Association of Disease, Adolescent, and Family Factors with Medication Adherence in Pediatric Inflammatory Bowel Disease

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Objective To examine factors associated with adolescent and parent-reported adherence to prescription and over-the-counter (OTC) medications in a cross-sectional sample of youth with inflammatory bowel disease (IBD). **Method** Ninety adolescents and their parents completed measures of medication adherence and disease, individual, and family factors while attending an outpatient gastroenterology appointment. **Results** Longer time since diagnosis, greater perceived disease severity, and a lack of autonomous motivation to adhere predicted adolescent report of lower adherence to prescription medications. Similarly, longer time since diagnosis predicted adolescent report of lower adherence to OTC medications. Less time since diagnosis, greater maternal involvement in the medical regimen, higher perceived disease severity, and less perceived conflict predicted better parent-reported adherence to OTC medications. **Conclusions** Interventions for improving adherence in adolescents with IBD should address disease, individual, and family factors with special attention given to adolescents who have been diagnosed longer.

Key words adherence; adolescent; inflammatory bowel disease.

Introduction

Inflammatory bowel disease (IBD), consisting of Crohn's Disease, ulcerative colitis, and indeterminate colitis, is a chronic, autoimmune disease of the digestive tract that affects approximately 71 out of 100,000 youth below the age of 20 years in USA (Kappelman, et al., 2007) and is often diagnosed in adolescence (Sandler & Eisen, 2000). Symptoms can include abdominal pain, diarrhea, weight loss, growth and pubertal delay, fever, fatigue, and arthritis (Mackner, Sisson, & Crandall, 2004). Treatment for IBD primarily involves oral medications including anti-inflammatories, immunomodulators, corticosteroids, and antibiotics. Medical management also involves over-the-counter (OTC) medications that have been prescribed by the physician such as multivitamins, calcium supplements, vitamin D, zinc, and folic acid. These medications insure adequate ingestion of vitamins and minerals that may be lacking due to anorexia or malabsorption following intestinal inflammation and medication side effects (Stark et al., 2005). Adherence to these medications is a significant concern, particularly for adolescents who are among the least adherent of age groups (DiMatteo, 2004).

The consequences of nonadherence can include decreased quality of life, additional and otherwise unnecessary prescriptions, drug interactions, drug resistance, and increased morbidity and mortality (Quittner, Modi, Lemanek, Ievers-Landis, & Rapoff, 2008). However, few studies have examined factors associated with medication adherence in youth with IBD. In a study with 50 adolescents with IBD, Mackner and Crandall (2005) found that only 48% of adolescents and 38% of parents reported the adolescent as ''always adherent'' to prescription IBD medications. When asked about adherence to nonprescription medications, only 44% of adolescents and 58% of parents reported the adolescent as ''always adherent.'' Within the same study, adherence was found to be positively related to

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better family functioning and less use of maladaptive coping mechanisms. Using a combination of self-report and objective measures, including metabolite bioassays and pill counts (Hommel, Davis, & Baldassano, 2009), pediatric patients with IBD were found to have nonadherence rates of 38–49% when using objective measures. Self-reported nonadherence was markedly lower, however, with rates of only 2–10%. Finally, a recent review of treatment adherence in pediatric gastroenterological disorders found that reported rates of adherence for pediatric IBD have ranged from 16% to 62% (Hommel, Mackner, Denson, & Crandall, 2008). Research on the relationship between adherence and quality of life in youth with IBD has shown mixed findings depending on the class of medication prescribed, with 6-MP/azathioprine adherence being related to better physical quality of life and 5-ASA adherence being related to poorer psychological quality of life (Hommel, Davis, & Baldassano, 2008).

