higher sibling conflict at the end of the first year of treatment. Perceived treatment intensity and life threat were not associated with conflict. No stressors were associated with conflict at the within-family level. **Conclusions** During pediatric cancer treatment, some stressors may spill over into family relationships and contribute to increases in sibling conflict.

Key words: cancer and oncology; family functioning; stress.

A diagnosis of pediatric cancer is a stressful experience that affects the entire family (Long & Marsland, 2011). Parents experience fear for the survival and well-being of the child with cancer, and may also be concerned for the well-being of other children in the family. Siblings may fear for their ill brother or sister, feel isolated from parents, or struggle with changes as the family environment shifts to accommodate treatment (Wilkins & Woodgate, 2005). The stress of a cancer diagnosis increases the risk for psychosocial maladjustment and distress in parents, and in a subset of children with cancer and their siblings both after diagnosis and over time (Alderfer et al., 2010; Sawyer et al., 2000). Relationships within the family are also impacted by pediatric cancer. Overall, families of children with cancer report higher levels of conflict than comparison families (Pai et al., 2007). Conflict may increase in the parent–child relationship (Marine & Miller, 1998), and some couples report marital dissatisfaction or distress after diagnosis (Burns et al., 2017; Hoekstra-Weebers et al., 1998). However, few studies to date have investigated the effect of a child's diagnosis and treatment on

sibling relationships (Alderfer & Kazak, 2006). To address this deficit, the current study examines how the sibling relationship is impacted by stressors associated with the diagnosis and treatment of cancer.

In the past few decades, the sibling relationship and its role in family functioning have been extensively studied within the normative literature. From a family systems perspective, the sibling relationship both affects and is affected by other family relationships and dynamics within the family as a whole (for a review, see Feinberg, Solmeyer & McHale, 2012). Given their lifelong nature, sibling relationships are a unique and valuable source of potentially long-term social and instrumental support. They are also a primary context for socialization. Among typically developing children, positive sibling relationships have been associated with fewer adjustment difficulties concurrently (Pike, Coldwell & Dunn, 2005) and over time (Kim, McHale, Crouter & Osgood, 2007). Conflict within the sibling relationship is also common and may include both verbal and physical aggression (Kahn & Monks, 1997). High levels of sibling conflict predict higher levels of depressed mood, anxiety, and delinquent behavior over time (Kim et al., 2007), and may be more predictive of behavior problems than positive sibling relationship qualities (Buist, Deković & Prinzie, 2013). Because sibling relationships are a major aspect of development and influence the functioning of the family as a whole, it is important to understand how this relationship may be affected by pediatric cancer. Moreover, the quality of relationships within the family, including the sibling relationship, may have implications for how children and healthy siblings adjust during treatment and thereafter (Van Schoors et al., 2017).

To our knowledge, two quantitative studies have examined sibling conflict among families of children with cancer. Labay and Walco (2004) found that perceptions of sibling conflict were similar between the ill children and their healthy siblings, and less conflict was reported as the age of the healthy sibling increased. In this study, sibling conflict did not predict adjustment. Among adolescents with cancer, sibling conflict levels did not differ from a healthy comparison sample (Marine & Miller, 1998). Both of these studies used a cross-sectional design in which conflict was measured once during active treatment at a broad range of times since diagnosis. As such, these findings do not elucidate how sibling conflict may vary over time, and, given the older average ages of the children with cancer in these samples, cannot be generalized to younger children. These studies also do not assess the influence of specific aspects of the cancer experience or mechanisms by which it may affect sibling conflict.

One way in which pediatric cancer might influence the sibling relationship is via stress associated with diagnosis and treatment. Treating cancer involves difficult regimens that are experienced as highly stressful for patients and their families (McCaffrey, 2006). Families often must reorganize roles, as one parent typically becomes the primary caregiver for the child with cancer, while the other cares for siblings, the home, and provides for the family economically. Families also may experience financial stress or material hardship during this time (Bona et al., 2014). Finally, families are burdened with concern about the ill child's well-being during treatment and worry about their survival (McCaffrey, 2006). These numerous stressors may impact interaction patterns between family members, including the siblings.

For children in families coping with the many stressors associated with pediatric cancer, typical sibling socialization processes may be disrupted (Conger, Stocker & McGuire, 2009). For example, long absences to receive treatment may result in decreased opportunity for communication or interaction between siblings (Breyer, Kunin, Kalish, & Patenaude, 1993), thus lessening intimacy or bonding opportunities. Moreover, when siblings do interact, the child with cancer may not be physically or psychologically capable of engaging in interaction or play with their sibling (Katz, Leary, Breiger & Friedman, 2011). Finally, among families for whom sibling conflict was already high before diagnosis, the stress inherent in cancer diagnosis and treatment may further exacerbate this conflict.

