

Friendship Quality and Health-Related Outcomes Among Adolescents With Cystic Fibrosis

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Objective During adolescence, the significance of peer relationships peaks, and the presence and quality of dyadic friendships impact psychosocial outcomes. Yet, friendships have been studied infrequently among youth with chronic illness, particularly youth with cystic fibrosis (CF). The current aims were to (1) describe friendships among adolescents with CF, including number, duration, frequency of interactions, and positive/negative friendship qualities, and (2) explore associations between friendship quality, treatment adherence, and health-related quality of life. **Methods** Participants ($N = 42$) reported on friendships with peers with and without CF; caregivers reported on adolescents' adherence and quality of life. **Results** Friendships with CF-peers were less common and lower quality than friendships with non-CF peers. Both positive and negative friendship qualities were associated with adherence; positive friendship qualities were uniquely associated with quality of life. **Conclusions** CF-related health promotion efforts may benefit from addressing the impact of friendships on adherence and quality of life.

Key words adherence; adolescents; chronic illness; cystic fibrosis; friendship; quality of life.

Cystic fibrosis (CF) is a life-limiting genetic disorder, affecting approximately 1 in 3500 live births; it is typically diagnosed in infancy, with time-intensive lifelong treatment implications (CFF, 2012; Quittner, Modi, & Roux, 2004). Rapid research progress has dramatically increased the life expectancy for individuals with CF, from a median of 8 years in 1974 to a current median life expectancy in the mid to upper 30s (CFF, 2012). However, with this increased life expectancy have come numerous, complex, and time-intensive treatments critical for longer-term health and survival. Adherence to these complex regimens may carry significant implications for adolescents, for whom extensive treatment burden and potentially declining health may impact quality of life and normative developmental experiences (Modi & Quittner, 2006; Quittner et al., 2000, 2004). Additionally, adherence often decreases during adolescence, with potentially irreversible impact on health and disease course. Thus, this

developmental period is a critical time for understanding the influence of peers on adherence, quality of life, and other health-related outcomes, yet these processes have received limited attention among youth with CF (La Greca, Bearman, & Moore, 2002; Quittner et al., 2000; Ricker, Delamater, & Hsu, 1998).

Within the normative developmental literature, the adolescent period often has been framed by the central importance of the peer group, and particularly dyadic friendships (e.g., Bagwell & Schmidt, 2011; Vitaro, Boivin, & Bukowski, 2009; Way & Silverman, 2012). Social-developmental theorists, such as Sullivan and Piaget, have contributed to a social bonding theory of friendship that focuses on the positive influence of friendship participation and adaptive outcomes associated with healthy friendships (Bagwell & Schmidt, 2011; Vitaro et al., 2009). For example, the presence of a stable, reciprocated friendship in childhood may predict

better emotional functioning in early adulthood (Bagwell, Newcomb, & Bukowski, 1998). Reciprocally, the absence of early friendships has been associated prospectively with poorer psychosocial functioning (e.g., Ladd & Troop-Gordon, 2003). However, even among reciprocated dyadic friendships, friendship *quality* can vary considerably along dimensions of both positive and negative friendship traits, such as companionship, intimacy, support, conflict, and criticism. High-quality friendships promote competency and prosocial development, and low-quality friendships contribute to poorer adjustment (Bagwell & Schmidt, 2011). Thus, considering both the *presence* and the *quality* of friendships has important developmental implications for youth.