Additional research on factors related to medication adherence within this unique patient population is needed to aid in the development of future interventions. In research on adherence with other chronic illness samples, patient and family factors and disease and regimen factors have been examined as potential correlates. However, few of these studies have incorporated a theoretical framework that could aid in the interpretation of results (Rapoff, 1999). The present study was guided by Wallander and Varni's (1992) disability-stress-coping model, a comprehensive model of children's adjustment when faced with a chronic physical condition. The overarching tenet behind the model is that stress and protective factors interact to affect children's adjustment. Three dimensions of risk and protective factors within this model have been postulated to exist including condition parameters (e.g., condition type, condition severity, and time since diagnosis), intraindividual or child parameters (e.g., age, coping, and cognitive processes), and social–ecological parameters (e.g., family functioning, parental stress, and peer relationships; Wallander, Thompson, & Alriksson-Schmidt, 2003). The current study will examine how condition, intraindividual, and social–ecological parameters relate to adherence in youth with IBD, with adherence conceptualized as a component of positive medical adjustment.

Given that factors related to adherence in youth with IBD are relatively understudied compared to other chronic illness groups, the current study was guided by past work with other chronic illness samples. Condition parameters that have been shown to be associated with adherence include time since diagnosis, with longer disease duration being predictive of poorer adherence in adolescents with type 1 diabetes (Kaufman, Halvorson, & Carpenter, 1999) and renal disease (Brownbridge & Fielding, 1994). Knowledge of the medical regimen and adherence has also been examined with mixed findings based on the age of the child. For younger children, maternal knowledge of the medical regimen appears to best predict adherence, whereas for adolescents, their own medication knowledge has been found to be related to better adherence (La Greca & Bearman, 2003). Examinations of the relationship between perceived disease severity and adherence have also been mixed, in part depending on the age of the patient. Greater perceived severity is associated with poorer adherence for adolescents (Bond, Aiken, & Somerville, 1992), while other findings have shown parents' and children's perceptions of disease severity to be positively related to adherence (Drotar, 2000). Physicians' ratings of disease severity have not been found to be reliable predictors of adherence (Rapoff & Barnard, 1991).

Intraindividual and social–ecological parameters have also been examined. In general, trends indicate that children become less adherent as they age, with adolescence being a risk factor for poor medical adherence (Modi, Marciel, Slater, Drotar, & Quittner, 2008). Family conflict has also been found to be associated with lower adherence across different chronic illness groups (Fiese & Everhart, 2006; Miller-Johnson et al., 1994). Family conflict could hinder adherence by disrupting daily activities associated with adherence or by creating an antagonistic environment in which illness-related behaviors are not discussed. Also, family conflict may be a reaction to adolescents' nonadherence (Lewandowski & Drotar, 2007).

Parental monitoring of the medical regimen has been associated with better adherence in adolescents with cystic fibrosis (Modi et al., 2008), as well as diabetes (Anderson, Ho, Brackett, Finkelstein, & Laffel, 1997). Although decreased parental monitoring may appear to be developmentally appropriate as a child ages, the data indicate that lower parental responsibility is associated with lower adherence. For some families, this may represent parents' granting of responsibility for the medical regimen prematurely and before it is developmentally or medically appropriate for some adolescents. The relationship between parental involvement and adherence for adolescents with IBD has not been assessed.

An additional intraindividual factor shown to be related to adherence primarily in adult samples is the type of motivation for adhering to medical regimens (Kennedy, Goggin, & Nollen, 2004). Guided by self-determination theory (Deci & Ryan, 1985), several types of motivation are theorized to exist, including autonomous motivation and amotivation. Autonomous motivation includes

behaviors performed because the person sees them as important and as a choice, whereas amotivation refers to the absence of autonomous motivation. Individuals who endorse amotivation deny feeling self-determined and intrinsically motivated to engage in a target health behavior. Amotivation has been associated with poorer adherence in adults (Levesque et al., 2007).