While no quantitative studies to date have directly assessed the influence of stress on sibling conflict, a number of qualitative studies provide preliminary evidence for this link. Schuler et al. (1985) identified a decrease in relationship quality after a child's cancer diagnosis coupled with an increase in jealousy and quarreling. During treatment, healthy siblings continue to experience the stress of disruption in the family environment (Long, Marsland, Wright, & Hinds, 2015; Woodgate, 2006), and commonly report feelings of anger, isolation and loss, or rivalry toward the child with cancer (Alderfer et al., 2010; Wilkins & Woodgate, 2005). These experiences may lead to increased conflict or decreased relationship quality between siblings.

The goal of the current study was to examine how stress associated with pediatric cancer influences sibling conflict through the first year of treatment. Studies of family adjustment to pediatric cancer have highlighted the importance of studying the family during the first year of treatment, when distress may be the highest (Houtzager et al., 2004; Pai et al., 2007; Sawyer et al., 2000). As highlighted by Houtzager and colleagues (2004), studying families during the first year of treatment is essential to account for the dynamic nature of the illness and the associated stressors that may affect families' adjustment. The current study assessed parent-perceived sibling conflict and stressors

monthly through the first year of treatment to examine the relationship between stress and conflict over time.

Using a longitudinal framework, we conceptualized the relationship between stress and sibling conflict in two ways. First, we investigated how an individual family is affected by monthly changes in their usual stress levels. While pediatric cancer is chronically stressful, the amount of stress at a given time may change based on factors such as progression through treatment and time since diagnosis. Conflict may also differ over time as a function of variation in stress, as conflict may be higher when a family's stress is higher than their typical level. To address this question, we examined how deviations in stress from a family's typical level related to concurrent changes in sibling conflict (i.e., a within-family effect). We predicted that as stress increases from a family's typical level, sibling conflict would also increase.

Second, we were interested in investigating how average amount of stress relates to sibling conflict over time. When a child has cancer, it is likely that all families are experiencing more stress than before diagnosis, but there is likely to be variability between families in their average stress levels over the course of treatment. Thus, the pattern of conflict over time may differ depending on the average amount of stress a family experiences. To address this question, we examined how families differed from one another in their average stress levels over time and how that relates to their sibling conflict trajectory (i.e., a between-family effect). We also predicted that higher average level of stress would be associated with higher sibling conflict.

Finally, we explored the hypothesis that there may be differential effects of stress on the sibling relationship based on the type of stress the family is experiencing. To do this, we separately assessed the influence of five sources of stress on conflict, including general life stress, cancer treatment-related stress, economic stress, assessment of life threat, and treatment intensity. For each stressor, we examined both within-family and between-family effects. Owing to the exploratory nature of this question, we did not make any specific a priori hypotheses regarding whether certain stressors would be more strongly associated with sibling conflict than others.

Method

Participants

Families in the current study were part of a larger study examining pediatric cancer and family adjustment ($N = 159$). Families were included in the present analyses ($N = 103$) if they reported having at least one sibling aged <5 years of the child with cancer. Children with cancer were 2–17 years old ($M_{age} = 6.36$, $SD_{age} = 3.51$, 52% male), and families had on average 2.6 children ($SD = 0.76$). While the majority of children with cancer were 2–10 years old, 12 adolescents were included. The majority of children with cancer were identified as White/Caucasian (85.6%) by the primary caregiver, with the remaining identified as Black/African-American (5.2%), Asian (1.0%), or other (8.2%). Total 15.5% of participants identified as ethnically Hispanic. The majority of children with cancer were diagnosed with leukemia (35.9%), followed by lymphoma (10.7%) or a sarcoma (9.7%), a Wilm's tumor (11.7%), a neuroblastoma (3.9%), or another form of cancer (7.8%). The remaining 20.4% of the children with cancer were diagnosed with a central nervous system tumor. On average, families had less than one inpatient admission per month, with the average number of admissions declining over time. Number of admissions were highest during the first month ($M = 1.94$, $SD = 1.21$), and lowest during the 12th month ($M = .09$, $SD = .29$).