Despite the large body of developmental literature on friendships within normative and clinical populations of youth, little is known about the presence and quality of friendships of youth with chronic illnesses, particularly youth with CF (Meijer, Sinnema, Bijstra, Mellenbergh, & Wolters, 2000; Spirito, DeLawyer, & Stark, 1991). Most often, pediatric research has focused on broad domains such as psychosocial functioning, social adjustment, or social activities (Meijer et al., 2000; Spirito et al., 1991), or on disease-related peer roles, such as certain forms of social support (e.g., Barker, Driscoll, Modi, Light, & Quittner, 2012; Graetz, Shute, & Sawyer, 2000; La Greca et al., 1995). Social support from peers may promote improved quality of life, adaptive psychological adjustment, and in some cases, greater treatment adherence (Bearman & La Greca, 2002; Helgeson, Lopez, & Kamarck, 2009; Herzer, Umfress, Aljadeff, Ghai, & Zakowski, 2009; La Greca et al., 1995). However, despite the overlap between elements of social support often provided by peers and commonly assessed elements of positive friendship quality (e.g., companionship, emotional support), these constructs are not synonymous, nor do measures of social support often capture elements of negative friendship quality (Barker et al., 2012; Graetz et al., 2000; La Greca et al., 1995). When friendship quality has been examined in other chronic illness populations, emerging evidence suggests possible links with psychosocial functioning, quality of life, and disease management (Helgeson et al., 2009; Helgeson, Reynolds, Escobar, Siminerio, & Becker, 2007; Herzer et al., 2009). Yet the potential roles of both positive and negative friendship qualities in the lives of youth with CF largely have been neglected. Furthermore, unique elements of the CF disease process may warrant specific attention to friendships among CF patients with healthy peers versus peers who also have CF.

For many youth with chronic illness, factors such as differences in physical appearance, tolerance for physical activities, daily self-care routines, or subjective feelings of being “different” from the normative peer group may impact the nature of adolescents’ friendships with healthy versus other chronically ill peers (Spirito et al., 1991). Research with other illness populations suggests that healthy friends and friends with an illness may serve different roles and functions in terms of support, acceptance, interactions, and relationship qualities (Bluebond-Langer, Perkel, & Goertzel, 1991; Meltzer & Rourke, 2005; Wu, Prout, Roberts, Parikshak, & Amylon, 2011). However, there are specific reasons to suspect that models of friendship within other chronic illnesses may not translate well to the friendship experiences of individuals with CF. For example, due to the risk of spreading potentially life-threatening infections, individuals with CF are discouraged from in-person contact with other individuals with CF (Saiman & Siegel, 2003). This infection control guideline stands in contrast to common practices in other illness populations (e.g., diabetes, cancer), in which summer camps, peer mentorship programs, and other support groups may offer unique opportunities for obtaining social support from peers who are experiencing similar health concerns (e.g., Sansom-Daly, Peate, Wakefield, Bryant, & Cohn, 2012). Little is known about the extent to which youth with CF actually adhere to these infection control guidelines or the extent to which youth with CF use alternative methods of obtaining social support from peers with CF, such as via electronic communication.

Thus, in light of the limited research that exists on dyadic friendships among adolescents with CF, the first aim of the current study was to describe the nature of friendships (e.g., duration, forms, and frequency of interaction in-person and electronically) and the positive and negative friendship qualities adolescents report within their best friendships with a non-CF peer and a peer with CF. Given the infection control guidelines endorsed by the Cystic Fibrosis Foundation (Saiman & Siegel, 2003), we hypothesized that adolescents would report fewer friendships, less frequent interactions, and lower quality friendships with their best friends with CF in comparison with their best friends without CF. The second aim was to examine concurrent associations between positive and negative friendship quality and two important health-related outcomes: Treatment adherence and quality of life. Consistent with social bonding theories of friendship (e.g., Bagwell & Schmidt, 2011; Vitaro et al., 2009) and prior empirical work within other illness populations (e.g., Helgeson et al., 2007, 2009; Herzer et al., 2009), we hypothesized that higher levels of positive friendship qualities

and lower levels of negative friendship qualities would be associated with greater treatment adherence and higher levels of health-related quality of life.