The current study examined condition, intraindividual, and social–ecological factors based on Wallander and Varni's (1992) disability-stress-coping model as they relate to medication adherence in pediatric patients with IBD. Adherence was assessed for both prescription and prescribed OTC medications, both of which are integral components of medical management of IBD. Parent and child reports of adherence were collected, and we expected their reports to be positively correlated based on recent findings of good parent–child agreement on adherence using self-report measures, and that parents' reports of adherence would be higher than adolescents' reports (Quittner et al., 2008). Based on prior research, it was expected that the condition and intraindividual factors of time since diagnosis, age, adolescent reports of perceived disease severity, and adolescents' and parents' amotivation would be negatively associated with adherence, whereas parents' perceived disease severity would be positively associated with adherence. Parent and adolescent medication knowledge were expected to be positively associated with adherence. Finally, we hypothesized that the social–ecological factor of maternal involvement in IBD management would be positively associated with adherence, whereas parent–adolescent conflict would be negatively associated with adherence. These factors were expected to be predictive of adherence when using hierarchical regression analyses.

Methods

Participants

Participants were 90 adolescents aged 11–18 years with a diagnosis of IBD and one of their primary caregivers. Parent respondents self-identified as the adolescent's mother (81%), father (18%), or grandmother (1%). Demographic characteristics of the sample can be seen in Table I. Participants were recruited from a large pediatric gastroenterology practice in the Southeast United States. Inclusion criteria included: (a) diagnosis of Crohn's disease, ulcerative colitis, or indeterminate colitis, (b) 11–18 years of age, (c) prescribed oral medications for the treatment of IBD, and (e) English fluency. Exclusion criteria included: (a) developmental delay. One parent–child dyad was excluded from participation because they were non-English speaking. Throughout recruitment for the current study, 106 parent–adolescent dyads were consecutively approached for participation, with the 90 consenting representing an 85% participation rate. Reasons for declining to participate included lack of time ($n = 5$), lack of interest ($n = 6$), adolescent felt too ill ($n = 3$), and chose not to indicate ($n = 2$).

Measures

A brief demographics and perceived disease severity questionnaire assessed the participant's age, gender, ethnicity, family income, diagnosis (CD, UC, or indeterminate colitis), date of diagnosis, and parental highest education levels. Parents and adolescents were asked to rate separately their perceived level of disease severity for the adolescents' IBD as: (a) inactive, (b) mild, (c) moderate, or (d) severe. Chart review of the participants' medical charts at the pediatric gastroenterology clinic were reviewed to obtain their currently prescribed medication regimen including the name, dosage frequency, dosage amount, and purpose of each medication as well as data for objective ratings of disease severity.

Pediatric Crohn's Disease Activity Index

The Pediatric Crohn's Disease Activity Index (PCDAI; Hyams et al., 1991) is a measure of disease severity in pediatric Crohn's disease. The measure is scored 0–100 based on: (a) subjective reports (i.e., abdominal pain), (b) objective reports (i.e., fever), (c) laboratory findings, and (d) growth. Summed total scores provide indices of disease severity: inactive disease ($\leq$10), mild to moderate disease (11–30), and severe disease (>30).

Pediatric Ulcerative Colitis Activity Index

The Pediatric Ulcerative Colitis Activity Index (PUCAI; Turner et al., 2007) is a measure of disease severity for pediatric patients diagnosed with ulcerative colitis that has been well validated against objective measures of disease status (Turner et al., 2010). Summed total scores from 0–85 provide indices of disease severity: inactive disease (<10), mild disease (10–34), moderate disease (35–64), and severe disease ($\geq$65).

The Treatment Self-Regulation Questionnaire Amotivation Subscale

The Amotivation subscale of the Treatment Self-Regulation Questionnaire (TSRQ; Williams, Grow, Freedman, Ryan, & Deci, 1996) consists of three items and measures the extent to which a person lacks autonomous motivation to engage in a health-related task. Adolescents were asked to indicate the extent to which they take medications