Among families who provided demographic information on healthy siblings ($N = 128$), 55.3% of children with cancer had one sibling, 28.2% had two siblings, 9.7% had three siblings, 5.8% had four siblings, and 1.0% had six siblings. Siblings ranged in age from 10 months to 25 years ($M_{age} = 8.34$, $SD = 5.61$); 61.2% of children had one or more older siblings, 58.3% had one or more younger siblings, and 5.8% had one or more siblings of the same age (twin or stepsibling). Families were asked to identify the primary and secondary caregivers for the child with cancer, and the relationship status between the caregivers. For primary caregivers, 85.9% identified a mother, 12.1% a father, 1.0% a grandmother, and 1.0% a stepmother. Relationship status of caregiver dyads included 77.5% married, 14.7% nonromantically involved, and 7.8% romantically involved but not married. Primary caregivers were on average 35.7 years old ($SD = 7.4$) and the majority were White/Caucasian (81.6%). The majority of primary caregivers had completed college (60.8%). Median annual family income was between $60,000 and $69,000. While this sample is representative of the population of the two urban clinics from which they were drawn, relative to the broader population of families of children with cancer in the United States, it likely overrepresents high SES, White/Caucasian families with highly educated caregivers.

Procedure

Participants were recruited as part of a larger study from two children's hospitals in urban areas of the Northwest and Southeast United States, and were approached within 2 weeks of diagnosis. Families were eligible if they had a child aged 2–17 years recently diagnosed with cancer and spoke English. Of 502 eligible families across both sites, 309 were

approached, 176 enrolled, with 159 completing at least one study component. Common reasons eligible families were not approached were that they had been recruited to another study or did not consent to be approached because they felt too overwhelmed, or because physicians did not approve of approach (e.g., because the child was too ill) or were unable to approach within the study window. Of the families approached who did not enroll, common reasons for refusal were because of either excessive time required or no reason was given. All study procedures were approved by the institutional review boards at all participating institutions. Consent was attained from the primary caregiver at the time of enrollment. Data were collected over a 12-month period beginning with an initial home visit, followed by 12 monthly questionnaire packets distributed through the mail completed by primary caregivers. The initial (Month 1) packet was received 1.6 months postdiagnosis on average. After the initial questionnaire packet (82.3%), the highest proportion of primary caregivers were retained at Month 6 (67.5%), and the lowest at Month 2 (5%). See Table 1 for sample size at each month, and Supplemental Figure S1 for patterns of data obtained from all eligible families at each time point. Number of completed packets was not associated with any demographic variables, and missing data were accounted for in all analyses.

Measures

Sibling Conflict

Sibling conflict was measured via primary caregiver report using the conflict subscale of the Sibling Relationship Questionnaire (SRQ; Furman & Buhrmester, 1985). Nine items assessing frequency of sibling conflict in the past month were rated 1 (hardly at all) to 5 (extremely much), with higher scores indicating greater frequency of conflict. Frequency of contact between siblings was also measured using one item in which response options assessed approximate number of days siblings interacted in the past month. To minimize participant burden, in families with two or more siblings, primary caregivers were instructed to complete the questionnaire thinking about the ill child's relationship with siblings in general rather than his or her relationship to an individual sibling. In our sample, Cronbach's alpha ranged from .91 to .99 with an average of .95 across time points.

General Life Stress

General life stress was assessed via primary caregiver report using an adapted version of the Negative Life Events Scale for Children (Sandler, Ramirez & Reynolds, 1986). This index was originally adapted by Lengua and Long (2002) for use with parent-report. Eighteen items from this 29-item adaptation were used in the current study based on negative events that were most relevant to families of children with cancer. Removed items included those that were obviously true for a cancer population (e.g., "your child suffered serious illness or injury"), as well as items that were assessed in other parts of the overall study (e.g., items related to interparental relationships). Eighteen items assessed a range of moderate to severe negative life events (e.g., "you or your partner lost a job," "a relative or close family friend died") in the past month. Items were rated for whether it occurred and if it did occur how upsetting it was for the child with cancer. This yielded two measures at each of the 12 time points: a summed frequency count score and difficulty for child score. Frequencies score had a possible range of 0–18, with higher scores reflecting greater frequency; difficulty for child scores ranged from 0 to 54, with higher scores representing more difficulty for the child with cancer. In prior studies, this measure is associated with measures of psychological adjustment and symptomatology (Lengua & Long, 2002; Sandler et al., 1986). As we are not concerned with shared item variance given that this index is intended to be composite of stressful events rather than a scale, internal consistency reliability information is not provided.