Methods

Participants and Procedures

Participants included 42 adolescents with CF ($n = 25$ females), ages 12–18 years (Mean [M] = 15.17, standard deviation [SD] = 2.08), recruited at routine clinic visits from a Cystic Fibrosis Foundation-accredited care center in a university medical center in the southeastern United States. Caregivers attending clinic visits ($n = 39$, 74% mothers) with the adolescents also were recruited for participation. Demographic characteristics for adolescents and caregivers are presented in Table I. A range of disease severity was observed among participants; however, over half ($n = 25$) fell within the guidelines for “acceptable” to “optimal” nutrition status measured by body mass index ($BMI \geq 25^{th}$ percentile), and two-thirds ($n = 27$) fell within the classification for normal to mildly impaired lung function (forced expiratory volume in 1 s, $FEV_1 \geq 70\%$ predicted) (CFF, 2012).

Adolescents were identified by the CF care team as eligible for recruitment if they (a) had a confirmed diagnosis of CF, (b) were scheduled for a routine (non-urgent) clinic appointment, (c) were fluent in English, and (d) were not cognitively or emotionally unable to complete questionnaires, such as due to a developmental disability. Adolescents meeting these criteria ($n = 75$) during the 2-month data collection period were identified; 15 did not attend their scheduled appointments, and 11 were not approached due to logistical challenges (e.g., parent not present to provide informed consent, multiple patients scheduled at the same time). Of the 49 patients approached, 43 provided consent to participate. Adolescents who declined to participate ($n = 6$) cited time constraints, disinterest, and prior research obligations as reasons for refusal. One participant who provided consent became ill unexpectedly during his appointment; his data were excluded owing to his inability to complete the measures.

All procedures were approved by the institutional review board. Active parental consent and youth assent were sought for all participants <18 years of age. Participants who were 18 years old were asked to provide consent to participate and permission for their caregivers to be approached about participation. All caregivers also provided informed consent. Adolescents received a \$10 gift card for participation. Families were approached regarding participation in a private area of the clinic waiting room or

Table I. Demographic Characteristics of Adolescent Participants and Their Caregivers

Demographic characteristics	<i>M</i>	<i>SD</i>	Range	<i>N</i>	Percentage
Adolescent characteristics					
Age (in years)	15.17	2.08	12–18		
Time since diagnosis (in years)	14.59	2.59	8.91–18.89		
BMI	19.36	2.74	14.90–26.10		
FEV ₁ (% predicted)	76.22	22.53	17–119		
Number of days inpatient (prior year)	13.17	27.01	0–107		
Male				17	40.5
Female				25	59.5
Race/Ethnicity					
Caucasian				39	92.9
African American				1	2.4
Mixed race/Other				2	4.8
Educational status					
Attending school				35	83.3
Homebound instruction				4	9.5
Graduated from high school				2	4.8
Not enrolled due to health				1	2.4
Insurance status					
Private				31	73.8
Public (e.g., Medicaid)				10	23.8
Other/Unknown				1	2.4
Caregiver characteristics					
Respondent					
Mother				29	74.4
Father				7	17.9
Grandmother				1	2.6
Aunt				1	2.6
Stepmother				1	2.6
Education					
High School/GED				9	23.1
Some college/Degree				23	59.0
Professional/Graduate degree				7	17.9
Age (in years)	42.54	7.39	28.85–65.63		

in their individual treatment rooms. Caregivers and youth were separated for completing questionnaires, and a research assistant remained with them during survey completion to answer any questions and ensure privacy (e.g., preventing medical staff from interrupting or viewing responses).

Measures

Friendship

Participants first were asked to list all of their friends without CF and all of their friends with CF, including the duration of each of these friendships. Participants were encouraged to list only friendships with similar-aged peers (i.e., not siblings, adult family friends, etc.). Consistent with procedures typically used to assess

friendship in the developmental literature (e.g., Furman & Buhrmester, 1985; Parker & Asher, 1993), next they were asked to select their closest friend from each list (i.e., closest friend without CF and closest friend with CF) to provide additional details regarding the quality of each of these friendships. Additionally, participants who provided a best friend with and without CF were asked to select their overall best friend between these two individuals; all participants endorsed the non-CF friend as being their overall best friend. Participants provided the number of hours spent with each friend per week in a variety of activities (at school, in-person activities, online, and phone contact).