Table I. *Demographic and Disease Characteristics of the Sample*

Variable	*n*	%
Child's gender		
Male	52	58
Female	38	42
Child's IBD diagnosis		
Crohn's disease	67	74
Ulcerative colitis	23	26
PCDAI score ($n = 67$)		
Inactive disease (≤10)	34	51
Mild disease (11–30)	28	42
Moderate/severe disease (>30)	5	7
PUCAI score ($n = 23$)		
Inactive disease (<10)	11	48
Mild disease (10–34)	11	48
Moderate/severe disease (>34)	1	4
Race		
White	70	78
African American	12	13
Asian	1	1
Hispanic	4	5
Other	3	3
Annual family income		
Under $10,000	2	2
$10,000–24,999	3	3
$25,000–49,999	12	13
$50,000–74,999	21	23
$75,000–99,999	15	17
$100,000 and above	34	38
Did not report	3	3
Maternal education level		
Some high school	1	1
High school diploma/GED	15	17
Some college	17	19
College degree	38	42
Professional degree	18	20
Missing	1	1
Paternal education level		
Some high school	3	3
High school diploma/GED	18	20
Some college	13	14
College degree	38	42
Professional degree	16	18
Missing	2	2

as prescribed because: (a) I really don't think about it, (b) it is easier to do what I am told than think about it, (c) I really don't know. Parents responded to the same questions based on the reasons they make sure their adolescent takes medications as prescribed. Participants responded using a 7-point rating from ''not true at all'' to ''very true'' and the mean of these responses represented the subscale score. In the current sample, Cronbach's alpha for the Amotivation subscale equaled .20 for adolescent report and .23 for parent report. Given the low alphas, the decision was made to examine the subscale at the item level. Analyses revealed that only the item, ''I really don't think about it'' was significantly related to the outcome variables of adolescent report of prescription adherence ($r = -.26$, $p = .02$). This same item was also most closely related to adolescent report of adherence to OTC medications as well as parent report of adherence to prescription and OTC medications. Consequently, only this item was retained for further analyses as an index of amotivation.

IBD Family Responsibility Questionnaire

The IBD Family Responsibility Questionnaire (IBD-FRQ; Greenley, Doughty, Stephens, & Kugathasan, 2009) is a 26-item, parent and adolescent-report measure used in the current study to assess adolescent and maternal involvement in IBD management. First, respondents are asked to identify a female caregiver who is involved in IBD maintenance and then rate on a 0–3 scale how involved the child and the identified caregiver are in various aspects of IBD maintenance, such as remembering when medications need to be taken. Total involvement scores are computed for the adolescent and the female caregiver by taking the mean of the items endorsed, with a possible range of 0–3 for each person. In the current sample, Cronbach's alphas for adolescent and parent report were good with $\alpha \geq .88$ and $\alpha \geq .92$, respectively.

Issues Checklist

The Issues Checklist (IC; Robin & Foster, 1989) is a 44-item measure for both parent and adolescent assessing common sources of conflict. Respondents rate how often they discussed each potential source of conflict in the last 4 weeks to assess frequency of discussion. Internal consistency estimates for the current sample were adequate to good with Cronbach's $\alpha = .68$ for adolescent report of conflict frequency and $\alpha = .89$ for parent report of conflict frequency.

Medical Adherence Measure

The Medical Adherence Measure (MAM; Zelikovsky & Schast, 2008) is a semi-structured interview to assess medication knowledge and adherence to prescribed and OTC medications over the past 7 days. The MAM was administered separately to parents and adolescents. To quantify adherence, the number of prescribed doses minus the number of missed doses is divided by the number of prescribed doses, and multiplied by 100.

The knowledge portion of the MAM was administered to assess parent and child knowledge of their prescribed medical regimen. Interviewees were asked to provide: (a) medication name, (b) dosage frequency, (c) dosage amount, and (d) purpose of the medication. Participants' responses were compared to their currently prescribed regimen in the medical chart. Each person's total knowledge score was a percentage based on number of correct responses.