Cancer-Related Stress

Cancer-related stress was assessed via primary caregiver report using the Treatment-Related Events Questionnaire. This measure was developed for this study based on qualitative work examining stressors among children with cancer (McCaffrey, 2006). See Supplemental Figure S2 for full measure. This 24-item scale used a similar format to the Negative Life Events Scale for Children to assess caregiver-reported treatment stressors (e.g., long hospital stays) and procedures (e.g., lumbar punctures) in the past month. Each item was rated 1 (never) to 5 (very often) for how frequently it occurred, and 1 (not at all) to 5 (extremely) for how difficult it was for the child. Two cancer-related stress scores were computed, one for frequency and one for difficulty, with higher scores reflecting greater frequency and difficulty. Cronbach's alpha ranged from .77 to .94, with an average of .91 across time points for the frequency score, and .77 to .94 with an average of .89 across time points for the difficulty score.

Financial Stress

Financial stress was measured via primary caregiver report using the Economics In My Family Questionnaire (Barrera, Caples, & Tein, 2001). This 10-item scale yields an overall financial strain score ranging from 1 to 39, with higher scores reflecting

Table I. *Descriptive Information for Sibling Conflict and Stress Predictors*

	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12
Construct (possible range)												
Sibling conflict (1–5)												
n	91	5	43	64	63	70	49	53	53	50	16	59
M (*SD*)	2.27 (0.89)	1.80 (0.65)	2.39 (0.99)	2.37 (1.00)	2.37 (0.85)	2.40 (0.90)	2.27 (0.86)	2.22 (0.90)	2.44 (0.96)	2.55 (1.09)	1.90 (0.67)	2.43 (0.90)
General life stress: frequency (0–18)												
M (*SD*)	3.03 (1.78)	1.71 (1.50)	2.35 (1.48)	2.09 (1.53)	1.81 (1.50)	1.62 (1.49)	1.55 (1.40)	1.72 (1.38)	1.47 (1.44)	1.72 (1.39)	1.61 (1.51)	1.51 (1.54)
General life stress: difficulty (0–54)												
M (*SD*)	5.98 (4.48)	2.87 (2.61)	4.12 (3.12)	3.61 (2.78)	3.30 (3.11)	2.79 (2.76)	2.78 (2.76)	2.76 (2.50)	2.43 (2.57)	2.86 (2.62)	2.71 (2.95)	2.52 (2.50)
Cancer-related stress: frequency (24–120)												
M (*SD*)	72.58 (16.03)	56.80 (26.41)	68.67 (16.73)	44.00 (14.85)	62.04 (19.72)	59.58 (18.25)	55.85 (19.86)	55.27 (21.44)	49.08 (19.85)	38.92 (15.84)	39.58 (19.91)	42.80 (16.59)
Cancer-related stress: difficulty (24–120)												
M (*SD*)	53.47 (15.81)	50.40 (15.57)	49.89 (17.32)	61.31 (18.07)	47.27 (18.41)	44.23 (16.41)	42.00 (15.30)	42.04 (16.30)	37.56 (15.56)	43.50 (17.67)	35.36 (18.61)	37.67 (16.93)
Financial strain (1–39)												
M (*SD*)	19.58 (7.01)	21.43 (5.71)	19.31 (5.83)	18.25 (6.85)	17.86 (6.99)	17.72 (6.99)	17.82 (7.64)	18.64 (6.97)	17.83 (7.80)	18.24 (6.92)	17.50 (7.69)	17.97 (7.42)
Treatment intensity (2–10)												
M (*SD*)	7.7852 (1.65)	7.57 (2.15)	7.90 (1.48)	7.61 (1.70)	8.03 (1.99)	7.55 (1.97)	8.13 (1.61)	7.87 (2.10)	7.44 (2.55)	7.56 (2.42)	7.78 (2.23)	7.44 (2.14)
Life threat (2–10)												
M (SD)	7.37 (2.20)	5.57 (2.50)	7.30 (2.37)	7.11 (2.19)	7.32 (2.20)	6.73 (2.46)	7.01 (2.25)	6.94 (2.53)	6.69 (2.48)	7.30 (2.59)	7.35 (2.40)	6.98 (2.42)

more strain. Cronbach's alpha ranged from .83 to .91, with an average of .88 across time points.