Participants also responded to items assessing positive and negative friendship qualities, on the Network of Relationships Inventory (Furman & Buhrmester, 1985). The positive quality index was composed of 15 items assessing companionship, intimacy, support, nurturance, and alliance. The negative quality index was composed of nine items assessing conflict, criticism, and antagonism. Youth responded to each item on a 5-point scale (1 = little or none, 2 = somewhat, 3 = very much, 4 = extremely much, 5 = the most). Prior research has demonstrated good reliability and validity for the subscales used, including among samples of community adolescents and hospitalized youth (e.g., Furman & Buhrmester, 1985; Shulman, Horesh, Scharf, & Argov, 2000). Internal consistency with the current sample also was excellent for both the positive and negative composite scores across CF and non-CF friendships (α s range from .95 to .99).

Treatment Adherence

Caregivers responded to 14 items assessing the frequency of adolescents' CF-related treatment completion on the Treatment Adherence Questionnaire–CF (TAQ-CF; Quittner et al., 2000). Items assess the frequency of completing common CF-related treatments, such as airway clearance, aerosolized breathing treatments, inhalers, oral and inhaled antibiotics, pancreatic enzymes, and prescription vitamins on a 6-point scale (0 = not at all, 1 = occasionally, 2 = three times per week, 3 = once per day, 4 = twice per day, 5 = three or more times per day). To obtain a treatment adherence score, each participant's medical chart was reviewed to assess the prescribed frequency for each treatment listed on the TAQ. Caregivers' responses for treatment completion were then subtracted from the prescribed frequency to generate an adherence value for each category of treatments (i.e., perfect adherence is represented by a value of 0, positive scores represent greater treatment completion than what was prescribed, negative scores represent less treatment completion than what was prescribed). A mean value across

these adherence values was then calculated for each participant to generate an overall adherence score. Prior research has demonstrated adequate 1-year test–retest reliability and teen/parent concordance on the TAQ (Ievers et al., 1999; Quittner et al., 2000).

Health-Related Quality of Life

Caregivers also reported on the participants' health-related quality of life using a 43-item disease-specific measure (the Cystic Fibrosis Questionnaire-Revised, or CFQ-R; Quittner, Buu, Watrous, & Davis, 2000). The CFQ-R assesses functioning across a variety of domains (e.g., physical, emotional, treatment burden, health perceptions). All items are scored on a 4-point scale, with specific anchors varying across question stems (e.g., a lot of difficulty to no difficulty; always to never); higher scores represent better quality of life. A total quality of life score was calculated by summing all responses (scored 0–3), dividing by the total number of item-points, and then multiplying by 100 to obtain a standardized score with range of 0–100. The CFQ-R has been used widely with CF populations; it has well-established reliability and validity (e.g., Modi & Quittner, 2003), and is correlated with objective measures of health and disease severity (Quittner, Modi, & Cruz, 2008). Internal consistency in the current sample also was excellent ($\alpha = .95$).

Health Status Index

To control for overall health status in regression analyses, a composite index was created using three markers of CF-related health functioning. Adolescents' BMI and FEV₁ (percent predicted) were gathered via chart review from the clinic visit on which the questionnaires were completed. BMI and FEV₁ (%) are widely regarded as the most relevant indicators of health status among individuals with CF (CFF, 2012) and typically are collected at every clinic visit. Additionally, as an indicator of the number and severity of CF-related exacerbations, medical charts were reviewed to determine the number of days participants spent hospitalized for CF-related care over 1 year before the study visit. Each of these three health status indicators was standardized, then a mean composite score was generated across the standardized BMI, standardized FEV₁%, and the inverse of the standardized hospitalization scores to reflect overall health functioning.