Procedure

All procedures were in accordance with Institutional Review Board approval. After obtaining the names and appointment times of potential participants from collaborating pediatric gastroenterologists and staff, research assistants contacted potential participants in clinic and invited them to participate in the study. Those who enrolled completed informed consent and assent, whereas those who declined enrollment were asked to complete an anonymous demographics screener in order to compare participants to nonparticipants. Adolescent and parent participants independently self-reported on all measures, excluding the MAM, which was administered as a semi-structured interview separately to adolescents and their parents by the first author or trained research assistants. Prior to completion of the MAM, charts were reviewed to obtain the currently prescribed medication regimen. All interviews occurred in an exam room immediately before or after the medical appointment. Both parent and child participants were compensated for their time with a $20 gift certificate to a local retail store.

Results

Preliminary Analyses

Results of one-way ANOVA and χ^2 tests revealed no significant ($p < .05$) differences between participants and those who declined participation based on adolescent's age, gender, IBD diagnosis (i.e., Crohn's disease or ulcerative colitis), race, family income, or parental education level. Correlation analyses were conducted to examine the relationship between adolescent and parent reported perception of disease severity and objective ratings of disease severity as measured via the PCDAI and the PUCAI, which were combined into a single variable representing objective disease severity for the following analysis. Objective disease severity was positively correlated with both parent perception of disease severity ($r = .46$, $p < .001$) and adolescent perception of disease severity ($r = .34$, $p < .01$).

Adherence Rates

Self-reported rates of adherence were calculated for adolescent and parent report of oral medication adherence to both prescription and OTC medications that had been prescribed by the adolescent's physician. Chart review indicated that adolescents were prescribed an average of 2.47 prescription medications ($SD = 1.54$, range 0–8) and an average of 1.49 OTC medications ($SD = 1.17$, range 0–5). Within the sample, adolescents were prescribed several classes of prescription medications including immunomodulators (56%), aminosalicylates (41%), corticosteroids (30%), proton pump inhibitors (38%), selective serotonin reuptake inhibitors (10%), antibiotics (9%), antispasmodics (i.e., hyoscyamine; 3%), and other (e.g., antihistamines, ulcer treatment, stool softeners; 27%). Adolescents were also prescribed OTC medications including multivitamins (56%), calcium (22%), iron (19%; taken as a prescription medication for an additional 4% of the sample), probiotics (11%), fish oil (9%), vitamin D (7%), folic acid (7%), and other (3%). Adolescents reported taking on average 89.54% of their prescription medication doses ($SD = 14.34\%$) and a significantly lower 66.73% of their OTC medication doses ($SD = 37.64\%$), $t(69) = 4.78$, $p < .01$. Parents reported on average that their adolescents took 92.76% of prescription medication doses ($SD = 13.02\%$) and a significantly lower 72.49% of OTC medication doses ($SD = 36.80\%$), $t(69) = 5.15$, $p < .01$. Analyses of differences between parent and adolescent report of adherence to prescription medications revealed a significant difference, $t(87) = 3.08$, $p < .01$, with adolescents reporting less adherence. No significant differences were found between parent and adolescent report of adherence to OTC medications $t(67) = 1.52$, $p = .13$. Correlational analyses found that adolescents' and parents' reports of adherence to prescription medications ($r = .75$, $p < .001$) and to OTC medications ($r = .84$, $p < .001$) were significantly related. Within reporter, neither adolescent's nor parents' reports of adherence to prescription and OTC medications were significantly related.

Associations among Factors and Adherence

The relationships between adolescents' and parents' reported adherence to prescription and OTC medications and condition, intraindividual, and social–ecological factors were examined using two-tailed Pearson product–moment correlation coefficients. (See Table II for means, standard deviations, and ranges for variables.) Adolescent-reported adherence to prescription medications was inversely associated with time since diagnosis ($r = -.20$, $p = .05$) and their amotivation ($r = -.26$,