Life Threat and Treatment Intensity

Perceptions of the child's life threat and treatment intensity were assessed via primary caregiver using the Assessment of Life Threat and Treatment Intensity Questionnaire (ALTTIQ; Stuber et al., 1997). The ALTTIQ has been used widely in studies of pediatric cancer. This four-item scale included two questions assessing perceived life threat and two questions assessing perceived treatment intensity. Possible scores ranged from 2 to 10 for each subscale, with higher scores reflecting more life threat or treatment intensity. For perceived life threat, Spearman–Brown reliability coefficients ranged from .66 to .84, with an average of .77 across time points. For Perceived Treatment Intensity, coefficients ranged from .52 to .91, with an average of .78 across time points.

Data Analytic Strategy

Given the wide age range of the patients in the sample (2–17 years), all analyses were conducted with and without the inclusion of the families of 12 adolescents with cancer in the sample to ensure that adolescent data did not change patterns observed among the younger children. There was no substantial difference in estimates or pattern of results across any stress variable, and therefore, results with the full sample are reported.

To examine change in sibling conflict over time, we estimated growth curve models with a Multilevel Modeling (MLM) approach using the Maximum Likelihood estimator in SPSS 18.0. Multilevel models are appropriate for examining nonindependent data (e.g., repeated measures), and can be used to model both within-family trajectories of conflict over time (Level 1 effects) as well as between-family differences in trajectories (Level 2 effects). Although some families did not have data at each time point (see Table 1), MLM handles missing data well by allowing trajectories to be estimated from different numbers of observations per family. Thus, families who were missing data at any time points were still included in the models as long as they had any follow-up data. Additionally, there was no correlation between number of missing data points and initial levels of sibling conflict. Power analyses suggested that the current study had sufficient power (.80) to detect small regression effects ($b = .10$–$.15$) and power approaching 1.0 to detect moderate ($b = .30$) to large effects within a multilevel framework. While many families did not have complete data, average cluster size (i.e., number of observations per family) is not important for power of these tests (Snijders, 2005).

We first estimated an unconditional linear growth model. This model estimated an intercept parameter, representing the level of sibling conflict at the 12-month follow-up, as well as a linear time parameter, which represents the rate of change over time in sibling conflict and the direction of such change. Time was coded from −11, Baseline, to 0, with each code representing the 2-week window in which data were received for each month of the 12-month follow-up. This approximately corresponded to time since diagnosis. We then tested random effects to examine whether there were between-family differences in the trajectory of conflict, and to indicate whether sufficient variance existed between families to test potential predictors (i.e., stress variables) that may have accounted for these within-family differences in conflict over time. Improvement in model fit was measured via −2 log likelihood differences.

To test the effects of predictors (i.e., stress) on sibling conflict, we followed the recommendations of Enders and Tofighi (2007) to center Level 1 and Level 2 predictors. We used centering within cluster at Level 1 to assess within-family effects and grand mean centering at Level 2 to assess between-family effects. To obtain within-family effects, each observation was subtracted from a given family's mean level across all observations over time. This score reflects a family's deviation from their own mean level of stress at a given time point, and its effect on the outcome explains why a family might differ from their expected trajectory of conflict at a given time point. At Level 2, or the between-family level, grand mean centering was used by deviating each family's mean level of the predictor from the average of all families' means. This score reflects each family's average level of stress over time, and its effects reflect how between-family differences in average stress levels across time influence level of sibling conflict at the intercept, in this case the final time point. We also tested two interactions: (1) an interaction between the between-family score and time, reflecting how differences in average stress levels were related to change over time in sibling conflict, and (2) a cross-level interaction, or the interaction between the within- and between-family effects. This score tested whether the within-family effect differed depending on a family's average level of stress over time.

Results

For fit statistics, see Table 2. The initial growth model indicated that on average sibling conflict changed in a linear fashion over time across the sample, and there were between-family differences in both the rate of change and ending point of sibling conflict. In the final model, there was a linear effect of time ($b = .02$,

Table II. *Building the Multilevel Growth Model and Final Parameter Estimates*

Building the multilvel growth model

	Fully fixed	Random intercept	Fully random
Model fit			
−2 restricted log likelihood	1,659.82	1,178.72	1,165.94
AIC	1,661.82	1,182.72	1,173.94
BIC	1,666.24	1,191.56	1,191.62
Fixed effects			
Intercept	2.40 (.07)****	2.49 (.09)****	2.49 (.10)****
Linear slope	.01 (.01)	.02 (.01)***	.02 (.01)**
Variance components			
Intercept		.57 (.09)****	.66 (.01)****
Linear slope			.01 (<.01)**