Data Analyses

First, to address aim 1, descriptive statistics were used to examine the number, duration, forms, and frequency of interactions, and positive and negative friendship qualities with friends with and without CF. Mean differences in

number of friendships with peers with versus without CF for the full sample were examined with paired-samples *t*-tests; paired-samples *t*-tests examining the remaining friendship indices (duration, interactions, and quality) were conducted among those participants who endorsed the presence of both types of friendships. To address aim 2, Pearson's correlation coefficients were examined preliminarily to understand bivariate associations among study variables. Then two linear regressions were conducted to examine unique relations between positive and negative friendship qualities in participants' best friendships (with non-CF peers) and two health-related outcomes: Treatment adherence and health-related quality of life, controlling for age and health status. Due to the low number of youth who reported friendships with CF-peers, correlations and regressions examining associations between health-related outcomes and friendship quality among CF-peers were not conducted.

Results

Aim 1: Describing Dyadic Friendships

First, descriptive data were examined for the number, duration, frequency of interaction, and quality of friendships with (a) non-CF peers and (b) CF-peers (see Table II).¹ Across the full sample, adolescents reported significantly more friendships with non-CF peers than with CF-peers, $t(41) = 10.57, p < .001, d = 2.00, 95\% \text{ CI } [5.37, 7.91]$. Among the 18 participants who endorsed having friends with CF, an average of 2.11 ($SD = 1.28$) friends were reported (range = 1–4 friends with CF). Of these 18 individuals, 7 reported that they do not spend face-to-face time with their best friend with CF, whereas 5 reported spending at least some time (range 1–60 hr per week). Paired samples *t*-tests for participants endorsing both types of friendships revealed no statistically significant differences in the duration of best friendships with non-CF and CF-peers or in time spent engaging in either (a) face-to-face interactions or (b) electronic interactions with non-CF and CF-peers. However, when the total time spent with friends was summed into a composite (inclusive of all face-to-face and electronic time), youths' report of time spent with non-CF best friends per week ($M = 36.13 \text{ hr}, SD = 26.76, n = 14$) was significantly greater than their report of total

time spent with CF best friends ($M = 17.21, SD = 22.88, n = 14$), $t(13) = 3.01, p = .01, d = 0.81, 95\% \text{ CI } [5.33, 32.49]$.² With regard to friendship quality, paired samples *t*-tests revealed no significant differences in negative friendship quality across best friendships with CF and non-CF peers. By contrast, adolescents reported significantly higher levels of positive friendship quality in their best friendship with a non-CF peer than a CF-peer, $t(14) = 3.45, p = .004, d = 0.89, 95\% \text{ CI } [0.53, 2.28]$.³

Aim 2: Dyadic Friendship Quality and CF-Related Outcomes

Descriptive data also were examined for caregiver-reported outcome measures (treatment adherence, $M = -0.79, SD = 0.82$, and health-related quality of life, $M = 70.81, SD = 16.23$). Outcome measures did not differ based on the gender of the participant or the gender of the caregiver respondent ($t_s = 0.38-1.11, p_s = .27-.71$). Significant bivariate associations were observed among friendship quality, treatment adherence, and quality of life (see Table III), as well as between age and adherence.

Next, two linear regressions were conducted to examine the unique associations between youth-reported positive and negative friendship quality and parent-reported outcome measures (treatment adherence and health-related quality of life; see Table IV). Findings indicated that age ($\beta = -0.35, p = .02$), positive friendship quality ($\beta = -0.35, p = .02$), and negative friendship quality ($\beta = -0.33, p = .02$) each was associated with parent-reported treatment adherence, controlling for health status, total $R^2 = .45, F(4, 30) = 6.23, p < .01$. Positive friendship quality ($\beta = 0.43, p = .01$) was associated with parent-reported health-related quality of life, controlling for age, health status, and negative friendship quality, total $R^2 = .28, F(4, 31) = 3.03, p = .03$.