$p = .02$). Adolescent report of adherence to OTC medications was inversely associated with age ($r = -.29$, $p = .01$) and time since diagnosis ($r = -.35$, $p < .01$). We also note that age and time since diagnosis were moderately correlated ($r = .34$, $p < .01$). Contrary to our hypotheses, a significant bivariate relationship was not found between adolescent-reported adherence and medication knowledge, perceived disease severity, maternal involvement in the medical regimen, or parent–child conflict. Parent report of adherence to prescription medication was also inversely associated with time since diagnosis ($r = -.23$, $p = .03$). Parent report of adherence to OTC medications was inversely associated with adolescents' age ($r = -.37$, $p = <.01$), time since diagnosis ($r = -.28$, $p = .02$), and level of parent–adolescent conflict ($r = -.28$, $p = .02$), and positively associated with parents' perceived disease severity ($r = .26$, $p = .03$) and total maternal involvement in the adolescent's medical care ($r = .30$, $p = .01$). Parental report of medication knowledge, amotivation, and adolescent involvement were not related to parent-reported adherence.

Hierarchical Regression

Given the differences in adolescent and parent report of adherence to prescription and OTC medications, separate regression models were evaluated for fit for adolescent report of adherence to prescription and OTC medication as well as parent report of adherence to prescription and OTC medication. The order of entry was guided by Wallander and Varni's (1992) disability-stress-coping model in addition to the bivariate relationship between the predictors and the outcome variables. Assumptions of multiple regression were examined and met for all models. Condition factors were entered first into the equation followed by intraindividual factors and finally social–ecological factors. For adolescent reports of adherence, the first block of each equation consisted of condition factors (time since diagnosis and adolescent perception of disease severity). The second block consisted of intraindividual factors (adolescents' amotivation and adolescent reported involvement in IBD management). Finally, the third block consisted of a social–ecological factor (adolescent report of parent-adolescent conflict). Therefore, this model examined factors associated with adherence from the adolescents' perspective.

For parent reports of adherence the order of entry mirrored that of the models built for the adolescents except that parent report of each of the predictors was used. The first block of each equation consisted of condition factors (time since diagnosis and parent perception of disease severity). The second block consisted of intraindividual/parent factors (parents' amotivation to promote their adolescents' adherence and parent report of maternal involvement in IBD management). Finally, the third block consisted of a social-ecological factor (parent report of parent–adolescent conflict). This model examined adherence from the parents' perspective. The same predictors and order of entry were used for each model to examine the unique predictors for each adherence rating from adolescent and parent perspectives. This approach is consistent with past research examining multiple adherence behaviors and multiple informants (DeLambo, Ievers-Landis, Drotar, & Quittner, 2004). Although all models included the full set of predictors, for ease of comprehension only those variables reaching significance at least at the .05 level in the third block are displayed in Table III.

Table II. *Means, Standard Deviations, and Ranges for Variables*

Variable	*M*	*SD*	Range
Age (years)	14.72	2.24	11–18
Time since diagnosis (months)	36.03	36.19	<1–182
Adolescent report			
Adherence: Prescription Medications (%)	89.54	14.34	25–100
Adherence: OTC medications (%)	66.73	37.64	0–100
Perceived disease severity[a]	2.19	0.91	1–4
Medication knowledge (%)	80.94	14.59	28–100
TSRQ: Amotivation[b]	3.72	2.14	1–7
IBD-FRQ: Total adolescent involvement	2.19	0.51	1.00–3.00
IBD-FRQ: Total maternal involvement	2.50	0.43	1.13–3.00
Issues Checklist: conflict frequency	46.40	38.70	0–154
Parent report			
Adherence: prescription medications (%)	92.76	13.02	21–100
Adherence: OTC medications (%)	72.49	36.80	0–100
Perceived disease severity[a]	2.39	0.93	1–4
Medication knowledge (%)	87.26	15.44	0–100
TSRQ: amotivation[b]	2.30	1.99	1–7
IBD-FRQ: total adolescent involvement	1.82	0.84	0–3.00
IBD-FRQ: total maternal involvement	2.78	0.28	1.67–3.00
Issues Checklist: conflict frequency	70.12	83.19	0–486

Note: [a]Perceived disease severity is based on a 1–4 scale with 1 = inactive, 2 = mild, 3 = moderate, and 4 = severe disease.
[b]Based on a 1–7 Likert scale with higher scores representing higher amotivation.