Stress predictors: final model parameter estimates

	Intercept	Within-family effect	Between-family effect	Sibling contact
General life stress				
Frequency	1.96 (.18)****	.02 (.02)	.21 (.08)**	.10 (.03)****
Difficulty	1.98 (.18)****	.01 (.01)	.10 (.03)****	.10 (.03)****
Treatment-related stress				
Frequency	1.94 (.18)****	<.01 (.01)	.01 (.01)**	.10 (.03)****
Difficulty	1.90 (.19)****	.002 (.002)	.02 (.01)**	.12 (.03)****
Financial stress				
Financial strain	1.91 (.18)****	.01 (.01)*	.03 (.01)**	.12 (.03)****
Assessment of life threat/treatment intensity				
Life threat	1.86 (.18)****	.01 (.02)	.05 (.04)	.12 (.03)****
Treatment intensity	1.87 (.19)****	.02 (.02)	.04 (.05)	.12 (.03)****

Note. All nonsignificant interaction terms were dropped from final models for parsimony. * = <.10; * = < .05, ** = < .01, *** = < .001. AIC = Akaike information criteria; BIC = Bayesian information criteria; "Sibling Contact" reflects estimates for covariate of amount of contact between siblings.

$p = .04$). The average final level of sibling conflict between families was 2.39 (possible range = 1–5). Thus, while sibling conflict increased slightly across time, levels were not elevated compared with the population, assuming that this construct is normally distributed. However, random effects for both the slope and intercept parameters indicated that variability existed between families in both the ending point and rate of change. Thus, assessing whether families' stress levels could explain some of this variability in trajectories of conflict was justified.

Predicting the Trajectory of Sibling Conflict

For each stress variable, we tested the effects of both within- and between-family predictors, as well as two interaction terms. We also controlled for frequency of contact with sibling(s) in the past month for all models. In all models, more sibling contact was significantly associated with more conflict. For results of all predictor models including covariates, see Table 2. Nonsignificant interactions were removed from the final models for parsimony.

General Life Stress

Higher average frequency of general life stress across the first year of treatment relative to other families (i.e., a between-family effect) was associated with higher levels of sibling conflict at the end of the first year of treatment ($b = .21$, $SE = .08$, $p = .02$). A similar pattern was found for the effects of difficulty of general life stress and sibling conflict. That is, for families for whom stressful events were, on average, more difficult for the child with cancer across all time points relative to other families, sibling conflict was higher at the final time point ($b = .10$, $SE = .03$, $p = .001$). However, monthly fluctuations in general life stress were unrelated to concurrent sibling conflict levels (i.e., a within-family effect), and average stress levels did not affect the rate of change of sibling conflict over time.

Cancer-Related Stress

Families who on average had a higher frequency ($b = .01$, $SE = .01$, $p = .02$) and difficulty ($b = .02$, $SE = .01$, $p = .02$) of cancer-related stressors relative to other families across time had higher sibling conflict at the end of the first year of treatment. However, monthly fluctuations in cancer-related stress were unrelated to concurrent levels sibling conflict, and average stress levels did not affect the rate of change.

Financial Stress

Families who had higher average financial stress relative to other families across time had higher sibling conflict at the end of the first year of treatment ($b = .03$, $SE = .01$, $p = .02$). However, monthly fluctuations in financial stress were unrelated to sibling conflict, and average financial stress levels did not affect the rate of change.

Life Threat and Treatment Intensity

There were no effects for within- or between-family predictors.

Discussion

The current study is the first to empirically examine the relationship between caregiver perceptions of stress and sibling conflict over time in families where a child has been recently diagnosed with cancer. We assessed the impact of stress both at the within- and between-family levels to understand how stress concurrently affects of sibling conflict within an individual family, as well as how average stress levels affect the trajectory of conflict over time.

Results showed a between-family effect for general life stressors, cancer-related stressors, and economic stress, such that higher average levels of stress compared with other families predicted higher levels of caregiver-perceived sibling conflict. While no quantitative studies to date have directly assessed the relationship between stress and sibling conflict in families where a child has cancer, this finding is in accordance with some literature reporting higher sibling conflict in other stressful family circumstances, such as when one sibling is developmentally delayed (Gamble & McHale, 1989). However, research on sibling conflict in other disease or disability groups is scant, and comparisons should be considered in light of relevant differences between illness characteristics or historical context that may affect sibling interactions.