² Of note, six participants had missing data for time spent in face-to-face interactions with CF peers; one participant who endorsed spending face-to-face time with her best friend with CF declined to provide a numeric response, but responded that she hangs out with this person "all the time," which was omitted in statistical analyses. Four participants had missing data for time spent in electronic interactions with CF peers. The total time spent with CF friends was calculated if the participant had completed data on either face-to-face time or electronic time (or both).

³ Effect sizes (Cohen's *d*) and 95% confidence intervals are provided to contextualize the magnitude of differences across comparisons of means, particularly given the low number of participants in the current sample who endorsed friendships with CF peers. Medium to large effect sizes were observed across the paired-samples *t*-test comparisons ($d_s = 0.29-2.00$), despite low power to detect statistically significant differences.

¹ One participant indicated that her boyfriend was also her best friend without CF; her friendship quality data were removed from analyses, due to potential differences in romantic versus platonic adolescent peer relations. Three participants (all males) endorsed best friendships with opposite-sex, non-romantic partners; the remaining participants endorsed same-sex best friendships.

Table II. Descriptive Data for Friendships With Non-CF and CF Peers

Friendship variables	Non-CF peers M (SD)	CF peers M (SD)	t (df)	Effect Size (d)
Number of friends	7.55 (3.68)	0.90 (1.34)	10.57 (41)***	2.00
Friendship duration (years)	4.54 (2.75)	5.69 (6.14)	1.07 (15)	0.29
Face-to-face time (hr/week)	27.12 (27.50)	11.50 (21.27)	1.18 (11)	0.36
Electronic time (hr/week)	13.83 (20.81)	7.43 (10.76)	1.23 (12)	0.36
Total time with friends (hr/week)	42.34 (40.04)	15.13 (22.05)	3.01 (13)**	0.81
Positive quality	3.72 (1.07)	2.42 (1.25)	3.45 (14)**	0.89
Negative quality	1.35 (0.63)	1.56 (1.21)	1.16 (14)	0.44

Note. Duration, time spent with friends per week, and positive/negative quality for friendships with CF peers are reported only among those individuals who endorsed having at least one friend with CF (*ns* range from 11 to 15 owing to missing data among the 18 participants who reported CF-friendships); Non-CF friendship data were provided by all participants. Effect sizes (*d*) for paired samples *t*-tests correct for dependence between means (Morris & DeShon, 2002).

****p* < .01, ***p* < .001.

Table III. Bivariate Correlations Among Youth-Reported Indices of Peer Relationships, Parent-Reported Outcomes, and an Objective Health Status Index

	2	3	4	5	6	7	8	9
1. Number of non-CF friends	-.17	.18	.39*	-.28	-.06	.17	.15	-.23
2. Duration of non-CF friendships	–	.23	-.22	.10	-.06	.19	-.18	.52**
3. Total time spent with non-CF friends	–	–	.39*	.28	.12	.19	-.10	-.18
4. Positive quality non-CF friends	–	–	–	.17	-.44**	.40*	.20	-.07
5. Negative quality non-CF friends	–	–	–	–	-.43**	-.23	-.06	.11
6. Adherence (parent-report)	–	–	–	–	–	.16	-.03	-.40*
7. Quality of life (parent-report)	–	–	–	–	–	–	.25	-.08
8. Health status (chart review)	–	–	–	–	–	–	–	-.16
9. Age	–	–	–	–	–	–	–	–

Note. *ns* range from 31 to 41 owing to missing data.

p* < .05, *p* < .01.

Table IV. Cross-Sectional Regressions Predicting Caregiver-Reported Health Outcomes (Adherence and Quality of Life) From Youth-Reported Friendship Quality in Non-CF Best Friendships, Controlling for Age and Health Status

Predictor	Caregiver-reported adherence			Caregiver-reported quality of life		
	<i>B</i>	<i>SE</i> (<i>B</i>)	β	<i>B</i>	<i>SE</i> (<i>B</i>)	β
Health status	-.15	.16	-.13	3.24	3.45	.15
Positive friendship qualities	-.31	.12	-.35*	7.17	2.56	.43**
Negative friendship qualities	-.43	.18	-.33*	-6.79	3.40	-.27

Note. *B* is the unstandardized coefficient; *SE*(*B*) is standard error of the *B*; β is the standardized beta weight.

p* < .05, *p* < .01.