Adolescent-reported Adherence to Prescription Medications

For adolescent reported adherence to prescription medications, time since diagnosis ($p = .02$), adolescent perceived disease severity ($p = .05$), and the adolescent's amotivation to adhere to the medication regimen ($p = .02$) emerged as significant predictors. Adolescents who had been diagnosed for fewer months and reported less disease severity and amotivation reported better adherence to prescription medications.

Table III. *Summary of Hierarchical Multiple Regression Analyses*

Dependent variable and significant predictors	*B*	*SE B*	*β*	*F*	R^2
Prescription adherence (adolescent report)				3.49**	.20
Time since diagnosis	.000	.000	−.253*		
Adolescent perceived disease severity	−.034	.017	−.216*		
Adolescents' amotivation to adhere	−.017	.007	−.256*		
OTC adherence (adolescent report)				2.56*	.19
Time since diagnosis	−.004	.001	−.389**		
Prescription adherence (parent report)				2.23	.13
–					
OTC adherence (parent report)				8.10**	.41
Time since diagnosis	−.003	.001	−.252*		
Parent-perceived disease severity	.114	.044	.295**		
Parent's self-reported maternal involvement in IBD care	.537	.151	.377**		
Parent–child conflict—parent report	−.002	.000	−.395**		

Note. Variables were entered in blocks. First block: Condition Parameters; second block: Intraindividual Parameters; third block: Social–Ecological Parameters. Only the variables reaching significance at least at the .05 level in the third block are displayed.
*$p \leq .05$; **$p \leq .01$.

Adolescent-reported Adherence to OTC Medications

Based on adolescents' reports of adherence to OTC medications, time since diagnosis emerged as a significant predictor ($p < .01$), with adolescents who had been diagnosed longer reporting poorer adherence.

Parent Report of Adherence to Prescription Medications

In the final model predicting parent report of adherence to prescription medications, no significant predictors were identified.

Parent Report of Adherence to OTC Medications

Significant predictors of parent-reported adherence to OTC medications were time since diagnosis ($p = .02$), parent-perceived disease severity ($p = .01$), parent-reported maternal involvement ($p < .01$), and parent report of the frequency of parent–adolescent conflict ($p < .001$). Parents who reported less time since diagnosis, greater perceived disease severity, more maternal involvement in the management of their adolescent's IBD, and less parent–adolescent conflict reported greater adherence.

Discussion

The current study examined condition, intraindividual, and social–ecological predictors of adherence to prescription and OTC medications in a cross-sectional sample of adolescents with IBD. Analyses indicated that both adolescents and parents reported higher rates of adherence to prescription medications compared to OTC medications. Regression analyses revealed unique predictors for adolescent and parent perspectives for both prescription and OTC medications. Results extend past research on adherence in IBD by explicitly examining both prescription and OTC medications and by examining factors related to adherence. The data from this study provide preliminary support for Wallander and Varni's (1992) disability-stress-coping model in that condition, intraindividual, and social–ecological factors were found to be predictive of adherence.

Hierarchical regression models were used to identify unique predictors of adherence for each informant and type of adherence. The final model predicting adolescent's report of adherence to prescription medications accounted for 20% of the variance and identified time since diagnosis, adolescent perceived disease severity, and adolescent's amotivation to adhere as predictive of less adherence. As expected, adolescents who had been diagnosed for longer and reported higher levels of amotivation reported poorer adherence to prescription medications. Also as hypothesized, adolescent report of higher levels of disease severity was associated with poorer adherence, which could possibly be explained by feelings of hopelessness leading to poorer adherence. Similarly, time since diagnosis emerged as a predictor of adolescent report of OTC adherence, with adolescents with a longer time since diagnosis reporting poorer adherence.