From a family systems perspective, stressful experiences such as those associated with pediatric illness may directly or indirectly influence all family members and their relationships with one another (Kazak, Rourke & Crump, 2003). In the case of prolonged stress, psychological resources of family members may become exhausted and stress may then spill over into family relationships. For example, stressed parents may be less available or able to scaffold sibling interactions, leading to more conflict between siblings over time as smaller conflicts go unresolved. Parents dealing with stress may also be more likely to engage in differential parenting practices between siblings (Crouter, McHale & Tucker, 1999). Indeed, studies indicate that siblings commonly perceive differential treatment from parents when their brother or sister has cancer (Wilkins & Woodgate, 2005), which may contribute to conflict. Finally, children in families who experience continuous stress may also be more reactive to minor stressors resulting in greater conflict with their siblings (Nixon & Cummings, 1999).

Higher average levels of stress compared with other families predicted higher conflict across three of the five sources of stress, suggesting that during a highly stressful time such as when a child has cancer, the specific type of stressor may be less relevant than overall amount of stress. After diagnosis and during treatment, the family may already be so taxed that they are less able to cope with the stressor adaptively regardless of its source. However, while each of these stressors may affect sibling conflict, the mechanism may differ depending on the stressor. For example, some stressors, such as loss of a job or financial concerns, may affect parents more directly than children and thus affect sibling relationships via a decline in parenting quality. Other stressors, such as treatment procedures, may directly affect the ill child and their healthy siblings' abilities to regulate their own emotions and behavior. Future research may elucidate these mechanisms by examining parenting behavior and children's emotion regulation as buffers between stress and sibling conflict. Importantly, a body of qualitative research has identified increases in family closeness and cohesion after a child's cancer diagnosis (Brody & Simmons, 2007; Long & Marsland, 2011; Woodgate 2006). Thus, while stress may influence sibling conflict, it may also bring the family closer and strengthen other aspects of the sibling relationship, such as warmth or closeness. Future research assessing both positive and negative qualitites of sibling relationships is thus needed to comprehensively understand the effect of cancer on sibling relationships.

It was notable that no stress predictors affected sibling conflict at the within-family level. Given that there was sufficient variance at this level to examine predictors, the lack of within-family effects suggests that stress does not account for these within-family differences. One possibile explanation is that monthly fluctuations in stress do not affect concurrent sibling conflict because it takes longer than 1 month for the effects of a short-term increase in stress to spill over into family relationships. A second possibility is that temporary fluctuations in stress do not affect sibling conflict as long as average levels of stress remain low. For example, in the context of cancer treatment, if a family has 1 month in which the child has a few more stressful treatment procedures than usual, this may not affect the sibling relationship, provided most other months do not involve many stressful procedures. In contrast, if the child has many stressful procedures every month, the continued stress may then eventually spill over into the sibling relationship.

Taken together, results suggested that families reporting higher stress compared with other families also reported higher levels of sibling conflict. Thus, families dealing with more stress may experience elevated levels of sibling conflict that may then negatively influence adjustment of both the child with cancer and their siblings (Kim et al., 2007; Stocker, Burwell & Briggs, 2002). For these families especially, maintaining positive sibling relationships and minimizing conflict during pediatric cancer treatment may be particularly important. High-quality sibling relationships may provide a unique source of long-term social support for survivors who are at risk for encountering continued challenges into adolescence and adulthood. For example, many survivors of childhood cancer will encounter late effects, or long-term sequelae of treatment that may range from mild to life-threatening (Nathan et al., 2007; Oeffinger et al., 2000). Thus, a sibling may be a valuable source of emotional and instrumental support in the case of late effects during adolescence or adulthood. Moreover, close sibling relationships may also be protective for the siblings of children with cancer themselves, given that a subset of siblings encounters poor adjustment outcomes such as posttraumatic stress or emotional distress (Alderfer et al., 2010; Labay & Walco, 2004). Taken together, these findings highlight the importance of maintaining high-quality relationships for children with cancer and their healthy siblings alike.

This study has a number of strengths. First, few studies to date have examined sibling conflict among children with cancer. Identifying both the trajectory of conflict and how it is affected by stress is the first step to understanding how the sibling relationship may influence adjustment for children with cancer and their siblings. Second, the longitudinal, month-to-month design is a novel approach in pediatric psychooncology research, and allowed us to not only examine change in sibling conflict over time but also to examine the effect of stress both relative to individual families' typical levels and on average between all families. Third, this study also uses a relatively large sample for this population, thereby increasing statistical power.