Discussion

Adolescence is a developmental period characterized by the primary importance of peer relationships, and within the psychosocial literature, great attention has been devoted to the role of dyadic friendships in youths' overall functioning. Yet, little research has addressed the role of friendship within the lives of youth with chronic illness, and particularly among youth with CF. Thus, the purpose of the current study was to (1) describe the nature of dyadic

friendships between adolescents with CF and their non-CF versus CF peers, and (2) examine associations between youth-reported positive and negative friendship quality and parent-reported treatment adherence and health-related quality of life.

Adolescents reported fewer friendships and less frequent interactions with friends with CF than with non-CF peers. These findings are not particularly surprising for a number of reasons, including the scarcity of

CF-peers in most adolescents' typical social settings, as well as the infection control policies endorsed by the CF Foundation, discouraging patients from spending time in direct contact with one another (Saiman & Siegel, 2003). However, despite this recommendation, of the participants who reported having friendships with other CF patients, over one quarter engaged in weekly face-to-face contact. Frequent electronic interactions also were reported (over 7 hr per week); however, these electronic media appear to be used *in addition to*, rather than *instead of* in-person contact in many cases. The cross-sectional nature of the current data precludes the ability to determine whether electronic contacts served as a precursor to in-person contacts or occurred simultaneously within a friendship's development. Additionally, the small sample size of the current study contributes to complexity with interpretation of the findings. However, given the potentially life-threatening consequences of sharing treatment-resistant pathogens, future work must continue to address the social needs of youth with CF, including ways to reduce the risk of cross-contamination if youth choose to pursue friendships with peers who also have CF.

Within their best friendships with non-CF peers, adolescents endorsed significantly higher levels of positive friendship qualities, relative to their best friendships with CF-peers. Given the lower rates of interactions with CF peers compared with non-CF peers, some forms of positive friendship qualities focused on direct contact (e.g., companionship) may be more difficult to achieve for adolescents with CF. This difficulty could be compounded for boys with CF, given their gender-normative reliance on friendship qualities such as shared activities to a greater degree than more emotionally focused friendship goals characteristic of female friendships (e.g., Rose & Rudolph, 2006). However, electronic communications could still offer the potential for achieving other forms of positive friendship qualities (e.g., support, intimacy). Support from peers who understand adolescents' life experiences is important (e.g., Meltzer & Rourke, 2005), and for youth who choose to pursue friendships with other peers with CF, achieving this support in a venue that minimizes disease-related risks remains an important area for future research.

Both positive and negative friendship qualities were associated with parent-reported treatment adherence, and positive friendship qualities also were associated with parent-reported health-related quality of life. Whereas positive and negative friendship qualities have been associated in prior work with general indices of internalizing and externalizing symptoms (e.g., Vitaro et al., 2009), the current study extends this prior work to the specific health-related

domains of treatment adherence and health-related quality of life among youth with CF. Yet, the current findings present a mixed picture in terms of the potential benefits of friendships, particularly for treatment adherence goals. Specifically, the current data suggest that lower levels of negative friendship qualities are associated with higher levels of treatment adherence. These findings are consistent with prior work demonstrating associations between lower levels of negative friendship qualities (e.g., conflict, criticism) and improved psychosocial functioning and adjustment among healthy youth (e.g., Bagwell & Schmidt, 2011), as well as findings on the harmful impact of conflict and negative friendship quality on the health of adolescents with diabetes (Helgeson et al., 2007, 2009).