The regression analysis to predict parent report of adherence to prescription medications did not identify any significant predictors. It is likely that there are important predictors of parent report of adherence to prescription medications that were not identified in the current investigation. Since parents reported significantly higher rates of adherence to prescription medications compared to adolescents, it may be that parents' lack of awareness of non-adherence and associated factors reduced the likelihood of identifying significant predictors.

The final model predicting parent reported adherence to OTC medications accounted for 41% of the variance and

included significant condition, intraindividual, and social–ecological factors. Similarly to adolescent report of OTC adherence, longer time since diagnosis predicted poorer parent report of adherence. Unique to this model, parent-perceived disease severity emerged as a significant predictor with increased perceived disease severity predicting improved adherence to OTC medications. This finding builds upon past research that has shown higher perceived disease severity to be associated with better adherence (Drotar, 2000). Parents who perceive their adolescent's disease to be more severe may be more diligent about insuring adherence to OTC medications due to the belief that their child is most at risk for the consequences of severe disease including vitamin and mineral deficiencies. In addition, parent's self-reported maternal involvement was a significant predictor, with parents who reported more maternal involvement reporting better adherence to OTC medications. These results suggest that maternal involvement offers an important and unique protective factor for adolescent's adherence to OTC medications.

Finally, parent report of parent–child conflict emerged as a predictor of poorer adherence to OTC medications. Perhaps parents who perceive more conflict in their relationship with their adolescent are less likely to promote adherence to OTC medications out of avoidance of yet another conflict. It is interesting to note that time since diagnosis was the only predictor to emerge as significant in three out of the four regression analyses evaluated. Also, although the correlation between age and time since diagnosis was significant, the correlation was at the low end of the range of medium effect if interpreted according to commonly accepted guidelines for Pearson's correlation coefficient *r* as an effect size (Cohen, 1988). This indicates that time since diagnosis is not simply a proxy for age and is a unique predictor of adherence behaviors in youth with IBD. Adolescents and parents may become more lax over time in their emphasis on adherence as they become more accustomed to living with their condition and/or possibly fatigued by the continual vigilance required to always be adherent.

Despite the important findings of the current study, several limitations must be noted. First, self-reports of adherence have been shown to be higher compared to more objective methodologies (Hommel et al., 2009), increasing the likelihood that actual adherence was lower than was reported by these adolescents and parents. Second, the current study utilized a cross-sectional design which precludes the ability to make conclusions concerning the directionality of the findings. Third, the condition, intraindividual, and social–ecological factors poorly predicted parent report of adherence to prescription medications indicating that additional unmeasured factors likely exist. Finally, the sample was primarily middle to high income and Caucasian and limited to adolescents, limiting generalizability to IBD patients of different ethnicities, socioeconomic statuses, and ages.

The results from the current study are an important addition to the literature on adherence in youth with IBD. Factors associated with adherence to both prescription and OTC medications were identified. In addition to identifying risk factors for poorer adherence such as longer time since diagnosis, the current study also identified increased maternal involvement in IBD care as a protective factor for better adherence. The results of the current study suggest that greater attention from healthcare providers should be given to those patients who have been diagnosed for longer periods of time, with continuing emphasis on adherence and maternal involvement in IBD management. Given that the current study was adequately powered, non-significant relationships are most likely related to small effects as opposed to limited statistical power to detect significant effects. Future research in this area should expand on these findings by assessing additional factors that may be associated with adherence such as beliefs about the effectiveness of prescription and OTC medications as well as assessing adherence longitudinally to determine important predictors of adherence across the developmental trajectory. It will also be important to assess the association between barriers and adherence for both prescription and OTC medications for youth diagnosed with IBD, especially given the lower rates of adherence to OTC medications found in the current study. The identification of unique predictors for adherence to prescription and OTC medications will be important for healthcare professionals working to improve adherence in youth diagnosed with IBD and for the future development of manualized interventions for promoting adherence.

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Conflicts of interest: None declared.

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