The current study had a number of limitations that are important to note, including issues related to measurement, attrition, and generalizability. First, future research may benefit from examining composition of sibling dyads in more detail. The current study assessed conflict between the child with cancer and their siblings in general rather than individual dyads, so estimates of conflict likely reflected average amounts of sibling in which the child with cancer was involved. More variability may have been observed if parents had reported on individual dyads or the most conflictual dyad (e.g., the child with cancer and brother or sister with whom they had the most conflict). While all families had at least one sibling aged <5 years of the child with cancer, assessments of conflict may have potentially included siblings not living in the home or those substantially older or younger than the child with cancer. While frequency of contact between siblings was controlled for analytically to account for these differences, different patterns may still exist between siblings close in age or living in the home compared with those more removed from the child with cancer. The current study also did not obtain data regarding sibling gender. Thus, future work examining specificity such as gender composition of dyads, birth order, or age difference may be useful to inform whether stress differentially affects conflict based on these factors. For example, Labay and Walco (2004) found that less conflict was reported as the age of the healthy sibling increased. It is possible that older siblings are better able to cope during stressful times, and thus, stress may be less likely to spill over into the sibling relationship.

Future research may also contribute to our knowledge of sibling conflict by using observational measures, or self-reports from the child with cancer and their siblings rather than solely caregiver report to better capture the children's experiences and improve validity. The SRQ used to assess sibling conflict in this study was originally developed for child self-report rather than caregiver report. Though the SRQ has been used with parent report in other studies (Fullerton et al., 2017), comparisons with other studies using child self-report may be limited. Importantly, because the primary caregiver completed both the conflict and stress measures in the current study, single-reporter bias may have influenced the findings such that highly stressed caregivers may have been more likely to perceive or notice conflict in the sibling relationship, or conversely stressed caregivers may not notice sibling conflict and thus underreport. It is ultimately important to note that these findings only speak to caregivers' perceptions of conflict and do not necessarily reflect objective levels, as factors such as caregiver psychological distress or trait negative affect may influence perceptions of both stressors and sibling conflict.

There is some potential for bias within the current sample because of recruitment methods and attrition. First, systematic differences may have existed between families who were approached versus those who were not. Specifically, families who did not consent to approach by the study team because of feeling overwhelmed or because the child was too ill may have systematically differed in their stress levels or sibling conflict levels compared with those who did consent to approach. Second, concerns with attrition were present in this study, and while missing data were

accounted for analytically, nonrandom missing data may still have affected results. For example, factors such as overall family functioning or disease prognosis may have contributed to a families' likelihood to complete questionnaires, and may also be related to different patterns of sibling conflict. Additionally, when stress or family conflict was higher in a given month, families may have been less likely to complete questionnaires, leading to underreporting of stress and conflict levels. In terms of feasibility, assessing families on a monthly basis during the first year of cancer treatment may be excessively burdensome. Finally, generalizability of findings may be limited by the homogenous nature of our sample.

The findings of this study may inform development of future interventions to promote sibling relationship quality during cancer treatment. For example, existing treatments such as the *More Fun with Sisters and Brothers* program (Kennedy & Kramer, 2008) may be useful for this population. This treatment focuses on fostering emotion regulation skills to help siblings navigate negative emotional interactions more effectively. As emotion regulation may be challenging during treatment, fostering these skills may help ameliorate sibling conflict. In addition, interventions aimed at fostering coping skills in all family members may also help to lessen conflict within the sibling relationship and protect its quality.

Finally, these findings could be extended to study the effect of sibling relationships on adjustment among children with cancer and their siblings. While sibling relationships have been found to predict adjustment among normative samples (Kim et al., 2007), few studies have examined this link among children with cancer. Given that these children and their siblings may be at risk for the poor adjustment, identifying risk or protective factors within the family may aid in prevention. Ultimately, identifying the relationship between stress, sibling conflict, and adjustment would provide an understanding of one way in which cancer may affect children's adjustment, and illuminate clear targets for intervention.

Owing to their unique nature, lifelong importance, and links to later adjustment, sibling relationships are important to understand and protect for all individuals but may be particularly valuable for pediatric cancer survivors. Studies that focus on describing and explaining changes in the family during pediatric cancer may ultimately help identify ways to minimize additional challenges and promote positive outcomes for children with cancer and their families.

Supplementary Data

Supplementary data can be found at: http://www.jpepsy.oxfordjournals.org/.

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