Conversely, the current findings suggest that higher levels of positive friendship qualities may be associated with *lower* levels of treatment adherence, despite being associated with higher levels of health-related quality of life. Bivariate correlations suggest that positive friendship quality may be associated with spending greater time with peers (and perhaps thus spending less time completing treatments); however, future work is needed to disentangle these relations and further clarify the mechanisms by which friendship quality impacts adherence and quality of life. Given the critical importance of treatment adherence to the long-term survival of individuals with CF, and given the characteristic decrease in treatment adherence observed across the adolescent period (Quittner et al., 2000; Ricker et al., 1998), the current findings offer promising avenues for future research on both the benefits and risks of peer relationships for youth with CF. Furthermore, health-related quality of life increasingly has been recognized as a critical element of patient and family-reported outcomes among youth with chronic illness (Quittner et al., 2008), and the current findings continue to build on this growing body of literature for youth with CF.

Limitations and Future Directions

The current study offers several unique strengths and contributions to the literature on peer relationships among adolescents with CF; however, findings should be interpreted in light of its limitations. First, the current study is cross-sectional in nature and thus cannot address directionality of the findings or possible mechanisms for explaining the current results. For example, it is possible that other indicators of psychosocial functioning relate to both friendship quality and health-related outcomes in ways that help to contextualize the current findings. Future research should expand on the current work to examine how peer relationships influence health and behavioral functioning over time, including examining

possible mediators and moderators of these effects. One strength of the current study involves the use of multiple informants; parents and caregivers reported on outcome measures, and youth reported on friendship qualities, thus reducing the potential confounds of shared-method variance. However, future work also could expand on the current findings by including friends' reports of friendship qualities or other outcome measures. Additionally, future work should attend to possible nuances of measurement related to friendship quality among youth with CF. For example, disease-specific forms of social support may particularly contribute to positive friendship dynamics (e.g., Barker et al., 2012; Graetz et al., 2000; La Greca et al., 1995). Also, scales of positive and negative friendship quality that have been developed within normative populations may not adequately capture the unique nature of relationships among youth with CF, for whom in-person interactions are discouraged.

Finally, the current sample was relatively small and drawn from a single CF center. Future research should examine the generalizability of findings within larger representative samples, as well as extend the current work in several possible directions. For example, larger sample sizes would particularly aid in the understanding of friendships with peers who also have CF, which may be less commonly observed, thus limiting statistical power, as was the case in the current study. Larger sample sizes also would offer the benefit of providing greater statistical power for studying age differences or developmental effects over the course of adolescence, as well as for studying the impact of the course of disease progression, both of which were precluded in the current study given the small and relatively healthy sample. Additionally, larger samples could enhance the study of possible gender differences across both participants and caregivers' reports, particularly given some evidence in prior work for differences in mothers' and fathers' experiences of a child's chronic illness (e.g., Goldstein, Akre, Bélanger, & Suris, 2013; Knafel & Zoeller, 2000).

Conclusion

In conclusion, the current study offers a preliminary examination of dyadic friendships within a small sample of adolescents with CF. Despite the low prevalence of friendships with peers with CF, these relationships did exist and also occurred, at least in some cases, within the discouraged framework of face-to-face encounters. Both positive and negative friendship qualities in non-CF friendships were demonstrated cross-sectionally to be negatively

associated with treatment adherence, whereas positive friendship quality was positively associated with health-related quality of life. Future work should attend to the longitudinal implications of these findings and explore methods for improving the quality of friendships among youth with CF, while simultaneously reducing the risks associated with friendships, particularly in face-to-face encounters with peers who also have CF. The role of health-care providers in addressing social issues effectively with youth with CF is an important topic for future work, and current findings suggest that friendships may provide both benefits and risks to youths' health that need to be addressed within the health context. Specifically, high-quality friendships may enhance quality of life, despite some mixed evidence for their association with treatment adherence. However, in-person interactions with friends who also have CF may place youth at significant health risk, and apparently may occur with some regularity for certain youth, despite explicit guidelines against doing so. Thus, balancing the social and health needs of adolescents with CF may represent an ongoing challenge and area for future research and clinical focus.

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